Regional Reports on Renewable Energies

30 Country Analyses on Potentials and Markets in:

West Africa (17) East Africa (5) Central Asia (8)

Energy-policy Framework Papers,

Section »Energy and Transport«

Eschborn, December 2009

gtz Promotion of Renewable Energies

On behalf of
Federal Ministry
for Economic Cooperation
and Development

Renewable Energies in West Africa

Regional Report on Potentials and Marktes – 17 Country Analyses

Energy-policy Framework Papers,
Section »Energy and Transport«

gtz Promotion of Renewable Energies

On behalf of
Federal Ministry
for Economic Cooperation
and Development

IMPRINT

Authors of Country Chapters

Benin	Daniel Finagnon Assogba (Dipl.-Eng.)
Burkina Faso	Bassirou Quedraogo (Dipl. Eng.) Souleymane Sow (Eng.)
Cameroon	Emmanuel Ngnikam (Dipl.)
Cape Verde	Louis Seck (MSc., DEA, MBA)
Côte d'Ivoire	Kouame Kadjo (Ing.)
Gambia	Bah F.M. Saho (Dipl. Agr., MSc. RE)
Ghana	Vincent Yankey (MBA, BSc)
Guinea	Bocar Sada Sy (Eng.)
Guinea-Bissau	Louis Seck (Msc., DEA, MBA)
Liberia	Augustus V. Goanue (MSc. Reg. Sc., BA Eng.)
Mali	Souleymane Diallo (Dr. Ing. Eng.)
Mauritania	Mohamed Elhacen Ould Khouna (Dipl. Eng.) revised version by Louis Seck (MSc., DEA, MBA)
Niger	Safiatou Alzouma (MSc. Eng.)
Nigeria	Prof. Anthony O. Adegbulugbe Dr. Adeola Adenikinju
Sierra Leone	Michael A. Conteh (MSc. Eng.)
Togo	Mawé Afo Aledjou (Dipl. Eng.)

Coordination and Review of the Country Chapters

Anton Hofer (MSE, Dipl.-Ing./FH, M.A.)
Dr. Rainer Janssen
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Contribution by

Rolf-Peter Owsianowski, Energy Expert for West Africa

Editor

Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of

Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff

Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

FOREWORD

Background

In recent years a large number of developing and emerging countries have changed the structure of their energy sectors, often accompanied by a liberalization of their markets. In many cases, **Renewable Energies (RE)** are a more and more important strategic component for the countries' diversification of their national energy supply.

A growing energy demand deriving from the increasing energy consumption of growing economies worldwide, accompanied by volatile prices for fossil fuels and by increasing environmental and climate challenges, boosts the demand for RE technologies. RE have a **competitive advantage** because they provide a long-term energy supply (for electricity, heating or cooling) based on locally available RE sources and thus help to reduce dependency on energy imports. In addition, RE provide appropriate technological solutions for the electrification of rural or semi-urban areas where they can be used independently from grid-connection. RE are a key for the provision of modern energy services in these areas and contribute to the local economic and social development.

While the technical potential for RE resources such as wind, solar, hydropower, biomass or geothermal energy is considered high in most developing and emerging countries, these regions are still faced with significant barriers for the development of commercially driven and sustainable RE markets. The lack of appropriate policies and the respective business environment are constraints that restrict the dissemination of RE in these countries. The success of comprehensive policy frameworks for the promotion of RE – such as RE feed-in-tariffs or incentive instruments like tax relieves – can be observed in more and more countries, for example Germany or France. However today, also developing countries and emerging markets such as South Africa, Kenya or the Philippines reveal the **significance of adequate policy frameworks for favorable market conditions**. Investments in RE markets, in particular by the private sector, very much depend on the existence of these national or regional framework conditions, incentives and financing options on the one hand, but also on sufficient **transparency and knowledge about these conditions**, which are thus part of the bottleneck for the deployment of RE.

Objective

Current and accurate information and data availability are – as stated above - important prerequisites for the development of RE energy markets and a broader dissemination of commercial activities – particularly in markets where information is scarce and where framework conditions are under transition. **The Regional Reports on Renewable Energies comprising 30 country analyses on RE potentials and markets in West Africa, East Africa and Central Asia** are a substantial contribution to the dissemination of comprehensive and precise knowledge on RE markets and related investment options and thus help to further pave the way for the promotion of RE in these regions.

As such the publication **addresses potential businesses and investors** – including manufacturers, technology providers, wholesalers, suppliers, project developers, operators, services companies, planning offices, consultancy firms, as well as financing institutions. The Regional Reports are both meant for those who are already active in the assessed RE markets, but also for those exploring new markets for their business activities. Of course, the publication also serves as a database with country-specific insights into the assessed African and Central Asian regions for interested actors from the public and civil sector.

The **geographical scope** of this publication is twofold: the **Regional Reports on Renewable Energies** focus on **West Africa and East Africa** which are mainly represented by developing countries and economies, and on **Central Asia** as a region predominantly characterized by **countries in transition**. All of these regions are promising markets for the RE industry and for potential investors as they offer remarkable, but still largely untapped RE potentials. Although market conditions which spur the promising RE potentials still need to be improved in almost all of the assessed countries, positive trends for the promotion and deployment of RE can be observed in many cases. Even in those countries, where the policy level still needs to be convinced of RE, political reformers more and more commit to take action for RE on the rise.

Deliverables

The **Regional Reports on Renewable Energies** showcase comprehensive, but still selective information on the specific characteristics of the energy sectors of the **30 assessed countries – 17 in West Africa, 5 in East Africa and 8 in Central Asia**. Key facts and figures on these energy markets and their RE potential is given in the **executive summary** of each regional report.

Each country analysis comprises an **introduction to the socio-economic, geographical and political background** of the country. It also includes an **overview** on the **national energy sectors**, including figures on power generation capacities, energy consumption and price levels as well as information on relevant market structures. This is followed by a presentation of the respective energy policy framework conditions. The chapter on **the status quo of RE** presents data on country-specific technical and economic RE potentials, as well as and on current RE investment projects and possible **RE business opportunities**. In addition, the report gives information on market challenges and risks. A snapshot of the **relevant actors of the energy sector** (private, as well as public, civil and scientific) is also included and serves as a source for identifying potential (business) partners for RE projects. Finally, each country analysis includes a **bibliography** and an **annex** containing additional graphs and figures on RE sources and technologies.

The presented regional reports series is part of the Energy-policy Framework Papers of the "Energy and Transport" section of Deutsche Gesellschaft für Technische Zusammenarbeit (gtz) GmbH.

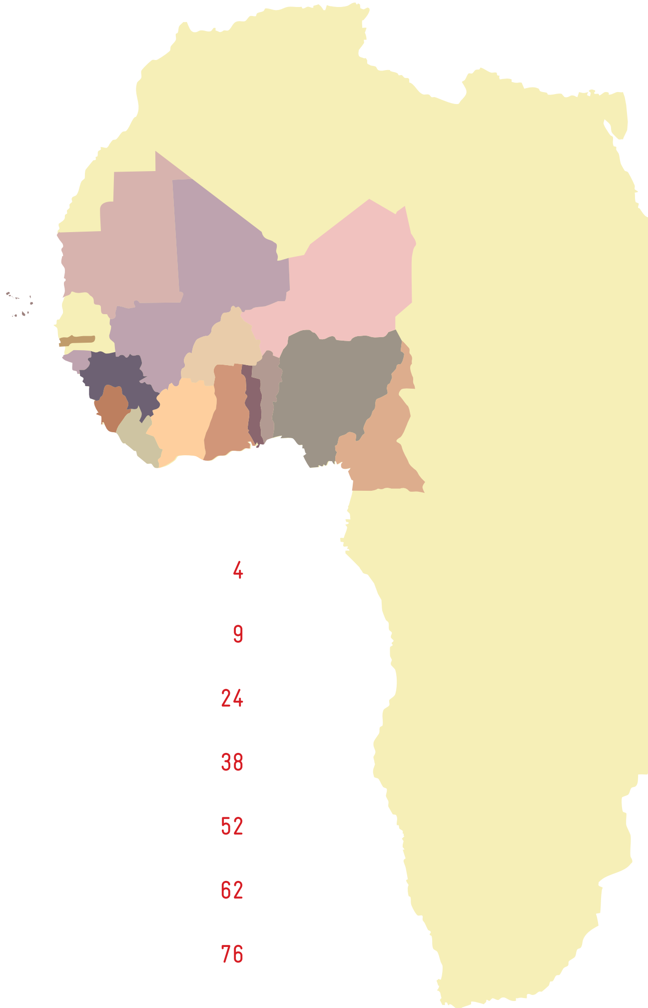
The Regional Reports are also available for free of charge download on the GTZ website:
http://www.gtz.de › Themes › Sustainable Infrastructure › Energy › Renewable Energy › Further information › Downloads; or
http://www.gtz.de/de/themen/umwelt-infrastruktur/energie/4552.htm

The editorial team – Eschborn, December 2009

Acknowledgements

The editorial team – also on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ) – would like to thank all contributors, in particular all authors and coordinators (especially Anton Hofer of WIP, Rafael Wiese of PSE AG and Dr. Klaus Jorde of Entec AG) who have contributed to this publication by sharing their valuable insights and experiences.

Special thanks also to Rolf-Peter Owsianowski for his efforts to identify appropriate local experts as authoring contributors, to Barbara Meder for editing of the reports and to "die Basis – Kommunikation. Ideenwerk. Design." for the design of the publication.



CONTENTS REGIONAL REPORT WESTAFRIKA

NOTE:
Main references/indications of sources are provided in the respective country chapters and not in this summary of the country chapters.

REGIONAL REPORT SUMMARY – BASED ON THE 17 COUNTRY CHAPTERS

BENIN, BURKINA FASO, CAPE VERDE, CAMEROON, COTÊ D'IVOIRE, GAMBIA, GHANA, GUINEA, GUINEA BISSAU, LIBERIA, MALI, MAURITANIA, NIGER, NIGERIA, SENEGAL, SIERRA LEONE, TOGO

Author of the Regional Report Summary
Anton Hofer (MSE, Dipl.-Ing./FH, M.A.)
Wip-Renewable Energies
www.wip-munich.de
Munich, Germany

ACRONYMS AND ABBREVIATIONS

REGIONAL REPORT SUMMARY

ECOWAS	ECONOMIC COMMUNITY OF WEST AFRICAN STATES (COMMUNAUTÉ ÉCONOMIQUE DES ÉTATS DE L'AFRIQUE DE L'OUEST – CEDEAO)
EBID	ECOWAS BANK FOR INVESTMENT AND DEVELOPMENT
GDP	GROSS DOMESTIC PRODUCT
USD	UNITED STATES DOLLAR
RE	RENEWABLE ENERGIES
WAPP	WEST AFRICAN POWER POOL
CHP	COMBINED HEAT AND POWER
ERC	ENERGY REGIONAL CENTER
EE	ENERGY EFFICIENCY
UNIDO	UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
GEF	GLOBAL ENVIRONMENTAL FACILITY

MEASUREMENTS

KWH	KILOWATT HOUR
KM	KILOMETER
M²	SQUARE KILOMETER
MW	MEGAWATT HOUR

1 INTRODUCTION TO THE REGION OF THE ECONOMIC COMMUNITY OF WEST AFRICAN STATES (ECOWAS)

1.1 GENERAL OVERVIEW

The Economic Community of West African States (ECOWAS or in French: CEDEAO)[1] is a regional alliance of fifteen countries[2] established in 1975. As defined in Article 3 of the ECOWAS Treaty[3], the overall goal of the community is to promote co-operation and integration in order to establish an economic union in West Africa. The union intends to raise the living standards of its inhabitants, to maintain and enhance economic stability, to foster relations among the member states and to contribute to the progress and development of the African continent.

In order to achieve these aims, ECOWAS shall, by stages, ensure both the harmonization and coordination of all national policies and the promotion of integration programs, projects and activities focusing on various sectors (especially food, agriculture and natural resources, industry, transport and communications, environment trade, finance, taxation, economic reform, science, technology, legal matters and energy). Moreover, ECOWAS aims at the establishment of a common market with a total liberalization of trade between its member states. Structure-wise, the Economic Community of West African States consists of four major institutions, namely:

- The Commission
- The Community Parliament
- The Community Court of Justice
- ECOWAS Bank for Investment and Development (EBID)

The Commission (formerly "ECOWAS Secretariat") and the ECOWAS Bank for Investment and Development (formerly "Fund for Cooperation, Compensation and Development") are the two central institutions to support the implementation of programs and development projects in ECOWAS member states.

1.2 GEOGRAPHIC AND ECONOMIC CONDITIONS OF THE ECOWAS REGION

According to official figures issued by ECOWAS, the current population is estimated at 220 million inhabitants, which amounts to roughly 40 % of the total population of Sub-Saharan Africa. It is estimated that by 2015, about 325 million people will live in the ECOWAS region. The area of the ECOWAS territory is 6.1 million km². The Gross Domestic Product (GDP) of ECOWAS reaches a total of 106.7 billion USD.

1 A PRESENTATION WITH MORE DETAILED INFORMATION ON ECOWAS IS AVAILABLE ON THE ECOWAS WEBSITE: WWW.COMM.ECOWAS.INT/SEC/EN/PPS/ECOWAS.PPS

2 BENIN, BURKINA FASO, CAPE VERDE, CÔTE D'IVOIRE, GAMBIA, GHANA, GUINEA, GUINEA BISSAU, LIBERIA, MALI, NIGER, NIGERIA, SENEGAL, SIERRA LEONE, TOGO. ALTHOUGH MAURITANIA IS NO LONGER A MEMBER STATE OF THE ECOWAS (MAURITANIA LEFT THE COMMUNITY IN 2001), IT IS ALSO CONSIDERED AS COUNTRY CHAPTER OF THE REPORT "RENEWABLE ENERGIES IN WEST AFRICA – REGIONAL REPORT AND MARKET ANALYSIS".

3 ECOWAS, AS OF 2007

2 ENERGY MARKET OF THE WEST AFRICAN COMMUNITY REGION

2.1 OVERVIEW OF ENERGY SITUATION AND RENEWABLE ENERGY POTENTIAL

Currently, the ECOWAS region suffers from a huge demand/supply gap (more than 40 %) in modern energy services. About 64 % of the total energy supply are covered by thermal power plants, 31 % are generated with Hydro Power, 5 % come from imports and other energy resources such as Renewable Energies (RE). With a total contribution of 80 %, traditional biomass is currently a vital part of the primary energy consumption within ECOWAS. Moreover, the region is strongly dependent on fossil fuels. Less than 10 % of the rural population have access to electricity and modern energy services. Therefore it is necessary to utilize local and RE sources in order to enhance the energy situation within the ECOWAS region.

The hydroelectricity potential of the ECOWAS region is estimated at 25,000 MW. Up to now, only 16 % are developed and utilized. With regard to the utilization of wind energy, considerable wind speeds are encountered along the coasts and the desert zones. The average solar irradiation in West Africa offers a significant solar energy potential of 4–6 kWh/m²/day.

2.2 EXISTING IMPEDIMENTS AND DEFICIENCIES

The development of existing RE sources is currently neither limited by missing local availability nor by lack of technical feasibility. The illustrated potentials for sustainable RE supplies, however, are rather handicapped by a variety of obstacles and deficiencies in the ECOWAS region:

- Financial aspects (higher costs of RE as compared to fossil fuels, lack of financing facilities)
- Lack of local experts and skilled personnel (financial, technical and administrative area)
- Limited production capacity for technical installations & equipment (expensive imports)
- Inefficient institutional structures (energy services in rural areas and peri-urban areas)
- Bureaucratic and legal barriers (lack of tax incentives and feed-in-tariffs)
- Little interest to diversify the existing energy mix and the energy supply structure
- Lack of strategic planning and coordination in the energy sector and energy markets

3 (RENEWABLE) ENERGY FRAMEWORK CONDITIONS AND POLICY INITIATIVES

Faced with significant deficiencies in the energy supply sector, the ECOWAS member states have adopted ambitious regional policies, committing themselves to harmonize national energy legislation, to increase the autonomy of energy supply and to significantly raise the level of access to modern energy services. In order to achieve these goals, various policy initiatives and programs have been developed in the ECOWAS region.

The Common Energy Policy covers the introduction of an integrated energy planning system, the promotion of RE and the speeding up of the connection of interlinked systems for electricity grids in cooperation with ECOWAS.

The ECOWAS Energy Protocol[4] is a legal text formalizing the juridical framework of enterprises in the energy sector. It was designed as a guarantee for foreign direct investments in the energy sector. The adoption and ratification of this convention is an eligibility criterion for access to the World Bank Facility for the West African Power Pool (WAPP).

The White Paper[5] aims to provide energy access to at least half of the population living in rural and peri-urban areas by 2015. It has formulated three major specific objectives: (i) the reinforcement of regional integration, (ii) the promotion of coherent, institutional and political frameworks for improved access to energy services in the ECOWAS region and (iii) the development of coherent energy programs with focus on poverty reduction. Within its specific objectives, the White Paper focuses on capacity building of private and public actors, the enhanced availability of soft loans, grants and private sector funds for energy services in rural or peri-urban areas, the improved exchange, promotion and dissemination of sub-regional experiences in view of energy services and the promotion of local energy production and energy services.

The West African Power Pool (WAPP)[6] aims at the integration of national electricity grids in a number of West African countries (i. e. Nigeria, Benin, Togo, Ghana, Côte d'Ivoire, Niger, Burkina Faso and Mali) by building up more than 5,600 km of interconnection lines. The medium- to long-term goal is to guarantee the citizens of ECOWAS member states a stable and reliable electricity supply at affordable costs. In order to reach this goal, the framework conditions of national energy markets within the ECOWAS region need to be harmonized.

The West African Gas Pipeline aims to strengthen the energy supply through a gas pipeline system. Based on natural gas imports from Nigeria, it is planned that Combined Heat and Power (CHP) plants in Benin, Ghana and Togo (total capacity of 3,000 MW) will be supplied via a 678 km gas pipeline network.

4 OUTLOOK AND ACTIVITIES FOR RENEWABLE ENERGIES

Based on the White Paper's goal for improving energy access in West Africa, the ECOWAS will shortly establish a West African ECOWAS Regional Center for Renewable Energy and Energy Efficiency (ERC) hosted by Cape Verde. The specific goal of the center is to provide a platform for leading and coordinating the implementation of the ECOWAS Regional White Paper on Energy Access focusing on RE and also on Energy Efficiency (EE). This will be facilitated through the center's four major activities: funds mobilization, policy and capacity development, knowledge management and communications and the demonstration of RE/EE technologies.

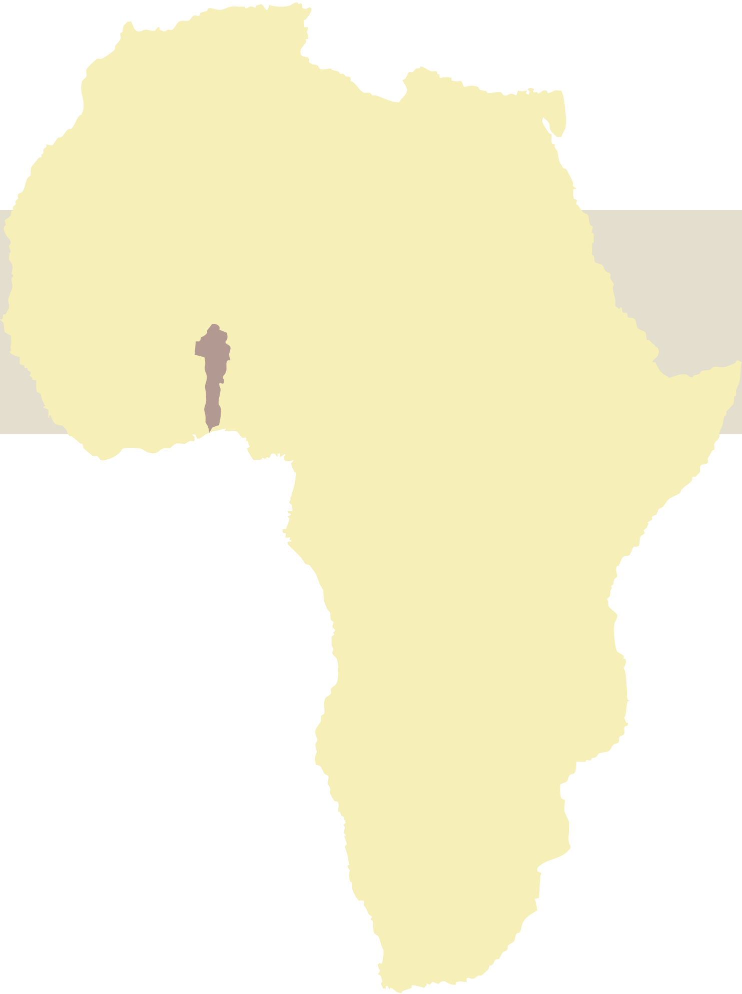
One of the major financing and promotion programs is the recently initiated Energy Program for West Africa issued by the United Nations Industrial Development Organization (UNIDO) and the Global Environmental Facility (GEF) which comprises – besides the 15 ECOWAS countries – also Mauritania, Chad and Burundi. The program with an overall project budget of 46 million USD focuses on three main objectives: (i) taking a programmatic approach in promoting RE and EE projects at the national level in the countries of the region, (ii) scaling up access based on RE and promoting EE measures in the industry, households and the public sector and (iii) creating markets to catalyze private sector investments. Among the main program components are demonstration projects, support for policy or regulatory framework, capacity building and RE based mini-grids for productive uses in rural areas.

A more detailed insight into the individual country RE market situations in the ECOWAS region is provided by the 16 analyses[7] of this regional report on RE in West Africa.

4 ECOWAS, AS OF 2003
5 ECOWAS/UEMOA, AS OF 2005
6 SEE WEBSITE OF THE WAPP: WWW.ECOWAPP.ORG
7 THE REGIONAL REPORT WEST AFRICA DOES NOT INCLUDE A SEPARATE COUNTRY CHAPTER FOR THE ECOWAS COUNTRY OF SENEGAL, AS THE KEY INFORMATION ON THE SENEGALESE RE MARKET IS ALREADY AVAILABLE BY TWO OTHER STUDIES EDITED AND COMPILED BY GTZ ON BEHALF OF THE GERMAN GOVERNMENT. REFERENCE: GTZ/TERNA (2004): ENERGY POLICY FRAMEWORK CONDITIONS FOR ELECTRICITY MARKETS AND RENEWABLE ENERGIES – 21 COUNTRY ANALYSES, PART SENEGAL (IN ENGLISH) => WWW.GTZ.DE/DE/DOKUMENTE/DE-PROJEKTERSCHLIESSUNG-SENEGAL-LAENDERREPORT.PDF ‹WWW.GTZ.DE/DE/DOKUMENTE/DE-PROJEKTERSCHLIESSUNG-SENEGAL-LAENDER-REPORT.PDF›

5 BIBLIOGRAPHY

- ECOWAS (2007): Treaty of ECOWAS (www.comm.ecowas.int/sec/index.php?id=treaty&lang=en)
- ECOWAS (2003): ECOWAS Energy Protocol A/P4/1/03 (www.comm.ecowas.int/sec/en/protocoles/WA_EC_Protocol_English-_DEFINITIF.pdf)
- ECOWAS/ UEMOA (2005): White Paper for a regional policy (www.gm.undp.org/Reports/ECOWAS%20energy%20white%20paper.pdf)
- West African Power Pool, WAPP, www.ecowapp.org



COUNTRY CHAPTER: BENIN

Author of Country Chapter
Daniel Finagnon Assogba (Dipl.-Ing.)

Coordination and Review of the Country Chapter
Anton Hofer (MSE, Dipl.-Ing./FH, M.A.)
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS BENIN

ACRONYMS AND ABBREVIATIONS

BENIN

ABERME	Agence Béninoise d'Electrification Rurale et de la Maîtrise (Benin Agency for Rural Electrification and Energy Control)
ACP	Africa, Caribbean, Pacific
AFD	Agence Française de Développement (French Development Agency)
AU	African Union
BIC	Bénéfices Industriels et Commerciaux (tax on industrial and trade benefits)
BOAD	Banque Ouest Africaine de Développement (West African Development Bank)
CBRST	Centre Béninois de la Recherche Scientifique et Technique (Beninese Scientific and Technical Research Center)
CCIB	Chambre de Commerce et d'Industrie du Bénin (Beninese Chamber of Trade and Industry)
CEB	Communauté Electrique du Bénin (Beninese Electricity Community)
CENAPI	Centre National de la Propriété Industrielle (National Intellectual Property Center)
CFE	Centre de Formalités des Entreprises (Enterprises Formality Center)
CIA	Central Intelligence Agency
DGE	Direction Générale de l'Energie (General Directorate of Energy)
ECOWAS	Economic Community Of West African States
EDF	Electricité de France (Electricity of France)
EU	European Union
GDP	Gross Domestic Product
HDI	Human Development Index
IDA	International Development Association
IEPF	Institut de l'Énergie et de l'Environnement de la Francophonie (French Speaking Countries Environment and Energy Institute)
IMF	International Monetary Fund
INSAE	Institut National de Statistique et de l'Analyse Economique du Bénin (National Institute of Statistics and Economy Analysis)
IPC	Investments Promotion Center
IPP	Independent Power Producer
IUT	Institut Universitaire de Technologie (University Technology Institute)
LIFAD	Laboratoire d'Ingénierie, de Formation et d'Assistance en Développement Local (Laboratory of Engineering, Training and
Local	Development Association)
LPG	Liquefied Petroleum Gas
NGO	Non-Governmental Organization
MIC	Ministère de l'Industrie et du Commerce (Ministry of Industry and Trade)
MEE	Ministère de l'Energie et L'Eau (Ministry of Energy and Water)
NDF	Nordic Development Fund
OHADA	Organisation pour l'Harmonisation en Afrique du Droit des Affaires (Organisation for the Harmonization of Business Law in Africa)
ONAB	Office National du Bois (National Wood Ressources Office)
PFSE	Projet de Fourniture de Services d'Energie (Energy Services Provided Project)
PV	Photovoltaic
RE	Renewable Energy
RPTES	Review of Politics and Traditional Energy Sector
SBEE	Société Béninoise d'Energie Electrique (Beninese Electric Energy Company)
S.I. e.	Système d'Information de l'Energie du Bénin (Energy Information System Benin)
SONACOP	Société Nationale de Commercialisation des Produits Pétroliers (National Oil Company)
SUCOBE	Sucrerie Complant du Bénin
TBE	Table of Board of Energy
UAC	Université d'Abomey-Calavi (Abomey-Calavi University)
UNDP	United Nations Development Programme
USD	United States Dollar
VAT	Value Added Tax
WAEMU	West African Economic and Monetary Union

MEASUREMENTS

GWh	gigawatt hour (1 GWh = 1,000,000 kilowatt hours (kWh))
km^2	square kilometres
MW	megawatt (1 MW = 1,000 kW)
m^3	cubic meter
mm	millimeters
toe	tons of oil equivalent
kV	kilovolt
m/s	meters per second
€	Euro

SUMMARY

The Country Study of Benin is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Benin. The study is structured as follows:

Chapter one provides **Background Information on Benin**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic andsocio-economic conditions of Benin.

Chapter two summarizes facts and figures of **Benin's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Benin. This includes an overview of support mechanisms for photovoltaic (PV) as well as existing regulations, incentives and legislative framework conditions concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Benin.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Benin.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Benin is a West African country surrounded by Togo in the West, Nigeria in the East, Burkina Faso and Niger in the North. The country's territory comprises 112,620 km² with an estimated population of about 8,532,000. The capital of Benin is Porto Novo.

MAP OF BENIN

Benin has four main geographical regions. The southern region is a narrow coastal zone fringed in its North by a series of interconnected lagoons and lakes with only two outlets to the sea. In the Northwest of Benin there are forested mountains. The major part of the country is influenced by transitional tropical conditions. The dry season starts in November and lasts until the beginning of April. The rainy season covers the period of April to October. The southern part of the country (the coastal zone), is influenced by a northern transitional equatorial climate, marked by a long dry season from November to the end of March, a first rainy season from April to July, a small dry period in August, and a second rainy season in September and October. The average rainfalls vary between 1,400 mm per annum in the south to 850 mm in the North.

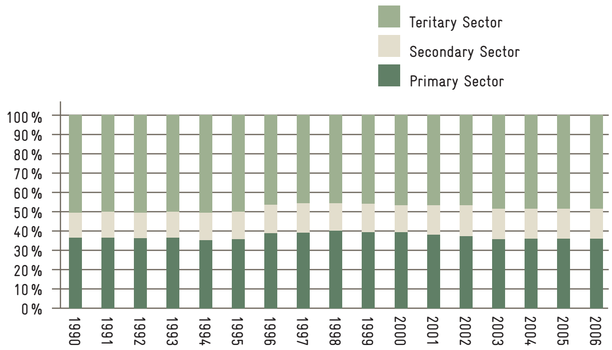
1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

Benin gained its independence from France in 1960. After the National Conference and a referendum, several democratic reforms were adopted in February 1990. Free elections were established in 1991, marking the transition to a political multiparty system with a presidential regime. The constitution of Benin guarantees human rights and individual freedom. The total population of Benin (as of 2008) comprises 8,532,000 inhabitants. The population structure includes two distinctive features: a very young population (55.6 % are less than 17 years old) and a feminine dominance of about 51.5 %. The spatial distribution of population is highly irregular, as about 45.5 % of the population are resident in six departments in the South of Benin equaling an area of only 10 % of the country's territory. The share of urban population adds up to 38.85 %.

The GDP of Benin amounted to 1,077 billion Euros in 1998, while in 2005 it accounted for 1,603 billion Euro, at constant market prices in both years comparable to those in 1985. Between 1998 and 2005, the annual growth was about 5.85 %. Figure 2 illustrates the development of the sector-based components of the GDP.

FIGURE 2

Development of GDP by Sectors



Source: INSAE data compiled by the author, as of 2008

According to the 2007/2008 World Human Development Report[1], the country ranks at position 163 out of 177 with a HDI of 0.437 and a GDP per capita of USD 1,141. Table 1 illustrates the levels of poverty on the rural, urban and national level of Benin in 2002 and 2006. The average monetary poverty per inhabitant was analyzed according to the usual indicators of incidence (P0), of depth (P1) and of severity (P2) for the exemplary years of 2002 and 2006.

TABLE 1

Incidence, Depth and Severity of Poverty by Area

	2002			2006		
Areas	P0	P1	P2	P0	P1	P2
Urban (%)	23.60	0.11	0.11	27.02	0.11	0.06
Rural (%)	31.60	0.11	0.06	40.60	0.15	0.08
National (%)	28.50	0.11	0.06	36.80	0.14	0.07

Source: IMF, 2008, p. 26

1 UNITED NATIONS DEVELOPMENT PROGRAM (UNDP)–
HUMAN DEVELOPMENT REPORTS (WWW.HDR.UNDP.ORG)

2 ENERGY MARKET IN BENIN

2.1 OVERVIEW OF THE ENERGY SITUATION

Benin is characterized by a predominance of biomass energy in the overall energy mix.

TABLE 2

Energy Mix of Benin

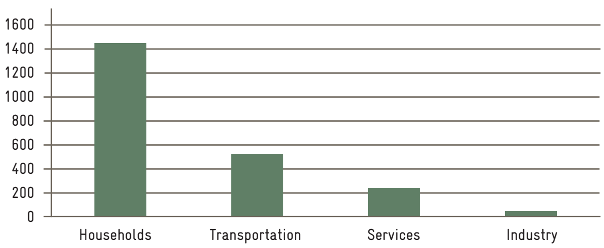
	BIOMASS	PETROLEUM PRODUCTS	ELECTRICITY
Consumption (toe)	1,338,714	866,540	50,628
Contribution (%)	59.40	38.40	2.20

Source: S.I.e. Benin, as of 2006

The major part of the total energy consumption can be allocated to households, with a total of approximately 63.9 %. The transport sector accounts for 23.2 %, the service sector for 10.6 % and the barely developed industry sector of Benin consumes about 2.3 %. Figure 3 visualizes the energy consumption per sector, while Figure 4 presents the detailed consumption of the industry sector.

FIGURE 3

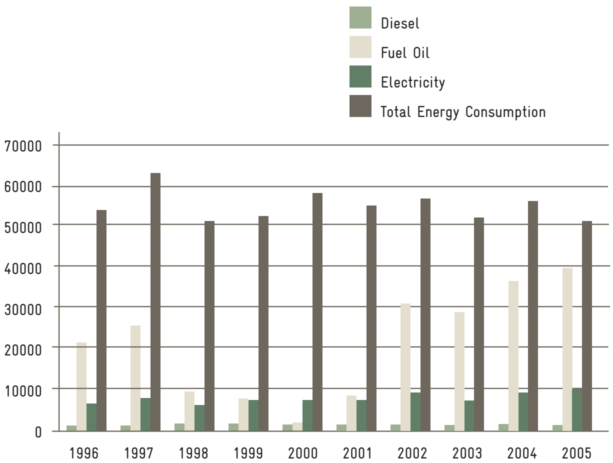
Energy Consumption per Sector (toe)



Source: S.I.e. Benin with data from DGE, as of 2006

FIGURE 4

Energy Consumption of the Industry Sector



Source: S.I.e. Benin with data from DGE, as of 2006

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

The electricity sector of Benin has a total production capacity of 97,484 MW; only 60 MW, however, are continuously available. The existing shortage in energy production capacity results in an insecurity of power supply (mainly caused by a lack of production capacities) and has forced industrial enterprises to set up stand-by power generators of their own. In 2007, the total power output of the National Power Utility was estimated at 180 GWh. The electricity sector of Benin is state-owned and managed by the Benin National Power Utility (SBEE), the exclusive owner of thermal power stations and the national electricity network. Figure 5 shows the national electricity production between 1996 and 2005; Figure 6 presents the electricity consumption by sector.

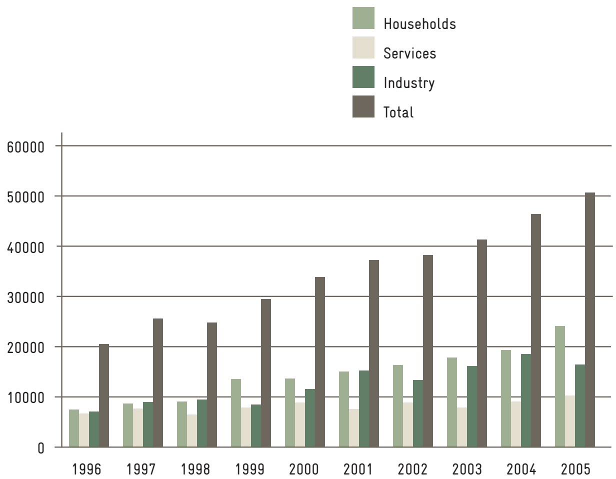
FIGURE 5

National Electricity Production (MWh)

Source: S.I.e. Benin with data from DGE, as of 2006

FIGURE 6

Electricity Consumption by Sector (MWh)



Source: S.I.e. Benin, as of 2006

Since its foundation in 1973, SBEE has been changing electricity tariffs four times. The tariff structure, however, remained the same. The electricity tariffs are appointed by the Government and are standardized throughout Benin. The detailed electricity prices are summarised in table 3.

Petroleum Sector

Benin has no national oil refinery. Therefore, all petroleum products are imported to Benin via licensed (the national oil company Société Nationale de Commercialisation des Produits Pétroliers – SONACOP) and unlicensed (informal market) importers. As the majority of imports are carried out by unlicensed importers, the respective numbers need to be estimated. The overall amount of imported petroleum products reached 837,000 tons in 2005. Table 4 indicates figures of the national petroleum product consumption of 2005.

TABLE 3

Electricity Tariffs for Different Types of Use

TYPE OF USE	SOCIAL SLICE		SLICE 1		SLICE 2	
	Quantities invoiced	Price/kWh	Quantities invoiced	Price/kWh	Quantities invoiced	Price/kWh
Domestic use (light, air-condition etc.)	0–20 kWh	0,08536 €	21–250 kWh	0,12957 €	>251 kWh	0,14482 €
Professional use (shops, restaurants, hotels etc.)	total consumption	0,134.15 €	total consumption	0,134146 €	total consumption	0,13415 €

Source: SBEE, as of 2008

TABLE 4

National Petroleum Product Consumption in 2005 (tons)

FUEL-OIL	DIESEL	KEROSENE	GASOLINE	BUTANE
40,526	118,190	294,536	376,229	7,609

Source: S.I.e. Benin with data from DGE, as of 2006

TABLE 5

Prices of Petroleum Products

PRODUCT	PRICE
Gasoline	0.533 Euro/litre
Kerosene	0.533 Euro/litre
Diesel	0.572 Euro/litre
LPG	0.640 Euro/kg

Source: Ministry of Industry and Trade, as of February 2009

Benin is highly dependent on foreign imports of petroleum products. In 2005, these imports accounted for 2.2 % of the country's GDP (about 33.54 million €). Benin has several crude oil reserves that are officially subdivided in 17 blocks. Seven blocks have already been granted to companies who are currently actively exploring existing resources. From 1982 to 1998, Benin has exploited a small offshore oil field. The cumulated production is an estimated 22 million barrels of crude oil. Potential reserves are assessed at more than 5 billion barrels of crude oil and more than 91 billion m^3 of natural gas. Therefore, several multinational oil companies are investigating in the availability and sites of local reserves.

Benin's tax policy allows selling electricity and petroleum products at the same price all over the country. Prices are officially fixed by the Government and maintained by cooperating with licensed distributors. The current prices of petroleum products are indicated in table 5.

1 LAW 027-2002/AN OF 9 OCTOBER 2002, REFERRING TO THE AUTHORIZATION OF BURKINA FASO'S ACCESSION TO THE KYOTOPROTOCOL (JOURNAL OFFICIEL NO.47 DU 21 OCTOBRE 2002)

Biomass Sector

The potential resources of wood energy were surveyed in 1999. The potential of wood energy includes contributions generated through National Reforestation Campaigns as well as allocations of the National Wood Resources Office. The objective of the dedicated firewood project is to increase the supply of wood energy on the market by enlarging plantations in the South of Benin. In this respect, the involvement of the National Wood Resources Office also contributes to the reduction of deforestation in the natural forests. Table 6 presents the current and future potential of traditional wood energy, while related prices (as of 2005) are indicated in table 7.

Besides traditional wood energy, a substantial potential of about 5 million tons is identified for agricultural residues. With regard to potential resources for biofuels, there are currently only few production capacities for ethanol. For example, Benin sugar plant "Sucrerie Complant du Bénin" (SUCOBE) produces ethanol at an output capacity of 40,000 tons of sugar and 4,200 m^3 of ethanol per year. Furthermore, the YUEKEN Benin International plant has an output of 3,000 m^3 of ethanol per year deriving from cassava. Due to the missing distribution infrastructure however, this amount is currently not used for energy or transport purposes.

Currently, Benin is characterized by the preponderance of traditional biomass energy. Future plans aim at modern biomass energy utilization like biogas, biofuels and various residues. In the following, a more detailed overview is presented.

Biogas

The utilization of biogas is currently only planned for the large-scale level. Pilot production units for biogas from animal residues are planned at former state-owned farms with financing from private investors. Several pilot electricity production units and three bigger production units (mainly using household residues) will be gradually implemented at 5 MW per time in 2011, 2018 and 2024.

Biofuels

Considering the assumed demand for diesel and the potential substitution with biodiesel, this development is expected to generate a market for the future. Various vegetable oils like pourghère oil, castor oil, palm oil, cotton, soy and peanut oil could be used for the production of biodiesel. In order to develop a market for biofuels, a regulatory, institutional and legal framework is needed to support the promotion and development of the sector.

In Benin there are few plants that can process vegetable oil to transport fuels. Two plants with a combined capacity of 210,000 tons are located in Bohicon. Furthermore, there is a palm oil plant in Hinvi. The capacities of these plants are not fully exploited yet (currently just about 30 % are being used).

A utilization of ethanol at an admixture rate of 15 % will create a market of about 33,000,000 liters per annum. Regulatory, institutional and legal provisions need to be implemented in order to support the creation of industrial ethanol plants in Benin. A recent survey identified a substantial potential of 46.5 million liters in 2011, 116 million liters in 2015 and 229 million liters in 2020. If the marketplace of the European Union is taken into account, these figures are even higher.

Wood and Agricultural Residues

In Benin, several wood processing plants produce waste and residues that could be used for energy production. The National Wood Resources Office (ONAB) plant in Bohicon, for example, creates about 14,000 m^3 waste and residues per year. Currently, these materials are used by households for cooking. They could, however, also contribute to the production of electricity from biomass. With regard to agricultural residues, it is planned to install power production units (5 MW by 2010, 30 MW by 2020) in cotton production areas of Benin.

The cashew nut industry in Benin is growing fast (average growth of 40–50 % per annum during the past 15 years)[2] and is currently the second largest source of agricultural exports (cotton being the most important). The cashew industry offers many attractive features, especially for the utilization of residues for energy production. Up to now, however, the actual processing is still a marginal activity in Benin, with some 97 % of raw cashew being exported. Furthermore, promising by-products such as cashew apple and shells are not being exploited yet. Especially the development of the ethanol production from the apple of cashew nuts in the North Zou and Collines districts is a very promising opportunity for the future.

TABLE 7

Medium Price of Traditional Wood EnergyPrices of Petroleum Products

WOOD	CHARCOAL
0.034 Euro/kg	0.533 Euro/litre

Source: LIFAD Survey, as of 2005

TABLE 6

Potential of Traditional Wood Energy

YEAR	1997	2002	2007	2012	2017	2022	2027
(tons/year)	6,719,469	6,554,064	6,392,754	6,235,436	6,082,012	5,932,386	5,786,462

Source: LIFAD Survey, as of 2005

2 DATA OF THE AFRICAN CASHEW ALLIANCE: WWW.AFRICANCASHEWALLIANCE.ORG.

2.3 MARKET ACTORS AND REGULATION STRUCTURES

Electricity Sector

The Ministry of Energy and Water (Ministère de l'Energie et l'Eau – MEE) is responsible for the overall electricity sector and all related policies in this field. Furthermore, it is in charge of managing the Hydro Power potential as well as all matters related to alternative energy sources in Benin. Besides the Ministry of Energy and Water, three main public operators are involved. The **Communauté Electrique du Bénin (CEB)** is the state-owned international electricity company of Benin and Togo. CEB is fully in charge of the production, distribution and import of electricity in both countries and is therefore jointly owned and managed by Benin and Togo. Furthermore, CEB is responsible for the development of the electricity infrastructure of both partner countries. The **Benin National Power Utility (SBEE)** is largely involved in the overall electricity distribution within the national territory of Benin. SBEE is also responsible for the development and upgrade of the interconnection of the North Togo/North Benin networks. The **Benin Agency for Rural Electrification and Energy Control (ABERME)** was founded in 2004 and is responsible for the implementation of policies in the field of rural electrification. ABERME aims to implement a wide spectrum of energy efficiency measurements in Benin.

Petroleum Sector

The MEE controls and supervises the petroleum sector of Benin. It is the major regulatory institution and decides all matters within this sector. Besides the Ministry of Energy and Water, several oil companies are involved in the petroleum sector of Benin. The national oil company SONACOP, together with several licensed companies such as TOTAL BENIN, TEXACO BENIN S. A. and ORYX BENIN S. A. is in charge of import and distribution activities in Benin. Furthermore, several unlicensed importers and distributors have created an informal market for petroleum products. Decree Nº 95–139 of May 3rd 1995 relating to the means of importing and distributing oil products puts the accent on safety measures for the importing, storage and distribution of oil products and their derivatives. Only the State has authority over this activity. The authorities of Benin have just approved of the installation of private companies. Official distributors need a license issued by the **Ministry of Industry and Trade** (Ministère de l'Industrie et du Commerce – MIC) to conduct their business.

Biomass Sector

The Ministry of Environment and Nature Protection is in charge of the management of forest resources and environment problems. The corresponding regulatory framework is currently being updated and improved in order to promote biofuels for local and national transport as well as renewable bioenergy in Benin. In reality, however, the biomass sector of Benin is basically governed by producers and traders of firewood and charcoals, the **National Wood Resources Office (ONAB)** and several wood processing and service companies. Furthermore, a number of NGOs are operating in Benin, especially in the field of reforestation and the rational use of the wood energy.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The existing policies for renewable energy aim to promote and develop the utilization of available RE resources in order to satisfy the demand of energy in remote and rural areas. The objective is to increase the national electricity production and to promote a significant contribution of RE to the overall energy supply of Benin. Therefore, the promotion of locally available RE resources will help to establish an energy supply with broad self-sufficiency. In particular energy from biomass will play a significant role in this process.

The strategy for an improved efficiency of wood energy utilization includes the eased access to cost-effective cooking stoves as well as the substitution of traditional, for example fossil fuel based methods with alternative energy resources. This is to significantly reduce the dependence on wood energy and to create regulated energy markets in the rural areas of Benin. The objective is to diversify the energy mix in order to meet the demand in a more sustainable way. Therefore, it is necessary to establish an adequate institutional, legal and regulatory framework that supports the development and implementation of RE. Although already defined in various policy and strategy documents of Benin, the promising sector RE does not always receive adequate and sufficient attention.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

In order to solve the problem of insufficient energy supply, several national initiatives have been started in Benin. This includes the PV electrification of 38 villages by the Beninese Agency of Rural Electrification with funds from the Islamic Development Bank and the national budget of Benin. Another initiative is the Energy Services Supply Project (PFSE) aiming to increase the access to modern and affordable energy services in urban and rural areas of Benin. Furthermore, the project is to reduce the deforestation, to promote renewable fuels and to diversify the overall energy supply of Benin. The project is financed by the International Development Association (IDA), the West African Development Bank (BOAD), the Nordic Development Fund (NDF), the Benin National Power Company (SBEE), the Benin Electric Community (CEB) and the Government of Benin.

Other initiatives are dealing with the implementation of new gas turbine power stations, the electrification of rural localities, the upgrading of existing Hydro Power plants, the implementation of PV installations and the utilization of modern biomass energy. With regard to increased energy efficiency and the diversification of the energy supply, several dedicated policies and strategies are currently under development. In order to reduce the utilization of small diesel generators, the Government is going to implement a project to interconnect urban and rural areas via the national power grid. This grid expansion includes one power line (161 kV) from Ouake to Bembereke and one (63 kV) from Djougou to Natitingou.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

The utilization of traditional biomass contributes significantly to the overall energy mix of Benin. On top of that, a significant potential of sustainable biomass resources is available for heat and electricity production. This includes residues from agricultural products as well as waste from agro-industries, food processing and households. These residues are estimated to be sufficient to produce about 1,500 GWh of electricity. In urban areas of Benin, substantial amounts of household refuse could be used for energy production. According to studies of the city of Cotonou, more than 700 tons of refuse would be available every day. The waste and residues from wood processing plants is identified as another potential source for electricity generation. Another significant potential lies in the cashew nut industry. Up to now, however, the actual processing is still a marginal activity in Benin. Especially energy relevant by-products such as cashew apple and shells are not utilized yet.

4.2 SOLAR ENERGY

The solar energy potential of Benin varies between 3.9 kWh/m² and 6.2 kWh/m², depending on the location. Table 8 presents selected PV installations in Benin.

TABLE 8

PV Installations in Benin

TYPE OF INSTALLATION/FUNDING SCHEME	NUMBER OF INSTALLATIONS	CAPACITY
PV units at villages, funded by Government	14	56 kW
PV units at villages, funded by Government & Islamic Development Bank	24	182 kW
PV unit at public health centres	n.a.	50 kW
Domestic use	n.a.	10 kW
Solar system for telecommunication	50	150 kW

Source: DGE and ABERME, as of 2002

4.3 WIND POWER

According to the available data of the National Meteorological Office, the wind speed varies between 3 and 6 m/s. More detailed information is not available; therefore it is not possible to give a complete overview of the existing potential.

4.4 HYDRO POWER

Benin has a significant potential of Hydro Power that can be used for electricity production. A recent survey shows that the potential of the Oueme River is sufficient to install twenty sites with a total capacity of 760 MW and an annual output of more than 280 GWh. Moreover, approximately 80 other sites are equipped with small-scale hydro power installations for rural electrification.

5 MARKET RISKS AND BARRIERS

In spite of already implemented mechanisms that support the investment in the energy sector, there are still some major obstacles to be found in this sector. It is, for example, difficult to register for a purchase agreement as potential investors have to discuss their application with two state monopolists (CEB for the production and the SBEE for the distribution of energy).

There are also some risks in legal aspects. These are, however, not a major constraint for investment in this field. Outdated technology, the lack of technical knowledge and inadequate finance are major barriers in the implementation of RE in Benin. Also, no incentive measures like exemption from taxes or other benefits are available for potential investors.

The high costs of RE equipment on the one hand and the low level prices for conventional energy on the other hand are not encouraging potential investors at all. Benin has several local experts in the field of RE mostly in technical departments, universities and research centers. There is, however, a need for technical cooperation in the energy sector.

The Government of Benin set up an Investment Facilitation Department in order to support cooperation and investment of the private sector and foreign investors. The Investment Promotion Center was established in order to assist investors in the setting-up of business, the identification of local partners and the correspondence with institutions. The Formalities Center of the Enterprises (CFE) supports investors during the foundation of an enterprise. Furthermore, several other departments are engaged to support the promotion of investment in the energy sector. Benin is implementing structural and economical reforms in order to promote private investment. Table 9 presents the results of the World Bank Ease of Doing Business Survey 2008 for Benin.

TABLE 9

"Ease of Doing Business"–Benin 2008 Ranking

TOPIC	RANKING
Ease of doing business	157
Starting a business	142
Dealing with construction permits	123
Employing workers	117
Registering property	120
Getting credits	141
Protecting investors	148
Paying taxes	162
Trading across borders	130
Enabling contracts	174
Closing a business	109

Source: "Ease of Doing Business", World Bank, as of 2008

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 10

List of Selected Business Partners

INSTITUTION	CITY	FIELD OF ACTIVITY	CONTACT
Electric Community of Benin (CEB)	Lome, Togo	Production, distribution and import of electricity	BP 1368, Lome, Togo Phone: +228 2215795
La Société Béninoise d'Energie Electrique (SBEE)	Cotonou	Import and distribution of electricity	01 BP 123, Cotonou Phone: +229 21312145
Société Nationale de Commercialisation des Produits Pétroliers (SONACOP)	Cotonou	Import, storage and distribution of petroleum products	01.BP 245, Cotonou Avenue Jean-Paul II Phone: +229 21311347
Society Oryx Benin	Cotonou	Import, storage and distribution of petroleum products	Cotonou Phone: +229 21306547
Society TOTAL	Cotonou	Import and distribution of petroleum products	08 BP 701, Cotonou Avenue Jean-Paul II
ENERDAS	Cotonou	Distribution and installation of solar systems and solar equipment	02 BP 8155, Cotonou Phone: +229 21301490
MIERT	Cotonou	Distribution and installation of solar systems and solar equipment	07 BP 1244, Cotonou Phone: +229 21325010
SOLARISS	Cotonou	Distribution and installation of solar systems and solar equipment	05-BP 24522, Cotonou Lot 4053 J Sodjeatinmè
Sucrerie Complant du Bénin (SUCOBE)– Benin sugar plant	Cotonou	Sugar and ethanol producer	BP 6, Cotonou Phone: +229 21305537
Yueken International Benin	Cotonou	Producer of ethanol from cassava roots	071 BP 75, Cotonou Lot 1436 Phone: +229 21384606
Investments Promotion Center (IPC)	Cotonou	Promotion and development of foreign investments in Benin	01 BP 2022, Cotonou Phone: +229 21303062 www.cpibenin.com
Formalities Center of the Enterprises Chambre de Commerce et d'Industrie du Benin	Cotonou	Business creation and modification	01 BP 31, Cotonou Phone: +229 21314386 www.ccibenin.org

TABLE 11

List of Selected Ministries of Benin

MINISTRY	ADDRESS	CONTACT PERSON
Ministry of Energy and Water	Av. Jean Paul VI 01 BP363 Cotonou Phone: +229 312429	Assogba Daniel
Ministry of Industry and Trade	Av. Jean Paul VI 01 BP363 Cotonou Phone: +229 21303024	Senou Louise
Ministry of Agriculture, Animal Husbandry and Fishing	Av. Jean Paul VI 01 BP363 Cotonou Phone: +229 300410	Gbehounou Galbert

7 BIBLIOGRAPHY

- African Cashew Alliance: (www.africancashewalliance.org)
- Association Nationale des Praticiens de la Microfinance du Bénin, Consortium ALAFIA (2002/2005)
- Analysis and Prospective Vision of the Electric Energy Sector in Benin (1998)
- CEB (1984): Report on Hydro Power: Togo and Benin Hydroelectric Potential Resources and Leading Plan of the Production and the Transportation
- Central Intelligence Agency – CIA (2009): World Fact Book (www.cia.gov/library/publications/the-world-factbook)
- Code on Water in the Republic of Benin (1987)
- Government of Benin (1997/1998): Compilation of the Laws on the Decentralization (law nº 97 – 028 on the orientation of the organization of territorial administration, law nº 97 – 029 on the organization of the communes, law nº 98 – 005 on the organization of communes having a particular status, law nº 98 – 006 on the communal and municipal electoral system, law nº 98 – 007 on the financial regime of the communes)
- Power Sector Development Policy and Strategy in Benin
- Government of Benin (January 2008): Financial law 2007 – 33
- INSAE (2008): Various sets of data
- LIFAD (1999): Annual Survey
- LIFAD (2005): Annual Survey
- Ministry of Agriculture, Animal Husbandry and Fishing (2008): Strategic Plan for Agricultural Sector Development in Benin
- Ministry of Environment (1998): National Program of Actions for Struggle Against the Desertification
- MEE (2003): Energy Policy and Strategy
- MEE (2004): Rural Electrification Policy
- Head State of Office (2008): Politics and Strategy Document on Electric Energy Sector Development in Benin
- Ministère Charge du Plan, de la Prospective et du Développement/INSAE (2004): Rapport de la Première Session Ordinaire de l'Année 2004, Cotonou (Population Census Report Benin of 2004)
- President Office (2007): Document of the Think-Tank on the Vision of the Electric Energy Sector
- Report on the development of ethanol gel fuel as cooking energy in the WAEMU (2007)
- SBEE (2007): Annual Report
- Direction Générale de l'Énergie – DGE (2006): Energy Information System in Benin
- International Monetary Fund – IMF (2008): Republic of Benin: Growth Strategy for Poverty Reduction, Country Poverty Reduction Strategy Paper for 2007 (www.imf.org/external/pubs/ft/scr/2008/cr08125.pdf)
- UNDP (2009): Human Development Reports (www.hdr.undp.org)
- World Bank (2008): Ease of Doing Business
- Government of Benin (2006): Strategic Orientations of Benin Development (2006–2011) Government Program

8 ANNEX

TABLE 12

Quantity of Residues and Potential Electricity Production

CROPS	AVAILABLE RESIDUES (TONS)	POTENTIAL (GWH/YEAR)
Local maize	2,453,952	1,962.6
Improved maize	742,233	593.6
Sorghum	518,429	407.1
Small millet	92,044	72,3
Rice	80,872	68.2
Cotton	1,378,619	1,577.7

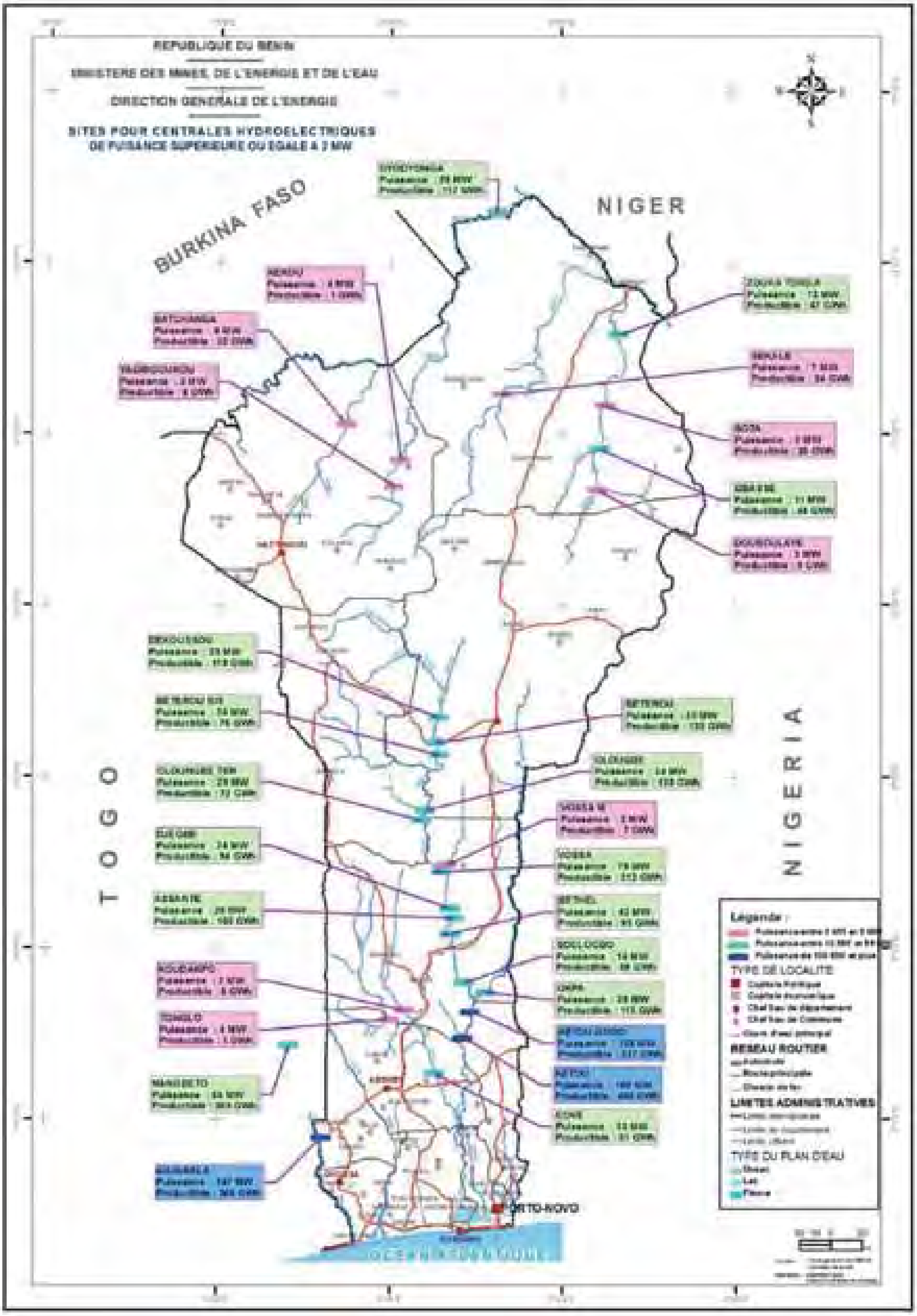
Source: S.I.e. Benin with data from DGE, as of 2006

FIGURE 7

High and Medium Voltage Electricity Grid in Benin

Source: Data compiled by the author, as of 2008

FIGURE 8
Potential Hydro Power Sites in Benin



Source: DGE, as of 2008

COUNTRY CHAPTER: BURKINA FASO

Authors of Country Chapter
Bassirou Quedraogo (Dipl. Eng.)
Souleymane Sow (Eng.)

Coordination and Review of the Country Chapter
Anton Hofer (MSE, Dipl.-Ing./FH, M.A.)
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS BURKINA FASO

ACRONYMS AND ABBREVIATIONS

BURKINA FASO

ADDAX	Name of supplier based in Geneva
AIJ	Activities Implemented Jointly
APEES	Association Pour la Promotion de l'Exploitation de l'Énergie Solaire (Association for the Promotion and Use of Solar Energy)
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)
CCA	Centres de Communication et d'Activités (Centers of Communication and Activities)
CET	Common External Tariff
CFAF	CFA Franc
CIF	Cost, Insurance and Freight price for import/export of petroleum products
CIFAME	Commission Intersectorielle de Facilitation de l'Approche Multisectorielle dans le Domaine de l'Énergie (Interdepartmental Committee for Multisector Approach Facilitation in the Sector of Energy)
CILSS	Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel (Interstate Committee for Desertification Control)
DDO	Direct De-oxygenation (Fuels for Electricity Generation)
DMN	Direction de la Météorologie Nationale (National Direction of Meteorology)
ERD	Electrification Rurale Décentralisée (Decentralized Rural Electrification)
FDE	Fonds Développement de l'Électrification (Electrification Development Fund)
GDP	Gross Domestic Product
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation Agency)
IRSAT	Institut de Recherches en Sciences Appliquées et Technologies (Research Institute of Applied Sciences and Technology)
LBN	Libre Blanc National (National White Book Investment Plan)
MEPRED	Mainstreaming Energy for Poverty Reduction and Economic Development Project
n.a.	not applicable
PNGT	Programme Nationale de Gestion des Terroirs (National Community Land Management Program)
PRS	Programme Régional Solaire (Regional Solar Energy Program)
PV	Photovoltaic
RE	Renewable Energies
RPTES	Regional Program for the Traditional Energy Sector
SIR	Société Ivoirienne de Raffinage (name of Ivorian Refinery Company)
SME/SMI	Small and Medium Sized Enterprises/Small and Medium Sized Industries
SSD	Sociétés de Services Décentralisées (Societies of Decentralized Services, e.g. CCA of Gomboro, Bognounou & Bokin)
TPA	Taxe Patronale et d'Apprentissage (Employers' and Learning Tax)
VAT	Value Added Tax
WAEMU	West African Economic and Monetary Union
XOF	West African CFA Franc (as opposed to XAF = Central African CFA Franc)

MEASUREMENTS

GWh	gigawatt hour (1 GWh = 1,000,000 kilowatt hours (kWh))
m^2	square meter
MW	megawatt (1 MW = 1,000 kW)
MVA	megavolt-ampere
Wp	Watt-peak (1 kWp = 1,000 Wp)

SUMMARY

The Country Study of Burkina Faso is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Burkina Faso. The study is structured as follows:

Chapter one provides **Background Information on Burkina Faso**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Burkina Faso.

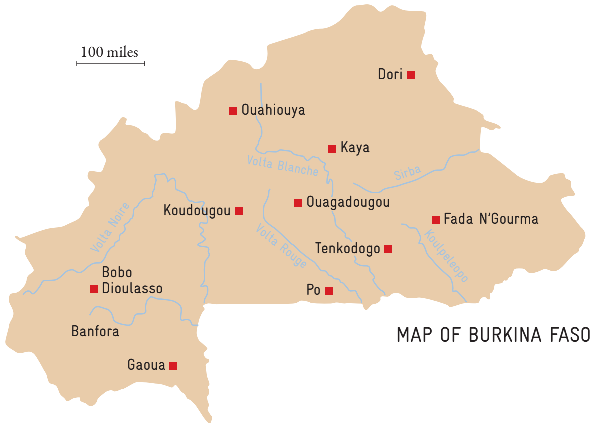
Chapter two summarizes facts and figures of **Burkina Faso's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Burkina Faso. This includes an overview of support mechanisms for Photovoltaic (PV) as well as existing regulations, incentives and legislative framework conditions concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Burkina Faso.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Burkina Faso.



MAP OF BURKINA FASO

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Burkina Faso is a landlocked country surrounded by Mali in the North, Niger in the East, Benin in the Southeast, Togo and Ghana in the South, and Côte d'Ivoire in the Southwest. The country's territory comprises 274,000 km² with an estimated population of about 13,200,000. The capital of Burkina Faso is Ouagadougou.

Burkina Faso has a primarily tropical climate with two seasons. The dry season lasts from eight months in the North to five or six months in the South, followed by the rainy season with up to 1300 millimeters of rainfall per annum. There are three climatic areas in Burkina Faso: the Sudanian zone with extensive rainfalls during the rainy season, the Sudano-Sahelian zone, located in the centre, and the Sahelian zone with a very short and moderate rainy season. The climatic situation of Burkina Faso includes long dry periods and therefore causes serious problems in view of sufficient water supply.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

Burkina Faso's constitution of 2 June 1991 established a semi-presidential government with a parliament. The presence of this new political stability allowed the country to set up various institutions that are now fully capable of acting. During the last decade the democratic process was being consolidated significantly. With approximately 13,340,000 inhabitants from of about sixty ethnic groups, Burkina Faso is one of the most populated countries of West Africa. Approximately 82.6 % of the overall population lives in rural areas. Burkina Faso is one of the poorest countries in the world with more than 40 % of the population still living below the poverty line. The annual per capita income is less than 1,000 Euro. Since the 1990s, Burkina Faso has been starting a series of economic reforms with the support of the World Bank and the International Monetary Fund in order to streamline the economy, stimulate economic growth and to reduce poverty.

2 ENERGY MARKET IN BURKINA FASO

2.1 OVERVIEW OF THE ENERGY SITUATION

Besides the utilization of Hydro Power, the electricity production of Burkina Faso mainly relies on diesel generators. Due to high production costs, fluctuating oil prices and a steadily increasing demand for electricity, Burkina Faso has started to import electricity from its neighbors Ghana and Côte d'Ivoire. Currently, only 10 % of the country are connected and have access to electricity. Due to the lack of fossil fuel resources, the country is completely dependent on fuel imports. In rural areas of Burkina Faso, energy requirements are almost completely met by the utilization of traditional biomass.

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

The electricity consumption of Burkina Faso is met by local production and imports from Ghana and Côte d'Ivoire. The monopolist SONABEL is fully responsible for the production, import and distribution of electricity in Burkina Faso. Table 1 shows characteristic data of the country's electricity sector.

TABLE 1

Characteristic Data of the Electricity Sector (2004–2007)

YEAR	2004	2005	2006	2007
Electricity imported (kWh)	96,183,557	125,337,589	139,323,910	123,910,359
Thermal production (kWh)	371,789,678	415,751,943	467,728,921	501,295,228
Hydro production (kWh)	101,458,980	100,472,905	80,668,451	111,416,699
Average cost per kWh (XOF)	113.19	117.89	121.21	129.62
Average cost per kWh (EURO)	0.17234632	0.17950268	0.18455781	0.19736311
Number of thermal plants	30	30	29	28
Number of hydro plants	4	4	4	4
Thermal power installed (MVA)	181	204	223	217
Hydro power installed (MW)	32	32	32	32

Source: SONABEL, as of November 2008

As indicated above, the electricity supply of Burkina Faso is still in the process of development. Especially the interconnection of rural areas is an important issue. Within the framework of the Electrification Development Fund (FDE), several villages have now got access to electricity, either via regular connection to the grid of SONABEL or decentralized diesel generators. Regarding this, the challenge is to provide rural areas with reliable and cost effective electricity.

The electricity tariffs in Burkina Faso vary according to the level of consumption and the type of utilization. Table 2 provides an overview of past (up to June 2005) and present electricity prices, tariff structures and consumption levels.

TABLE 2

Electricity Tariffs Provided by SONABEL

TARIFF STRUCTURE	CONSUMPTION LEVEL (kWh)	ENERGY CHARGE (XOF)	1 EURO = 656.759 XOF
		Sept. 2004 until June 2005	July 2006 until now
Tariff 1	Domestic		
Tariff A	0–50	73	75
	51–00	120	128
	Above 100	125	138
	Min. charge	1,132	1,132
Tariff B	0–50	86	96
	51–200	90	102
	Above 200	95	109
	Min. charge	381–637 (dep. on amperage)	457–764 (dep. on amperage)
Tariff 2	Domestic and locomotive tasks		
Tariff C	0–50	86	96
	51–200	95	108
	Above 200	100	114
	Min. charge	1,022–1,144 (dep. on amperage)	1,226–1,373 (dep. on amperage)
Tariff 3	Non-domestic (low voltage)		
Tariff D1 (non-industrial)	Peak Hour	143	165
	Full Hour	77	88
	Min. charge	7,115	8,538
Tariff D2 (Industrial)	Peak Hour	110	140
	Full Hour	51	75
	Min. charge	5,929	7,115
Tariff 4	Non-domestic (average voltage)		
Tariff E1 (non-industrial)	Peak Hour	121	139
	Full Hour	56	64
	Min. charge	7,115	8,538
Tariff E2 (industrial)	Peak Hour	110	118
	Full Hour	51	54
	Min. charge	5,929	7,115
Tariff 5	Street lighting		
Tariff F	Unique tariff	120	122
	Min. charge	n.a.	n.a.
One phase	5 A to 15 A	0	381
	Above 20 A	0	637
Three phase	10 A to 15 A	0	1,022
	Above 20 A	0	1,144

Source: SONABEL, as of November 2008

Petroleum Sector

The state-owned company SONABHY has supply contracts with the Ivorian Refinery Company (SIR) and ADDAX, a supplier based in Geneva. Furthermore, petroleum products are bought at international spot markets and imported through the Port of Lomé. Additional imports come from the Tema refinery in Ghana. SONABHY has two depots in Burkina Faso, one in Bingo (Ouagadougou) and the other in Bobo Dioulasso. The price structure of petroleum products is fully regulated by the Ministry of Trade. Fuels for electricity generation (DDO) as well as for cooking purposes are subsidized. For all other purposes, petroleum products are regularly taxed.

2.3 MARKET ACTORS AND REGULATION STRUCTURES

For the planning and regulation of the energy sector, various ministries are involved in Burkina Faso. The legal and regulatory framework of the energy sector is managed by the Ministry of Energy in close cooperation with the ministries in charge of trade, finance and environment. Moreover, the sectors of education, health, agriculture and hydraulics, also being related to the energy sector, are involved through the corresponding ministries in charge.

Electricity Sector

In November 2007, the Parliament adopted law N° 027/AN[1] in order to regulate the general electric energy supply of Burkina Faso. This law is to enhance the qualitative and quantitative security of energy supply. It also aims at the reduction of the overall electricity costs by liberalizing the production and distribution of electricity within Burkina Faso because currently the electricity sector is dominated by the monopolist SONABEL. In the overall reorganization of the electricity sector, several authorities are involved:

- The Ministry of Energy (responsible for energy policy, general control and planning)
- The Ministry of Trade (responsible for the fixation of the electricity price)
- Independent control authorities for electricity price fixation and consumer protection
- Authorities issuing regulations to support the overall price setting process
- Authorities providing fund management for the development of rural electrification

Petroleum Sector

The supply of petroleum products is fully organized and controlled by SONABHY, a state-owned company. The Ministry of Trade supervises SONABHY with regard to import and trade issues, while the Ministry of Finance coordinates and controls all financial matters. The Burkina Bureau of Mines and Geology is in charge of the quality control for retailed petroleum products. The overall tasks of SONABHY can be summarized as follows:

1 LAW 027-2002/AN OF 9 OCTOBER 2002, REFERRING TO THE AUTHORIZATION OF BURKINA FASO'S ACCESSION TO THE KYOTO PROTOCOL (JOURNAL OFFICIEL NO.47 DU 21 OCTOBRE 2002)

- Import, storage, conditioning and marketing of petroleum products and gas
- Construction of storage infrastructures to guarantee sufficient distribution
- Support of research activities for alternative energy resources and energy conservation

Biomass Sector

The biomass sector of Burkina Faso is mainly administrated by the Ministry of Environment that focuses on the sustainable production of firewood and charcoal. The Ministry of Trade regulates the transport of these commodities as well as related tax issues. The Ministry of Energy plans and regulates the firewood and charcoal demand in urban areas of Burkina Faso.

TABLE 3

Existing Support Mechanisms for PV Solar Energy

TYPE	PROJECTS
Beneficiary	– ERD Ganzourgou PV component, subsidies 40 % to 45 % – PV FONDEM/Kouritenga Appropriations, subsidizes 35 % to 45 %
Management committee	– National Community Land Management Program II (PNGT II)415.751.943 – Burkina Faso Plan – Activities Implemented Jointly (AIJ)/Regional Program for the Traditional Energy Sector (RPTES) – Spanish project – Regional Solar Energy Program I (PRS I), subsidizes 100 % of equipment costs
Users Association	– Kouritenga Energy services, subsidizes 90 % of equipment costs
Group or co-operative society	– COOPEL Electric systems, subsidizes 60 % of equipment costs
Private promoter	– Societies of Decentralized Services (SSD) ex. CCA of Gomboro, Bognounou & Bokin, subsidizes 100 % of equipment costs

Source: Césaire SOME, Modes of Funding Basic Energy Services for Burkina Faso, MEPRED, as of 2008

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

Despite the considerable potential of RE resources in Burkina Faso, up to now, there are no policies or strategic directions for the utilization of RE. However, a guiding principle for PV was expressly outlined in a program to supply basic energy services. Adopted in 2007, the Strategy for Rural Electrification strongly supports solar energy for the electrification of rural areas currently lacking connection to the SONABEL grid. The implementation of PV projects supports the promotion of solar energy and could help to achieve a supportive policy framework for RE in Burkina Faso. A list of selected projects and programs can be found in Chapter 8 (Annex). Table 3 provides an overview of already existing support mechanisms for PV.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

The new regional policy supporting the access to energy services for rural areas of Burkina Faso, known as the Regional White Paper, was approved of and adopted on 12 January 2006 by the ECOWAS Authority of Heads of States. The regional policy aims at an effective contribution of energy to achieve the Millennium Development Goals (MDG) and to reduce poverty. In order to reach this goal, all members of ECOWAS need to develop appropriate policies for energy services.

Recently, a national multiple stakeholder group, the Interdepartmental Commission of Multisector Approach Facilitation in the Sector of Energy (CIFAME) was formed by the Ministry of Mines and Energy by ministerial decree 06–21/MCE/SG/DGE[2] of 5 May 2006. After several meetings, the commission drafted the National White Paper (LBN) focusing on the provision of modern energy services to the entire population of Burkina Faso by the year 2020. Therefore, renewable energy is considered to be a major contributor to this ambitious goal.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

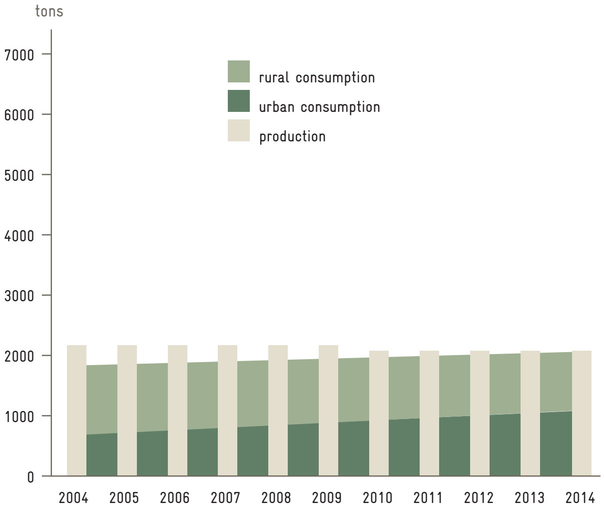
In many provinces of Burkina Faso, especially in the Sudano-Sahelian and Sudanian Zone, sufficient biomass resources are available.[3] Particularly the forest areas of the East, the West and Southwest are offering substantial biomass resources. An analysis of the correlation between rural/Urban consumption and production is shown in Figure 2 and Figure 3.

Within the framework of the "Biogas for Better Life" initiative, a feasibility study was carried out by GTZ in 20074 in order to identify the potential for biogas installations. The study envisages the installation of 15,000 biogas production units at farms and another 20,000 units in semi-urban households.5 The costs of such biogas installations vary between CFAF 450,000 and CFAF 650,000, depending on size and location. Moreover, it is foreseen to implement 2,000 biogas production facilities for agro-business SME/SMIs by 2015. A total of 25,000 units are to be realized by 2015 and more than 100,000 units by 2030. Table 4 presents the number of the projected biogas installations in Burkina Faso.

2 CIFAME, AS OF 2009
3 SEE ALSO COMPETE, 2008
4 GTZ, 2007
5 EXISTING INSTALLATIONS ARE BASED ON MULTIPLE TECHNOLOGIES (FLOATING DRUM, PLUG FLOW, FIXED DOME, BATCH, SEMI-BATCH). SEE ALSO GTZ, 2007, P. 43

FIGURE 2

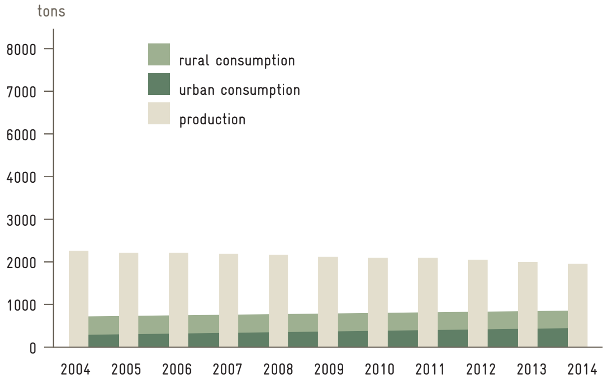
Rural/Urban Consumption and Production: Sudano-Sahelian Zone



Source: The Second Phase of National Plan of Electrification, as of 2006

FIGURE 3

Rural/Urban Consumption and Production: Sudanian Zone



Source: The Second Phase of National Plan of Electrification, as of 2006

TABLE 4

Projected Biogas Producing Units (2008–2030)

YEAR	2008	2009	2010	2011	2012	2013	2014	2015	2030
Phases	Pilot Phase		Implementation Phase						
Stages	0	I	II	III	IV	V	VI	Midterm	Long term
Demonstration	50	50							
Rural households	0	250	1000	2500	3000	3500	3750	14000	90267
Peri-urban households		100	400	1000	1500	3000	4000	10000	20000
Agro-business		100	120	160	170	200	250	1000	1343
Total	50	500	1520	3660	4670	6700	8000	25000	111610

Source: GTZ, as of July 2007

TABLE 5

Solar PV Installation Situation in 1998 and in 2002

YEAR	1998		2002	
Energy Services	Capacity (Wp)	Part (%)	Capacity (Wp)	Part (%)
Water pumping	209	19	205.20	15
Telecommunication	220	20	218.88	16
Lighting	671	61	0	0
Video and television	0	0	41.04	3
Lighting and refrigeration	0	0	902.88	66
Total	1,100	100	1,368	100

Source: Energy Services Financing, National White Paper, MEPRED, as of May 2008

4.2 SOLAR ENERGY

Burkina Faso has strong potential in the field of solar energy. According to a study of the Research Institute of Applied Sciences and Technology (IRSAT) and the Direction of National Meteorology (DMN), the average potential is estimated at 5,5 kWh/m^2/day for 3,000 to 3,500 hours per annum. Currently, PV solar systems are used for refrigeration, water pumping, communication, lighting, video and television. Table 5 provides an overview of capacities installed in 1998 and 2002.

4.3 WIND POWER

Due to the western location of Burkina Faso, the potential for wind power is very limited. The average wind speed ranges between 1 and 3 meters per second, while the maximum only to be obtained in the North of the country. Therefore, a large-scale utilization of wind energy is not advisable. However, small-scale generators at suitable sites and for selective purposes (e. g. water pumping, desalination systems etc.) might be reasonable.

4.4 HYDRO POWER

A survey of hydroelectric sites was done within the EDF-SONABEL – Centre National d'Equipement Hydraulique (National Centre of Hydraulic Equipment) study. The study covers large-scale hydroelectric sites as well as small-scale installations. The capacity ranges between 65 and 550 kW with 5 to 15 GWh/year and 550 to 1,700 kW with at least 5 GWh/year. The study shows that the Hydro Power potential of rural areas is sufficient for a decentralized electricity production. The study identifies some sites where the estimated production cost ranges between CFAF 100 and 175 per kWh, several other sites with estimated costs of at least CFAF 200 per kWh. The current hydroelectricity utilization covers about 20 % of the national electric consumption (incl. imports from Ghana and Côte d'Ivoire).

TABLE 6

Distribution of the Mini/Micro Hydro Sites in Burkina Faso

LOCATION	CAPACITY (MW)
Center, South	2.5
Boucle du Mouhoun	2.5
Southwest	5
Center, East	1.2
Center, West	6.25
East	7.5
Cascades	5
Sahel	3.125
Hauts Bassins	3.125

Source: Inventory of Burkina Faso Hydroelectric Sites, EDF-SONABEL-CNEH, as of March 1999

5 MARKET RISKS AND BARRIERS

Regarding market risks and barriers, there are several issues to be considered in Burkina Faso. Besides corruption, the lack of local expertise and outdated technical equipment, high costs for research and development as well as mostly capital intensive technologies[6] are substantial barriers for the broad implementation of RE. Due to the lack of financial resources, many companies in Burkina Faso need to operate with supplier credits or documentary credits. National financial institutes hardly contribute to the financing of projects aiming at the provision of energy services for rural areas. As to the access of rural population to basic energy services, only people banks – "Caisses Populaires" – offer very limited credits to facilitate the acquisition of PV kits. As other financial institutions charge high interest rates, such credits are not suitable to finance PV equipment. Even though there are microfinance institutions in Burkina Faso – which in general provide more adequate financial support services to low income groups and also SMEs – their credits are only granted for short term periods limited to a maximum of three years.

According to the World Bank's Ease of Doing Business report of 2008, Burkina Faso moved from position 164 in June 2007 to 148 in 2008. The country is one of the ten world leaders in regulatory reforms aiming to facilitate business activities. Burkina Faso, for example, reduced the corporate tax rate from 35 to 30 percent and the dividend tax from 15 to 12.5 percent. Table 7 provides an overview of the country specific rating.

In terms of tax incentives, the import of energy equipment is subject to the WAEMU common external tariff (CET). The country's value added tax (VAT) rate is currently 18 % while the employers and training tax (TPA) is 4 % (8 % for foreigners).

TABLE 7

Burkina Faso – Ease of Doing Business 2008 Rankings

SELECTED INDICATOR	RANKING
Ease of doing business	148
Starting a business	113
Dealing with construction permits	106
Employing workers	57
Registering property	148
Getting credit	145
Protecting investors	142
Paying taxes	132
Trading across borders	173
Enforcing contracts	110
Closing a business	110

Source: Ease of Doing Business, World Bank, as of 2008

6 SMALLER AND SMALLEST APPLICATIONS ARE LESS COST-INTENSIVE IN SOME RESPECTS. OFTEN INITIAL INVESTMENTS, HOWEVER, ARE STILL HIGH FOR THE CORRESPONDING USER GROUPS SUCH AS LOW-INCOME PRIVATE CLIENTS OR SMES.

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 8

RE Companies and Stakeholders in Burkina Faso

ORGANIZATION	FIELD OF ACTIVITY	LOCATION/CONTACT
CB Energie	Supply, installation and maintenance of solar systems	Dédougou Phone: +226 20 52 10 cbenergie@yahoo.fr www.cb-energie.com
MICROSOW	Supply & maintenance of solar systems, solar cookers, charging units for cell phones	Somgandé Phone: +226 5035 63 22 info@microsow.com www.microsow.com
SOLTECH	Supply and installation of solar energy and electricity equipment, energetic audit and training	Ouagadougou Phone:+226 50 34 23 02 Email: nasol@fasonet.bf
OMA-SENISOT SA	Solar energy installation, installation of electricity	Ouagadougou Phone: +226 50 31 42 69 oma.senisot@fasonet.bf
Sahel Énergie Solaire	Solar pumps and community systems within the Regional Solar Energy Program, electrification of 150 departmental administration centers	Ouagadougou Phone: +226 50 30 69 73 energie.solaire@fasonet.bf
K&K International	Solar lighting, solar pumps and refrigerators	Ouagadougou Phone: +226 50 31 17 68 joachim@voila.fr
INTELFAC	Solar water heating systems, PV systems in health facilities and households	Ouagadougou Phone: +226 50 36 37 88 progi@fasonet.bf
ATESTA	Installation of solar systems at social housings	Ouagadougou Phone: +226 50 36 35 79 atesta@fasonet.bf
TLE NAFA	Supply and installation of solar cookers	Bobo-Dioulasso Phone: +226 20 98 11 69 sanoukaridia2002@yahoo.fr
Association for the Promotion and Use of Solar Energy (APEES)	Oil and solar energy cookers, installation of solar energy collectors and solar water heating systems	Bobo-Dioulasso apees.bobo@fasonet.bf
Institute of Applied Research in Sciences and Technologies (IRSAT)	Production, installation and control of photovoltaic systems	Phone: +226 50 35 70 31 wereme@yahoo.fr

Source: data compiled by the author

Currently, there are several ongoing investment initiatives and projects in the field of RE such as the Regional Solar Energy Program Phase II (funded by the European Union), the Regional Biomass Energy Program (funded by a Dutch cooperation through WAEMU) and the National White Paper Investment Plan. Concerning transregional banking institutions, the ECOWAS Community Investment and Development Bank (BIDC) raises funds dedicated to the development of RE in ECOWAS member states. Table 9 provides an overview of ongoing RE investments in Burkina Faso.

TABLE 9

Donor Aid Investments in Renewable Energies by Stakeholders

STAKEHOLDER	SOURCE OF TARGETED RENEWABLE ENERGY
World Bank	Photovoltaic and solar thermal energy (dryers, water heaters), biofuels, sustainable wood energy, fuel efficient stoves
Dutch cooperation	Biogas, modern valorization of traditional biomass
NGOs, Associations	Photovoltaic and solar thermal energy (dryers, cookers), Jatropha Curcas
Private promoter	Photovoltaic and solar thermal energy (dryers, cookers), Jatropha Curcas
BMZ via GTZ	Fuel efficient stoves
Danish cooperation	Sustainable forestry, sustainable wood energy
Luxembourg cooperation	Sustainable forestry, sustainable wood energy
Japanese cooperation	Sustainable forestry, sustainable wood energy
European Union	Institutional cooperation in the field of sustainable forestry
Canadian Development Agency	Training program in the field of solar energy, cooperation with the University of Ouagadougou

Source: Ease of Doing Business, World Bank, as of 2008

7 BIBLIOGRAPHY

- CIFAME (2008): Investment Plan of the National White Paper
- Commission Intersectorielle de Facilitation de l'Approche Multisectorielle dans le domaine de l'Energie – CIFAME (2009): Organisation de la CIFAME (www.cifame.org/index_fichiers/Page346.htm)
- COMPETE (2008): National Policies and Strategies on Bioenergy in Africa. Case Study: Burkina Faso (www.compete-bioafrica.net/policy/.../COMPETE-032448-NationalBioenergyPolicy-BurkinaFaso-0801.pdf)
- Government of Burkina Faso (2005): Legislation on the Electricity Sector in Burkina Faso, Loi N° 016-05 sur la Réglementation Générale de l'Approvisionnent du BF en Énergie Électrique (www.mines.gov.bf/SiteMines/documents/autres/decret-fonds.pdf)
- Government of Burkina Faso (1998): Legislation on the Provision of Electricity in Burkina Faso, Loi N°016-05 Portant Réglementation Générale de l'Approvisionnement du Burkina Faso en Énergie Électrique (www.mines.gov.bf/SiteMines/documents/autres/loi-060-98-an.pdf)
- GTZ (2007): Feasibility Study for a National Domestic Biogas Program in Burkina Faso
- MEPRED (2008): Models of Funding Basic Energy Services in Burkina Faso, Césaire Some
- MEPRED (2008): Energy Services Financing, National White Paper
- Ministry of Economy and Finance (2005–2007): Burkina Faso. Poverty Reduction Strategy Paper. Priority Actions Plan
- Ministry of Mines and Energy (2002): Letter for the Development Policy of the Energy Sector (www.mines.gov.bf/SiteMines/textes/lpde.pdf)
- Ministry of Mines and Energy (2006): National Plan of Electrification; The Second Phase of National Plan of Electrification
- Ministry of Mines and Energy (2007): Rural Electrification Strategy Document
- Ministry of Mines and Energy (2009): Rapport National d'Investissement Burkina Faso (www.mines.gov.bf/SiteMines/index.jsp)
- National Geographic Institute (2003): Map of Burkina Faso
- OECD/AfDB (2002) African Economic Outlook. Burkina Faso, page 59–70
- Ouedraogo, B. (2008) Bioenergy, Agriculture and Rural Development. National Report on Burkina Faso. Study Commissioned for input to the Regional Report on Bioenergy, Agriculture and Rural Development in UEMOA Countries (in prep.)
- SAWADOGO, A./Government of Burkina Faso (1997) Code on Environment from January, (www.sos-dechets.bf.refer.org/imprimersans.php3?id_article=52)
- SONABEL (2004–2007): Activity Reports (www.sonabel.bf)
- SONABHY (2006): Activity Report
- World Bank (2008): Ease of Doing Business (www.doingbusiness.org)
- Ministère du Commerce, de la Promotion de l'Entreprise et de l'Artisanat / Ministry of Trade, Promotion of Entrepreneurship and Handikrafts (http://www.commerce.gov.bf, as of 2008)

8 ANNEX

LIST OF SELECTED PROJECTS AND PROGRAMS (ALREADY IMPLEMENTED)

1. The Regional Solar Energy Program (PRS) is a region-wide project implemented by the Standing Interstate Committee on Desertification Control (CILSS) in the years 1990–1998. The program aimed to set up:

- Photovoltaic equipment for water pumping (800 Wp to 3.6 kWp)
- Photovoltaic equipment for electricity generation (120 Wp) at schools and community centers
- Photovoltaic standard lamps for street lighting
- Electrical equipment (refrigerators, color TVs, radio cassette players, etc.)

Project Costs:
- Installed systems: 3,412,000,000 XOF
- Supportive actions: 28,180,000 XOF
- Total cost of PRS I: 3,440,180,000 XOF

Funding Scheme:
- European Union funding the total costs
- Governmental fund raising with taxes, serving to finance maintenance costs

2. The „Spanish" Project is a project supporting PV installations. It was implemented in the years 1998–2000. The project is laid out to provide:

- Photovoltaic equipment for electricity generation (120 Wp) at schools and community centers
- Photovoltaic powered street lighting

Project Costs and Funding:
- 5,950,000,000 XOF subsidized by the government of Spain

3. A Joint Project within the Regional Program for Traditional Energy Sector supplied photovoltaic equipment for 6 villages and was implemented in the years 1998–2004. The installed equipment included:

- Photovoltaic equipment for electricity generation at schools and community centers
- Photovoltaic lamps for street lighting
- Total installation of 9.45 kWp

Project Costs and Funding:
- 500,000,000 XOF, funded by Norway under the administration of the World Bank

4. The National Community Land Management Program (PNGT) running from 2002–2005 focused on the implementation of PV equipment in schools, literacy centers, hospitals etc. The overall achievements included 262 PV installations:

- 27 installations at schools (lighting purposes)
- 76 installations at literacy (lighting purposes)
- 125 installations at hospitals and health care centers (lighting purposes)
- 3 installations at hospitals and health care centers (refrigeration purposes)
- 4 water pumping installations
- 27 individual installations of PV kits

Project Costs and Funding:
- There is no reliable information available.

5. The Burkina Faso PV Plan was implemented in the years 1999–2007 and funded about 130 individual PV installations for schools, community centers, hospitals and healthcare centers, offices etc.

Project Costs and Funding:
- There is no reliable information available.

6. The Ganzourgou Decentralized Rural Electrification (ERD) project was realized between 2000 and 2001. Within the project, two different types of PV kits were tested.

Project Costs and Funding:
- Total costs of 300,000,000 XOF financed by the French Development Agency and the people banks (Caisses Populaires) of Burkina Faso

7. The National White Book Investment Plan (LBN) corresponds to the objectives of the Regional White Book and will be implemented in the years 2008–2015. It mainly aims to provide modern energy services to semi-urban and rural areas of Burkina Faso.

Project Costs and Funding:
- About 65 to 90 billion XOF invested by The World Bank,
- the Government of Burkina Faso, SONABEL and interntional cooperation initiatives

4. The National Community Land Management Program (PNGT) running from 2002–2005 focused on the implementation of PV equipment in schools, literacy centers, hospitals etc. The overall achievements included 262 PV installations:

- 27 installations at schools (lighting purposes)
- 76 installations at literacy (lighting purposes)
- 125 installations at hospitals and health care centers (lighting purposes)
- 3 installations at hospitals and health care centers (refrigeration purposes)
- 4 water pumping installations
- 27 individual installations of PV kits
-

Project Costs and Funding:
- There is no reliable information available.

5. The Burkina Faso PV Plan was implemented in the years 1999–2007 and funded about 130 individual PV installations for schools, community centers, hospitals and healthcare centers, offices etc.

Project Costs and Funding:
- There is no reliable information available.

6. The Ganzourgou Decentralized Rural Electrification (ERD) project was realized between 2000 and 2001. Within the project, two different types of PV kits were tested.

Project Costs and Funding:
- Total costs of 300,000,000 XOF financed by the French Development Agency and the people banks (Caisses Populaires) of Burkina Faso

7. The National White Book Investment Plan (LBN) corresponds to the objectives of the Regional White Book and will be implemented in the years 2008–2015. It mainly aims to provide modern energy services to semi-urban and rural areas of Burkina Faso.

Project Costs and Funding:
- About 65 to 90 billion XOF invested by The World Bank,
- the Government of Burkina Faso, SONABEL and intern
- tional cooperation initiatives

TABLE 10

Sectoral Contribution to GDP Growth (in %) to (2003–2007)

YEAR	2003	2004	2005	2006	2007
Primary sector	2.94	−0.87	3.50	0.26	−0.13
Food crops	−2.74	−2.05	2.56	0.50	0.85
Cash crops	0.36	0.82	0.22	−0.81	−1.43
Livestock	5.25	0.25	0.56	0.44	0.32
Forestry	0.06	0.09	0.13	0.10	0.12
Fishing	0.01	0.01	0.02	0.01	0.01
Secondary sector	2.16	1.25	1.28	1.18	1.79
Mining	0.01	0.04	0.09	0.18	0.55
Modern drinks and tobacco	0.20	0.31	0.52	−0.13	−0.06
Cotton shelling	0.70	0.50	−0.61	0.01	−0.63
Electricity, gas and water	0.45	−0.19	0.25	0.14	0.27
Other modern processing industries	0.78	0.25	−0.12	−0.74	1.08
Informal processing industries	−0.42	0.51	0.51	1.05	0.07
Building works	0.45	−0.17	0.65	0.66	0.52
Services sector	3.38	3.29	2.22	3.37	1.52
Market services	2.01	2.88	1.96	2.55	0.89
Trade	0.60	0.44	0.45	0.03	0.10
Transport	0.22	0.57	0.17	0.34	0.20
Mail and telecommunications	0.12	0.22	0.10	0.08	0.02
Financial services	0.13	0.20	0.11	0.15	0.01
Other market services	0.95	1.44	1.12	1.95	0.55
Non-market services	1.38	0.42	0.26	0.82	0.64
Import duties and taxes	−0.37	1.11	0.19	0.82	0.73
SIFIM	−0.10	−0.15	−0.09	−0.12	−0.01
G.D.P. (Market price)	8.0	4.6	7.10	5.5	3.9

Source: data compiled by the author

TABLE 11

Price Structure of Petroleum Products at Ouagadougou (Bingo) Depot (July 2008)

PRICE XOF PER LITER 1 Euro = 656.759 XOF	GASOLINE	PARAFFIN OIL	GAS OIL	DDO (ELECTRICITY PRODUCTION)
1. CIF price at coastal depots	310.49	328.33	357.67	352.32
2. Charges at coastal depots	15.55	15.53	15.19	15.45
3. Transport and transit	43.70	43.70	43.70	43.70
4. Importers expenses and spreads	28.41	28.39	28.31	27.92
5. Outside depot excluding taxes	398.15	415.95	444.87	439.39
6. Customs duties and taxes	40.51	24.05	45.89	25.61
7. Petroleum products dues	125.00	0.00	50.00	0.00
8. Value-added taxes	96.34	0.00	92.24	0.00
9. Outside depot including all taxes	660.00	440.00	633.00	465.00
10. Subsidy	0.00	0.00	0.00	0.00
11. Distributors expenses and spreads	36.00	25.00	40.00	31.00
12. Retailers expenses and spreads	24.00	25.00	22.00	5.00
13. Pump selling price	720.00	490.00	695.00	501.00

Source: Ministry of Trade, Promotion of Entrepreneurship and Handikrafts, as of July

TABLE 12

Price Structure of Petroleum Products at Bobo Dioulasso Depot (July 2008)

PRICE XOF PER LITER 1 Euro = 656.759 XOF	GASOLINE	PARAFFIN OIL	GAS OIL	DDO (ELECTRICITY PRODUCTION)
1. CIF price at coastal depots	310.49	342.42	357.67	352.32
2. Charges at coastal depots	11.17	10.95	10.92	10.70
3. Transport and transit	38.04	38.04	38.04	38.04
4. Importers expenses and spreads	28.18	26.08	27.94	27.80
5. Outside depot excluding taxes	387.88	417.49	434.57	428.86
6. Customs duties and taxes	39.72	24.51	45.12	25.14
7. Petroleum products dues	125.00	0.00	50.00	0.00
8. Value-added taxes	94.40	0.00	90.31	0.00
9. Outside depot including all taxes	647.00	442.00	620.00	454.00
10. Subsidy	0.00	0.00	0.00	0.00
11. Distributors expenses and spreads	40.00	24.00	35.00	32.00
12. Retailers expenses and spreads	21.00	24.00	19.00	2.00
13. Pump selling price	708.00	490.00	674.00	488.00

Source: Ministry of Trade, Promotion of Entrepreneurship and Handikrafts, as of July 2008

COUNTRY CHAPTER: CAMEROON

Author of Country Chapter
Emmanuel Ngnikam (Dipl.)

Coordination and Review of the Country Chapter
Anton Hofer (MSE, Dipl.-Ing./FH, M.A.)
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS CAMEROON

ACRONYMS AND ABBREVIATIONS

CAMEROON

AER	Agence de l'Énergie Rural (Rural Electricity Board)
AES-Sonel	AES Corporation – Société Nationale d'Électricité du Cameroun (National Electrical Society of Cameroon)
ARSEL	Agence de Régulation du Secteur de l'Électricité (Electricity Regulation Board)
CCNUCC	Convention-cadre des Nations Unies sur les Changements Climatiques (United Nations Conventions on Climatic Changes)
CDM	Clean Development Mechanism
CEMAC	Communauté Économique et Monétaire de l'Afrique Centrale (Monetary and Economic Community of Central Africa)
CPLC	Cameroon Power and Lighting Company
CREF	Cameroon Renewable Energy Fund
E+CO	Investment company for local energy businesses in Africa, Asia & Latin America
ERA	Environnement Recherche Action au Cameroun (Environmental Studies Action of Cameroon)
FCFA	Franc de la Communauté Financière d'Afrique (CFA Franc; 1 Euro = 655,957 FCFA)
GDP	Gross Domestic Product
IEA	International Energy Agency
INS	Institut National de la Statistique du Cameroun (National Institute of Statistics)
MDG	Millennium Development Goals
MINEE	Ministère de l'Eau et de l'Énergie du Cameroun (Ministry of Energy and Water Resources)
MINIMIDT	Ministère de l'Industrie, des Mines et du Développement Technique (Ministry of Industry, Mines and Technology Development)
MSE	Medium Size Enterprise
n.a.	not applicable
NEAPRP	National Energy Action Plan for the Reduction of Poverty
pm	post meridiem
PRSP	Poverty Reduction Strategy Paper
RE	Renewable Energies
SCDP	Société Camerounaise de Dépôt Pétroliers (Cameroon Petroleum Depot Society)
SNH	Société Nationale des Hydrocarbures (National Hydrocarbons Corporation)
SNI	Société Nationale d'Investissement du Cameroun (National Investment Corporation)
SONARA	Société Nationale de Raffinage (National Refinery Corporation)
SONEL	Société Nationale d'Électricité (National Electricity Corporation)
UNDP	United Nations Development Program
USD	United States Dollar
WAEMU	West African Economic and Monetary Union

MEASUREMENTS

€	Euro (1 Euro = 655.957 FCFA)
d	day
GWh	gigawatt hour (1 GWh = 1,000,000 kilowatt hours (kWh)
km^2	square kilometer
kVA	kilovolt ampere
kW	kilowatt
kWh	kilowatt hour
m^2	square meter
m^3	cubic meter
mm	millimeters
MW	megawatt (1 MW = 1,000 kW)
°	degree
t	tons
TJ	terajoule
toe	tons of oil equivalent
TWh	terawatt hour

SUMMARY

The Country Study of Cameroon is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Cameroon. The study is structured as follows:

Chapter one provides **Background Information on Cameroon.** This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Cameroon.

Chapter two summarizes facts and figures of **Cameroon's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Cameroon. This includes an overview of support mechanisms for photovoltaic (PV) as well as existing regulations, incentives and legislative framework conditions concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Cameroon.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Cameroon.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Cameroon is a unitary republic of Central and Western Africa and is bordered by Nigeria in the West; Chad in the Northeast; the Central African Republic in the East and Equatorial Guinea, Gabon, and the Republic of the Congo in the South. With a total area of about 475,000 km² the country extends over 1,200 km from latitude 2° North to 13° North and over 800 km from longitude 3° East to 16° East. Cameroon is divided into 10 provinces that are again divided in divisions, subdivisions and districts.

Cameroon represents all major geographical, climatic and vegetation related characteristics of the African continent, i.e. coastal, desert, mountain, rainforest, and savannah regions. The coastal plain extends over 150 kilometers from the Gulf of Guinea and is characterized by a hot and humid climate with a short dry season. The southern plateau is dominated by the equatorial rainforest with a less humid climate than the one in the coastal plain. In general, Cameroon has a humid climate with extensive rainfalls of up to 3,000 mm/year in the Northwest and up to 8,000 mm on the slopes of Mount Cameroon.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

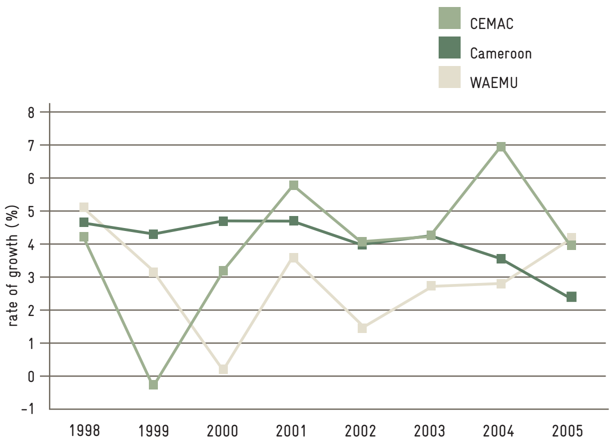
In comparison with other African countries, Cameroon enjoys a substantial political and social stability. Nevertheless, corruption and poverty are still major problems to be solved. The economic development of Cameroon – as in most developing countries – is mainly based on the primary sector. With the production and export of primary products like cocoa, coffee, cotton, banana, pineapple rubber etc., Cameroon's agricultural sector is the largest in Central Africa. Incomes from farming and agricultural resources and the profits from the oil and forestry sectors, provide a solid basis for economic development in Cameroon. In 2002, the Gross Domestic Product (GDP) was estimated at 11.6 billion €, accounting for almost 50 % of the entire CEMAC zone with 25.34 billon €. The growth of GDP averaged 4 % during the period 1998–2005, almost the same level of growth as in the CEMAC zone, but above the average growth rate of 2.9 % in the West African Economic and Monetary Union (WAEMU/UEMOA) zone. Figure 2 presents the trend of GDP growth in 1998–2005.

With the implementation of the Poverty Reduction Strategy Paper (PRSP) in 2006, Cameroon reached the completion point permitting creditors of Cameroon to grant debt alleviations of USD 28,000 million. In the overall socio-economic development, the availability of energy plays a crucial role. The improvement of economic profitability is necessary to attract private investors, to increase economic activity and to reduce poverty.

The initial analysis of the poverty reduction document made clear that too little attention had so far been given to the energy sector. In order to cope with this shortcoming, the Government of Cameroon – together with the United Nations Development Program (UNDP) and the World Bank – adopted a national energy plan[1] to reduce poverty and improve the access to energy in rural and urban areas of Cameroon.

FIGURE 2

Trend of GDP Growth in Cameroon, CEMAC and WAEMU



Source: Banque de France, Rapport Annuel de la Zone Franc, as of 2001, 2002, 2003, 2005

1 PLAN D'ACTION NATIONAL ÉNERGIE POUR LA RÉDUCTION DE LA PAUVRETÉ (HTTP://GO.WORLDBANK.ORG/KFS10MN8V0)

2 ENERGY MARKET IN CAMEROON

2.1 OVERVIEW OF THE ENERGY SITUATION

The energy supply of Cameroon is mainly met by petroleum products and electricity. In the overall energy assessment of Cameroon, household cooking continues to be the prime factor in energy consumption. Cameroon has a comparatively high RE potential. Especially the country's Hydro Power potential offers a number of opportunities for future development. Table 1 provides the country's energy mix, table 2 presents an overview of the country's energy production and consumption by sector and source.

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Hydroelectricity Sector

Cameroon has the second highest hydroelectric potential in Africa (after the Democratic Republic of Congo with about 774 TWh/year)[2]. The hydroelectric potential of Cameroon is estimated at 294 TWh/year. Table 3 presents an overview of the hydroelectricity potential.

TABLE 1

Energy Mix of Cameroon

YEAR	1990	1995	2000	2002
Consumption of petroleum products (TJ)	38,560.0	36,383.0	40,403.0	41,449.3
Consumption of electricity (97 % hydro)	8,438.4	7,837.2	9,788.4	9,133.2
Consumption of biomass (TJ	159,987.0	183,000.0	208,740.0	218,137.0
Total consumption (TJ)	206,985.0	227,220.0	258,931.0	268,720.0

Source: IEA, as of 2005

Petroleum Sector

Even though Cameroon is the seventh largest producer in Africa, the national production of hydrocarbons is modest. About 56 oilfields are currently in operation with an overall production of 84,000 barrels per day. Within the petroleum sector, the focus is on the rational management and the recovery of production associated gas (850 million m³ per annum). The foreseen decrease in oil production (about 50 % in less than 20 years) stimulated the National Hydrocarbons Corporation (SNH) to take care of this issue. An active campaign towards the promotion of alternative energy resources aims at the doubling of available energy resources within a period of five years. Table 4 presents imports and exports of petroleum products.

Biomass Sector

Biomass energy is used in both, the industrial and the residential sector of Cameroon. About 75 % of the residential sector's energy consumption is covered by biomass resources. Within the industrial sector of Cameroon, more than 90 % of the overall energy requirements are covered by energy from biomass. Since 2005, the utilization of biodiesel from palm oil has been developing as a new and promising market. Currently, the produced biodiesel is mainly used for agricultural purposes. Almost 108,000 hectares of land are used for the oil palm cultivation. From 2001–2006, the cultivation area was enlarged by about 30,000 hectares in order to extend the existing cultivation area. The key issue for the future is to adopt and apply principles and criteria for sustainable palm oil production. Table 5 presents the consumption of biomass for energy purposes.

TABLE 2

Overview of Energy Production and Consumption Figures by Sector and Source

TYPE OF SOURCE (TOE)	1990	1995	2000	2001	2002	2003
Production of crude oil	7,930.0	6,208.0	7,346.0	7,025.0	6,439.0	6,419.0
Production of RE	3,820.5	4,370.0	4,984.7	5,094.4	5,209.1	5,322.3
Production of charcoal	n.a.	n.a.	49.5	50.5	51.5	52.5
Thermal production of electricity	3,526.0	2,752.0	3,268.0	5,762.0	10,148.0	13,416.0
Hydroelectricity	228,416.0	236,758.0	296,012.0	298,800.0	273,652.0	303,408.0
Production of petroleum products	838.0	1,220.0	1,543.0	1,49.00	1,177.0	1,401.0
Export of crude oil	–7,067.0	–4,945.0	–5,717.0	–5,452.0	–5,146.0	–4,957.0
Export of petroleum products	–42.0	–343.0	–545.0	–519.0	–275.0	–467.0
Consumption of petroleum products	921.0	869.0	965.0	946.0	990.0	1,010.0
Industry sector	n.a.	n.a.	n.a.	n.a.	67.0	63.0
Transport sector	603.0	593.0	647.0	662.0	721.0	732.0
Consumption of electricity	201,584.0	187,222.0	233,834.0	226,352.0	218,182.0	241,402.0
Industry sector	116,874.0	109,994.0	130,376.0	122,980.0	96,148.0	108,876.0

Source: IEA, as of 2005

2 UNECA, 2009

TABLE 3

Hydroelectricity Potential in Cameroon

REGION	SITE/RIVER	NATURAL POTENTIAL (TWH)	DEVELOPMENT POTENTIAL (TWH)	HYDRO POWER PLAN (MW)
Sanaga	Sanaga	162	72	5,600
	Mbam	n.a.	n.a.	1,600
Southwest	Nyong	17	7	700
	Ntem	22	8	1,000
	Other Region	8	3	500
West	Wouri (Noun)	10	5	3,300
	Katsina	9	5	n.a.
	Manyu Munaya	6	2	n.a.
	Other Region	7	2	650
East	Dja	13	4	n.a.
	Boumba	8	2	n.a.
	Kadei	5	1	n.a.
	Other Region	2	1	350
North	Benoue Faro	14	2	n.a.
	Vina du Nord	10	2	n.a.

Source: MINEE, as of 2006

TABLE 4

Exports and Imports of Petroleum Products

YEAR	1990	1995	2000	2001	2002	2003
Crude oil (1,000 t)	7,930	6,208	7,346	7,025	6,439	6,419
Export of crude oil (1,000 t)	–7,067	–4,945	–5,717	–5,452	–5,146	–4,957
Import of crude oil (1,000 t)	–42	–343	–545	–519	–275	–467
Production of petroleum products (1,000 t)	838	1,220	1,543	1,490	1,177	1,401
Final consumption of petroleum products (1000 t)	921	869	965	946	990	1,010
Consumption in the transport sector (1,000 t)	603	593	647	662	721	732

Source: IEA, as of 2005

TABLE 5

Consumption of Biomass (in tons)

YEAR	1999/2000	2000/2001	2001/2002	2002/2003	2003/2004
Firewood	9,120,070	9,375,432	9,423,210	9,468,152	9,288,530
Charcoal	81,303	83,580	84,790	86,100	90,500

Source: MINEE, Cameroon Statistics Directory, as of 2006 and INS, 2006

TABLE 6

Production and Consumption of Electricity by Sector (in million kWh)

YEAR	2000/2001	2001/2002	2002	2003	2004	2005
Global production	3,534,599	3,300,587	3,413,104	3,686,444	3,919,679	4,003,825
Thermal	61,023	118,728	110,511	157,619	190,364	231,552
Hydro Power plan	3,473,576	3,181,859	3,302,593	3,528,826	3,729,315	2,772,273
Network transmission	3,443,524	3,271,202	3,374,998	3,654,626	3,885,116	3,956,161
Consumption	2,799,249	2,511,997	n.a.	2,802,320	3,094,773	3,264,407
Low voltage	751,480	773,449	n.a.	846,128	977,889	1,071,965
Mid – low voltage	618,157	620,287	n.a.	707,553	724,103	747,815
Special customers	1,429,611	1,118,261	n.a.	1,248,639	1,392,781	1,444,626
Number of subscribers	452,994	484,563	493,766	505,361	507,838	528,049
Low voltage subscribers	1,151	1,154	1,207	1,214	1,258	n.a.
High voltage subscribers	5	5	3	3	3	3

Source: AES-SONEL, Cameroon Statistics Directory, as of 2006 and INS, 2006

Overall Energy Consumption

The overall energy consumption per inhabitant is estimated at 0.4 toe and 200 kWh of electricity produced with Hydro Power. Due to the limited availability of sufficient data, consumption figures are only valid for 2002 and 2003. In 2003, about 65,595 GWh of RE (94.4 % from biomass and 5.6 % from Hydro Power) were produced in Cameroon. In the same year, the residential sector's energy mix consisted of 75 % RE, essentially biomass (48,938 GWh) and hydroelectricity (428 GWh). The industrial sector consumed almost 17.4 % of RE, especially biomass (1,0150 GWh) and hydroelectricity (1,266 GWh). Table 6 presents an overview of the electricity production and consumption by sector.

Electricity Prices

In Cameroon, electricity tariffs are established at national level by a joint decision of the Ministry of Energy and the Ministry of Trade in agreement with AES-Sonel and ARSEL. The tariffs are standardized throughout the day but vary in two seasonal tariffs (dry season with higher prices compared to the rainy season). The price for average voltage is distinguished in two billing periods, the rush-hours (between 6–11 pm) and the slack period. The actual price for electricity is determined according to the overall consumption and the subscribed tariff. High voltage tariffs are directly negotiated between the individual consumer and the producer. The various electricity tariffs of Cameroon are presented in Tables 6 a–d.

TABLE 6A

Low Voltage Tariff for Domestic Use

NORMAL PRICE	›200	FIXED PRICE SCALE	65.00	75.00
STRUCTURE OF PRICE		FIXED PRICE BT		
		FIXED PRICE	TARIFFS (FCFA/KWH[3]) 157,619	
Domestic use	Monthly consumption in kWh	FCFA/kVA Subscribed energy power	Rainy season (01/07 to 31/12)	Dry season (01/01 to 30/06)
Social price	‹50	n.a.	50.00	50.00
Reduced price	Between 51 and 200	n.a.	60.00	67.00
Normal price	›200	n.a.	65.00	75.00
Street lighting		n.a.	40.00	46.50

Source: ERA – Cameroon, as of 2007

TABLE 6B

Low Voltage Tariff for Professional Use

PRICING STRUCTURE		LOW VOLTAGE PRICE SCALE		
		PRICE SCALE	PRICE (FCFA/KWH – CONVERSION RATE SEE[3])	
Professional use	Monthly consumption in kWh	FCFA/kVA Subscribed energy power	Rainy season (01/07 to 31/12)	Dry season (01/01 to 30/06)
First phase	‹180	2,000	63.00	50.00
Second phase	›180	2,000	55.00	60.00

Source: ERA – Cameroon, as of 2007

TABLE 6C

General Average Voltage Price

AVERAGE VOLTAGE PRICING STRUCTURE		GENERAL AVERAGE VOLTAGE PRICE SCALE		
		MONTHLY PRICE	PRICE (FCFA/KWH – CONVERSION RATE SEE[3])	
Duration (hour)	Period	FCFA/kVA Subscribed energy power	Rainy season (01/07 to 31/12)	Dry season (01/01 to 30/06)
‹200	Peak hour: 6 pm to 11 pm	2,500	54.00	67.50
	Off-peak hour: 11 pm to 6 pm		43.00	53.75
›200	Peak hour: 6 pm to 11 pm	4,200	49.00	61.25
	Off-peak hour: 11 pm to 6 pm		40.00	50.00

Source: ERA – Cameroon, as of 2007

TABLE 6D

Zone Industrial Average Voltage Price

AVERAGE VOLTAGE PRICING STRUCTURE		GENERAL AVERAGE VOLTAGE PRICE SCALE		
		MONTHLY PRICE	PRICE (FCFA/KWH – CONVERSION RATE SEE[3])	
Duration (hour)	Period	FCFA/kVA Subscribed energy power	Rainy season (01/07 to 31/12)	Dry season (01/01 to 30/06)
‹ 200	Peak hour: 6 pm to 11 pm	2,500	35.00	43.75
	Off-peak hour: 11 pm to 6 pm		30.00	37.50
›200	Peak hour: 6 pm to 11 pm	4,200	32.00	40.00
	Off-peak hour: 11 pm to 6 pm		25.00	31.25

Source: ERA – Cameroon, as of 2007

3 MONETARY CONVERSION RATE (AS OF MARCH 2009): 1€ = 655.957 FCFA

Price of Petroleum Products

The actual price of petroleum products is fixed by the Government and depends on the fluctuation of the international crude oil price. Figure 3 presents the price trend of various petroleum products. The current prices of the main petroleum products are presented in Table 7.[4]

Market Strategies

In order to improve the framework conditions of the energy market in Cameroon, several strategies are to be implemented. This includes the development of new electricity production facilities (mainly for Hydro Power), the modernization of the national electricity network and distribution infrastructure and the promotion of modern energy services (with special focus on rural areas). Therefore, the National Energy Action Plan for the Reduction of Poverty (NEAPRP) aims to provide modern energy services to 1,263 education centers, 923 health centers and 191 drinking water supply networks. Within the petroleum sector of Cameroon, the Government aims to liberalize the market and promote private investments. Several reforms are already being implemented in order to improve the overall market for oil refinery sector. Up to now, no Governmental strategy has been realized for the promotion of RE.

FIGURE 3

Price Trend of Petroleum Products (July 1999–July 2008)

Source: INS, as of 2006, and Cameroon Tribune, as of 29 July 2008

TABLE 7

Prices of Petroleum Products

Product	End Consumer Price	Additional Charge
Gasoline	594 FCFA	5 to 15 FCFA
Diesel	549 FCFA	5 to 15 FCFA
Lamp oil	350 FCFA	5 to 20 FCFA

Source: ERA – Cameroon, as of 2007

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The energy sector of Cameroon consists of several market actors and institutional stakeholders. Law 1998/022 of 24 December 1998 was passed to reform the institutional framework of the electricity sector in Cameroon.

The **National Electricity Corporation (SONEL)** is exclusively in charge of the electricity supply in urban areas of Cameroon, whereas the electricity supply in rural areas is not regulated at all.

The **Ministry of Energy and Water Resources (MINEE)** defines policies in the overall energy sector and grants concessions and licenses to market actors. Other tasks include the development of the energy sector, the planning of rural electrification and the promotion of RE. The main focus of activities is on the electricity sector. Up to now, only the Energy Master Unit, a service of the department of electricity, is taking initial steps towards the promotion of RE.

The **Electricity Regulation Board (ARSEL)** supervises and regulates the electricity sector, ensures the financial stability and approves of investments. Further tasks include the management of concessions and licenses, the authorization of electricity supply in rural areas, consumer protection and the promotion of private investments.

The **Rural Electrification Board** ensures the promotion of modern electricity services by granting operators and consumers technical and financial assistance in order to develop and implement RE for rural electrification strategies.

The **National Operator AES-Sonel** is the main electricity producer and supplier in Cameroon. The company is controlled by the AES Corporation, the Government of Cameroon and the AES Cameroon Holding.

The petroleum sector of Cameroon is dominated by the **National Hydrocarbon Corporation (SNH)**, the **National Refinery Corporation (SONARA)** and the **Société Camerounaise de Dépôt Pétroliers (SCDP)**. The distribution sub-sector has been liberalized, and activities are being shared between multinational companies like MOBIL, TOTAL and TEXACO. On top of that, several approved national companies[5] are active in the petroleum sector of Cameroon.

4 MONETARY CONVERSION RATE (AS OF MARCH 2009): 1€ = 655.957 FCFA.

5 PECTEN CAMEROON, NOBLE ENERGY, PETRONAS CARIGALI SDN BHD, PERENCO CAMEROUN, KOSMOS ENERGY, ADDAX PETROLEUM CAMEROON, GLENCORE EXPLORATION LTD, AFEX GLOBAL LTD, STERLING OIL & GAS, EUROIL LTD, RSM PRODUCTION CORPORATION, RODEO RESOURCES, PETROVIETNAM EXPLORATION PRODUCTION LTD, PRONODAR LTD.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The Government of Cameroon has already developed a strategy aiming at the modernization of the country's electricity sector. Even though this includes several measures to facilitate the introduction of RE, no fiscal incentives are available so far.

For the provision of modern energy services to rural areas of Cameroon, the Government has implemented the Rural Electrification Board. The board's task is to support the allocation of licenses for electricity production in order to increase the production capacity in rural areas of Cameroon.

The investment company E+CO and the National Investment Corporation (SNI) have created the Fund for Modern and Renewable Energy Resources (Cameroon Renewable Energy Fund – CREF). The fund's mission is to increase the availability of modern energy services through the provision of capital and expertise for the development of energy projects in the field of Hydro Power and biomass energy. Moreover, CREF offers an opportunity to mobilize concession-based financing and private sector investments. The involvement of new market actors aims to promote the development of a production and distribution infrastructure and to ease the transfer of knowledge and modern technologies.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

The recent reform of the national electricity sector of Cameroon aims to liberalize the overall electricity sector. After a transitional period of five years, the monopolist SONEL will be privatized. Moreover, the wholesale market for electricity will be liberalized in order to allow consumers to choose freely between several suppliers.

The free access for new market actors and operators through competitive calls for tender is supplemented by the creation of a solid management structure for the distribution network. The enhanced involvement of the local authorities aims to improve the implementation of policies for rural electrification. This includes the adoption of the National Rural Electrification Plan and the Energy Plan for Poverty Reduction.

For the implementation of the Clean Development Mechanism (CDM), Cameroon has ratified the United Nations Framework Convention on Climate Change on 19 October 1994 and the Kyoto Protocol on 23 July 2002. Moreover, Cameroon has created a designated national authority for CDM in 2006 while the Ministry of Environment and Nature Protection established a national committee for the implementation of CDM projects. The criteria and indicators defined for the promotion of a sustainable development in Cameroon serve as a basis for approving of future CDM projects.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

For small and medium size enterprises operating in the forest sector, there are numerous opportunities to produce energy from biomass. In 2006, 66 units with a transformation capacity of 2.7 million m^3 were identified. Nine of the sites were equipped with a biomass drying machine and with gasoline generators for the production of the required in-house electricity.

An inventory of the electricity in-house production structures in 2006 identified the new energy technologies already in use. The most used technologies are based on cogeneration, namely of steam turbines using gas or biomass. The cogeneration technologies from biomass are mainly applied in the food industry sector. The overall capacity of steam turbines using biomass is estimated at 12.8 MW. This shows that local enterprises already have a good grasp of this technology. Table 8 presents an overview of companies that already have implemented steam turbines for energy cogeneration.

The identified biomass potential of Cameroon mainly originates from national agro- and wood industries. Table 9 presents available biomass residues from wood transformation activities. Table 10 presents available biomass residues for the most relevant crops.

TABLE 8

Companies Using Steam turbines for Energy Cogeneration

COMPANY	UNITS	TOTAL CAPACITY (kW)
PAMOL (Lobe)	1	310
PAMOL (Mudemba)	1	450
SPFS (Fermes Suisses, Edea farms)	1	1,124
SOSUCAM (Nkoteng)	1	9,054
SODECOTON	1	400
Global	8	12,801

Source: ERA – Cameroon, as of 2007

TABLE 9

Biomass Residues of the Wood Transformation Sector

SECTOR	COMPANIES	ANNUAL CAPACITY (m^3)
Simple sawmills and sawmills with drier	45	1,475,000
Integrated sawmill with carpentry	13	792,000
Roll-out factory, jib board or cutting	8	412,000
Global	66	2,679,000

Source: ERA – Cameroon, as of 2007

TABLE 10

Available Biomass Residues from Crops

CROP	RESIDUES	ANNUAL CAPACITY (m^3/ tons)
Rubber	Timber	132,000 m^3
Cotton	Cotton/seed cake	147,642 tons/45,780 tons
Robusta coffee	Chaff	145,900 tons
Sugar cane	Bagasse/molasses	244,750 tons/32,040 tons
Palm oil	Stalks/palm kernel shells	57,695 tons/28,847 tons

Source: ERA – Cameroon, as of 2006

4.2 SOLAR ENERGY

The solar energy potential is abundant, but not sufficiently developed (South: up to 4 kWh/d/m^2; North: up to 5.8 kWh/d/m^2). Currently, only about 50 small PV installations are implemented in Cameroon. The sites include several health care centers, telecommunication relay stations, isolated train stations, churches and police stations. Only very few PV modules are installed at private households (as of 2006, only 6 installations were identified).

4.3 WIND POWER

The potential for wind power is but marginal. In the North and in some coastal zones there are some favorable sites for wind energy. Currently, only two rapid wind turbines are installed at a hotel in Douala.

4.4 HYDRO POWER

The potential for small Hydro Power installations (up to 1 MW) is estimated at 1.115 TWh, mainly in the eastern and western regions of Cameroon. In spite of the considerable potential, small Hydro Power installations are almost non-existent in Cameroon. Very few are located in the North and the Southwest of the country. Projected investments for the construction of Hydro Power installations are estimated at 1,330.7 million Euros (80 % of the global investment). 38.1 million Euros are to be invested in the construction of small Hydro Power installations that will guarantee the electricity supply for seven isolated areas of Cameroon. Table 11 presents future investments in the Hydro Power sector of Cameroon.

TABLE 11

Future Investments in the Hydro Power Sector of Cameroon (2005–2015)

SITE/CAPACITY	INVESTMENT (MIO €)
Edea/Song Loulou (30 MW)	76.22
Lom Pamgar (170 MW)	76.22
Nachtigal (280 MW)	228.67
Warak (75 MW)	114.33
Song Dong (280 MW)	266.78
Meve ,Elé (200 MW)	304.9

Source: Ngnikam, as of 2007

5 MARKET RISKS AND BARRIERS

The development of industrial and commercial activities in the field of RE in Cameroon is currently hindered by several constraints. In general, the institutional environment of Cameroon does not encourage investments at all. This is due to insufficient investment regulations and a lack of standards and quality control mechanisms. The misjudgment of potential risks for RE projects makes it almost impossible to collaborate with traditional financial institutes. Therefore, many progressive projects are blocked due to inadequate financing mechanisms.

The lack of basic prerequisites makes it very difficult to establish a national market for RE. Unreliable infrastructure, insufficient distribution networks, anticompetitive commercial framework as well as administrative bottlenecks and financial insecurity are the most important risks and barriers.

Recently, the institutional landscape of electricity production and electricity supply has been revised. New laws for the liberalization of the overall electricity sector are already implemented. The company AES-Sonel emanated from the privatization of Sonel and now holds a concession for the supply sector.

As of now, the production and distribution for large-scale consumers (more than 1 MW of subscribed capacity) is fully open to competition. The rural areas of Cameroon are not affected by the concession, therefore the production, transport and distribution of electricity is entirely liberalized. Since there are only very few large-scale consumers, the most profitable urban zone is almost exclusively supplied by AES-Sonel which again creates a monopoly.

New operators are forced to join the market at the conditions of AES-Sonel. As the cost of transportation within the existing network has not been defined yet, there are several uncertainties that prevent investments.

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 12
Local Business Partners

INSTITUTION	CONTACT	FIELD OF ACTIVITY
RWKING Corporation	P.O Box 4022 Douala Phone: +237 33 42 59 45 Fax: +237 33 42 22 85 rwking@rwkingcam.com	Specialized in the supply and maintenance of industrial equipment and energy equipment
OMNIUM SIRA	P.O Box 15474 Douala Street Drouot Phone: +237 33 37 74 86 Fax: +237 33 37 74 83 secretariat@omnium-sira.com	Supplier and service provider in the field of RE
MAGUYSAMA Technologies	P.O Box 5033 Douala Phone: +237 33 40 92 81 Fax: +237 33 40 92 81 maguysama@maguysama.fr	Energy supply systems for private and commercial applications
Environnement Recherche Action au Cameroun (ERA – Cameroun)	P.O Box 3356 Yaoundé Phone: +237 22 31 56 67 secretariat@era-cameroun.com	NGO active in the bioenergy sector
Cameroon Power and Lighting Company (CPLC)	P.O Box 2425 Douala Phone: +237 99 82 92 39 cplcsa@yahoo.fr	Supplier of solar equipment
GECOSER	P.O Box 20440 Yaoundé Phone: +237 22 21 23 62 Fax: +237 22 20 04 79 gecoser@yahoo.fr	Supplier of solar equipment

TABLE 13
Sector-specific Ministries and Corporations of Cameroon

MINISTRY/CORPORATION	CONTACT	FIELD OF ACTIVITY
Ministry of Energy and Water Resources (MINEE)	Minister's Cabinet: Phone: +237 22 22 34 00 Fax: +237 22 22 61 77 Department of Electricity: Phone: +237 22 22 20 99	Definition of policies regarding energy, granting concessions and licenses, promotion of RE
Ministry of Industry, Mines and Technology Development (MINIMIDT)	Phone: +237 22 22 38 71 Fax: +237 22 22 95 86	Definition of policies regarding mines and technology development, control of industrial installations
Electricity Regulation Board (ARSEL)	P.O Box. 6064 Yaoundé Phone: +237 22 21 10 Fax: +237 22 21 10 14	Supervision and regulation of the electricity sector
Rural Electricity Board (AER)	P.O Box 30704 Yaoundé Phone: +237 22 21 23 84 Fax: +237 22 21 23 81	Promotion of rural electrification
National Investment Corporation (SNI)	P.O Box. 423 Yaoundé Phone: +237 22 22 44 22 Fax: +237 22 23 13 32 sni@sni.cm	Financing of development projects and projects in the electricity sector
National Hydrocarbon Corporation (SNH)	P.O Box.955 Yaoundé Phone: +237 22 20 19 10 Fax: +237 22 20 98 61	P.O Box.955 Yaoundé Phone: +237 22 20 19 10 Fax: +237 22 20 98 61

7 BIBLIOGRAPHY

- ARSEL (2006): Energy Survey Work Document
- CEMAC (2006): Action Plan for the Promotion of Energy in the CEMAC Zone (final report of the study realized by “IED”)
- Central Intelligence Agency – CIA (2009): World Fact Book (www.cia.gov/library/publications/the-world-factbook)
- ERA – Cameroon, ENEFIBIO (2006): The Cameroon Preliminary Report
- (www.cgdev.org)
- ERA – Cameroon, ENEFIBIO (2007): Cameroon Medium Size Enterprises (MSE) Investigation Report, EU, COPENER ProgramIEA (2005): Statistics of Energy of the Non-member Countries of OCDE 2002–2003
- International Rivers (2005): LOM PANGAR DAM, CAMEROON. Drought Could Cripple Cameroon’s Hydro-Heavy Energy Sector (www.irn.org/programs/lom-pangar/pdf/050105lpfact.pdf)
- MINEE (2006): Long-term Development Plan of the Electricity Sector 2006
- MINEPAT (2003): Cameroon: Progress of the Millennium Goals for Development (MGD)
- Ministry of Environment and Forestry (2001): Initial National Communication of Cameroon within the Framework of the United Nations Conventions on Climatic Changes (CCNUCC), Yaoundé
- National Institute of Statistics – INS (2003): Second Investigation in Cameroon Done in Households: Poverty and Gender in Cameroon in 2001
- National Institute of Statistics – INS (2004): Third Health Population Investigation (EDS III)
- National Institute of Statistics – INS (2002): Second Investigation in Cameroon Done in Households: Poverty and Job Market in Cameroon in 2001
- National Institute of Statistics – INS (2002): The Living Conditions of the Population and the Poverty Profile in Cameroon in 2001
- National Institute of Statistics – INS (2006): Cameroon Statistical Yearbook 2006, Yaoundé
- Ngnikam, E. (2007): Reinforcing the Resilience to the Climatic Change, Cameroon Report Yaoundé
- Ngnikam, E. (2006): World Observatory of Energy Viability: Cameroon Report, Yaoundé
- Ngnikam, E., Tanawa E. (1998): World Observatory of Energy Viability: Cameroon Report (available on the website of Helio International, www.helio-international.org)
- Republic of Cameroon (2005): Strategy Reduction Poverty Paper (the June 2005 revised version), Yaoundé
- Republic of Cameroon (2003): Strategy Reduction Poverty Paper, Yaoundé
- Tamba, J. C., Tchatchouang; Doua, R. (2007): The Central Africa, the Paradox of Resources: Extractives Industries, Governance and Social Development in the CEMAC States
- The World Bank (2007): Plan d‘Action National Énérgie pour la Réduction de la Pauvreté (http://go.worldbank.org/KFS10MN8V0)
- United Nations Economic Commission for Africa – UNECA (2009): African Transport & Energy Infrastructure Atlas (http://geoinfo.uneca.org/africaninfrastructure/?pageToDisplay=energy)

8 ANNEX

FIGURE 4

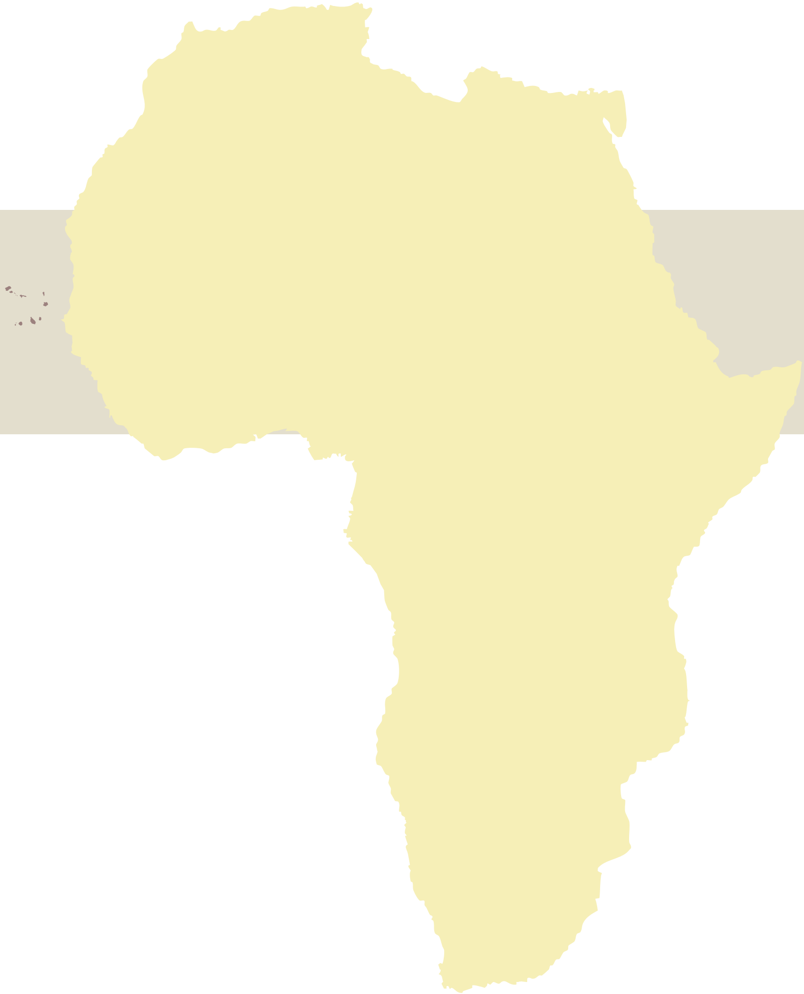
Map of the Northern Electricity Network of Cameroon

Source: MINEE, as of 2006

FIGURE 5

Map of the Southern Electricity Network of Cameroon

Source: MINEE, as of 2006



COUNTRY CHAPTER: CAPE VERDE

Author of Country Chapter
Louis Seck (MSc., DEA, MBA)

Coordination and Review of the Country Chapter
Anton Hofer, (MSE, Dipl.-Ing./FH, M.A.)
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS CAPE VERDE

ACRONYMS AND ABBREVIATIONS

CAPE VERDE

ARE	Agência de Regulação Económica (Agency for Economic Regulation)
CVE	Cape Verdean Escudo (1 Euro = 1,010 CVE)
DGIE	Direcção Geral da Indústria e Energia (General Direction of Industry and Energy)
GDP	Gross Domestic Product
HDI	Human Development Index
LPG	Liquefied Petroleum Gas
MDG	Millennium Development Goals
ONG/NGO	Organisation Non Gouvernementale (Non Governmental Organization)
PAICV	Partido Africano da Independência de Cabo Verde (African Party for the Independence of Cape Verde)
PAIGC	Partido Africano da Independência da Guiné e Cabo Verde (African Party for the Independence of Guinea-Bissau and Cape Verde)
PROMEX	Centro de Promoção Turística, do Investimento e das Exportações de Cabo Verde (Center for Tourism and Export Promotion of Cape Verde)
PRS	Programme Régional Solaire (Solar Regional Program)
PV	Photovoltaic
RE	Renewable Energies
UNDP	United Nations Development Program
USD	United States Dollar

MEASUREMENTS

€	Euro (1 Euro = 1,010 Cape Verdean Escudo)
km	kilometer
km^2	square kilometer
kWh	kilowatt hour
m/s	meters per second
mm	millimeters
MW	megawatt (1 MW = 1,000 kW)
°C	degree Celsius
toe	tons of oil equivalent

SUMMARY

The provision of modern energy services is a crucial aspect for economic development and the enhancement of social standards. The limited access to energy in general and modern energy services in particular, is a massive barrier towards future development of semi-urban and rural areas.

Likewise the lack of appropriate policies and regulations are significant constraints towards the development of an efficient market for Renewable Energies.

The Country Study of Cape Verde is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Cape Verde. The study is structured as follows:

Chapter one provides **Background Information on Cape Verde.** This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Cape Verde.

Chapter two summarizes facts and figures of **Cape Verde's Energy Marke**t including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Cape Verde. This includes an overview of support mechanisms for photovoltaic (PV) as well as already existing regulations, incentives and legislative framework conditions concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Cape Verde.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most **relevant Renewable Energy Business Information and Contacts** of Cape Verde.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Cape Verde is an archipelago off the western coast of Africa, located between the equator and the Tropic of Cancer at 15°02' North and 23°34' West. It is situated about 455 km from the West African coast (Dakar, Senegal) and 1,400 km South South-West of the Canary Islands.

With a surface of 4.033 km², it consists of ten major islands and about eight islets. The relief is mountainous and of volcanic origin. Cape Verde has a Sahelian climate tempered by the oceanic position of the country.

Rainfalls vary from 300 mm/year in the South West to 1,500 mm/year in the North East of the island. Rainfall is very irregular from one year to another and poorly distributed in space. The driest areas are located at the coast. They receive an average of 0 to 300 mm of water per year. The slopes under wind receive more rain and areas of altitude above 600 m may receive up to 800 mm of rain per year. The rainy season is between July and October in low altitude, but mountain areas may also receive small rains during the dry season. The seasons are marked by the alternation of winds from North and East during the dry season (November to July) and by marine winds in South East South direction during the rainy season. In the dry season, the winds of the North provide a cool climate and weather, while winds of continental North East – corresponding to the Harmattan[1] – bring a dry climate. These winds can be violent during the winter for several days. Extreme temperatures remain within a relatively restricted interval because of the oceanic position of the territory. These temperatures rarely exceed 38 °C in summer, while minimum temperatures around 0 °C can be observed at high altitudes e.g. on the volcano of Fogo, particularly during the months of December and January. The average temperature per month varies between 22 °C and 28 °C. It is higher during the wet season, sometimes softened by the ocean, with maximum values in September and minimum values in February.

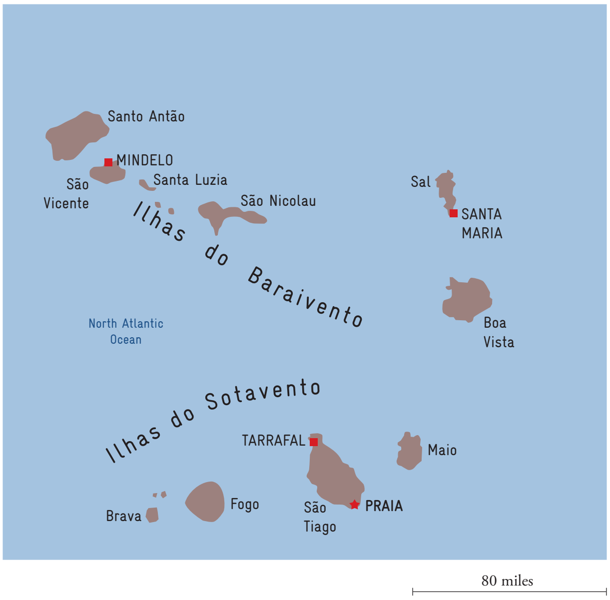
1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

Cape Verde is a former Portuguese colony and one of the first countries in Sub-Saharan Africa to switch from a single-party to a pluralistic democratic system. During the first years after independence (achieved in 1975), the political landscape is dominated by the African Party for the Independence of Guinea-Bissau and Cape Verde (PAIGC), transformed in 1981 after the separation from Guinea Bissau to the African Party for the Independence of Cape Verde (PAICV).

The population of the Cape Verde is estimated at 487,118 inhabitants in 2006. 53 % of the population is female. In the two major urban centers – Praia and Mindelo – approximately 39 % of the population are concentrated. 700,000 inhabitants of Cape Verde constitute the Diaspora and live abroad. The growth rate of the population between 2000 and 2006 is 1.8 %. The life expectancy is 72.3 years while the rate of schooling is 72 % (for young people) and 79 % (for adults).

FIGURE 1

Map of Cape Verde



In spite of the good development of its economy (see below), the unemployment of young people under 25 years is 21.1 % in Cape Verde. The general poverty rate rose from 30 % in 1989 to 37 % in 2002, while the rate of extreme poverty changed from 14 % to 20 % over the same period. 70 % of the poor and 85 % of very poor live in rural areas. In general, poverty rate and unemployment are on the decline.

The economy of the Cape Verde is characterized by the prevalence of the following sectors: tourism (177 hotels), fishing (14 % of the population), construction, trade and services of public administration. The agricultural sector is fragile, but constitutes the principal activity of the rural population by employing more than 50 % of the working population. Insufficiency of local resources is compensated by the flow of goods and services from outside the country, financed by international cooperations in form of gifts and loans and by the Diaspora (the latter is providing approximately 140 million USD per year).

The revenue per capita has risen from 190 USD in 1975 to 2,316 USD in 2006. Primary school enrolment is about 100 % while life expectancy is over 70 years. There has been a strong and continuous improvement in human development. The Human Development Index (HDI) increased from 0.587 in 1990 to 0.722 in 2006[2]. Today, Cape Verde has already achieved some of the Millennium Development Goals (MDP) while it is on target to achieve the rest by 2015. Between 2001 and 2006, the Gross Domestic Product (GDP) showed an average growth of 6.2 % (10.9 % in 2006) while inflation remained weak at around 2 %. Table 1 presents an overview of the economy of Cape Verde.

1 THE HARMATTAN IS A DRY AND DUSTY WEST AFRICAN TRADE WIND, BLOWING SOUTH FROM SAHARA INTO THE GULF OF GUINEA BETWEEN THE END OF NOVEMBER AND THE MIDDLE OF MARCH (WINTER).

2 UNDP, AS OF 2006

TABLE 1
Cape Verde Economy Overview (2001–2006)

	2001	2002	2003	2004	2005	2006
GDP growth (%)	6.1	5.3	4.7	4.4	5.8	10.9
Inflation (%)	3.4	1.9	1.2	61.9	0.4	5.4
Budgetary deficit (%)	4.8	3.4	3.4	1.3	4.0	4.7

Source: Bank of Cape Verde and National Institute of Statistics, as of 2007

2 ENERGY MARKET IN CAPE VERDE

2.1 OVERVIEW OF THE ENERGY SITUATION

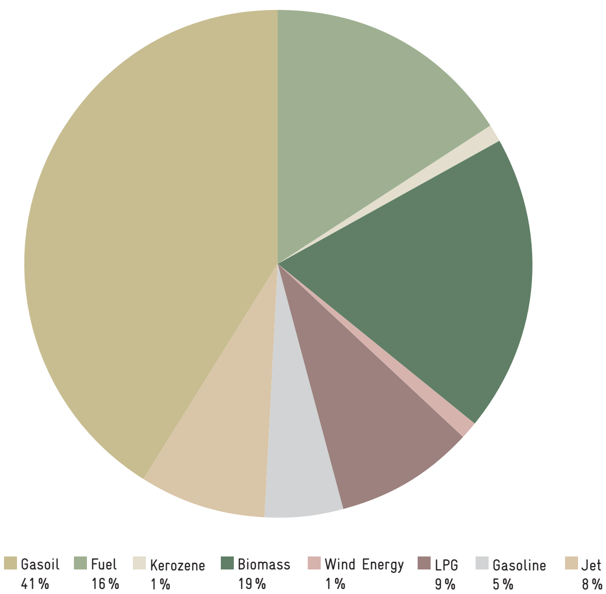
The energy sector of Cape Verde strongly depends on imported petroleum products, primarily imported oil. The use of solar power is quite negligible. The electrical network covered 60 % of the country in the year 2000 (against 25 % in 1990).

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

The energy sector of Cape Verde comprises of three sub-sectors: petroleum, electricity with RE and biomass. Figure 2 presents the energy mix of Cape Verde.

The main energy consumers are the transport sector (47 %) and the residential sector (34 %). A major part of the energy consumption is for domestic use, transport, electricity production and water desalination.

FIGURE 2
Energy Mix of Cape Verde



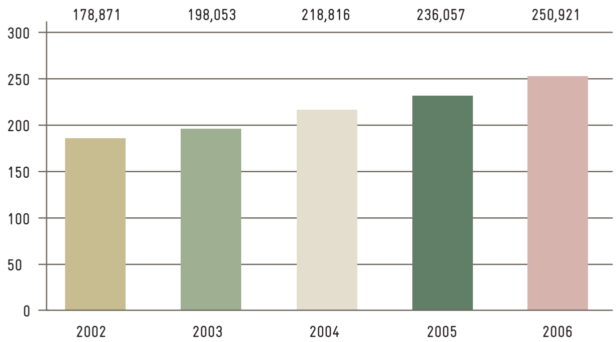
Source: Direction General of Industry and Energy of Cape Verde, as of 2003

Electricity Sector

Concerning electrical power, the overall production registered a growth rate of 8.8 % between 2002 and 2006. The main company Electra produced 236,000 MWh in 2005 and 250,000 MWh in 2006. Cogeneration capacities of steam turbines at water desalination plants contributed a total of 4.4 %. Figure 3 presents the annual increase of electricity production.

The electricity production by wind power went down from 16 % in 1995 to 3 % in 2005 in the total production of electricity. This decrease is due to the lack of investments in the wind energy production during this period. Electricity tariffs are fixed according to decree No. 03/2008. Table 2 presents an overview of current electricity tariffs.

FIGURE 3
Evolution of Electricity Production (1,000 MWh)



Source: Direction General of Industry and Energy of Cape Verde, as of 2006

TABLE 2
Electricity Tariffs

CATEGORY	PRICE (CVE/ kWh)[3]
up to 40 kWh	23,91
>40 kWh	33,41
Street lighting	19,31
Special low voltage	25,75
Medium average	20,91

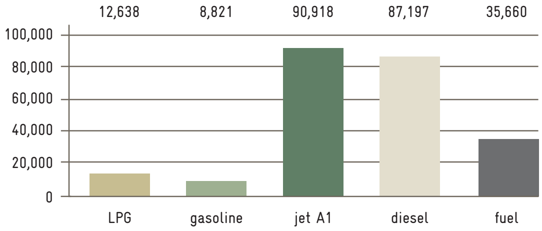
Source: Direction General of Industry and Energy of Cape Verde, as of 2008

Petroleum Sector

Cape Verde has no proven oil reserves. Therefore, the country has to import petroleum products to meet its requirements. The overall fuel demand of Cape Verde includes diesel, gasoline, kerosene for cooking, LPG, lubricants, marine diesel and Jet A1. Diesel (43,378 toe) and LPG (12,927 toe) are the most important in terms of oil product consumption. The major consumption of LPG is due to the country's lack of biomass resources (firewood and coal). Figure 4 visualizes the amount of imported petroleum products while table 3 presents the prices for different petroleum products.

3 1 EURO = 1,010 CAPE VERDEAN ESCUDO (CVE)

FIGURE 4
Imports of Petroleum Products in toe



Source: Direction General of Industry and Energy of Cape Verde, as of 2004

TABLE 3
Prices for Petroleum Products[4]

PRODUCT (IN CVE/LITER)	GASOLINE	DIESEL	DIESEL ELECTRICITY GENERATION	MARINE DIESEL	KEROSENE
Price (March 2003)	145.80	106.30	94.30	78.70	78.60
Price (January 2009)	160.00	112.40	105.07	84.60	83.50

Source: ARE, as of 2009

Biomass Sector

Due to the climatic conditions, Cape Verde has a very low biomass potential. The total production was estimated at 22,264 toe in 2004. This is a problem for households, especially in rural areas with the urgent need for biomass energy for cooking purposes.

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The management of the energy sector in Cape Verde is under the control of the **General Direction of Industry and Energy** (Direcção Geral da Indústria e Energia – DGIE) of the **Ministry of the Economy, Growth and Competitiveness** and the multisector **Agency for Economic Regulation** (Agência de Regulação Económica – ARE). The DGIE is responsible for the formulation and the implementation of the policy, while the ARE is in charge of regulatory issues. The National Assembly enacts the laws and provides the statues under which the agency manages the energy sector.

In the petroleum sector, the National Company Fuel – ENACOL and Shell Cape Verde are responsible of the commercial system of supply.

For the production and the distribution of electric power and water produced by desalination, the Company of Electricity and Water (Electra) is fully in charge.

The biomass sector is managed by the Ministry of Environment, Rural Development and Marine Resources. This ministry also ensures the implementation of the production, the assembly of the wind pumps and the construction of improved stoves. It coordinates the Solar Regional Program – PRS (phase 1 and 2) of the European Union.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The Government of Cape Verde already took important measures to create incentives for the implementation of RE. Article 16 of the law nº 20/VII/2007, for example, allows the import of RE equipment such as solar panels, wind generators etc. with remarkable tax exemptions. The Government further intends to strengthen the role of RE within its upcoming energy policies. The major objective is to reduce the high dependence on imported fossil fuels. The Government thus intends to meet 50 % of the overall energy needs (as opposed to presently 3.2 %) by 2020 through RE resources[5] . In the same period, the Government wants to reduce energy costs that are currently about 70 % above the European Union average.

The strategy for implementing this ambitious program is to open the energy market to national and international private sector investments and to reorganize and privatize Electra. Using the various existing international instruments for RE management and promotion and creating a national conscience in favor of RE are the key elements of this strategy. The development of incentives for RE is a key objective of this policy; it will increase the participation of the private sector and facilitate the building and securing of the RE sub-sector in the country. Cape Verde will only achieve its vision of a fossil-fuel-free future through the investment in, and the development and adoption of technologies and innovative approaches that will reduce its energy use and dependency on oil products. It is why the country has decided to develop special partnerships with innovative firms in the area of RE and alternative energy. Capacity building will be facilitated, especially through the University of Cape Verde, to increase national capabilities. Strategic experimentation and public-private partnership will be encouraged.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

The implementation of Cape Verde's energy policy will reinforce the rural electrification. Thus, after having invested 500 Million CVE in the rural electrification over the 2005–2008 period, the Government intends to considerably increase the investments in this sub-sector of the energy sector. For providing rural energy services, the Government has decided the promotion of concessions. There will be two concession areas: one comprising the Santiago Island and the other comprising the remaining nine inhabited islands of Cape Verde. The concessions will not have geographic monopolies, but will be free to operate wherever chosen within a designated concession area. Concessions will be allowed for ten years and will be awarded via a competitive tender for which detailed bidding documents have been prepared. Concessions will have three

4 COSTS OF FUEL IN CAPE VERDE HAVE FALLEN STRONGLY IN 2009; SEE ALSO WEBSITE OF ARE (WWW.ARE.CV › ELECTRICIDADE › COMBUSTÍVEIS › TRANSPORTES)
5 SEE ALSO REN21, VIEWED IN SEPTEMBER 2009

main responsibilities: (i) sell off-grid electrification systems for either cash or credit, (ii) sell electricity or electricity services by a fee-for-service arrangement for consumers and (iii) manage publicly owned equipment. For isolated sites where the extension of the network is difficult or impossible, innovating solutions of electrification for these zones will be developed with focus on applications for solar energy.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

Due to the existing climatic conditions, the status and future potential of biomass energy in Cape Verde is very low.

4.2 SOLAR ENERGY

The potential of solar energy of Cape Verde is very high. The solar irradiation is one of the highest of the ECOWAS countries: 6 $kWh/m^2/day$. Due to the high potential of solar energy, it is intended to cover 2 % of the total energy consumption by 2010. Up to now, there are several successful PV-based applications for water pumping, lighting and telecommunication systems.

4.3 WIND POWER

The average wind velocity in Cape Verde is more than 6 m/s; thus Cape Verde is one of the rare ECOWAS countries with an unuaually high and interesting potential for wind energy. Cape Verde has been exploiting wind energy mainly for electricity production and desalination since 1995. This proves that the economic potential for this resource is substantial.

4.4 HYDRO POWER

Like the biomass potential, there is almost no (economically feasible) potential for Hydro Power.

5 MARKET RISKS AND BARRIERS

Cape Verde offers many advantages in view of business activities for the development of RE. Over the last years, successful investment strategies gained up to 1 billion USD (as was the case in 2007). Trough the commitment of the Cape Verde Government adequate taxation, tariffs and financial mechanisms in favor of RE have been promoted.

This is mainly due to the existence of a reliable legal framework with guarantees for intellectual property rights and guaranteed safety for investments. In addition to this, Cape Verde offers good infrastructural prerequisites (three international airports, ports, hotels, the University of the Cape Verde, a large number of specialized educational institutions etc.). The conditions for setting up a company are very flexible in Cape Verde. The Government adopted the Foreign Investment Law (Law No. 89/IV/93)[6] and the Industrial Statute (Decree Law No. 108/89)[7] establishing general conditions, rights and guaranteed measurements for investments in the country.

The Foreign Investment Law defines the conditions for foreign direct investment in any sector of economic activities. All sectors are open to investment unless the enterprise is a threat to national security, the environment or public health or violates domestic laws and regulations (see section IV.3 (d) for further discussion on the Foreign Investment Law).

The new investment policy ensures that applicable procedures are open, efficient and transparent. Investors can easily obtain clear guidance on these procedures from the Center for Tourism and Export Promotion of Cape Verde (PROMEX), a Government department under the supervision of the Ministry of Economy, Growth and Competitiveness in charge of promoting trade and investment opportunities in Cape Verde.

Cape Verde offers quite a range of investment incentives and guarantees for foreign investors, companies in free trade zones and companies producing goods and services exclusively for exports.

6 PUBLISHED IN THE OFFICIAL BULLETIN 13/12/93
7 PUBLISHED IN THE OFFICIAL BULLETIN 30/12/89

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 4

Local Business Partners

NAME	CONTACT/ADDRESS	PROFILE
Association of the Friends of the Nature (ONG)	S/C Direction of Environment and Sustainable Development Phone: +238 261 8984	Capacity building and distribution of RE products
General Direction of Industry and Energy	Phone: +238 261 48 00 Fax: +238 261 33 15 abrao.lopes@govcv.gov.cv	Energy policy (fossil and RE)
Direction of Environment and Sustainable Development	Phone: +238 261 89 84	Environment and energy policy (biomass)
National Institute of Management of Hydraulic Resources	Phone: +238 261 24 13 prs_cv2@yahoo.fr	Hydraulic and energy policy (solar and wind pumping)
Fuel ENACOL	Phone: +238 251 1120 Fax: +238 231 4873	Distribution of oil products
Authority Regulation (ARE)	Phone: +238 260 0424 Fax +238 261 6053 are@are.cv	Regulation of energy sector and other sectors such as water, communication etc.
Electra	Phone: +238 230 3030 Fax. +238 232 44 46	Electricity production, transport and distribution

7 BIBLIOGRAPHY

- BAD/OCDE (2008): Perspectives Économiques en Afrique 2008: Le Cap Vert
- Banque Mondial/ PNUD (without year): Étude de Stratégies pour l'Énergie Domestique
- Cap Vert-UE (2007/08): Document de Stratégie de Coopération pour la Période 2001-2007
- DGIA of Cape Verde (2004): Rapport Bilan Énergétique du Cap Vert
- DGIE (2008): Document de Politique Énergétique du Cap Vert
- ECOWAS (2005): White Paper on Access to Energy Services
- World Bank (2000): Regulatory Approaches to Rural Electrification and Renewable Energy: Case Studies from Six Developing Countries (Working Paper), Eric Martinot and Kilain Reiche
- Gouvernement du Cap Vert (2001): Mémoire à la 3éme Conférence des Nations Unies sur les Pays les Moins Avancés, Bruxelles
- Institut National des Statistiques du Cap Vert (2006): Cap Vert en Chiffres
- DGIE (1996): Politiques et Stratégies de l'Énergie et de l'Environnement, Lopes Back Santos
- M. Abdallah SAMBA, CILSS/AGRHYMET, Niamey et M. Inussa BARRY, Consultant National Cap Vert (2008): Rapport de la Mission Conjointe CILSS/FAO/FEWS-NET/Gouvernement d'Évaluation de la Campagne Agricole 2008/2009 au Cap Vert, Praia
- CEAN, IEP-Université Montesquieu-Bordeaux IV (without year): Politique Institutionnelle au Cap Vert, Boubacar Issa Abdourhamane
- Ministry of Environment of Cape Verde (1999): National Communication on the Climatic Changes
- Ministry of Finances of Cape Verde (1990): Rapport de l'Aide Bilatéral
- N. N. (2004): National Assessment of the Barbados Program "Action + 10" Review, Praia
- Prof. Ogunalde Davidson (2008): Scaling Up-Market for Renewable Energy in Africa, Thematic Background Paper for International Conference on Renewable Energy in Africa, Dakar
- N. N. (2004): Rapport sur les OMD: Cap Vert – une Évaluation des Efforts
- Renewable Energy Policy Network for the 21st Century – REN21 (2009): various publications (www.ren21.net/pledges/detail.asp?id=1031)
- United Nations Development Program – UNDP (2006): Human Development Report
- Agência de Regulação Económica (Agency for Economic Regulation) – ARE: (www.are.cv)

COUNTRY CHAPTER:
CÔTE D'IVOIRE

Author of Country Chapter
Kouame Kadjo (Ing.)

Coordination and Review
Anton Hofer, (MSE, Dipl.-Ing./FH, M.A.)
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Editor
Deutsche Gesellschaft für Technische
Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic
Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS CÔTE D'IVOIRE

ACRONYMS AND ABBREVIATIONS
CÔTE D'IVOIRE

AIPO	African Intellectual Property Organization
ANARE	Agence Nationale de Régulation de l'Électricité (National Regulatory Agency)
ANDE	Agence Nationale de l'Environnement (National Environmental Agency)
BNETD	Bureau National d'Étude Technique et de Développement (National Office for Technological Studies and Development)
CACI	Cour d'Arbitrage de Côte d'Ivoire (Côte d'Ivoire Arbitration Court)
CET	Common External Tariff
CFAF	CFA Franc (1 Euro = 655,957 CFAF)
CICA	Cour d'Arbitrage de Côte d'Ivoire englische Erklärung ergänzen
CIE	Compagnie Ivoirienne d'Électricité (The Ivorian Electricity Company)
CIPREL	Compagnie Ivoirienne de Production d'Électricité (The Ivorian Electricity Production Company)
CME	Centre des Métiers d'Electricité (Electricity Trade Center)
CNR	Canadian National Resources International CI
CNRA	Centre National de Recherche Agronomique (National Center for Agricultural Research)
CTFT	Centre Technique Forestier Tropical (Technical Center for Tropical Forestry)
EDF	Électricité de France (Electricity of France)
GDP	Gross Domestic Product
GESTOCI	Société de Gestion des Stocks Pétroliers de la Côte d'Ivoire (Petroleum Product Management Company of Côte d'Ivoire)
I2T	Institut de Technologie Tropicale (Tropical Technology Institute)
IMF	International Monetary Fund
IPP	Independent Power Producer
IREN	Institut de Recherche sur les Energies Renouvelables (Research Institute on Renewable Energies)
MDP	Mécanisme pour un Développement Propre (Clean Development Mechanism – CDM)
MP	Member of Parliament
NGO	Non-governmental Organization
OIPI	Office Ivoirien de la Propriété Industrielle (Ivorian Industrial Property Office)
PETROCI	Société Nationale d'Opérations Pétrolières de la Côte d'Ivoire (National Petrol Society)
SIR	Societé Ivoirienne de Raffinage (Ivorian Refinery Society)
SMB	Société Multinationale des Bitumes (Multinational Bitumen Society)
SODEDAM	Société d'Exploitation et de Développement Aéroportuaire, Aéronautique et Météorologique (Society for Airport Operation and Development, Aviation and Meteorology)
SODEFOR	Société pour le Développement Plantations Forestières (Forest Plantation Development Society)
SOGEPE	Société de Gestion du Patrimoine du Secteur de l'Electricité (Company for the Management of the Electricity Sector's Patrimony)
SOPIE	Société d'Opération Ivoirienne d'Electricité (National Electricity Operation Society)
UN	United Nations
VAT	Value Added Tax
WAEMU	Western African Economic and Monetary Union
WAPP	West African Power Pool

MEASUREMENTS

bbl/d	barrels per day
kWh	kilowatt hour
m/s	meter per second
m^2	square meter
m^3	cubic meters
MW	megawatt
MWh	megawatt hour
toe	tons of oil equivalent
TWh	terawatt hour

SUMMARY

The Country Study of Côte d'Ivoire is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Côte d'Ivoire. The study is structured as follows:

Chapter one provides **Background Information on Côte d'Ivoire**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Côte d'Ivoire.

Chapter two summarizes facts and figures of **Côte d'Ivoire's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Côte d'Ivoire. This includes an overview of support mechanisms for photovoltaic PV as well as existing regulations, incentives and legislative framework conditions for other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Côte d'Ivoire.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Côte d'Ivoire.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Located in West Africa and in the intertropical zone, Côte d'Ivoire has a land area of 322,462 km². It is bordered by the Atlantic Ocean in the South and shares borders with Ghana in the East, Burkina Faso and Mali in the North and Guinea and Liberia in the West. The country is influenced by two air masses: a moist equatorial air mass called Monsoon and a dry tropical air mass coming along with a drying wind named Harmattan, with a saturation of 65–90 %.

There are four major climate zones in Côte d'Ivoire, namely an equatorial climate (or Attiean climate), a semi-damp tropical climate (or Baoulean climate), a dry tropical climate (or Sudano-Guinean climate) and a wet tropical climate (or mountain climate). Three types of vegetations can be found in the country: One vegetation area spans over the southern half of the country and the coastal basin; the Sudanese area in the North is characterized by a scattered vegetation covering (savannah). In-between these regions, a pre-forest area spans East to West with dense bush formations and gallery forests along watercourses.

The geography of Côte d'Ivoire includes plains in the South with swampy areas and a few hills no higher than 200 meters. Plateaus covering the center and the North form isolated hills or hill chains with a height of 200 to 500 meters. In the West of the country, there are chains of mountains with a height of more than 1,000 meters and single peaks of 1,300 meters and even 1,752 for Nimba Mount, the highest summit.

MAP OF CÔTE D'IVOIRE

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

In Côte d'Ivoire, a new constitution has been drafted in 2000, providing three separated powers: the executive power held by a Government headed by a President, the legislative power held by the parliament which consists of Members of Parliament (MPs) from several political parties and a judicial power. The political and social unrests, violence, coups d'état and rebellions did not allow the population to reap the fruit of this democratic system. The administrative system is decentralized and run by elected local representatives. Examples are the General Councils at regional level and municipalities (mayors) for the direct management of the population's needs. Since its independence, the country has been establishing a free market economic system.

Côte d'Ivoire has an estimated population of 20,807,216 inhabitants (as of 2008) with over 26 % of immigrants coming mainly from neighboring countries. There are around 60 ethnic groups belonging to four major affiliations: Gurs, Mandés, Akans and Krus. Côte d'Ivoire is a lay country with several coexisting religious denominations, the major ones being Islam (38.6 %), Christianity (35.8 %) and Animism (25.6 %). The country has two capital cities: Yamoussoukro, the political capital, and Abidjan, the economic capital. Moreover, Côte d'Ivoire is characterized by a significantly high urbanization rate and a population with about 40.3 % of its members being 15 years and under.

The economy of Côte d'Ivoire has been experiencing a slow decline since the outbreak of an armed rebellion in September 2002. As a consequence, most of the foreign aid flow was interrupted (except for humanitarian assistance), thus increasing the internal and external debt burden and inducing a severe downturn in foreign and domestic investments. The Gross Domestic Product (GDP) growth rate was 0.9 % in 2006 and 1.7 % in 2007. The IMF anticipates a positive GDP growth rate of 3.8 % in 2008. The Ivorian economy is largely dependent on external factors such as weather conditions and international raw material prices. The standard of living of the population and the state of infrastructure has deteriorated since 2002. The inflation rate was approximately 2.5 % in 2007.

The economy of the country rests on agriculture providing jobs for two thirds of the national manpower and contributes to the GDP to the tune of 20 %. Côte d'Ivoire is the leading world cocoa exporter with a yearly production of several million tons. Some mining activities such as gold, diamond and manganese mining are also conducted in the country. In 2005, however, the UN Security Council banned diamond export because it served to fund arms procurement. Industrial and material development sectors account for approximately 22 % of the GDP while the tertiary sector contributes 57 %.

Côte d'Ivoire is the hub for trade activities in Western Africa, and foreign trade accounts for 90 % of the GDP. Côte d'Ivoire is a member of WAEMU (Western African Economic and Monetary Union) applying a common external tariff (CET). It is also a member of the CFAF Zone. Its top three export partners are France, the United States and the Netherlands. Cocoa is the country's main export good (generating 40 % of its export receipts). In terms of import, the top three partners of Côte d'Ivoire are France, Nigeria and Singapore. The main import goods are fuels and oils, vehicles, ships and vessels, grains and machinery.

2 ENERGY MARKET IN CÔTE D'IVOIRE

2.1 OVERVIEW OF THE ENERGY SITUATION

Côte d'Ivoire's oil industry started to take off in 2001 during the period of civil war. By 2007, oil exports accounted for 28 % of the Governments export revenues. The majority of Côte d'Ivoire's electricity is generated through stations powered with natural gas and hydroelectricity accounting for around 20 %. More than half of the domestic energy needs are met by combustible renewable resources and waste, mainly in the form of biomass. Table 1 presents the production/consumption figures of Côte d'Ivoire.

TABLE 1

Energy Production/Energy Consumption

TYPE OF ENERGY	2004	2005	2006	2007
Production				
Electricity (MWh)	5,403,895	5,570,205	5,543,9164	5,515,481
Electricity (MWh)	5,403,895	5,570,205	5,543,9164	5,515,481
Petroleum products (1,000 tons)	1,302	2,044	3,135	2,418
Natural gas (million m³)	1,555	1,738	1,708	1,398
Consumption				
Electricity (MWH)	2,989,808	3,004,062	3,262,877	3,432,915
Petroleum products (1,000 TONS)	799	695	813	833
Natural gas (MILLION M³) 1,708	1,555	1,738	1,708	1,398

Source: Direction Générale de l'Energie (Energy Information System), as of 2004–2007

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

As of 2005, Côte d'Ivoire had installed an electric generation capacity of 1,210 megawatts (MW). In 2005, Côte d'Ivoire generated about 5.4 billion kWh of electricity, while consuming about 2.9 billion kWh. Electricity is exported through the West African Power Pool (WAPP). Most of the electricity is generated through conventional thermal power stations (> 70 %), with hydroelectricity supplying the remainder. The 288 MW Azito Power Station, in operation since 1999, is located in Abidjan's suburbs and produces more than a third of the country's electricity. The phased construction of a third turbine in Azito has been delayed. Côte d'Ivoire's main hydroelectric plants include Ayame I and II, Kossou, Taabo, Buyo and Grah. Table 2 presents the electricity production capacities; Table 3 indicates the current electricity tariffs.

TABLE 2

Electricity Production Capacities

HYDRAULIC POWER PLANTS	INSTALLED POWER (MW)
Ayamé 1	20
Ayamé 2	30
Kossou	174
Taabo	210
Buyo	165
Grah	5
Total	**604**
THERMAL POWER PLANTS	
Vridi	100
Ciprel	210
Azito	288
Total	**606**
Overall	**1,210**

Source: Société d'Opération d'Electricité, SOPIE, as of 2008/2009

TABLE 3

Electricity Cost (in CFAF)

LOW VOLTAGE COST		PRICE FOR LOW VOLTAGE	
Household use	Price ET	Professional use	Price ET
Fixed price per kWh	1,176	Fixed price	1,664.98
Nominal tariff rate/ kWh	36.05	1st price band	92.59
General tariff rate/ kWh	57.43	2nd price band	78.75

CATEGORY OF SUBSCRIBER	MEDIUM VOLTAGE COST	HIGH VOLTAGE COST
Short-term use		
Fixed price/ kW/year	18,850.76	46,658.33
kWh cost for busy hours	63.59	57.01
kWh cost for peak hours	98.40	104.41
kWh cost for non-busy hours	45.68	32.15
General use		
Fixed price	25,936.38	63,120.76
kWh cost for busy hours	51.71	38.46
kWh cost for peak hours	75.95	104.41
kWh cost for non-busy hours	46.09	32.15
Long-term use		
Fixed price	37,686.39	79,563.98
kWh cost for busy hours	53.47	34.42
kWh cost for peak hours	67.91	38.46
kWh cost for non-busy hours	46.48	32.71

Source: Agence Nationale de Régulation de l'Électicité (ANARE), prices including VAT, as of 2008/2009

Petroleum Sector

Côte d'Ivoire has proven crude oil reserves of 100 million barrels; the vast majority is located offshore. Oil production increased from around 15,000 barrels per day (bbl/d) in 2002 to approximately 62,000 bbl/d in 2006. Production problems at the so-called Baobab field constrained the oil production in 2007 to almost 52,000 bbl/d. The production is expected to increase to 70,000 bbl/d by 2009 following repairs at three of the five shut-in wells at the Baobab field. Côte d'Ivoire currently has one refinery: the SIR (Société Ivoirienne de Raffinage) located in Abidjan with a capacity of 65,000 bbl/d. The refinery receives crude oil from West African and other countries, then exports products to neighboring countries (detailed production figures are available in the Annex/Table 10 of this report). An oil pipeline connects the SIR refinery to the so-called Lion and Panther fields. The state currently owns 47.3 % of SIR; other partners include the Government of Burkina Faso, Total, Shell, ExxonMobil and Chevron. A petroleum product depot, adjacent to SIR, stores petroleum products for domestic use as well as for export (to Mali, Burkina Faso, Niger and Chad). Other fuel depots are located in Bouake and Yamoussoukro. In 2006, the national oil consumption reached 26,000 bbl/d with about 36,000 bbl/d being exported. Table 4 presents the current prices for petroleum products.

TABLE 4

Price of Oil Products

PRODUCT	PRICE (CFAF)
Butane (12.5 kg bottle)	4,500
Unleaded gasoline	790
Kerosene (jet)	495
Diesel	685
DDO	793.61
FO180	471.99

Source: Direction des Hydrocarbures, as of November 2008

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The institutional framework of the overall energy sector is rather complex as several ministries have direct or indirect influence on this keysector.

The **Ministry of Mining and Energy**, through its technical body named **Office for the Promotion of Energy Efficiency** (Bureau des Économies d'Énergie) and through the **Sub-Directorate of Energy Control and Renewable Energies** (Sous-Direction de la Maîtrise de l'Énergie et des Énergies Renouvelables), ensures the promotion of energy efficiency actions and RE development actions. For that purpose, the two bodies jointly carry out the following actions:

- Monitoring of the "Improved Stoves Popularization Program"
- Monitoring of power billing for public buildings in consultation with the Laboratory of Construction and Civil Engineering (Laboratoire du Bâtiment et des Travaux Publics) of the Ministry of Economic Infrastructures
- Monitoring of the use of residues in some industrial companies
- Monitoring of the activities of charcoal producers in cooperation with the National Center for Agricultural Research (Centre National de Recherche Agronomique) of the Ministry of Higher Education and Research
- Monitoring of experimental solar stations in cooperation with the Research Institute on Renewable Energies (Institut de Recherche sur les Energies Renouvelables) of the Ministry of Higher Education and Research

The **Ministry of Agriculture and Forestry** also ensures control of wood and charcoal sub-sectors.

The **Ministry of Higher Education and Research** coordinates the activities of the research centers involved in the energy sector, i. e. the Research Institute on Renewable Energies (IREN), the Tropical Technology Institute (Institut de Technologie Tropicale – I2T) and the National Center for Agricultural Research (CNRA).

The petroleum sector of Côte d'Ivoire is regulated and supervised by the Société Nationale d'Opérations Pétrolières de la Côte d'Ivoire (Petroci). In 1998, Petroci was divided into four units: Petroci Holding (responsible for portfolio management of the oil sector), Petroci Exploration/Production (responsible for upstream hydrocarbon activities), Petroci-Gaz (responsible for the natural gas sector), and Petroci Industries Services (responsible for all other related services).

The electricity sector of Côte d'Ivoire includes the following market actors:

- SOGEPE manages the asset base and financial flow of the power sector.
- SOPIE supervises the provision of facilities with focus on the implementation of the rural electrification program.
- The National Regulatory Agency (Agence Nationale de Régulation – ANARE) is the regulatory authority for the electricity sector.
- The Ivorian Electricity Company (Compagnie Ivoirienne d'Électricité – CIE) has been granted concession for the power utility and exploits electricity generation, conveyance and distribution facilities.
- Private electricity generation operators (Independent Power Producers – IPP) including CIPREL and AZITO ENERGY and new IPPs such as EEI and LAUCHAN are about to sign an agreement with the Government, which contributes considerably to the implementation of the energy policy.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The development of RE is hindered by a lack of comprehensive planning as Côte d'Ivoire does not have a clearly defined energy policy with substantial financial means to promote RE. On the institutional level, the management of RE is incumbent on the Energy Directorate and is ensured through the Sub-Directorate of Energy Control and Renewable Energies (see 2.3). Several operators and institutions (ministries, research institutes and centers, etc.), however, are active in this sector without genuine coordination. In 2005, the decision to establish a Renewable Energy Directorate (Direction des Énergies Renouvelables) within the Ministry of Mining and Energy has set a distinctive hallmark in the official RE development policy.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

As already mentioned, there is a massive lack in legal and fiscal framework conditions for the implementation and promotion of RE. Up to now, there are no specific regulations, incentives or legislative framework conditions available. The new regulations currently being drafted at the Ministry of Mines and Energy will, however, provide the necessary environment to develop the RE sub-sector in Côte d'Ivoire.

Several private enterprises are getting involved in rural electrification after securing the approval of SOPIE, the principal contractor for the provision of electrical facilities. In order to obtain this approval, all enterprises applying have to give evidence of their financial and technical capacities.

The National Authority (AN-MDP) is responsible for the MDP (Mécanisme pour un Développement Propre - Clean Development Mechanism (CDM)) implementation in Côte d'Ivoire. The AN-MDP Focal Point is housed at the National Environmental Agency (Agence Nationale de l'Environnement – ANDE). The National Work Plan on the MDP has been validated since May 2003.

Several projects (development of household wastes, sustainable forest management etc.) are currently being evaluated in order to classify them as projects liable to be funded within the opportunities provided by the MDP.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

Biomass energy is the most common energy source in Côte d'Ivoire. Up to 60 % of the overall energy requirements are covered by this energy source, including:

- Fuel wood and charcoal for households, small restaurants, bakeries, arts and crafts centers (smithies, jewelry-making shops, potteries etc.).
- Agricultural and forest residues for the production of steam and/or electricity in some agro-business companies (oil works, sugar refineries etc.) and sawmills

The anaerobic generation of biogas was experimented with in several pilot projects, but was not implemented in regular operation up to now. Currently, some private investors are applying for the authorization to produce electricity from household wastes, especially in Abidjan. The main sources of supply in fuel wood are natural forests, savannah woodlands and tree and bush savannahs, productive farms as well as fallows and tree plantations.

Comprising 16 million hectares of moist forests at the beginning of the previous century, the forest stand has diminished to presently 6.38 million hectares including 4.2 million hectares of highly degraded forests and two million hectares of protected areas. Resources from agro-industrial residues, crops and plantations are estimated at over 4.3 million toe per year. They represent a key energy source and the most directly useable RE potential. Table 5 presents the available biomass potential.

TABLE 5

Biomass Potential

GEOGRAPHIC AREA	FORM OF ENERGY	VALUE IN TOE
North	Bagasse	120,000
	Sugar cane molasses	30,000
	Cotton seed shell	10,475
Center and South	Cobs, palm fiber and shell	100,000
	Shell, coffee hull	32.15
General use	Cocoa beans	74,000
	Cocoa cops and shells	25,000
	Rice husk	10,000
	Urban waste	104.41
District of Abidjan		› 1,000,000 tons

Source: Direction Générale de l'Énergie, 2008

4.2 SOLAR ENERGY

Côte d'Ivoire enjoys abundant sunshine with a good sunshine average, estimated at 4–5 kWh/m²/day with a daily sunshine time of 6 hours (more detailed information can be found in the Annex/Figure 3 of this report). Despite this satisfactory potential, solar energy has not been developed significantly up to now. Some PV solar energy systems have been implemented in the framework of small-scale projects developed by private initiatives or NGOs for electricity supply for households, schools and health facilities. Moreover, several telecommunication facilities have also been equipped with PV solar energy systems for stand-alone energy supply. Thermal solar energy is sometimes used for water heating and solar drying purposes while solar ovens and cookers have not yet started being popularized. Recently, some private operators have started activities basically oriented towards the import, sale and installation of solar equipment.

4.3 WIND POWER

There are no wind measurements available beside those for civil aviation compiled by the "Société d'Exploitation et de Développement Aéroportuaire, Aéronautique et Météorologique (SODEXAM) services. These measurements taken at 12 m above the ground generally range from 1–2 m/s. San Pedro on the western shoreline and Korhogo in the North record wind frequencies between 20–35 % for wind speeds above 6 m/s. Bouake in the Center,and Tabou on the western shoreline are swept by winds with frequencies from 20–45 % and speeds faster than 4 m/s. There are no other wind tapping projects known to date except those in Touba and Korhogo.

4.4 HYDRO POWER

Up to now, four large identified hydroelectric sites have not been developed yet. These sites have a power capacity ranging from 5–288 MW. Several other sites have potential for small Hydro Power plants with capacities of 0.5–5.0 MW, but have also not been exploited yet. The potential identified in the context of a study conducted by Électricité de France in 1980 adds up to an estimated theoretical hydroelectricity capacity of 46 TWh. The economically exploitable potential equals 12.4 TWh, i.e. 27 % of the theoretical potential. Table 6 presents the available Hydro Power potential of Côte d'Ivoire. A detailed map of Hydro Power potential is available in the Annex of this report (Figure 4).

TABLE 6

Hydroelectric Potential

SITE	RIVER	POTENTIAL CAPACITY (MW)
Soubré	Sassandra	288
Ndielesso	Comoé	100
Malamalasso	Comoé	90
Louga	Sassandra	280
Singrobo	Bandama	67
Kokumbo	Bandama	78
Bouloubré	Sassandra	156
Daboitié	Bandama	91
Gribo popoli	Sassandra	112
Tiassalé	Bandama	51

Source: based on a study conducted by Électricité de France, as of 1980

5 MARKET RISKS AND BARRIERS

The business environment in Côte d'Ivoire is ruled by national and regional legal institutions and instruments:

- The OHADA Treaty is a legal purview regulating business law in the sixteen states signed in to the treaty including Côte d'Ivoire. It comprises common legal rules designated as the "Uniform Acts".
- The Labor Code developed in 1995 aims at three goals: enabling companies to meet their requirements in terms of manpower and competitiveness; preserving the workers' fundamental rights; rehabilitating enterprises and confirming their prominent place in the economic and socio-development process through their capacity to generate wealth and employment.
- The Environment Code of 1996 is the legal basis of the environmental protection and preservation policy in Côte d'Ivoire. The Rural Land Code was passed in 1998 and is amended in Article 26 in 2004.
- The Côte d'Ivoire Arbitration Court (Cour d'Arbitrage de Côte d'Ivoire – CACI) and the Common Ohada Justice and Arbitration Court (Cour Commune de Justice et d'Arbitrage de l'OHADA) are redress bodies in case of conflicts.

Côte d'Ivoire is allied with several European Union countries through bilateral agreements tending to avoid double taxation and to prevent tax evasion in terms of income tax. The Ivorian Industrial Property Office (Office Ivoirien de la Propriété Industrielle – OIPI) is the national entity cooperating with the African Intellectual Property Organization (AIPO), which protects intellectual works such as inventions, brands, drawings or industrial design or trademarks. It ensures an effective control of counterfeiting and unfair competition.

There are several private and public universities in the country. Public universities and engineering colleges like the Institut Polytechnique Houphouët Boigny, as well as research centers like the CNRA and Institut de Technologie Tropicale (I2T) also serve as centers of cooperation with external organizations and provide for incentives to invest in Côte d'Ivoire. This type of investment encouragement has been reinforced since the outbreak of the September 2002 crisis to support the private sector.

- Special privileges are granted by the four specific legal texts: the Investment Code, the Mining and Oil Code, the Law Establishing Information and Communication and the Law Establishing a Biotechnology Free-Trade Zone.
- Common law privileges are recorded in the General Tax Code and are applied every year by a Tax Schedule to the Appropriation Act.
- Customs measures: The WAEMU Treaty has established a common market by the enforcement of the Common External Tariff (TEC). Third party countries are in general subject to the following import duties: custom duties ranging from 0–20 %, a statistics due of 1 % in general and the Community Solidarity Levy of 1 % of the total value of the products

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 7

Authorities and Societies in the Energy Market

NAME	ADDRESS	PROFILE
Société Nationale d'Opérations Pétrolières de la Côte d'Ivoire (PETROCI)	Building Les Hévéas 14, Boulevard Carde Plateau BP V194 Abidjan Phone: +225 20 20 25 00 Fax: +225 20 21 68 24 info@petroci.ci	Ensures the promotion of the Ivorian sedimentary basin and the development of its oil and gas resources through the exploration and exploitation of the Ivorian oil and gas deposit in partnership with key international companies
Société de Gestion des Stocks Pétroliers de la Côte d'Ivoire (GESTOCI)	GESTOCI Abidjan 15 BP 89 Abidjan 15 Phone: +225 21 75 98 00 Fax: +225 21 2717 82 gestoci@gestoci.ci	Ensures the management of security stocks for a SIR shutdown period of 60 days and also manages the means of transport between the three depots Abidjan, Bouaké, Yamoussoukro
Société d'Opération Ivoirienne d'Electricité (SOPIE)	Il Plateaux 7ème Tranche 01 BP 8529 Abidjan 01 Phone: +225 22 52 76 00 Fax: +225 22 52 76 13 courrier@sopie.ci www.sopie.ci	Supervision of works in the electricity sector
Autorité Nationale de Régulation du Secteur de l'Electricité (ANARE)	Tour EECI 16 BP 1106 Abidjan Phone: +225 20 20 63 18 Fax: +225 20 20 61 14 recours@anare.ci	Monitoring of compliance with regulations and conventions; arbitration of conflicts between the players of the electricity sector; defense of consumers' interests
Société de Gestion du Patrimoine du secteur de l'Electricité (SOGEPE)	Tour EECI 01 BP 1345 Abidjan 01 Phone: +225 20 20 60 00 sogepe@sogepe.ci	Management of the power sector assets and financial flows
Société Ivoirienne de Raffinage (SIR)	Vridi Boulevard Petit Bassam 01 BP 1269 Abidjan 01 Phone: +225 20 20 25 00 Fax: +225 20 21 68 24 info@sir.ci	State-of-the-art refinery with two atmospheric distribution units, and one of the only two hydrocrackers existing in Africa
Société Multinationale des Bitumes (SMB)	Vridi Boulevard Petit Bassam 12 BP 622 Abidjan 12 Phone: +225 21 23 70 70 www.smb.ci	Specialized in bitumen production.
Société des pour le Développement Plantations Forestières (SODEFOR)	01 PB 3770 Abidjan 01 Phone: +225 22 44 46 16 Fax: +225 22 44 02 40	Reforestation program to fight deforestation, to enhance bush fire control, to participate in public sales and to control quota of timber for export
Bureau National d'Etude Technique et de Développement (BNETD)	04 BP 945 Abidjan 04 Phone: +225 22 44 28 05 Fax: +225 22 44 56 66 www.bnted.sita.net	Development and implementation of public or private investment projects of all kinds in all sectors of economy (including energy)
Agence Nationale de l'Environnement (ANDE)	Il Plateaux, 7ème tranche 08 BP 09 Abidjan 08 Phone: +225 22 42 70 93	Protection of the environment and promotion of RE
Chambre de Commerce et de l'Industrie de Côte d'Ivoire	6, Avenue Joseph Anoma 01 BP 1399 Abidjan 01 Phone: +225 20 33 16 00 Fax: +225 20 32 39 42 demma@chamco-ci.org	Training and information concerning economy, finance and commerce (for members)
Cour d'Arbitrage de Côte d'Ivoire (CICA)	Phone: +225 20 31 90 73 Fax: +225 20 21 72 56 acoulibaly@fnisci.net webad@fnisci.ci	Management and handling of enquiries related to energy development projects
Bourse de Sous-Traitance et de Paternariat de Côte d'Ivoire	Phone: +225 20 33 88 94 Fax: +225 20 32 02 60 secretariat@bstp-ci.com	Promotion of the market of subcontractors, development of conditions for an optimal use and performance of business capacities

TABLE 8

Private Companies and Organisations

NAME	ADDRESS	PROFILE
Groupe EOULEE	Marcory, Zone 4C 20 BP 347 Abidjan 20 Phone: +225 21 25 41 44	Management of the Akouédo dumpsite (biomass)
Groupe THANRY	Rue de l'Indenié Abidjan Plateau 01 BP 3916 Abidjan 01 Phone: +225 20 21 31 33 Fax: +225 20 21 71 00	Wood processing, generation of industrial steam and electricity out of industrial agro-industrial residues
Compagnie Ivoirienne d'Electricité (CIE)	1, Avenue Christiani, Treichville 01 BP 6923 Abidjan 01 Phone: +225 21 23 33 00 Fax: +225 21 23 35 88 www.cie.ci info@cie.ci	Concession holder of a national utility with 12 regional directorates for the generation, conveyance, distribution, export and import of electrical energy
AZITO ENERGIE	II Plateaux, rue K57 Lot 33 BP 1296 Cedex 1 Phone: +225 22 40 02 40 Fax: +225 22 41 75 18 www.azitoenergie.com info@azitoenergie.com	Second independent electricity producer with an installed capacity of 296 MW
Compagnie Ivoirienne de Production d'Électricité (CIPREL)	Building SIDAM 01 BP 4039 Abidjan Phone: +225 20 31 97 95 Fax: +225 20 32 80 27	First independent electricity produce with an installed capacity of 210 MW
Canadian National Resources International CI (CNR)	01 BP 8007 Abidjan 01 Building Kharrat Phone: +225 20 31 00 15 Fax: +225 20 31 00 40	Exploration and production of crude oil and natural gas; operating company of the Espoir & Baobab oil fields
DEVON Côte d'Ivoire	04 BP 827 Abidjan 04 Phone: +225 20 25 40 40 Fax: +225 20 22 62 29 Koyate.fatou@dvn.com	Exploration and production of crude oil and natural gas; operating company of the Espoir & Baobab oil fields
FOXTROT International	15 BP 324 Abidjan 15 Phone: +225 21 21 76 00 Fax: +225 21 21 76 31	Exploration and production of crude oil and natural gas

TABLE 9

Research and Training Centers

NAME	ADDRESS	PROFILE
Centre National de Recherche Agronomique (CNRA)	Abidjan, Km 17, Route de Dabou 01 BP 1740 Abidjan 01 Phone: +225 23 47 24 24 Fax: (225) 23 47 24 11 www.cnra.ci info@cnra.ci	Agricultural research, technological research, biotechnologies, agricultural produces conservation, processing, bioenergies
Centre Technique Forestier Tropical (CTFT)	08 BP 33 Abidjan 08 Phone: +225 22 44 28 58	Technical training in forest management
Centre des Métiers d'Électricité (CME)	Phone: +225 22 40 34 12	Training of high level technicians, skilled workers and staff for Ivorian companies and countries in the sub-region; training for development and continuous education
Société Ivoirienne de Technologie Tropicale (I2T)	04 BP 1137 Abidjan 04 Phone: +225 21 27 91 51	Development of agricultural by-products (coconut cops) for stand-alone generation of electricity from gas generator

7 BIBLIOGRAPHY

- BBC (2009): Country profile (http://news.bbc.co.uk/2/hi/africa/country_profiles/1043014.stm)
- Centre de Promotion des Investissements en Côte d'Ivoire – CEPICI (2009): Accueil CEPICI (www.cepici.ci, last viewed October 2009)
- Central Intelligence Agency – CIA (2009): World Fact Book (www.cia.gov/library/publications/the-world-factbook)
- Direction Générale des Douanes – Direction de l'Informatique (2009): Douanes de Côte d'Ivoire. Site Officiel (www.douanes.ci)
- Énergie Electrique de la Côte d'Ivoire (2008): Rapport Annuel
- Gallagher, Kevin (2008): Handbook on Trade and Environment
- International Energy Agency (2008): Energy Statistics of Non-OECD Countries
- International Monetary Fund – IMF (1996): Côte d'Ivoire – Statistical Annex
- Le Système d'Information Énergétique (2008): Rapport 2008
- NASA (2008): Scientific Centre on Atmospheric Data (http://eosweb.larc.nasa.gov)
- OECD/African Development Bank (2003/2004): African Economic Outlook
- Présidence de la République de Côte d'Ivoire (2007): Le site Officiel de la Présidence de la République de Côte d'Ivoire (www.cotedivoirepr.ci, last viewed October 2009)
- Profil Environnemental de la Côte d'Ivoire (2006): Final Report
- United Nations Department of Economic and Social Affairs (2005): Statistics Pocketbook
- United Nations Statistics Division – UNSD (2006): Energy Statistics Yearbook
- USA International Business Publications (2008): Energy Policy, Laws & Regulation Handbook
- World Bank (2009): Climate Change and the World Bank Group
- World Bank (2006): World Development Indicators
- World Bank (1996): Lending for Electric Power in Sub-Saharan Africa

8 ANNEX

FIGURE 2

Electricity Network of Côte d'Ivoire

Source: unknown

FIGURE 3

Overview of Sun Energy Potential

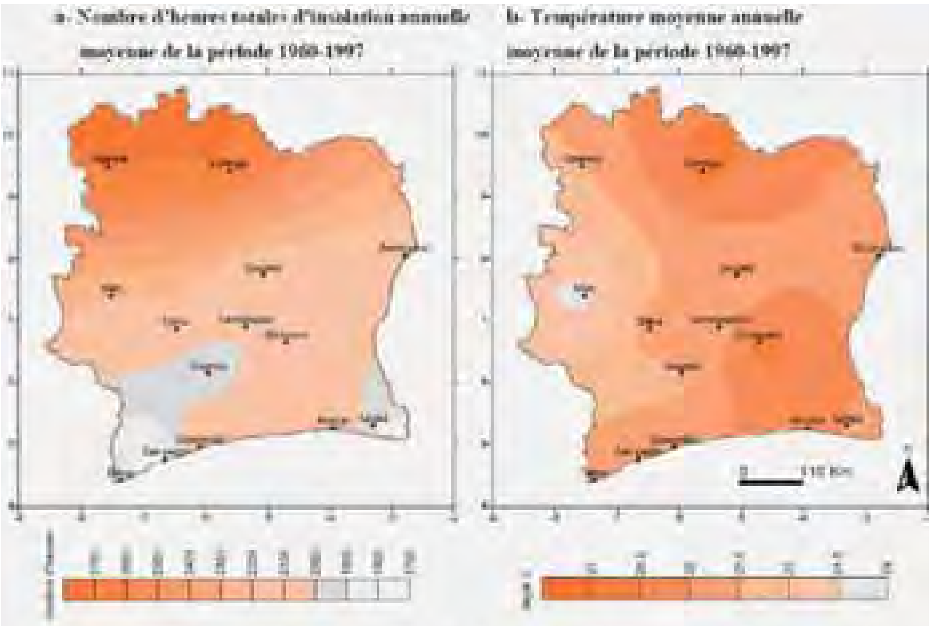


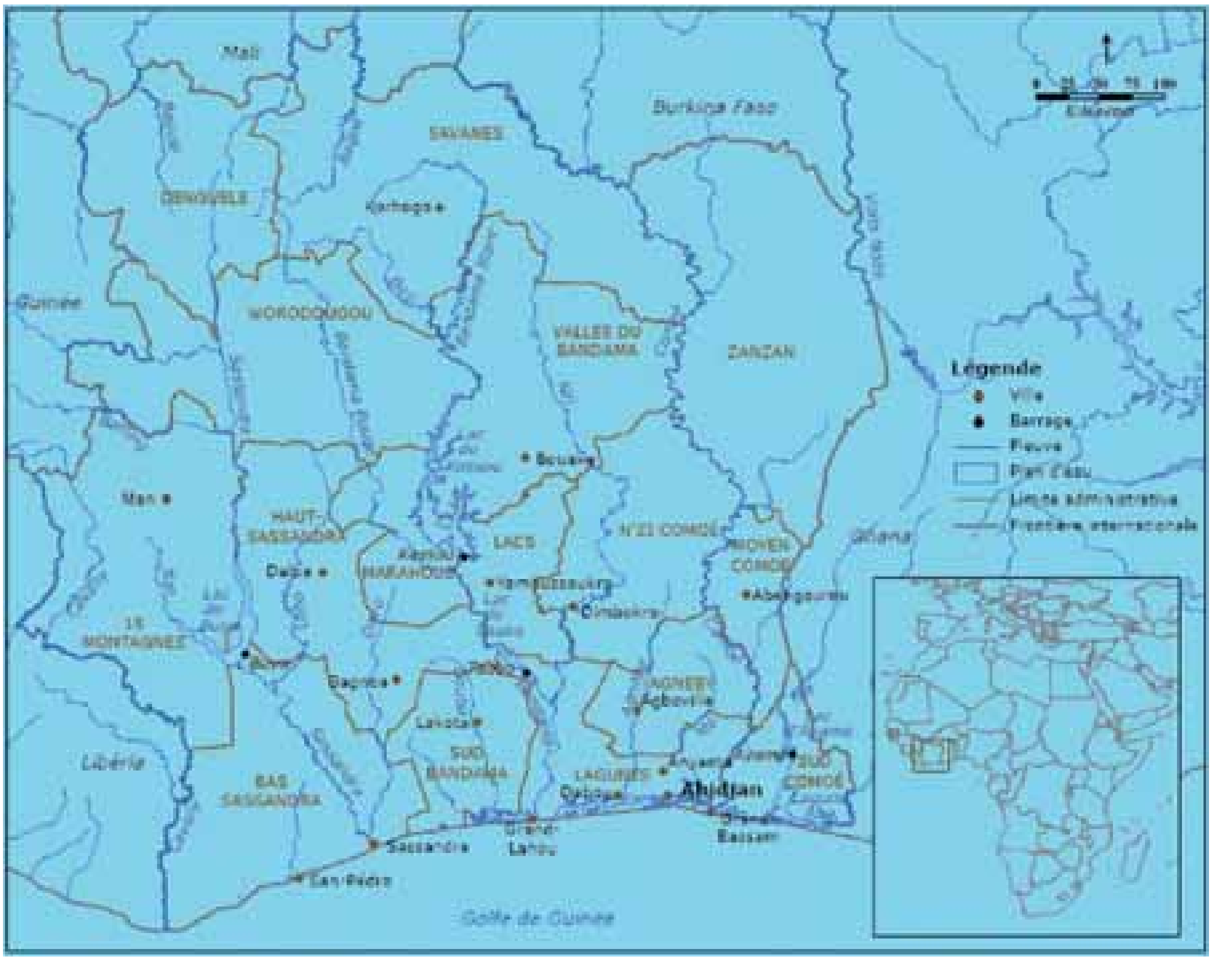
Tableau 4 : Température (°C) et insolation (heures) moyenne de1977 à 1999

Stations	Paramètres	J	F	M	A	M	J	Jt	At	S	O	N	D	année
Abidjan	Température	26.7	27.5	27.8	27.9	27.5	26.1	24.9	24.0	24.5	26.0	27.3	27.0	26.4
	Insolation	212	206	218	216	202	130	133	110	134	197	221	207	2191
Daloa	Température	25.7	27.2	27.3	26.9	26.4	25.3	24.3	24.4	24.9	25.4	25.6	24.9	25.7
	Insolation	212	204	201	210	208	162	116	111	140	183	181	177	2111
Korhogo	Température	26.6	28.9	29.3	28.7	27.5	25.9	24.9	24.7	24.6	26.0	26.8	26.7	26.7
	Insolation	273	243	230	225	244	209	160	162	183	240	256	258	2690

Source: unknown

FIGURE 4

Map of Available Hydro Power Potential



Source: unknown

TABLE 10

Production Figures of Petroleum Products (SIR–2007)

PRODUCT	2007	2006	Variation (%)
Butane	83,588	76,367	9.46
Unleaded gasoline	564,284	604,840	–6.71
Kerosene (paraffin/jet)	932,828	975,842	–4.41
Gasoil	1,088,501	1,209,526	–10.01
DDO	146,530	58,990	148.40
HVO	74,033	84,411	–12.29
Fuel oil	289,309	521,446	–44.52
Total for petroleum products	3,179,073	3,531,422	–9.98

Source: Direction des Hydrocarbures, as of 2008

COUNTRY CHAPTER: GAMBIA

Author of Country Chapter
Bah F. M. Saho (Dipl. Agr., MSc. RE)

Coordination and Review of the Country Chapter
Anton Hofer, (MSE, Dipl.-Ing./FH, M.A.)
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS GAMBIA

ACRONYMS AND ABBREVIATIONS

GAMBIA

CFL	Compact Fluorescent Lamp
CRR	Central River Region
DMCI	Development Management Consultant International
DoSPEMR	Department of State for Petroleum, Energy and Mineral Resources
DoSFEA	Department of State for Finance and Economic Affairs
DoSFNRE	Department of State for Forestry, Natural Resources and the Environment
DoSLGL&RA	Department of State for Local Government, Lands & Religious Affairs
EE	Energy Efficiency
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIPFZA	Gambia Investment Promotion and Free Zone Agency
GREC	Gambia Renewable Energy Centre
HFO	Heavy Fuel Oil
ICT	Information and Communication Technologies
IPP	Independent Power Producer
LAG	Local Government Area
LPG	Liquefied Petroleum Gas
LRR	Lower River Region
NAWEC	National Water and Electricity Company
NBR	North Bank Region
NEA	National Environment Agency
PRSP	Poverty Reduction Strategy Paper
PURA	Public Utilities Regulatory Authority
PV	Photovoltaic
R&D	Research and Development
SPA	Strategy for Poverty Alleviation
UNIDO	United Nations Industrial Development Organization
URR	Upper River Region
USD	United States Dollar
WR	Western Region

MEASUREMENTS

€	Euro (1 Euro = 33.21 Dalasi)
GWh	gigawatt hour
km	kilometer
km^2	square kilometer
kW	kilowatt
kWh	kilowatt hour
kWp	kilowatt peak
m	meter
m^2	square meter
m^3	cubic meter
mm	millimeter
MW	megawatt
°C	degree Celsius
s	second

SUMMARY

The Country Study of Gambia is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Gambia. The study is structured as follows:

Chapter one provides **Background Information on Gambia**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Gambia.

Chapter two summarizes facts and figures of **Gambia's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Gambia. This includes an overview of support mechanisms for photovoltaic (PV) as well as already existing regulations, incentives and legislative framework conditions concerning also other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Gambia.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

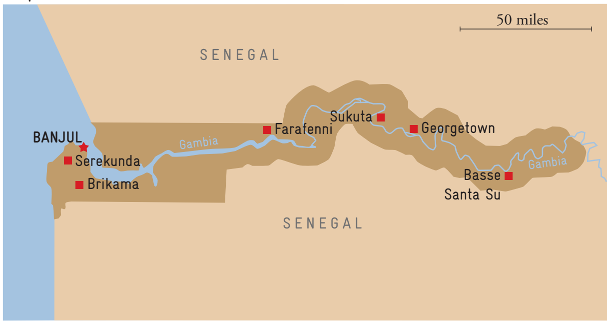
Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Gambia.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Gambia is located in the valley of the Gambia River on the West coast of Africa stretching as a narrow band of land approximately 480 km long and varying in width from 48 km near the estuary of the river to 24 km inland with an overall land area of 10,689 km². The country is bordered on three sides by Senegal and dissected by the Gambia River into North and South Bank. The current population of 1.36 million (as of 2003) is estimated to grow by 2.77 % per year.

FIGURE 1
Map of Gambia



Stretching between latitude 13 ° 3' and 13 ° 49' North and longitude 16 ° 48' and 13 ° 47' West, Gambia is situated in the South of the Sahel zone, a region which is largely semi-arid with only one rainy season in the year and a dry period of 6–7 months. The wet season starts in June and ends in September, while the dry season lasts from October till May. Average daily temperatures in the dry season are 30 °C and fall slightly to 27 °C in the wet season. There are three main agro-ecological zones: (i) the Sahelian zone which is a small concave in the extreme North of the Central River Region (CRR North) with a rainfall of less than 600 mm, (ii) the Sudano-Sahelian zone with a rainfall ranging from 600 to 900 mm covers the remaining parts of CRR North, all of CRR South, the Lower River Region (LRR) and parts of the North Bank Region (NBR), the Upper River Region (URR) and the Western Region (WR) and (iii) the Sudano-Guinean Zone which occupies the western ends of WR and NBR with a rainfall of 900 to 1,210 mm.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

The Gambia gained independence from Britain in 1965, became a republic in 1971 and was one of the very few multiparty democracies in Africa at that time. A military coup in 1994 briefly interrupted the country's democratic process, which was restored in 1996 through Presidential elections followed by National Assembly elections in 1997 completing the return to a civilian government.

Administratively, the Gambia is divided into five regions or provincial divisions (Western Region, North Bank Region, Lower River Region, Central River Region and Upper River Region) plus Banjul. Gambia has eight Local Government Areas (LGAs): Janjanbureh (Georgetown), Kuntaur, Kanifing, Banjul, Basse, Brikama, Kerewan and Mansa Konko. The next level of administrative division is the district level, which comprises of a total of 39 districts. In addition, there are two municipalities: Banjul City Council and Kanifing Municipal Council. Politically, the relevant units are the LAGs, districts, wards and villages.

The economy is primarily agrarian, with agriculture employment equaling about 70 % of the labor force and accounting for about 30 % of the Gross Domestic Product (GDP). The services sector accounts for over 50 % of the GDP resulting from re-export trade and tourism. Financial Services and Information and Communication Technologies (ICT) are also emerging and gaining importance. The manufacturing sector contributes 5 % to the GDP reflecting the low level of manufacturing activities. This is very little compared to average levels registered in the region of the ECOWAS (Economic Community of West African States or CEDEAO – Communauté Économique Des États de l ,Afrique de l'Ouest). With an average GDP growth rate of 5 %, Gambia has one of the most liberalized and best performing economies in the West African sub-region. The country is well positioned as a trading hub for the West Africa – Europe trade and transshipment. Sustained economic growth has, however, been constrained by the prevailing undiversified economic base, poor infrastructure, particularly roads/transportation and energy, slow pace in the implementation of policies and reforms, low levels of human capital and the lack of a culture of public-private partnership.

Gambia is among the poorest countries in the world with a per capita income of about 302 USD per year and ranked 155 out of 177 in 2005. The population was 1.3 million people in 2003 as compared to 1.03 million in 1993 equaling a growth rate of 2.8 % in this period. The population density grew from 97 to 128 persons per m² over the same period, representing one of the highest in Africa. About 61.2 % of the population mainly living in rural areas are considered as poor. High levels of unemployment in the urban areas have contributed an increase in urban poverty. Significant progress was made in gender parity, education, water and sanitation as well as moderate gains in health services. The country has been implementing programs addressing poverty since 1994 when the launch of its First Strategy for Poverty Alleviation (SPA) took place. Poverty reduction, however, continues to be evasive as the number of people living in poverty is rising rather than decreasing. Moreover, poverty studies conducted in 1998 and 2003 indicate that in addition to the increase in the prevalence and severity of poverty, inequality is also on the increase.

Using the upper poverty line, based on per capita consumption, the head count index (i.e. the percentage of poor people) is calculated at 61.2 %. The poverty gap is calculated at 25.9 % whilst the poverty severity accounts for about 14.3 %. Data obtained in 2003 indicate that the overall poverty has been on the increase in both rural (from 61 % in 1998 to 63 % in 2003) and urban (from 48 % to 57 %) areas. The rise in rural poverty is partly associated with the poor performance of the agricultural sector particularly as it relates to declining productivity and the farmers' lack of access to markets and other social services due to poor rural infrastructure. The rise in urban poverty is attributed to the lack of employment opportunities.

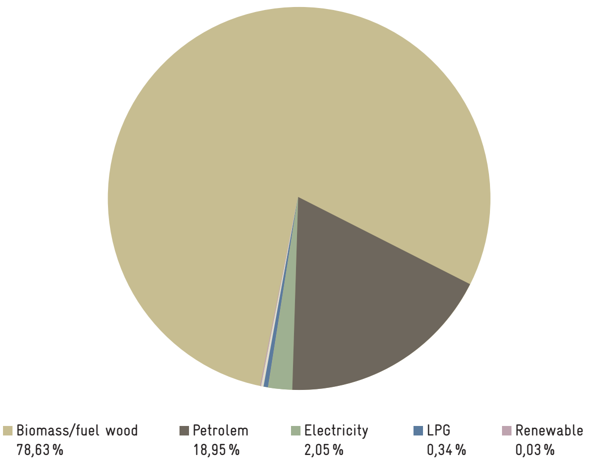
2 ENERGY MARKET IN GAMBIA

2.1 OVERVIEW OF THE ENERGY SITUATION

Gambia relies almost entirely on biomass fuels and imported petroleum products to meet its energy requirements. As part of the Government's efforts to build a sound and sustainable socio-economic infrastructure, this policy was introduced in June 2005[1] to provide the framework for the provision of an efficient, reliable and affordable energy supply to support the socio-economic development of the country. Figure 2 presents the energy mix of Gambia while Table 1 provides an overview of the evolution of the national energy mix.

FIGURE 2

Energy Mix of Gambia



Source: DoSPEMR for Energy, as of 2008

TABLE 1

Evolution of the Energy Mix of Gambia (1,000 TOE)

YEAR	BIOMASS/ FUELWOOD	ELECTRICITY	PETROLEUM	LPG	RE	TOTAL
1996	295.940	4.190	72.160	1.160	0.070	373.530
1997	304.820	5.330	71.720	1.210	0.080	383.170
1998	313.960	6.160	76.980	1.260	0.090	398.460
1999	323.380	7.170	81.880	1.310	0.110	413.850
2000	333.090	6.850	86.890	1.360	0.110	428.300
2001	343.080	8.770	83.770	1.420	0.110	437.150
2002	353.370	9.900	83.100	1.470	0.121	447.960
2003	363.970	8.860	82.460	1.530	0.132	456.950
2004	374.890	7.170	84.730	1.590	0.133	468.510
2005	386.140	9.440	86.040	1.660	0.134	483.410
2006	397.720	10.370	95.880	1.720	0.134	505.830

Source: DoSPEMR for Energy, as of 2008

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

Until August 2006, the electricity power supply of Gambia was highly inadequate, erratic and extremely unreliable. The electricity generation increased tremendously after the commissioning of the power plant in Brikama (4 x 6.5 MW Deutz generators running on HFO) in August 2006. The first truly Independent Power Producer (IPP) power plant of 25 MW has an output capacity of 22 MW. This new installation adds to the existing installed capacity at the main power station at Kotu about 28 MW to provide an available capacity of 50 MW in the Greater Banjul Area. Table 2 presents figures on the production, consumption and distribution losses of electricity in Gambia. Table 3 includes the current electricity tariffs.

TABLE 2

Electricity Production, Consumption and Distribution Losses

YEAR	PRODUCTION	CONSUMPTION	LOSSES (GWH)	LOSSES (%)
1995	83.9	56.8	27.1	32.3
1996	86.0	48.7	37.3	43.3
1997	110.5	62.0	48.5	43.9
1998	122.2	74.8	47.4	38.8
1999	128.7	92.4	36.3	28.2
2000	137.9	90.7	47.2	34.2
2001	147.9	114.6	33.3	22.5
2002	163.1	128.4	34.7	21.3
2003	150.6	107.7	42.9	28.5
2004	128.1	93.3	34.8	27.1
2005	156.3	109.7	46.6	29.8
2006	162.6	120.6	42.0	25.8

Source: NAWEC, as of 2008

TABLE 3

Electricity Tariffs (Dalasi/kWh)[2]

APPLICATION	0–40 KWH	41–600 KWH	601–1,000 KWH	> 1,000 KWH
Domestic	2.02	6.83	7.58	9.07
Commercial	9.43	9.43	9.43	9.43
Maximum demand	10.43	10.43	10.43	10.43
Agriculture	9.07	9.07	9.07	9.07
Local authority (urban)	9.07	9.07	9.07	9.07
Local authority (rural)	9.07	9.07	9.07	9.07
Central government	9.07	9.07	9.07	9.07
Prepayment domestic	6.83	6.83	6.83	6.83
Prepayment commercial	9.43	9.43	9.43	9.43
Prepayment maximum demand	10.43	10.43	10.43	10.43

Source: NAWEC, as of 2008

1 NATIONAL ENERGY POLICY, AS OF 2005
2 1 EURO = 33.21 DALASI

Petroleum Sector

Gambia is heavily dependent on imports to meet its requirements of petroleum products. These include Liquefied Petroleum Gas (LPG) as a cooking fuel substitute and diesel and HFO for generating electricity. This is the second most important source of energy in the country accounting for about 18 % of the total primary energy needs as specified in the 2006 energy balance. In 2006, The Gambia imported 128 thousand metric tons of petroleum products, and there has been an increasing trend since 1995. Table 4 presents an overview of imported petroleum products. Table 5 presents the prices of various petroleum products.

TABLE 4

Import of Petroleum Products (1,000 tons)

YEAR	DIESEL	GASOLINE	KEROSENE	HFO	TOTAL
1995	27.00	17.58	12.30	13.53	70.38
1996	40.14	16.00	14.00	10.80	80.94
1997	35.60	15.89	18.18	23.44	93.11
1998	40.66	15.12	19.06	22.18	97.02
1999	47.01	15.47	17.17	24.44	104.09
2000	56.56	14.51	13.56	18.83	103.46
2001	57.17	13.27	11.19	25.59	107.22
2002	52.44	12.33	16.18	35.39	116.34
2003	48.93	13.48	17.86	31.13	111.40
2004	49.79	17.71	14.90	30.95	113.35
2005	45.80	19.60	18.20	31.76	115.36
2006	48.23	20.73	24.63	34.36	127.51

Source: Shell Marketing Gambia Ltd., as of 2008

TABLE 5

Prices of Petroleum Products (Dalasi/liter)[3]

PERIOD	GASOLINE	DIESEL	KEROSENE
Up to 10/01/03	15	12	7
11/01/03–08/10/04	19	18	9
08/10/04–15/08/05	22	21.5	9
15/08/05–23/04/07	27	25	12
23/04/07–20/05/08	30	28	21
20/05/08 to date	33	32	26

Source: Energy Division, DoSPEMR for Energy, as of 2008

Biomass Sector

More than 90 % of the population depend on fuel wood as their domestic energy source for cooking. This situation and the fast-growing number of inhabitants especially in the urban areas contribute to the rapid deforestation. Table 6 indicates the evolution of fuel wood consumption.

TABLE 6

Evolution of Fuel Wood Consumption (1,000 m³)

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
653.0	672.6	692.8	713.6	735.0	757.0	779.7	803.1	827.2	852.0	877.6	903.9

Source: DoSPEMR for Energy, as of 2008

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The energy sector of Gambia is controlled by the **Department of State for Petroleum, Energy and Mineral Resources (DoSPEMR)** created in September 2007. It serves as the main policy adviser regarding all aspects of energy. Prior to this period, the energy sector was under the purview of the Office of the President from February 2002. Previous to that, the energy sector was under the Department of State for Trade, Industry and Employment. The **Public Utilities Regulatory Authority (PURA)** was created by the Government of Gambia in order to regulate the electricity, water and telecommunication sectors of the country.

The Petroleum Act (2004) on exploration and production was enacted to rule the administration and management of the upstream sector of the petroleum industry. The Commissioner on Petroleum Exploration and Production administers this Act. Currently a license has been issued to the company of "Buried Hill of Canada" for some blocks in the identified potential area. The DoSPEMR has drafted a bill for petroleum products that was expected to be validated in late 2008. Until now, the management of the downstream petroleum has not had a coordinated management structure at central Government level. The **Department of State for Finance and Economic Affairs (DoSFEA)** sets the price of the products according to the taxes levied on petroleum products importation as a tax-based economy. LPG prices are not regulated and there is no Government tax levied.

The **Gambia Renewable Energy Centre (GREC)** is the technical supporter of the DoSPEMR responsible for Renewable Energy research activities as well as the development and promotion of RE. The **Forestry Department** (under the **Department of State for Forestry, Natural Resources and the Environment – DOSFNRE)** is responsible for the management of the nation's forest resources. The Forestry Act provides for the commercial trade in fuel wood and for the regulation of the movement of forest produce requiring valid licenses for production and sale of fuel wood.

The **Department of Community Development** is the technical supporter of the **Department of State for Local Government, Lands & Religious Affairs (DoSLGL&RA)** and is responsible for community mobilization. The department is engaged in promoting the efficient management of fuel wood resources through the promotion of substitutes and through improved end-use appliances for firewood such as improved cooking stoves and biogas research.

The **National Environment Agency (NEA)** is entrusted to ensure harmony between man and his environment and is tasked with the formulation, implementation, monitoring and compliance with environment standards.

3 1 EURO = 33.21 DALASI

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The National Energy Policy is consistent with the overall development policy objectives of Government as outlined in the Vision 2020 and the Poverty Reduction Strategy Paper (PRSP). The long-term aim of Gambia's Government for the energy sector is to maximize the efficient development and utilization of scarce energy resources to support economic development in an environmentally friendly way. The Government's overall objectives for the sector are to:

- Improve and expand existing energy supply systems through private sector partnership with the public sector
- Promote a domestic fuel sub-sector clearly focusing on sustainable management of forest resources
- Widen the population's access to modern forms of energy in order to stimulate development and reduce poverty
- Strengthen institutional and human resource capacity and enhance Research and Development (R&D) in energy development
- Provide adequate security of energy supply

According to the National Energy Policy document, the aim of the RE sub-sector is to ensure the promotion and considerate utilization of RE to support the sustainable development of the country. The specific objectives are to (i) promote the utilization of renewable forms of energy such as solar, wind and bio-mass (ii) promote the use and develop a domestic production capacity for RE fuels and technologies and (iii) ensure the sustainable supply of RE fuels, devices and technologies at competitive prices through private sector participation.

The Policy also encourages the use of alternative fuels and technologies as a substitute for petroleum products through the following strategies: (i) exploring the prospects of using gas, HFO, modern biomass (including bio-energy, groundnut shell and sawdust briquettes and bagasse) for energy generation, (ii) complement the Gambian Government's fiscal incentives with donor assistance to promote the use of efficient fuels and technologies, (iii) continue to provide fiscal incentives in the form of duty releases for fuel supply to the rural electrification project and (iv) encourage investment in efficient alternative technologies for energy generation.

To promote the utilization of new and RE technologies, the following strategies have been formulated: (i) popularize the use of solar PV, solar thermal and other RE systems to provide energy for various applications, particularly in rural areas, (ii) facilitate local and international donor intervention on the provision of grants, interest-free loans as well as other fiscal incentives for the acquisition of renewable energy devices including solar PV and thermal, wind and biomass systems, (iii) promote the use of solar water heaters in institutional facilities, hotels and private households, (iv) create awareness of the economic and environmental benefits of using RE technologies through public education (TV, radio and other media), (v) promote adaptive research and development of RE devices, (vi) encourage the production/assembly of RE devices in The Gambia, (vii) encourage utilization of efficient RE technologies by providing tax-free concessions on the technologies themselves and proven energy-efficient devices and (viii) encourage and support private sector participation in the promotion and development of RE fuels, devices and technologies at competitive prices.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

There is no legislation for the RE sector at the moment. It is, however, expected to be formulated under the Renewable Energy and Energy Efficiency program of the GEF-UNIDO Energy Program for West Africa. To cater for this present drawback, the Electricity Act provides the framework for regulation relating to electricity generation from renewable energies on a commercial basis, standards in terms of electricity generating or consuming devices and personnel to be licensed for any electrical works etc. For other RE fuels, provision has been made in the draft Petroleum Products Legislation. For the devices in the domestic energy sub-sector, e. g. improved cook-stoves, there are no provisions for regulation, legislation or standardization. These are produced according to regional or sub-regional specifications and track records.

For rural electrification, concessions and other incentives would be the only basis to encourage investment in rural areas, as these are otherwise unattractive for potential investors. At the moment, the national utility of NAWEC is the only provider of grid-electricity in the rural areas. The DoSPEMR, however, is encouraging the use of RE in the rural electrification program through private sector participation. A number of private parties have, however, installed stand-alone PV systems and solar water pumping systems in some of the villages.

With regards to incentives for RE and energy efficient devices, the Government of The Gambia has adopted a policy in March 2008 to encourage the use of RE and energy efficiency (EE) by granting a zero-import tax status to all solar PV panels, solar water heaters, wind energy equipment and energy efficient light bulbs (compact fluorescent lamps). In addition, there is no license fee for operators in the electricity sub-sector using RE.

As the national policy encourages the use of RE and EE, the Government welcomes and facilitates all initiatives of companies or other investors planning to invest in RE and EE devices. In most instances, additional incentives are provided by the Gambia Investment Promotion and Free Zone Agency (GIPFZA) for investments especially in energy and RE.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

The use of fuel wood and residues from wood processing for electricity generation is not encouraged because of the already present constraints in the utilization of wood for domestic cooking. More than 90 % of the population rely on wood to meet their energy needs. The use of other types of biomass is quite low due to the limited availability of agricultural waste and other potential sources.

There are some limited activities in the field of biofuels mainly produced from jatropha. Several projects were initiated by the Government in the 1980s in order to search for fuel alternatives to reduce the country's dependence on fuel wood and charcoal. This included the promotion of improved cooking stoves using firewood or charcoal and groundnut shell briquettes.

Biogas was subject to research activities in the early 1980s, but its implementation was rejected due to cultural barriers. Recently, however, the DoSPEMR participated in the promotion of biogas through the Peri-Urban Project for Agriculture. Within this, 20 biogas digesters in rural and peri-urban areas were implemented. At least two of these sites are running satisfactorily.

4.2 SOLAR ENERGY

With respect to solar energy, Gambia has a substantial potential of 4.5–5.3 kW/m²/day. Therefore, solar energy is one of the most promising RE sources of the country. By the end of 2006, PV installations with a capacity of more than 700 kWp were installed in Gambia. In addition to PV applications, the implementation of solar cookers and solar water heating units helps to reduce the high demand in electricity consumption.

4.3 WIND POWER

The available wind power potential of Gambia is about 3 m/s. Presently about 20 wind power applications are in operation for water pumping purposes. Even though the available wind power potential is modest, the coastal areas of Gambia offer substantial opportunities for the future.

4.4 HYDRO POWER

Gambia has no national Hydro Power potential. The country, however, cooperates with Guinea, Senegal and Guinea Bissau in order to construct two large-scale Hydro Power electricity generation units at Sambagalo and Kaleta.

5 MARKET RISKS AND BARRIERS

The promulgation of an Electricity Act (Electricity Act 2005) and the finalization of the Petroleum Products Bill expected to be legislated this year will provide the necessary environment for private investor participation with laws protecting the interests of both the consumers and investors. The Public Utilities Regulatory Authority (PURA) regulates the sector through the Acts.

The Gambian Government has made the process for private sector participation as transparent as possible in order to minimize the issue of corruption as much as possible. The Government has ratified the international Law on Intellectual Property Rights through the National Assembly in 2006 thus acknowledging the value and inviolability of innovations and creativity.

Private sector participation is the cornerstone of Government policy, including the National Energy Policy that acknowledges and encourages investments by the private sector. Domestic and foreign private sector commitment is most welcomed especially for the production and delivery of goods and services and employment creation. The GIPFZA acts as a one-stop shop for all investors to the country. This agency provides investment certificates and incentives for qualified investors in the energy sector. There are no restrictions on transfer of margins or profit, and the banking sector is completely liberalized including foreign exchange rates and transactions and transfer of foreign currency.

Capacity for trained personnel has been recognized as inadequate. Therefore, the DoSPEMR collaborates with other partners in order to provide training seminars on basic energy technology and RE technologies.

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

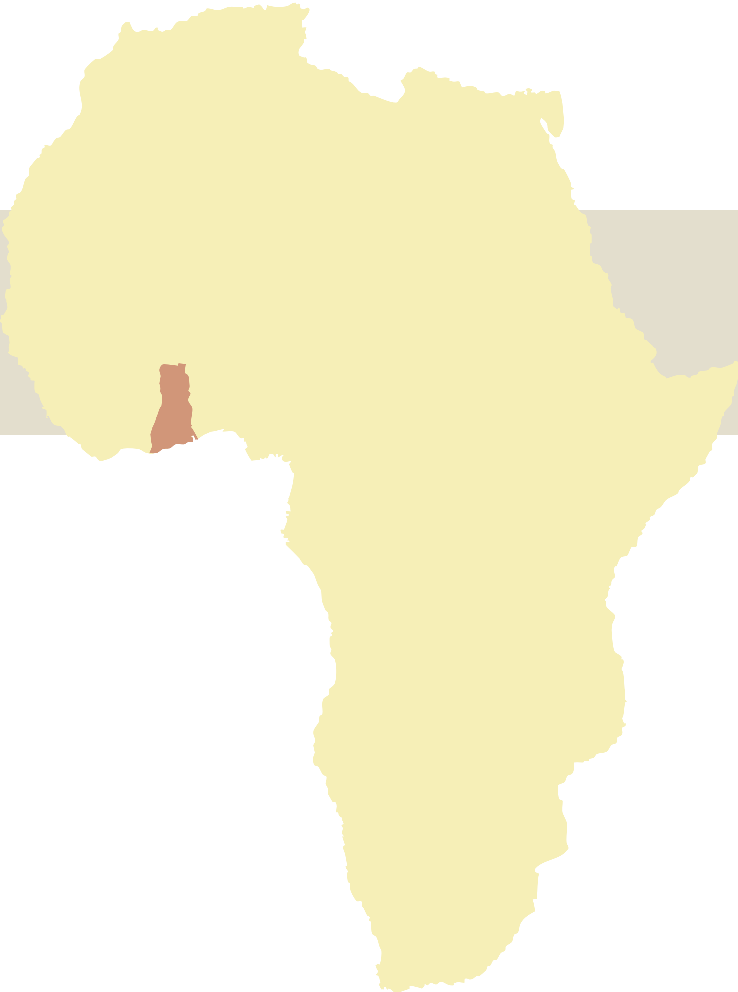
TABLE 7

Local Business Partners and Institutions

NAME	ADDRESS	PROFILE
Department of State for Petroleum, Energy & Mineral Resources	2nd Floor, Futurelec Building Bertil Harding Highway, Kotu Phone: +220 890 51 06 brusubii@yahoo.co.uk	Policy adviser to the Government in all aspects of energy responsible for policy formulation, implementation and monitoring
Gambia Renewable Energy Centre	DoSPEMR TK Motor Road, Kanifing Phone: Tel: +220 439 28 38	Technical supporter of the Department of Energy responsible for RE research, development and promotion
Department of Forestry	Phone: +220 448 48 44	Responsible for forest resource protection and management including the management of fuel wood supply
National Environment Agency (NEA)	Fitzgerald Street, Banjul Phone: +220 422 38 60 nea@nea.gm	Formulation, implementation and monitoring of environmental standards
National Water and Electricity Company (NAWEC)	53 Mamadi Manjang Highway P.O. Box 609, Banjul Phone: +220 437 62 33 Fax: +220 437 59 90 nawecmd@gamtel.gm	Electricity, water and sewage services in the urban and peri-urban areas
Public Utilities Regulatory Authority (PURA)	Bertil Harding Highway, Kololi Phone: +220 446 51 75 info@pura.gm	Regulatory body for electricity, water and telecommunication
Gambia Investment Promotion and Free Zone Agency (GIPFZA)	Phone: +220 437 73 77 info.gipfza@qanet.gm	Support and promotion of investments in Gambia
Development Management Consultant International (DMCI)	P.O Box 5342, Brikama Nyambia Phone: +220 448 45 24 sla@qanet.gm	Provides consultancy services in the energy sector and other sectors as well
RC Engineering	Phone: +220 990 94 34 reycarrol@gmail.com	Consultancy Services for solar power and water pumping systems
CES	Phone: +220 437 82 00 papasanneh@yahoo.com	PV and electrical equipment services
Sun Power	Phone: +220 422 92 83 Ibrahimdiame@yahoo.com	PV and water pumping systems
ESEIM Solar	Phone: +220 990 60 12 eseimsolarenergy@yahoo.co.uk	PV and water pumping systems
Solar Project Gambia	Phone: +220 439 90 92 mail@solarprojectgambia.com	Solar drying and cooking
Power Systems Engineering	Phone: +220 984 28 98 leroipoisson2002@yahoo.com	PV and wind energy
Gambia Electrical	Phone: +220 439 21 90 gec@qanet.gm	Electrical sales and contractor
SWE-GAM Co Ltd	Phone: +220 437 24 64 swegam@gamtel.gm	Water pumping systems and PV
JECCO	Phone: +220 446 17 09 jecco@qanet.gm	PV, pumps, borehole & well equipment
ABC Gaye's Association	Phone: +220 437 06 55 abcgaye@yahoo.com	Improved stoves
Gam Solar	Phone: +220 985 63 20 gamsolar@gmail.com	PV and water supply systems

7 BIBLIOGRAPHY

- Republic of The Gambia/European Community (2007): Country Strategy Paper And National Indicative Program. For the period 2008-2013 (http://ec.europa.eu/development/icenter/repository/scanned_gm_csp10_en.pdf)
- Development Management Consultants International – DMCI (2005): Report Household Energy Strategy for Gambia (HES)
- N. N. (without year): Review of Traditional Energy Sector (RPTES), Country Study 1st Draft, Banjul
- The Government of The Gambia (1998): Forest Bill
- de Bakker, Peerke (2003): The Gambia Country Side – European Union Energy Initiative for the Eradication of Poverty and Sustainable Development (EUI), Banjul
- N. N. (1982): Energy Survey and Master Plan Report, Draft Final Report, Banjul
- N. N. (without year): Report of the Study on The Feasibility of Producing Charcoal Briquettes in Gambia
- N. N. (2005): National Energy Policy 2005, Part I – Overview of the Situation and Part II – Policies and Strategies
- Government of The Gambia (1994): Vision 2020 Inc.
- Energy Department, Department of State for Energy (2008): National Energy Data
- N. N. (2005): Project for the Construction of a New Power Station in Gambia
- Management Development International – DMCI (2005): Final Report on a National Household Energy Consumption Survey in Gambia
- Department of State for Finance and Economic Affairs (2005/06): Gambia – The Second Strategy for Poverty Alleviation (SPAII). Poverty Reduction Strategy Paper (2003–2005)
- Lahmeyer International GmbH (2007): Final Feasibility Study – Solar Home System Program
- Lahmeyer International GmbH (2006): Final Feasibility Study – Small Scale Wind



COUNTRY CHAPTER: GHANA

Author of Country Chapter
Vincent Yankey (MBA, BSc)

Coordination and Review of the Country Chapter
Anton Hofer, (MSE, Dipl.-Ing./FH, M.A.)
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS GHANA

ACRONYMS AND ABBREVIATIONS

GHANA

AGSI	Association of Ghana Solar Industries
ATK	Aviation Turbine Kerosene
BST	Bulk Supply Tariff
CDM	Clean Development Mechanism
DANIDA	Danish International Development Agency
DSC	Distribution Service Charge
DSTC	Deng Solar Training Center
EC	Energy Commission
ECG	Electricity Company of Ghana
EPA	Environmental Protection Agency
ERP	Economic Recovery Program
EUT	End User Tariffs
GDP	Gross Domestic Product
GEDAP	Ghana Energy Development and Access Project
GEF	Global Environment Fund
GHp	Ghana Pesewas (1 GHp = 0.6313 Euro)
GHS	Ghana Cedi (currency of Ghana; 1 Ghana Cedi (GHS) = 100 Ghana Pesewas)
GIPC	Ghana Investment Promotion Center
GPRS	Growth and Poverty Reduction Strategy
GRIDCO	Grid Company Limited
GT	Ghana Telecom
GVCTF	Ghana Venture Capital Trust Fund
Hi-fi	high-fidelity (quality standard for audio technique)
IPP	Independent Power Producers
KITE	Kumasi Institute of Technology, Energy and Environment
LPG	Liquefied Petroleum Gas
M2+	key economic indicator and term used to forecast inflation
MIGA	Multilateral Investment Guarantee Agency
NED	Northern Electricity Department
NES	National Electrification Scheme
NREL	National Renewable Energy Laboratory
PURC	Public Utilities Regulatory Commission
PV	Photovoltaic
RESPRO	Renewable Energy Services Project
RFO	Residual Fuel Oil
SHS	Solar Home System
SLTV-HV	Solar Lamps and Television – high voltage
SLTV-LV	Solar Lamps and Television – low voltage
SLTV-MV	Solar Lamps and Television – medium voltage
SME	Small/Medium Enterprise
SMME	Small Micro and Medium Enterprises
SOE	State Owned Enterprises
TAPCO	Takoradi Power Company
TICO	Takoradi International Company
TSC	Transmission Service Charge
UNDP	United Nations Development Program
USD	United States Dollars
VAT	Value Added Tax
VRA	Volta River Authority

MEASUREMENTS

GWh	gigawatt hour
koe	kilograms of oil equivalent
kVA	kilovolt ampere
kWh	kilowatt hour
m^2	square meter
m^3	cubic meter
MJ	mega joule
mm	millimeter
MW	megawatt
°C	degree Celsius
t	ton
toe	tons of oil equivalent

SUMMARY

The Country Study of Ghana is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Ghana. The study is structured as follows:

Chapter one provides **Background Information on Ghana.** This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Ghana.

Chapter two summarizes facts and figures of **Ghana's Energy Market** including stakeholders and market actors and involved as well as related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Ghana. This includes an overview of support mechanisms for photovoltaic (PV) as well as already existing regulations, incentives and legislative framework conditions, concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Ghana.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Ghana.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Lake Volta, which runs through most of the eastern side of the country, is the world's biggest artificial lake, which resulted from the construction of the national power plant at Akosombo. Offshore hydrocarbon deposits explored at Cape Three Points have proven crude oil reserves, estimated at 1.8 billion barrels. The geographical location of the country also permits extensive fishing in the Atlantic Ocean. Ghana has tropical climatic conditions. It is warm and comparatively dry along the southeastern coast, hot and humid in the Southwest, hot and dry in the North. The country consists mostly of low plains with dissected plateaus in the southern central areas. The hottest months are March and April when the temperature reaches 31 °C. The wettest month is June when average rainfall is estimated at 178 mm, after which the main food harvest comes.

FIGURE 1

Map of Ghana

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

In 1957, Ghana became the first country in Colonial Africa to gain independence. A series of coups following independence resulted in the suspension of the constitution in 1981 and the proscription of political parties by the military government of that time. A new constitution, restoring multiparty politics, was approved in a national referendum in 1992. Flt. Lt. Jerry John Rawlings, head of state from 31 December 1981, won the presidential elections in December 1992 and December 1996. He was constitutionally barred from running for a third term in the 2000 elections, which was won by John Agyekum Kufour.

Presently, a consensus on economic paradigm is developing. Both the current and the previous Government welcome private sector participation and believe in economic and structural reforms including privatization of State Owned Enterprises (SOEs). Political stability is prevailing. Although general elections were expected to be held in December 2008, there was no real apprehension of the direction of the economy irrespective of the winner of the next elections.

Ghana's educational system is rated as one of the best in the sub-region. 68 % of the population have at least basic education. There are several universities and institutions of high learning catering for the needs of natives and foreigners. There is also a reasonably large pool of both skilled and unskilled labor, and for both wages are relatively low.

Road transport accounts for 98 % of all freight that is moved. The railway system, which has been reconstructed, consists of a triangular network connecting Accra, Kumasi and Sekondi-Takoradi. Ghana's two ports in Tema and Takoradi, however, are in a good state, and cargo handling has been increasing continuously. Whereas Tema concentrates on imports, Takoradi handles mainly exports. Ghana is well connected via international airlines including the national carrier of Ghana International Airlines.
In mid-2008, the Government sold 70 % of its 100 % share in Ghana Telecom (GT) to Vodacom from the United Kingdom. A second network operator, Western Telesystems Limited (now Zain), is also licensed to provide telephone and data services.

The main framework guiding Ghana's overall development is the Ghana Growth and Poverty Reduction Strategy (GPRS II). It aims to lift the country to middle-income status by 2015. Therefore, the Government has projected a per capita income of 1,020 USD (799.58 Euro) by 2015, a figure that many analysts see as unrealistic, looking at the pace of current economic development. Analysts and market watchers, however, agree that Ghana has experienced impressive growth rates over the last years, significantly rising from an annual growth rate of 3.7 % in 2000 to 6.4 % by the end of 2007.

Ghana's recent fiscal policy has tended to focus on creating an enabling macro-environment for private businesses and streamlining the operations of Government organizations to enable them to operate on full cost recovery basis by fixing the appropriate level of tariffs. Therefore, institutions such as the Public Utilities Regulatory Commission (PURC), the Petroleum Tender Board and the National Communications Authority were established to regulate tariffs. Petroleum and utility tariffs (water, electricity and telephone) were raised several times over the last three years in order to enable the Government to cut back on subsidies and hence reduce its high budget deficits.

The focus of the monetary policy over the years was on bringing down both interest rate and inflation or at least keeping them at manageable levels. This means the Central Bank has been averse to growth in broad money (the so-called M2+). It also pursues aggressive open market operations and complements this with deposit auctions.

2 ENERGY MARKET IN GHANA

2.1 OVERVIEW OF THE ENERGY SITUATION

The bulk of Ghana's energy consumption is covered by biomass (in the form of firewood and charcoal) accounting for about 59 % of the total energy consumption. Electricity products account for 9 % and petroleum products for 32 %. The per capita energy consumption is estimated at 360 kilograms of oil equivalent (koe). The overall energy consumption of Ghana is estimated at 6.6 million toe. The situation is worse in the rural areas where as much as 82 % still use kerosene, candles and other traditional fuels as sources of light. Their share of grid electricity accounts for only 17.1 %. Generators, dry cell and automotive batteries account for the remaining 0.9 %.

In the last few years, the predominant source of electric power and major energy source in Ghana was hydro. Biomass, including firewood and charcoal, forms the bulk of energy for cooking and water heating in the residential & commercial sector. Solar energy plays a significant role in the agricultural sector (crop production, drying etc.) and more recently in the tourist industry and educational institutions. Moderate wind speed identified in the southern part, particularly along the coastal belt, is yet to be exploited. The most recent development is the identification of crude oil in commercial quantities. Up to now, all crude oil and some petroleum products have been imported. The native natural gas deposits are too small to be commercially exploited, and there are also no nuclear or coal power plants in operation.

TABLE 1:
Electricity Generation Capacity of Ghana

SOURCE	CAPACITY (MW)	SHARE (%)
Total Hydro Power	1,180	68 %
Akosombo hydroplant	1,020	59 %
Kpong hydroplant	160	9 %
Total thermal power	550	32 %
TAPCO thermal power plant	330	19 %
TICO thermal power plant	220	13 %
Total energy capacity installed	1,730	100 %

Source: VRA, as of 2006

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

Ghana's power generation sources comprise two major installed hydroplants at Akosombo and Kpong with an overall generation capacity of 1,180 megawatts, constituting 68 % of total generation capacity. Two diesel-powered thermal generating plants in Takoradi have a total capacity of 550 megawatts, constituting the remaining 32 % of the total generation capacity. The electricity generation capacities are summarized in table 1.

Ghana's power generation trend from 2000–2007 has been erratic. The minimum reservoir elevation of the Akosombo dam, which generates about 56 % of the nation's electricity, is 238 feet. This level is required to generate hydroelectric power of 16 GWh/day. Table 4 presents the trend in electricity generation between 2000 and 2007. The main consumers of electricity are households, industry and commerce including educational institutions and health facilities. Consumption figures of these consumers are shown in table 5.

TABLE 2:
Consumption of Light Crude Oil for Thermal Electricity Generation (m^3)

SITE	LIGHT CRUDE OIL	DISTILLATE FUEL OIL
TAPCO	356,187	258
TICO	479,327	677
Total	835,514	935

Source: VRA, as of 2006

TABLE 3:
Average Thermal Generation and Energy Consumption

THERMAL GENERATION (ON AVERAGE)	ENERGY SOURCE	CONSUMPTION (T)
1 GWh of electricity by TAPCO combined cycle gas turbine	Light crude oil	221
1 GWh of electricity by TICO single cycle gas turbine	Light crude oil	332
1 GWh of electricity by diesel power generators less than 1.2 MVA	Diesel oil	300 (average)

Source: VRA, as of 2007

TABLE 4:
Trend in Electricity Generation (GWh) 2000–2007[1]

YEAR	2000	2001	2002	2003	2004	2005	2006	2007*
Hydro	6,610	6,608	5,036	3,885	5,281	5,629	5,619	3,727
Shares (%)	92	84	69	77	87	83	67	53
Thermal	613	1,251	2,260	2,015	758	1,159	2,810	3,251
Shares (%)	8	16	31	34	13	17	33	47
Total Generation	7,223	7,859	7,296	5,900	6,039	6,788	8,429	6,978

Source: VRA, Energy Commission of Ghana, as of 2007

1 NOTE: THE REDUCTION IN 2007 IS DUE TO THE DROP IN ENERGY GENERATION FROM THE AKOSOMBO PLANT CAUSED BY DROUGHT.

TABLE 5

Consumption Figures (GWh) 2000–2007

SECTOR	2000	2001	2002	2003	2004	2005	2006	2007
Household	1,584.56	1,687.71	1,795.34	1,853.91	1,970.99	1,956.62	2,079.50	2,094.87
Industrial	445.36	503.33	477.29	492.94	530.23	747.91	841.00	803.00
Commercial	4,026.38	4,336.48	3,899.75	2,206.08	2,085.28	2,542.56	3,592.00	26.85
Total	6,056.30	6,527.53	6,172.38	4,552.93	4,552.93	5,247.09	6,512.50	5,582.87

Source: Energy Commission of Ghana, as of 2007

Ghana is a net importer of electricity. In order to meet the Volta River Authority's (VRA) planned generation capacity, electricity generated in Ghana is complemented with imports from Côte d'Ivoire, a neighboring country. Ghana, however, also exports electricity to neighboring countries such as Togo and Burkina Faso. Table 6 shows the imports and exports of the product in GWh.

The Public Utilities Regulatory Commission Act 1997 (Act 538) bestows the statutory duty of setting power tariffs on the Public Utilities Regulatory Commission (PURC).[2] With effect of 1 November 2007:

1. The Volta River Authority (VRA) charges rates as defined in the First Schedule as Bulk Supply Tariff (BST).
2. The Ghana Grid Company Limited (GRIDCO) charges rates as defined in the Second Schedule as Transmission Service Charge (TSC).
3. The Electricity Company of Ghana (ECG) and Northern Electricity Department (NED) of the VRA charge the rates as defined in the Third Schedule as Distribution Service Charge (DSC).
4. The Electricity Company of Ghana (ECG) and Northern Electricity Department (NED) of the VRA charge the rates as defined in the Fourth Schedule as End-User Tariffs (EUT).

Petroleum Sector

Petroleum products constitute an important part of the overall energy mix in Ghana. Table 7 presents the various petroleum products used for the country's economic activities. Figure 2 visualizes the shares of each type of petroleum product.

With the exception of Hydro Power, no other RE source feeds into the national electricity grid. Prices of such energy sources were therefore not available at the time this report was completed. The national prices for petroleum prices are set by the National Petroleum Authority and presented in table 8.

TABLE 6

Overview of Electricity Tariffs and Prices[3]

TARIFF CATEGORY	PRICE (GHP/KWH)(1 GHANA PESEWA = 0.6313 EURO)	PRICE (EUROCENT/KWH)
BST	6.02	3.80
TSC	0.90	0.57
DSC	5.85	3.69
Residential		
0–50 (exclusive)	9.50	6.00
51–300	12.00	7.58
301–600	16.00	10.10
600 +	19.00	11.99
Service charge (GHp/month)	50.00	31.57
Non-residential		
0–300	14.00	8.84
301–600	17.00	10.73
600 +	19.00	11.99
Service charge (GHp/month)	250.00	157.83
SLTV-LV		
Maximum demand (GHp/KVA/month)	100.00	63.13
Energy charge (GHp/KWh)	16.00	10.10
Service charge (GHp/month	750.00	473.48
SLTV-MV		
Maximum demand (GHp/KVA/month)	900.00	568.17
Energy charge (GHp/KWh)	9.05	5.71
Service charge (GHp/month)	1,250.00	789.13
SLTV-HV		
Maximum demand (GHp/KVA/month)	900.00	568.17
Energy charge (GHp/KWh)	8.05.00	5.08
Service charge (GHp/month)	1,250.00	789.13

Source: Ministry of Energy of Ghana, as of 2006

TABLE 6

Electricity Imports & Exports (GWh)

Import	629
Export	755
Net import	126

Source: Ministry of Energy of Ghana, as of 2006

TABLE 7

Consumption of Petroleum Products (Tons)

Liquefied petroleum gas (LPG)	35,848	4 %
Gasoline (premium)	294,397	33 %
Kerosene	65,103	7 %
Aviation turbine kerosene (ATK)	46,247	5 %
Gas oil	294,164	33 %
Residual fuel oil (RFO)	155,521	18 %

Source: NPA, as of 2008

2 SEE ALSO SECTION 3.2.

3 NOTES:

1) THE EXCLUSIVE LIFELINE BLOCK CHARGE FOR RESIDENTIAL CONSUMERS IS SET AT GHP 9.50/KWH. THIS REDUCED CHARGE IS ONLY GRANTED TO CONSUMERS WHOSE CONSUMPTION IS WITHIN THE 0–50 KWH RANGE. CONSUMERS EXCEEDING 50 KWH PER BILLING PERIOD OF 30 DAYS CANNOT BENEFIT FROM THE LIFELINE TARIFF.

2) FOR A CONSUMPTION OF 51–300 KWH, A TARIFF OF GHP 12.00 PER UNIT APPLIES FOR RESIDENTIAL AND GHP 14.00 PER KWH FOR NON-RESIDENTIAL CONSUMERS

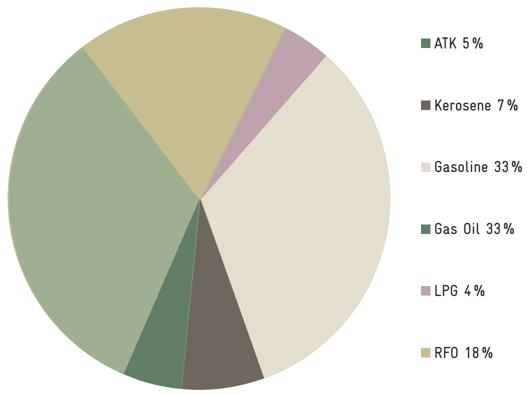
3) FOR A CONSUMPTION OVER 300 KWH UP TO 600 KWH, A TARIFF OF GHP 16.00 PER KWH FOR RESIDENTIAL AND GHP 17.00 PER KWH FOR NON-RESIDENTIAL CONSUMERS.

4) CONSUMPTION ABOVE 600 KWH ATTRACTS A TARIFF OF GHP 19.00 KWH APPLIES FOR RESIDENTIAL AND GHP 19.50 PER KWH FOR NON-RESIDENTIAL CONSUMERS.

5) EACH CONSUMER CLASS PAYS THE SERVICE CHARGE SPECIFIED IN THE FOURTH SCHEDULE

FIGURE 2

Shares of Petroleum Products



Source: NPA, as of 2006

TABLE 8

Retail Prices[4] of Petroleum Products (GHS/liter)[5]

PRODUCT	2000	2001	2002	2003	2004	2005	2006	2007
Gasoline	14.20	23.21	23.2	44.44	44.44	68.52	81.90	92.53
Diesel	13.25	19.56	19.56	38.89	38.89	61.33	76.61	87.31
Kerosene	13.25	24.64	24.64	38.89	38.89	50.36	64.47	77.44
LPG	20.70	22.00	22.00	38.00	38.00	53.84	68.46	82.32

Source: NPA, as of 2007

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The main actors for energy planning and regulation in Ghana are the relevant public institutions responsible for producing and enacting laws that regulate the distribution and tariffs. Recently, the private sector has been involved in the promotion of RE as an additional contributor to the national energy mix. The main actors are:

- Volta River Authority (VRA). The VRA is responsible for the generation and transmission of electricity in Ghana and supplies electricity in bulk to ECG for onward distribution to the southern part of the country. It also distributes power in northern Ghana through its subsidiary, the Northern Electricity Department (NED).
- The Energy Commission (EC) and the Public Utilities Regulatory Commission (PURC). Both function as regulatory agencies and have been established by Acts of Parliament to ensure the smooth cooperation of all players in the energy sector and to create the necessary environment for the protection of private investment in the sector.
- The EC was established in accordance with the Energy Commission Act of 1997 (Act 541). Its roles include the regulation and administration of utilization of energy resources in Ghana.
- The PURC Act of 1997 (Act 538) established the Public Utilities Regulatory Commission to regulate and oversee the provision of utility services by the public sector to consumers and related matters.

Ghana aims at achieving medium income status by the year 2015. Analysts believe that in order to achieve this goal, the Gross Domestic Product (GDP) has to triple. Energy is a critical success factor in this plan. As the economy is poised for growth, demand for energy also increases. Industries have to be supplied with adequate consumption levels to facilitate the production of goods and services. Households and educational institutions cannot be left out if all spheres of the economy will experience this considerable growth level. In this regard, modern energy is the main topic of discussion in different forums. The Minister of Energy, Felix Kwasi Owusu-Adjapong, claims that “Ghana needs to increase its power generation capacity beyond 4,000 MW within the next four years in order to attain a medium income status”.

Ghana’s Vision 2020 as framed within the scope of the National Electrification Scheme (NES) comprises a Government policy of achieving 100 % electrification by the year 2020 (as opposed to presently 54 %). The current generation level is inadequate for a nationwide extension of the grid, mainly due to energy shortfalls. These existing insufficiencies shift responsibility on policy makers to promote alternative energy sources such as RE for an overall growth of the energy sector.

4 ANNUAL AVERAGE PRICES

5 CONVERSION RATE: 1 GHS = 0.6313 EURO, AS OF OCTOBER 2008

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

Technical advice to the Ministry of Energy is vested in the Energy Commission. The Commission has recommended the integration of RE technologies as alternative sources to the energy mix of Ghana. One of the policies being developed by the Energy Commission in collaboration with the World Bank is the Renewable Energy Law. No valid regulations for RE, e.g. for the pricing of biodiesel as an alternative to fossil diesel, are in place. Tariffs for energy generated by wind turbines are not available at present. The Commission, however, has received funds for drafting and implementing the Renewable Energy Law that will cover all technologies found in Ghana including wind, solar, waste-to-energy and biomass. The Government's objective is to create an enabling environment that will lead to the integration of RE technologies as alternatives to the main and yet unsustainable energy sources found in the country. To demonstrate its commitment to strengthen the industry, the Government currently provides certain incentives to promote specific technologies and to provide a level playing field for all competitors throughout the industry.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

For investors importing generators to invest in the RE sector, the following specific incentives are available:

1. Total exemption from import duty on RE generators including solar generators, wind turbines and municipal waste
2. Exemption from VAT in importing RE products only if the components are brought in whole (i. e. not in separate pieces) into the country
3. Exemption from the payment of customs import duties on plant, machinery, equipment and accessories imported specifically and exclusively to establish the enterprise

RE legislation in Ghana is ruled by the Energy Commission Act of 1997 (Act 541) and the Public Utilities Regulatory Commission Act (Act 538). The Renewable Energy Division of the Energy Commission is responsible for developing national policies and strategies for all RE resources, technologies, demand and supply side management and generation such as solar PV systems for both stand-alone and grid connected applications wind energy resource assessment and generation, small hydro development in Ghana covering mini and micro projects, biomass/biofuel and wood fuel resource assessment, development and generation. The objectives of the Renewable Energy Division of the EC include the following objectives:

1. To develop codes and standards for solar, wind and bioenergy systems in order to support the deployment of RE technologies (especially for rural development and environmental care) as well as to enhance energy efficiency and supply for economic growth
2. To promote RE energy projects
3. To ensure that all RE service providers are provided with licenses/permits
4. To develop regulations and codes of practice to guide operations of charcoal exporters in the charcoal industry in order to ensure the conservation of the national forests
5. To ensure that RE service providers comply with licensing terms and conditions, regulations and codes of practice through effective monitoring and supervision
6. To collaborate with other divisions in order to strategically plan national energy resources and usage

Other regulatory institutions involved in the RE industry are the Environmental Protection Agency (EPA) and the Ghana Standards Board. The Ghana Standards Board's certification of product and environmental permit issued by the EPA are required for importing and selling solar systems in Ghana. Companies buying from the Ghanaian open market, however, are allowed to operate with the permits and licenses of the wholesalers until they start their own solar system importation.

The current level of national electrification is 54 %. Electrification is mainly accessible to the regional capitals, district capitals and commercial towns leaving most of the rural areas off the national electricity grid. The National Electrification Scheme, framed within Ghana's Vision 2020, inculcates a Government policy of achieving a one hundred per cent (100 %) electrification by the year 2020. Policy makers are confronted with meeting modern energy needs of rural Ghana. In order to endow this objective with appropriate funds, the Government has sought a grant from the World Bank and implemented the Ghana Energy Development and Access Project (GEDAP). Under this program, a 6 million USD revolving fund is managed by rural banks enabling rural households to access sustainable lighting products such as solar lanterns. The rural banks are loaning between 20–25 % per annum based on the profile of clients.

It has been suggested that RE can fill the gap in the rural-urban energy sector. One of the major projects aimed at addressing rural energy needs is the UNDP/Global Environment Fund (GEF), a joint project of the National Renewable Energy Laboratory (NREL), the USA and the Government of Ghana's Renewable Energy-Based Electricity for Rural, Social and Economic Development (RESPRO) in the East Mamprusi district of the Northern Region of Ghana aiming to provide solar energy on a user for fee basis. RESPRO is already operating solar systems in over 100 communities in 13 Districts of the three northern regions as well as in the Brong Ahafo Region. For the most remote communities, i.e. as islands that are off-grid, the Government aims at subsidizing the upfront investment cost for solar PV products.

The EC is the final statutory body required to issue licenses for organizations to establish a RE business in Ghana. Specific ventures such as municipal waste-to-energy, however, also require approval from the respective regulatory bodies such as the Accra Metropolitan Authority and Kumasi Metropolitan Authority mandated to carry out waste management. For hydroprojects, the PURC is responsible of the kilowatt pricing of electricity per hour whereas the VRA has to issue a permission for independent generators to feed into the national grid and EC has to agree to purchase the energy for distribution to consumers. Hence, depending on the RE technology, the approval has to be sought from the applicable body among all of the mentioned organizations.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

Apart from firewood and charcoal, energy derived from biomass is very unpopular. Biodiesel derived from plants such as jatropha was in the past promoted by the Government of Ghana. The lack of an adequate framework for the pricing and use of the technology as an alternative to fossil fuel, however, did not encourage the private sector to participate. Biogas from organic and municipal waste is gaining popularity in Ghana. There are a few companies that are developing biogas digesters for utilizing the methane generated for domestic use (in cooking and lighting). Biofuels have not yet gained popularity as an alternative source of fuel for automobiles and industrial engines against the e.g. conventionally used diesel. In the past, the Government was encouraging the promotion of biodiesel from the jatropha plant with the result that many farmers opted for jatropha plantation in place of cassava and maize. This, however, was strongly criticized by social authorities thus rendering the program unpopular. There are a few entrepreneurs who still believe biofuel could be profitable but lack the financial support to produce in commercial quantities.

There is no doubt that efficient use of biomass-based energy such as charcoal and biogas generated from municipal waste as well as biodiesel from appropriate organic materials saves money for users and trees for Ghana as a whole while reducing carbon dioxide emission for the world. Wood fuel accounts for 85.8 % of primary energy used in Ghanaian homes and provides income-generating activity (charcoal producers, transporters and retailers) to a substantial part of the rural community. In 2000, 16 million metric tons of wood fuel was consumed, 9 million of which was converted to charcoal. As of 2001, the rate of deforestation in Ghana was 740,000 hectares per year (equaling 1.7 % of the overall forestation).

Charcoal, which is used as a fuel source in most biomass cooking stoves, is still being produced in a crude way by the informal sector. In Ghana there is a lot of potential renewable raw material for charcoal production in the relatively large palm oil extraction factories such as found in Kade in the eastern region. These factories use part of the spines and shells to power their operation, but much is left to go waste. This process in itself presents investors with tremendous joint venture opportunities for more scientific production methods in biomass energy production. There is evidence of continued use of biomass energy (from charcoal or firewood) for cooking in most households in Ghana. One of the main reasons is the prevailing traditional method of how to cook maize and other cereal-based meals that require this source of fuel. In aiming at the reduction of deforestation, a few non-governmental organizations have introduced and promoted the use of various types of efficient biomass cook stoves on the Ghanaian market as alternatives to traditional cooking stoves. These stoves reduce charcoal consumption for household and commercial cooking. However, the efficiency in the use of charcoal as main fuel source could still be improved and thus contribute to carbon emission reductions which could then be monetized on international derivatives markets for carbon certificates under the Clean Development Mechanism (CDM).

4.2 SOLAR ENERGY

The main solar technology applications on the Ghanaian market are rural solar home systems (especially lanterns and torch lights), urban solar home systems (household appliances, lanterns), solar systems for schools, systems for lighting health centers, vaccine refrigeration, solar water heaters, solar water pumps, telecommunication, battery charging stations and solar streetlights. Solar technology spans the urban, peri-urban and rural Ghana. The dynamics of the distribution of specific products, however, differ from one place to another due to two main factors: Firstly, the generally occurring opportunity cost for deploying solar energy as an alternative energy source and secondly, the far distances of the locations from the national electricity grid in Ghana where solar energy is applied (off-grid locations).

In urban and peri-urban areas most of the towns are on the national grid making the use of solar energy unpopular in these locations. Solar energy uses in such areas are found in the form of solar water heaters in hotels and guesthouses. New hotels springing up in Accra, the capital city of Ghana, are deploying solar water heaters for various reasons. Solar energy generates long term cost savings although the initial capital outlay is high. Generally, the use of solar water heaters is still not very widespread in the country. Solar home systems are found among a few wealthy residents who use the technology to power basic electrical gadgets such as television and Hi-fi audio systems. Solar home systems have still not been able to penetrate the Ghanaian market.

Solar energy is predominant in clinics and other public places such as educational institutions that are off the national grid. Most of these projects have been deployed by the Ministry of Energy with the assistance of donor agencies such as UNDP, DANIDA and GEF. It is important to note that most of the solar activities in Ghana are carried out through public-private partnerships. In rural Ghana, solar technology is found in the form of lanterns, torch lights and cell phone battery chargers. Also, solar energy in the form of sunlight is the main energy for drying cloth and farm produce such as cocoa in the country.

Ghana is generously endowed with solar energy by virtue of its location within the tropics. Sunshine is even more pronounced in the northern regions with an annual solar radiation of 16–29 MJ/m^2. In Ghana, solar PV remains the main alternative energy (besides hydroenergy) for lighting in educational institutions, health facilities and households. The country has 54 % level of electrification. This is the percentage of communities on the national grid. The remaining 46 % use other sources of energy. Solar streetlights are gaining popularity in rural and peri-urban communities. Solar lanterns are displacing their kerosene counterparts due to long term cost savings and a major reduction of indoor pollution.

Also available on the Ghanaian market are solar water heaters. Larger units of solar water heaters are usually deployed in the hotel industry. Single units of 130–190 liter boilers are also available with or without electric booster heater. Solar water heaters, however, are unpopular in Ghana due to the fact that most people are not used to taking hot showers or baths. Although solar water heaters are available to large-scale industries such as hotels as well as small individual households, it has been observed that majority of such facilities still use grid connected electric water heaters.

The World Bank is a strong partner in promotion of solar energy in Ghana and has demonstrated this with the introduction of the Ghana Energy Development and Access Project (GEDAP) aiming at deploying over 7,500 PV systems to schools, hospitals and off-grid communities in Ghana. Within the GEDAP, end-users of solar products receive a 50 % grant (of the purchase price) while the rest is spread over a maximum term of three years with Apex Bank, an SME focused bank in Ghana. Barclays Bank is also considering end-user finance of solar products with the traditional rotating saving and credit funds known as "Susu" schemes. The participants of these schemes are organized in associations. These associations are the vehicles through which participants are educated on the acquisition of solar lanterns. Table 9 presents available PV applications in Ghana.

TABLE 9
Solar Photovoltaic Applications in Ghana

SOLAR SYSTEMS	INSTALLED CAPACITY	GENERATION (GWH)
Rural Solar Home Systems (SHS)	450	0.70–0.90
Urban SHS	20	0.05–0.06
Systems for schools	15	0.01–0.02
Systems for lightng health centres	6	0.01–0.10
Vaccine refrigeration	42	0.08–0.09
Solar water pumps	120	0.24–0.25
Telecommunication	100	0.10–0.02
Battery charging stations	10	0.01–0.02
Grid connected systems	60	0.10–0.12
Solar Streetlights	30	0.04–0.06
Total	853	1.34–1.82

Source: Energy Commission of Ghana, as of 2004

4.3 WIND POWER

There is general perception that wind speeds in Ghana are too low to generate energy. Recently, however, the Energy Commission has identified the costal belt, particularly the Volta and Central Regions, as viable places for harvesting enough wind for energy generation. The discovery has encouraged very little private participation so far, and major wind farms have been constructed yet. A few individuals have installed wind turbines to backup the intermittent power supply in some parts of the country. Industrial use of wind farms is under 1 % of the range of RE technologies in Ghana. Studies by the Energy Commission have shown that there is enough potential to generate wind energy in Ghana. The coastal belt and the Volta and Central Regions in particular have wind speeds of 3–5 miles per second which is enough to drive turbines to generate wind energy. The technology, however, has been virtually untapped by the private and public sectors.

4.4 HYDRO POWER

Hydroenergy is the most tangible RE technology that has been deployed in Ghana. The main hydroelectric plants are the Akosombo and Kpong dams which supply electricity to most parts of Ghana. Since 2008, the Government of Ghana has, started to build yet another major hydroelectric dam at Bui in the Brong Ahafo Region for 562 million USD (440 million Euro). When completed after the scheduled two-year building time, the Bui dam will serve the northern part of Ghana which falls in line with the National Electrification Scheme of targeting 100 % electrification of the country. There are about thirteen other river sites that have been earmarked for mini hydro projects requiring public private partnerships to implement.

As of 2006, the data available showed that the VRA planned to meet Ghana's total energy demand of 9,518 GWh with the following mix: 5,862 GWh from hydroenergy 2,856 GWh from thermal energy and 800 GWh from imports from Côte d'Ivoire. The generation level from hydroenergy from 2006 to 2008 was 5,619 GWh. This shortfall of 243 GWh of hydroenergy presents opportunities for investors and local engineers to install mini hydro systems on 13 rivers earmarked for such facilities by the VRA.

The latest crisis was experienced in the year 2007 and early 2008. This energy crisis sparked off the creation of opportunities for foreigners who wish to enter joint ventures with local partners for the construction of mini hydro dams. Fiscal incentives are available for such ventures and modalities for Independent Power Producers (IPP) are under discussion.

5 MARKET RISKS AND BARRIERS

The Ghana Investment Promotion Center (GIPC) Act 478 was issued in 1994 to enable the GIPC to adopt and implement an investor-friendly set of rules and regulations to boost private sector investments. Through the GIPC, the Government is now a facilitator and promoter of investments, unlike previously when its interest was in investment regulation. Currently, private sector investors are benefiting from the macroeconomic and sectoral reforms introduced under the Economic Recovery Program (ERP) as well as from the activities of the GIPC. These benefits include the rehabilitation of economic and social infrastructure, the liberalization of imports and foreign exchange and the eased remittance of dividends, profits and fees abroad.

All this has been made possible on account of the political stability that Ghana has enjoyed over the past couple of decades. The Government of Ghana has committed itself to establishing a new “Golden Age of Business” for the private sector. The Government therefore envisages an economy where the production and distribution of goods and services will be mainly the business of the private sector. This new production arrangement is anchored on a new robust collaborative partnership between a focused but strong public sector and a vibrant private sector. Ghana is a member of the World Bank’s Multilateral Investment Guarantee Agency (MIGA). MIGA provides investment guarantees for certain non-commercial risks (i.e. a political risk insurance) to encourage foreign investors for qualified investments in developing member countries. MIGA guarantees cover the following risks: transfer restriction, expropriation, breach of contract and war and civil disturbance. The Government’s pro-business orientation coupled with benefits deriving from MIGA ensures that investors obtain insurance cover against social and political business risks.

Trading across borders is very relevant to the RE sector given that most of the technology and equipment is usually imported. The Investment Climate Study looks at the procedural requirements as well as the time and cost of these procedures for both exported and imported goods transported by waterway. For importing goods, the procedures evaluated start at the vessel’s arrival at the port of entry and end at the shipment’s delivery at the importer’s warehouse. For export, the study starts to evaluate procedures from the time the goods are packed at the factory to their departure from Tema, Ghana’s port of exit. The costs of importing and exporting include import and export duties, levied by the Customs Excise and Preventive Services, as well as administrative charges. Specific incentives on imports of RE products are provided as described in Section 3.1. Specific incentives on exports are embodied in various mandates provided by Ghana Export Promotion Council, Ghana Investment Promotion Council and Africa Growth and Opportunity Act. Ghana’s economic policy keeps shortening the procedural requirements in order to make the country more competitive globally and to put an end to frequent demands of bribes during import and export procedures.

Various incentives and benefits are generally offered to most investors under Ghana’s new Investment Promotion Act (GIPC Act 1994, Act 478). In addition, entrepreneurs who invest in declared areas of priority (including energy and agriculture) are offered special/specific incentives. The general investment incentives are largely automatic and are granted in various forms to most investors. They incentives include the following: (i) exemption from the payment of customs import duties on specified inputs, plant, machinery and equipment required for the enterprise, (ii) increased capital allowance rates, (iii) tax reliefs for establishing enterprises at specified locations, (iv) retention of at least 35 % of exports earnings in an external account, (v) automatic immigrant quota for expatriate personnel in accordance with size of investment, (vi) guarantee against expropriation. The current corporate tax rate is 25 % of profits chargeable to tax.

Shareholders are protected by local regulations. They are also considered as the ‘legal backing’ of Commercial Courts as they have access to the company’s internal documents. Ghana’s Companies Code of 1963 defines the rights and obligations of shareholders and directors of limited liability companies. The Code covers approval procedures, requirements for immediate disclosure of transactions and availability of external reviews of transactions before they take place and disclosure in periodic filings and reports. A director liability includes the possibility for investors to hold a director or a board of directors liable of damages. Moreover, investors’ interests are protected by the Ghana Investment Promotion Center.

The laws that govern intellectual property rights in Ghana are the Copyright Act 2005 (Act 690) and the Patent Law of 1992. This section of the study looks at the number of procedures required to register a property as well as the time and cost it takes. In general, a large amount of properties in Ghana are not formally registered, and the process of registering a property is often difficult. Unfortunately, non-registered properties cannot be used as a guarantee for obtaining loans thus limiting financing opportunities for businesses. It takes a minimum of 5 procedures and an average of 34 days in registering an intellectual property in Ghana. The cost of the property is usually about 1.2 % of its value.

RE technologies are growing, although at a low pace. There is, however, local expertise in all the technologies found in Ghana, although limited. The VRA boasts of one of the finest assemblies of local engineers some of whom are periodically drawn to offer technical expertise to neighboring West African countries. There are not many solar energy engineers. The few SMEs involved in solar energy, however, are very competent. Biomass technologies are mostly implemented by academics having opted to commercialize them. Biogas technologies are employed in the tourist industry and educational institutions. Bio-fuel experts are few but exist.

There are some governmental regulations related to employment. To measure the ease or difficulty of employing workers, the study establishes two indicators: a rigidity of employment index and a firing cost measure. The rigidity of employment index comprises difficulty of hiring, rigidity of hours and difficulty of firing. Ghana has relatively less rigid regulations of employment. The firing cost indicator reflects the cost of firing an employee in terms of advance notice requirements, severance payments and penalties.

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 10

Local Business Partners

NAME	ADDRESS	FIELD OF ACTIVITY
GECAD Ghana Ltd	38 Independence Avenue P.O. Box C74, Cantonments, Accra, Ghana Phone: +233 21 228500 info@gecadgh.com	Power generation, supplier of parts and services for installations, operations and maintenance on gas turbines
DENG Solar Training Center Ltd (DSTC)	C12/13 Southeast Alajo P.O. Box AN 19996, Accra, Ghana Phone: +233 21 257100 Fax: +233 21 233778 info@dengltd.com	Expertise include RE (solar PV), power generation, control and transmission, water filtration and irrigation, civil engineering, industrial supplies, precision scales and balances, project management, training and education
Wise Energy	Abofu 1st Junction, Off Achimota, PMB 21, Kanda, Accra, Ghana Phone: +233 21 403135 richard.arku@wise-energy.org	**Targets areas with no access to the national electricity grid and provides high quality, thoroughly tested and approved components to build the necessary PV systems**
ecoZone	6 Vermont Plaza, Medlab Building, S.O.S. Road, Comm. 6, Tema, Ghana Phone: +233 22 214 646 info@ecozone.com.gh	Distributor of solar power systems, lighting, and water purification equipment to hospitals, schools, hotels, homeowners, contractors, Government, & non-governmental organizations & rural communities and other remote sites without electricity
Wilkins Engineering	No. 35 Dadeban Road, North Industrial Area, Kaneshie, Accra Phone: +233 21 23567 Fax: +233 21 252615 wilkins@africaonline.com.gh	Wholesales, retails, installs and maintains PV solar home systems (SHS) to households, public and private commercial institutions in Ghana
Toyola Energy Limited	H/No.011 Opa Road Sarpeiman, P.O. Box OF 266, Ofankor, Accra Phone:+233 245 482842 toyolaenergy@yahoo.com	Manufactures, distributes and sells biomass efficient cooking stoves (Gyapa stoves, www.enterpriseworks.org), to rural and peri-urban households and institutional customers in selected regions in Ghana
Biogas Technologies West Africa Limited	14/2 Guava crescent, community 19, Lashibi, Tema, Ghana Phone: +233 22 410638 jaidan@biogasonline.com	Biogas digester construction company in West Africa; provision of organic waste for useful energy and nitrogen-rich plant fertilizer as well as manufacturing of biogas stoves and biogas manometers
EnterpriseWorks Ghana	Crn. Josiah Tongogara/North Labone Ave P.O. Box CT 4808, Accra Tel: (021) 765454/781090 ewghana@africaonline.com.gh www.enterpriseworks.org	Active in the domestic energy sub-sector, providing financial and technical assistance to the USAID-funded Kenya Ceramic-Lined Stove Project including the Household Energy Program in Ghana, funded by USAID and Shell Foundation funding (focusing on manufacturing and commercialization of consumer-oriented stoves)
Raford Technologies	P.O. Box AN 7172, Accra-North, Ghana, Phone: +233 21 231207 raphenyoafor@yahoo.co.uk	Wind powered electrical plants

TABLE 11

Local Business Related Institutions

NAME	ADDRESS	FIELD OF ACTIVITY
Association of Ghana Solar Industries (AGSI)	P.O. Box 19996, Accra, Ghana Phone: +233 21 233779 Fax: +233 21 233778 info@ghanasolarindustries.com	Aims at raising the profile of the solar industry, improving the quality of design/installation, administering a membership accreditation programs, promoting the development of standards within the industry. Makes presentations for the Government in order to abolish taxes on solar components and to negotiate training agreement with Deng Solar Training Center (DSTC)
Ghana Venture Capital Trust Fund (GVCTF)	Premier Towers, 12th Floor, Ministries, Accra, Private Mail Bag, CT 449, Cantonments, Accra Phone: +233 21 671459 nanabonsu@venturecapitalghana.com	Governmental body responsible for providing investment capital to local SME's through existing venture capitalists; oversees the promotion of venture capital/private equity investments in Ghana
Kumasi Institute of Technology, Energy and Environment (KITE)	72 Old Achimota Road, Dzorwulu, P.O. Box AT 720, Achimota, Accra Phone: +233 21 256800-1 Fax: +233 21 256800 info@kiteonline.net	Non-governmental organization specialized in environmentally sound technical solutions and related policy interventions for sustainable development
Ghana Investment Promotion Center (GIPCI)	P.O. Box M193, Accra, Ghana Tel: +233 21 665125-9 gipc@ghana.com	Encourages, promotes and facilitates investments in all sectors of the economy except mining, petroleum, free zones activities, privatization of Government enterprises and portfolio investments

TABLE 12

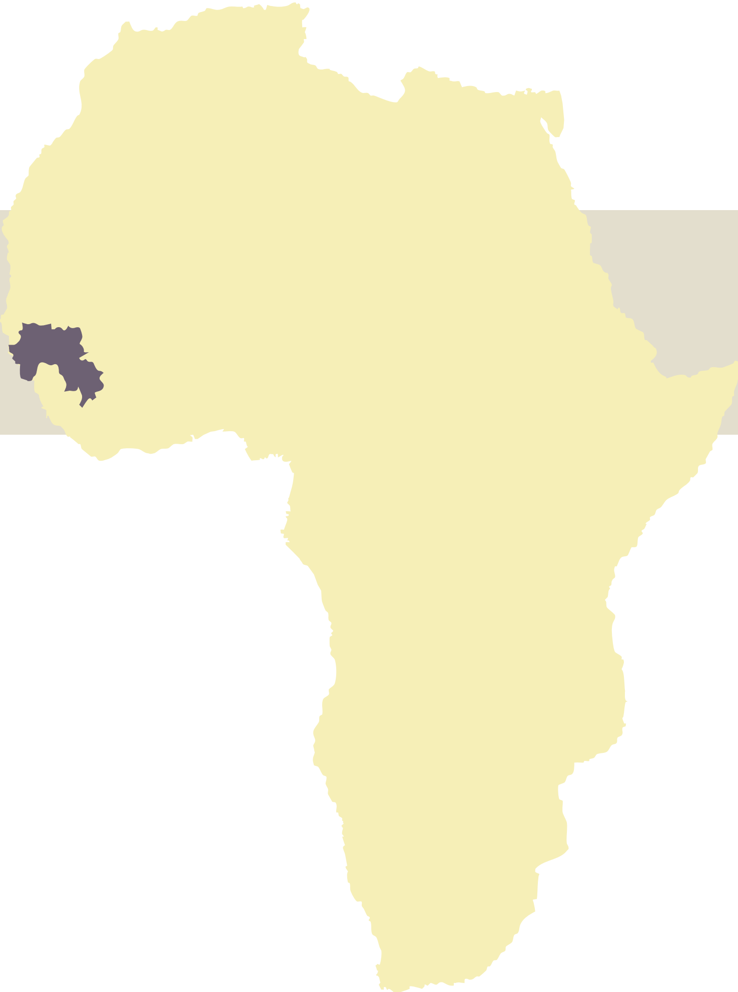
List of Companies and Related Business Organizations

NAME	ADDRESS	FIELD OF ACTIVITY
Energy Commission (EC)	FREMA House, Plot 40, Spintex Rd. P.M. B. Ministries, Accra – Ghana Phone: +233 21 813756 info@energycom.gov.gh	RE technologies advisor to Ghana's Government
Ministry of Energy	P.O. Box SD 310, Stadium, Accra Phone: +233 21 667156 cabavana@energymin.gov.gh www.energymin.gov.gh	Responsible for implementing all energy issues in Ghana
United Nations Development Program (UNDP)/Global Environment Facility (GEF)	P.O. Box 1423, Accra Phone: +233 21 227323 george0@unops.org	Global partnership to address global environmental issues while supporting national sustainable development initiatives
IFC Lighting Africa Program	No. 1 Central Link Street, South Legon, P.O. Box CT 2638, Accra, Ghana Phone: +233 21 513153 ckattah@ifc.org	Aims to recognize the success and vitality of the Africa small, micro and medium enterprises (SMME) sector; annual awards program specifically to acknowledge, encourage and celebrate excellence amongst African SMMEs
Environmental Protection Agency (EPA)	P.O. Box M326, Accra, Ghana Phone: +233 21 664697 Fax: +233 21 662690 cdm@epaghana.org	Ensures all social practices and businesses (including but not limited to renewable energy practices) are not detrimental to the Ghanaian environment
Electricity Company of Ghana (ECG)	Electro-Volta House, 28 th February Road, Accra Postal Address Post Office Box GP 521 Telephone+233-21-676727/676747 Fax +233-21-666262 ecgho@ghana.com www.ecgonline.info/ecgweb	State-owned entity responsible for the distribution of electricity to consumers in southern Ghana, namely Ashanti, Central, Greater Accra, Eastern and Volta Regions of Ghana
Energy Foundation Ghana (EF)	P.O. Box CT 1671 Accra, Ghana Tel: (+233 21) 515610/515611/515612 Fax: (+233 21) 515613 Mail: info@ghanaef.org www.ghanaef.org	Non-profit, public-private partnership institution (founded in collaboration of the Government of Ghana), devoted to the promotion of energy efficiency and renewable energy

7 BIBLIOGRAPHY

- Agyemang-Bonsu W. K. (2008): The DNA's CDM Approval Process and Preparedness for CDM Activities in Ghana, Austria JI/CDM Workshop
- Africa Growth and Opportunities Act – AGOA (without year): (www.agoa.gov)
- Government of Ghana (1963): Companies Code
- The World Bank Group/International Finance Corporation – IFC (2009): Doing Business, Measuring Business Regulations, (www.doingbusiness.org/ExploreEconomies/?economyid=76)
- ECOWAS (without year): Energy Protocol A/P4/1/03, (www.ecowapp.org/member_utilities.html)
- Energy Commission of Ghana (2006): Energy Supply to the Economy, Woodfuels and Renewables
- Energy Commission Act (1997): Act 541 (www.lexadin.nl/wlg/legis/nofr/oeur/lxwegha.htm)
- Food and Agriculture Organization – FAO (2003): The State of the World's Forests
- Ghana Association of Bankers (without year): (http://ghanaassociationofbankers.com)
- Ghana News Agency – GNA (2008): Section Economics/Business/Finance
- KITE (2000): Implementation of Renewable Energy Technologies – Opportunities and Barriers: Ghana Country Study
- Ministry of Energy (2003): Household Energy in Ghana
- N. N. (2002): Energy News
- Public Utilities and Regulatory Commission (2007): Publication of Electricity Tariffs
- Public Utilities and Regulatory Commission - PURC (1997): Act 538 (www.purc.com.gh/legislation.php)
- Statistical Service (2000): Population and Household Census
- Statistical Service (without year): Ghana Living Standards Survey-4

Websites
- Ghanaweb: (www.ghanaweb.com)
- Global Environment Facility: (www.gefweb.org)



COUNTRY CHAPTER:
GUINEA

Author of Country Chapter
Bocar Sada Sy (Eng.)

Coordination and Review of the Country Chapter
Anton Hofer, (MSE, Dipl.-Ing./FH, M.A.)
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS GUINEA

ACRONYMS AND ABBREVIATIONS

GUINEA

ADB	African Development Bank
ADB	Asian Development Bank
BERD	Bureau Électrification Rural Décentralisé (Rural Electrification Decentralized Office)
CEDEAO	Communauté Économique Des États de l ,Afrique de l'Ouest (Economic Community of West African States – ECOWAS)
DNEF	Direction National des Eaux et Forêts (National Division of Water and Forestry)
DNHE	Direction Nationale de l'Hydraulique et de l'Energie
ECOWAS	Economic Community of West African States
EDG	Electricité de Guinée (Guinea Electricity)
EU	European Union
GDP	Gross Domestic Product
GNF	Guinea Francs
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation Agency)
HDI	Human Development Index
HIPC	Heavily Indebted Poor Country
HV	high voltage
IEPF	Institut de l'Énergie et de l'Environnement de la Francophonie (Institute for Energy and the Environment in French Speaking Countries)
IFAD	International Fund for Agricultural Development
LPG	Liquefied Petroleum Gas
LPDSE	Lettre de Politique de Développement du Secteur de l'Énergie (Policy Letter for the Development of the Energy Sector)
LV	low voltage
MDG	Millennium Development Goals
MSF	Médecins Sans Frontières
MV	medium voltage
NDE	National Division of Energy
NGO	Non-governmental Organization
NMG	National Multisectoral Group
OPEC	Organization of Petroleum Exporting Countries
PDE	Direction Préfectorales de l'Éducation (Prefectoral Directorate for Education)
PREP	Poverty Reduction Program
PRSP	Poverty Reduction Strategic Paper
PV	Photovoltaic
SGP	Société Guinéenne de Pétrole (Guinean Oil Company)
SOGUIP	Société Guinéenne des Pétroles (Guinean Oil Society)
TSPP	Taxe Spéciale sur les Produits de Pétrole (Special Taxes on Petroleum Products)
UNDP	United Nations Development Program
USAID	United States Agency for Internal Development
USD	United States Dollar
WB	World Bank

MEASUREMENTS

€	Euro (1 EUR = 7,291 GNF; 1000 GNF = 0.13715 €).
GWh	gigawatt hour (1 GWh = 1,000,000 kilowatt hours (kWh))
km^2	square kilometer
kWh	kilowatt hour
kWp	kilowatt peak
m/s	meters per second
m^3	cubic meter
mm	millimeters
MW	megawatt (1 MW = 1,000 kW)
Wp	Watt-peak
°	degree

SUMMARY

The Country Study of Guinea is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Guinea. The study is structured as follows:

Chapter one provides **Background Information on Guinea**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Guinea.

Chapter two summarizes facts and figures of **Guinea's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Guinea. This includes an overview of support mechanisms for photovoltaic (PV) as well as existing regulations, incentives and legislative framework conditions concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Guinea.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Guinea.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

The Republic of Guinea[1] is located in West Africa between latitudes 7°05‘ and 12°51‘ South and longitudes 7°30 and 15°10‘ West. Its geographic size equals 245,857 km². It is bordered in the East by Mali and the Ivory Coast, in the West by the Atlantic Ocean (with 300 km of coastline) and Guinea-Bissau, in the North by Mali and Senegal and in the South by Sierra Leone and Liberia. Guinea comprises four physiographic provinces characterized by different climates, soils, vegetations and landscapes.

FIGURE 1

Map of Guinea

Guinea has a humid tropical climate with two alternating seasons, the dry season and the rainy season. The rainy season lasts an average of eight months in Forested Guinea and five months in High Guinea. Thus, Guinea is one of the few West African countries with high rainfalls, varying between 1,200 and 4,000 mm per annum. Most rivers of the West African region (Gambia, Senegal, Niger) spring from the Fouta Djallon Massif; that is why Guinea is called the “Water Tower” of Western Africa.

Maritime Guinea or Flat Guinea covers 18% of the country’s territory and is characterized by mangrove swamps. The coastal area has a huge water supply potential and offers opportunities for farming and fishing. The maritime region of guinea produces rice, fruit, vegetables, tubers, salt and palm oil but also bauxite and various manufacturing products.

The Middle Guinea or Fouta-Djalon covers 22% of the territory and is characterized by tree and bush savanna. Farming and livestock breeding are the predominant activities of its economy with 39% of all country’s livestock breeders being based in Middle Guinea. The region’s main products are fruit, vegetables, grain (fonio[2], corn and rice) and tubers (cassava, sweet potato and potato). Another important source of income is the crafts industry. Besides that, there is also a significant potential for the development of a tourism industry in this region.

High Guinea is characterized by tree and bush as well as grassy savanna covering 40% of the territory. Being an auriferous region “par excellence”, both industrial gold production and traditional gold washing are being performed. Livestock breeding (with 27% of identified livestock breeders ranking on position 2 behind Middle Guinea), farming and continental fishing in the Niger River basin further contribute to the region’s economy. People are also active in subsistence farming and commercial farming. These sectors, however, suffered from major production difficulties in the last few years. As a consequence, the industrial fruit and cotton processing units have ceased to operate for the time being. In the craft industry sector, traditional pottery is well developed.

The Forested Guinea is dominated by tropical rainforest and stretches over 20% of the territory. It is characterized by mining, agro-pastoral activities and forestry as well as craft industry activities. In addition to growing crops for their own livelihood, people are active in the production of products for export purposes, namely coffee, cocoa, tobacco, tea and rubber. Forestry resources are being exploited with both traditional and industrial methods.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

The Republic of Guinea is one of the very first French speaking countries in West Africa gaining independence in 1958. The following separation had a very positive effect on the political development and economic growth. In fact, Guinea clearly opted for stopping exchange and cooperation with former colonizers through its choice of a total and immediate independence. As a result of this, France decided the immediate withdrawal of the colonial administration. As an independent country, Guinea faced several difficulties and decided to enter a partnership with the Soviet Union. The country experienced a particularly active stage of political and social evolution during the liberation wars in Guinea-Bissau and Cape-Verde. The so-called “First Republic” (1958 to 1984) was characterized by a socialist and centralized type of state controlled economy. The state was intervening in all economic sectors including the productive sector, the commercial sector and even the banking system. The Second Republic (1985 up till now) is characterized by an open market economy with substantial economic and financial reforms.

The total population of Guinea is estimated at 9.4 million as of 2008 when the last general population census took place. Its gender distribution comes to 48.7% of men and 51.3% of women. The Guinean population lives mainly in rural areas (71.2%) with less than a third (28.8%) of its people living in urban areas. Conakry, the capital city of the country,

1 THE NATION IS SOMETIMES CALLED GUINEA-CONAKRY TO DISTINGUISH IT FROM ITS NEIGHBOUR GUINEA-BISSAU.

2 WHITE FONIO (D. EXILIS) IS THE MOST IMPORTANT OF A DIVERSE GROUP OF WILD AND DOMESTICATED DIGITARIA SPECIES THAT ARE HARVESTED IN THE SAVANNAS OF WEST AFRICA.

concentrates more than one half of the total urban population. This is why it grows faster than most of the big cities in the sub-region. Guinea is one of the less developed HIPC (Heavily Indebted Poor Country) countries. The country ranks at 156th out of 177 countries with a per capita GDP of 375 USD and a Human Development Index (HDI) of 0.466 (as of 2003). High Guinea and Middle Guinea remain the poorest regions of the country. Table 1 presents a summary of the country specific HDI figures.

TABLE 1

Human Development Indicators (HDI) of Guinea

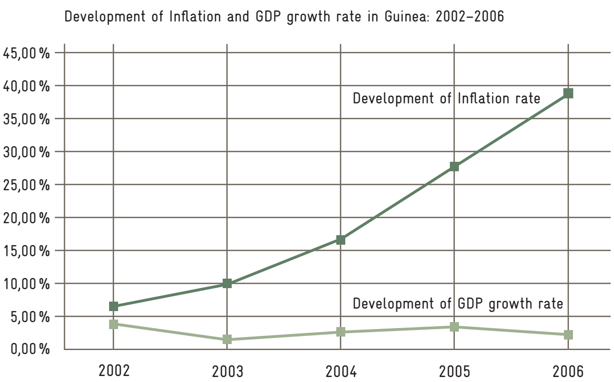
ISSUE	RATING IN GUINEA	RATING IN AFRICA
Life expectance at birth	49	53
Infant mortality rate	11,4 %	7,8 %
Access rate to health facilities	58 %	60 %
Access rate to potable water	48 %	60 %
Gross primary school enrolment	63 %	81 %
Gross secondary school enrolment	13 %	29 %

Source: UNDP, as of 2003, and UNDP/Human Development Report, as of 2009

The Guinean social situation still remains unstable, mainly because of consumer prices rocketing with a nearly 40 % rise in basic goods' prices, namely for rice, sugar, milk and cooking fuels. More than half of the Guinean population (approx. 53.6 %) lives on less than half a USD a day. A large group of the population (about 19 %) lives under extreme poverty, i.e. on less than USD 0.32 per day. Figure 2 illustrates the GDP growth compared to the development of the country's inflation rate.

FIGURE 1

GDP Growth Rate and Inflation Rate (2002–2006)



Source: IMF/Guinean Ministry of the Economy, Finances and Planning: PRSP, as of August 2007

The rapid inflation, shifting from 6 % in 2002 to nearly 40 % in 2006, made some donor partners (WB, ADB, IFAD, OPEC etc.) suspend ongoing projects and programs in Guinea.

2 ENERGY MARKET IN GUINEA

2.1 OVERVIEW OF THE ENERGY SITUATION

Guinea has a significantly low rate of access to electricity, with less than an estimated 17 % for the entire population. As a result of the insufficient production capacity, there are serious malfunctions and blackouts in the electric power sector of Guinea. As to hydrocarbons, Guinea does not have proven reserves despite of ongoing researches at various sites. Therefore, the bulk of the country's demand is covered by imports.

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

The installed electricity production capacity equals approximately 239 MW and is provided by 9 hydroplants and 18 thermal power plants. The production capacity of the 9 hydroplants is 127 MW. Table 2 presents an overview of existing electricity production facilities. Table 3 provides information on the cost structure of thermal electricity production.

The major performance indicators of the electricity sector are: (i) the low rate of access to electricity (less than 17 %, i.e. 1.5 out of 9 million inhabitants), (ii) the very low billing rate (53 %), (iii) the low rate of recovery/collection (an estimated 80 %). As a result of this particularly dilapidated state of the electric power industry, Guinea is suffering from a severe drop of its electrification rate.

In Guinea, electric power tariffs are fixed by joint order of the Ministry of Energy and Hydraulic (MEH) and the Ministry of Economy and Finance. The electricity tariffs of Guinea are presented in Table 4.

TABLE 2

Existing Electric Power Production Facilities

TYPE	PRODUCTION CAPACITY (MW)
Thermal Production (interconnected)	99,5
Hydroelectricity	127,16
Other Thermal Production Units (not interconnected)	12,26
TOTAL	238,92

Source: IDEACONSULT: LPDSE, as of 2006

TABLE 3

Thermal Production Cost Structure (per kWh)

DESIGNATION (2006 SITUATION)	COST PER kWh (EURO)	% OF TOTAL COSTS
Procurement of fuel	0,0302 €	33 %
Operation and maintenance	0,0064 €	7 %
Personnel costs	0,0093 €	10 %
Financial charges	0,0032 €	3 %
Depreciation expenses	0,0125 €	13 %
Provision	0,0306 €	33 %
Taxes	0,0006 €	1 %
Total costs	0,0928 €	100

Source: IDEACONSULT: LPDSE, as of 2006

TABLE 4

Electricity Tariffs of Guinea

TYPE OF USAGE	POWER RANGE KWH	KWH COST IN EURO	OBSERVATIONS
Domestic LV	1 to 60	0,014 €	Fixed premium = 0,739 Euro
	61 to 330	0,035 €	
	330	0,040 €	Three-phase fixed premium = 2,218 Euro
Professional, commercial and industries LV	1 – 330	0,122 €	fixed premium = 0,798 Euro
	330	0,197 €	Three-phase fixed premium = 2,396 Euro
Private and industrial MV/HV-Contracted load in kVA: 6312	Unique	0,197 €	
International institutions, NGO, embassies MV/LV Single-phase connection: 0,798 € Three-phase connection: 2,396 € Contracted load in kVA: 0,962 €	Unique	0,224 €	
Administration LV, MV, HV	Unique	0,271 €	

Source: EDG, as of 2008

Petroleum Sector

Up to now, Guinea does not have any confirmed hydrocarbon reserves. However, there are some ongoing research activities at various sites of the country. The bulk of the country's demand is covered by imports of hydrocarbons, estimated at 800,000 tons of petroleum, oils and lubricants in 2008 (excluding mining companies' consumption). As a result of the political disengagement of the Government in the productive and commercial sectors, there are four international petroleum companies: TOTALFINAELF, SHELL, MOBIL-OIL and Guinean company PETROGUI share the distribution market. The Guinean Petroleum Company (SGP) manages the deposits. All petroleum products consumed in Guinea are imported. In 2005, imports reached a total of 692,286 metric tons, as opposed to 727,820 metric tons in 2004 and 721,727 metric tons in 2003. Guinea also imports small quantities of Liquefied Petroleum Gas (LPG) equaling 316 tons in 2005; its relatively high price can only be afforded by the wealthiest of buyers. All the petroleum products consumed in Guinea are imported. Table 5 summarizes the imports from 1989 to 2003.

The transportation sector is the major consumer of petroleum products, with 52.2 % of total consumption. The products being consumed are divided into 54 % of gasoline, 36 % of diesel and 10 % of kerosene. The mining sector holds the second position with a consumption of more than 80 % of fuel oil. Petroleum products are distributed via the deposits owned by the Guinean Petroleum Company (SGP) and through a gas station network of various companies and privates distributors. Mining companies have their own storage capacities (company CBG: 50,000 m³, Friguia: 57,000 m³) and network of gas stations.

The prices of the different petroleum products are set for the whole country by decision of the Ministry of Commerce. The structure of prices is revised through the Economic and Financial Coordination Committee in its monthly technical support unit meeting. The selling price at the individual fuel pumps changes periodically according to the price fluctuation on the international market. The price increase in 2005 has been the last adjustment of retail prices since 1992. At present, the official retail prices are fixed at 0.60 €/liter of gasoline, 0.53 €/liter of diesel and 0.53 €/liter of kerosene. The stability of the retail price does, however, not prevent some of its determinants from varying from one month to another as the retail prices are subject to the fluctuations of the supply prices. The operating charges and different taxes, except for the Special Taxes on Petroleum Products (TSPP), are determined as a function of the price. The TSPP has been adjusted to the decrease and is presently fixed at 0.54 €/liter for gasoline, 0.037 €/liter for diesel and 0.024 €/liter for kerosene. Table 7 provides an overview of the current fuel prices.

TABLE 5

Imports of Petroleum Products (Metric Tons)

YEAR	GASOLINE	KEROSENE	DIESEL	FUEL OIL	TOTAL
1989	58,345	11,142	100,490	317,715	487,692
1990	75,948	8,565	91,772	334,551	510,836
1991	66,659	17,724	85,113	306,338	475,834
1992	57,321	37,940	97,016	286,360	478,637
1993	77,178	55,717	151,524	295,512	579,931
1994	78,700	45,784	126,041	315,477	567,002
1995	98,567	50,778	113,045	311,817	574,207
1996	101,519	45,497	132,025	323,767	602,808
1997	108,432	31,426	160,798	342,551	743,307
1998	96,732	26,941	154,982	344,299	622,954
1999	108,500	25,802	182,215	324,125	640,642
2000	74,181	24,122	139,242	362,183	599,728
2001	81,481	20,606	174,517	405,110	691,714
2002	74,579	21,890	201,723	420,705	718,897
2003	99,891	28,875	234,944	462,776	827,486

Source: UNDP, 2004

TABLE 6

Current Fuel Prices

YEAR	GASOLINE (€/LITER)	DIESEL (€/LITER)	KEROSENE (€/LITER)
2008	1.07	1.07	1.07
2009	0.74	0.74	0.74

Source: Ministry of Commerce, as of 2009

Biomass Sector

As it is the case in most West African countries, the energy balance of Guinea is highly dominated by the use of fuel woods (wood, charcoal). This is why biomass resources are ranking at the top of the country's energy resources. Despite of the high predominance of fuel woods in the energy balance of the country, its potential remains unknown. No comprehensive studies covering the entire national territory were conducted to assess the available potential. Due to several estimates[3], the accessible volume is about 8.5 million to 14 million m^3. Table 8 presents the current status of disposable woodland areas. Table 9 summarizes the accessible volume of wood energy for production.

TABLE 7

Current Status of Disposable Woodland Areas in Guinea

TYPE OF FORMATION	SURFACE (1,000 HA)	%
Mangrove swamps	250	1.02
Moist forests	700	2.85
Open woodland forest and tropical forest	1,600	6.51
Savanna woodland	10,636	43.25
Sub-total wood formations	13,186	53.63
Fallow lands and tree and bush savanna	7,500	30.51
Total forest wood formations	20,686	84.14
Agricultural utilization	1,700	6.10
Others	2,200	9.76
Total	24,586	100

Source: World Bank/RPTES – Final Report Guinea, as of 1998

TABLE 8

Accessible Volume of Wood Energy

TYPE	SURFACE (1,000 ha)	GROSS PRODUCTION m³	ACCESS AND USE m³
Mangrove swamps	260	1,690.0	338.0
Tropical rainforest	800	3,200.0	640.0
Open woodland forest	2,700	4,250.0	1,700.0
Savanna woodland and tree and bush savanna	12,000	18,000.0	9.000.0
Bush and fallow land	6,150	412.5	2,063.0

Source: World Bank/RPTES – Final Report Guinea, as of 1998

As to the distribution of the forestry resources, the data show a highly imbalanced distribution from one region to the other. The very low national coverage ratio (4.8 %) testifies a significant discrepancy as compared to the ecologically recommended standard (30 %). Due to this situation, there are various considerations how to create stronger awareness and policies for sustainable wood energy management.

3 WORLD BANK/RPTES REPORT AND OTHERS

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The **Ministry of Energy and Hydraulics (MEH)** is the governmental authority responsible for the energy sector. The sector management, however, is shared with other ministerial departments involved in the various segments related to the energy sector:

- The **Ministry of Environment** is in charge of water and forestry issues, thus playing an important role in the constituent dealing with traditional domestic wood fuel (biomass).
- The **Ministry of Mines and Geology** is in charge of oil prospection, thus managing the upstream segment of the hydrocarbon sector.
- The **Ministry of Commerce and Competitiveness** manages the downstream segment of the hydrocarbon sector.
- The **Ministry of Economy and Finance** plays a transversal role and is related to all governmental actions and segments in the energy sector.

The **National Division of Energy (NDE – Direction Nationale de l'Énergie – DNE)** is responsible for defining and conducting the country's energy related policy, except policy concerning hydrocarbons. The NDE comprises two divisions: the **Energy Planning and Regulation Division and the Renewable Energies Division**. A third division **(Division of Electricity)** was being planned when the study team visited the country in November 2008. The Energy Planning and Regulation Division comprises three sections: i) the Planning and Energetic Infrastructures Section, ii) the Regulation Section and iii) the Project Preparation Section. The Renewable Energies Division consists of four sections as depicted in the organizational chart presented below. Biofuels will be assigned to the bioenergy section in the course of the planned internal restructuring.

Biomass Sector

One of the characteristics of the traditional energies sector in Guinea is the fact that there have been but few stately interventions. Two departments are directly involved in this sector, namely the **MEH** for energy demand side aspects and the **Ministry of Agriculture, Waters and Forests (MAWF)** for offer aspects:

- As for the **MEH**, the strategy adopted for the Program of Economic and Financial Development includes a restructuring of the conventional, carbon-based energies sector through the improvement of management and operation structures and the development of a favorable environment for private investments. Up to now, however, traditional energies have not been taken into account.
- In the forestry domain, most of the programs aiming at the protection of the environment failed to integrate the energy dimension of the wood. The programs' priority was to fight soil erosion, forest fires and deforestation. What indeed has been constituted as a priority is the protection of inshore water bodies of the Fouta Djallon region[4], as well as essential activities for the preservation of the country's agricultural potential and ecological equilibrium.

4 MOUNTAINOUS REGION OF WEST-CENTRAL GUINEA, WHICH ALSO SERVES AS WATERSHED FOR SOME OF WESTERN AFRICA'S GREATEST RIVERS

- **The National Division of Water and Forestry (DNEF)** under the ministry in charge of forestry (MAWF) is responsible for the fuel woods production sub-sector (energy woods) without having any real organic relation with the DNE under the MHE. All offer-related energy wood issues – as mentioned already above – are handled by this division namely the development of strategies and the realization of forestry projects and programs.

Electricity Sector

The legal base for the electricity sector has been established by the laws of 1993 and by Law L/98/012[5] of June 1st 1998 relating to the foundation, construction, operation, maintenance and transfer of production infrastructures. The first section of this law defines institutions in charge of the management of the sector as well as their respective roles. These are:

- The **MEH** is in charge of the supervision, control and regulation of the sector. It defines and implements the energy policy and the structure of the tariffs.
- The **National Council for Electricity** acts as consultative organ. It consists of representatives of several ministerial departments, delegates of the dealers, the representatives of consumers and independent experts. The council is the instrument of mediation between the various actors of the electricity sector.
- The **Electricité de Guinée (EDG) Company** is in charge of the electricity sector.
- The **Electricity Sector Regulatory Body** was created in September 2005. It still lacks a clear definition of its mission.

Between 1994 and 2001, the electric power sector was managed by two companies: ENELGUI, the state owned company in charge of managing the electric power production and infrastructure, and the operating company SOGEL in charge of electric power transport and distribution. This organizational sub-division resulting from various reforms did, however, not meet the Government's expectations and ended with the termination of SOGEL's lease in October 2001. Since then, EDG, a business corporation established by the Government with the State as a majority shareholder, has been managing the sector. EDG is managing the capital and operation related rights and obligations and is responsible for the maintenance, restoration and development of electric power production, transportation and distribution facilities and equipment in order to guarantee public electric power service.

Petroleum Sector

In the petroleum sector of Guinea, the energy reform was implemented in 1992 thus permitting a thorough restructuring on the institutional level and allowing the transfer of storage, transport and distribution of petroleum products to private operator. Along this process,, an upstream regulation of the petroleum sector was implemented to ensure the technical control of the petroleum companies operating in Guinea. A regulatory framework body has been adopted and established by the Government for controlling and supervising compliance with these regulations. This implementation was done in cooperation with the World Bank[6].

In 2005, these structures have slightly been changed by an alteration of the responsibilities of the Ministries of reference and the National Directions that depend on this sector. For example, research is currently in the hands of the **National Direction of Oil Research** (belonging to the Ministry of Mine and Geology). The technical control of oil setups is performed by the **National Direction of Hydrocarbons** (belonging to the Ministry of Energy and Hydraulics). This direction is also responsible for addressing the country's need for oil products and is in charge of issuing the certificates of conformity and validation for the establishment of gas stations and fuel storage tanks. The **National Direction of Energy** (belonging to the Ministry of Energy and Hydraulics) is responsible for the oil product sector. This includes the compilation of consumption figures, import statistics and overall information on sector-related policies.

The oil imports are managed by the **Importing Committee** consisting of representatives of oil companies, the ministries in charge of commerce and finance, the Central Bank and the Government. The role of the committee is to define the quantities to be imported and to process calls to tender in order to acquire oil products.

The storage of oil products is in the hands of the Guinean Oil Company (SGP). The company is responsible for handling, storage and wholesale shipping of oil products. Transportation and distribution are performed by oil companies (Totalfinal, Shell and Petrogui) and by private Guinean companies. The **Ministry of Economy and Finance** is responsible for the collection of various taxes and is heading the Importing Committee. The official retail prices are fixed by order of the **Ministry of Commerce and Competitiveness**. The **Ministry of Mines and Geology** promotes the exploration of potential oil resources. Activities in this direction started in 1974 with the establishment of the Société Guinéenne des Pétroles (SOGUIP – Guinea Oil Society). Up to now, these activities have brought no tangible results despite promising findings in bordering countries. At present, there are no proven oil reserves in Guinea.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

Up to now, there is no institutional framework for Renewable Energies (RE). In general, however, the RE sector is subject to the same regulations as the other energy sectors. Thus, the energy sector policy document of 1992 (LPDSE 92) can be considered as the so far appropriate RE development policy framework in force in Guinea, also referring to RE related

5 SEE ALSO WEBSITE OF DROIT AFRIQUE WWW.DROIT-AFRIQUE.COM/INDEX.PHP/CONTENT/VIEW/104/220, AS OF 2009

6 SEE WEBSITE WORLD BANK: › COUNTRIES › AFRICA › GUINEA › PROJECTS & PROGRAMS › ALL PROJECTS (HTTP://WEB.WORLDBANK.ORG/EXTERNAL/DEFAULT/MAIN?MENUPK=351830&PAGEPK=141143&PIPK=399272&THESITEPK=351795), AS OF 2009

institutional aspects. A new policy document for the energy sector is being prepared (as of 2008[7]). It will be based on the new Electrification Master Plan that is under validation.

Since 2008, an energy sector development policy document is under preparation and validation. It is based on the achievements of the past few years resulting from major reforms in the energy sector and on the data compiled in the Electrification Master Plan. The DNEF is implementing several forestry programs and projects operating with wood energy components. It promotes natural vegetation development actions (moist forest and mangrove swamps), state controlled reforestation as well as community-based and private reforestation in order to enhance the production. On the political and statutory scale, the DNEF established a forestry policy document (in 1988) along with a six year Action Plan and Forestry Code[8] (in 1989), which are currently the major forestry resources' management tools (that need to be updated).

The Poverty Reduction Strategy Paper (PRSP)[9], passed in 2002, only considers the electric power sector in terms of basic infrastructures and accelerated economic growth. The proceeded PRSP revision is also an opportunity for the better consideration and integration of all energy sub-sectors (not only the electricity sector) within the PRSP in order to cope with the urgent demand for energy services and access in Guinea.

The ECOWAS Energy Services Access Program is part of the active membership of Guinea within the ECOWAS (Economic Community of West African States). With support of UNDP (through its Poverty Reduction Program (PREP), based in Dakar, Senegal) multisectoral consultations on the implementation of the objectives defined in the ECOWAS White Book in Guinea have been set up. At 20 September 2005, Order No 4545/MHE/SGG/2005[10] established the National Multisectoral Group (NMG) by defining its composition, its objectives and its attributes. The objectives of the NMG are defined as follows:

- Review the existing institutional and strategic framework for energy services and poverty reduction
- Analyze the national energy status in order to define an energy service access vision for Guinea
- Define the long-term objectives for energy services access at the national level
- Assess necessary investments

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

All regulations, incentives and legislative framework conditions are defined by the MEH and the **Decentralized Rural Electrification Office** (Bureau Electrification Rural Décentralisé – BERD). While the Ministry coordinates all energy sector specific regulations, the BERD executes a program designed to enhance the access to modern energy services in rural areas of Guinea. The project started in 2003 and was finished in December 2008.

Currently the emphasis of the Decentralized Rural Electrification Office is on training activities for private players operating energy services at decentralized sites. The training units consist of promotional activities, onsite technical capacity building and the provision of adequate calculation and management tools. So far, ten consulting companies and around twenty electrification operators were trained on RE projects' implementation. The overall incentives included the electrification of ten sites through "pico-diesel networks"[11] and the electrification of three sites via installation of PV solar kits. The PV incentive includes three service levels. The first level includes two solar lights (30 Wp), the second two lights plus one alternating current socket (60 Wp) and the third three lights plus one alternating current socket (90 Wp). Table 9 summarizes the RE achievements of Guinea.

TABLE 9
RE Achievements in Guinea

SYSTEM	IMPLEMENTED NUMBER	IMPLEMENTATION PERIOD	COST IN 1,000 USD	DONOR	OPERATING STATUS
Solar/photovoltaic	800 kWp	1984–2008	10,000	EU, WB GTZ , GTZ, R.W, USAID, RW	80 %
Biogas	92	1977–2004	59	China, EU, IEPF, Etat	30 %
Micro Hydro Power plant	2	1983–2004	2,500	North Korea, Canada	80 %
Wind pump	2	1990–2004	5	EU, MSF, China	60 %
Biomass (wood saving) – fuel saving oven		1992–2004	2,000	EU	85 %

Source: LPDSE, as of 2008

7 IDEACONSULT, AS OF 2008
8 DROIT AFRIQUE, AS OF 2009
9 IMF/GUINEAN GOVERNMENT, 2002; SEE ALSO LATEST PRSP VERSION: IMF/GUINEAN MINISTRY OF THE ECONOMY, FINANCES AND PLANNING, AS OF 2007
10 DROIT AFRIQUE, AS OF 2009
11 THE TERM 'PICO' CHARACTERIZES A VERY SMALL DIESEL-BASED ELECTRICITY NETWORKS OR GRIDS.

Between 2004 and 2008, further incentives contributed significantly to the increase of RE utilization. This includes the implementation of 800 kWp at health care centers, solar pumping facilities, street lighting and some private households.

In the field of hydroelectricity, governmental incentives started feasibility studies at 13 target sites with a total capacity of 23.6 MW. The so called “hydraulic ram program” aimed at installing ten hydraulic rams to supply 5 m³ of water per day for the supply of villages with 500 inhabitants in Middle Guinea. This program was very promising in the beginning, but was finally shut down due to lack of sustainability.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

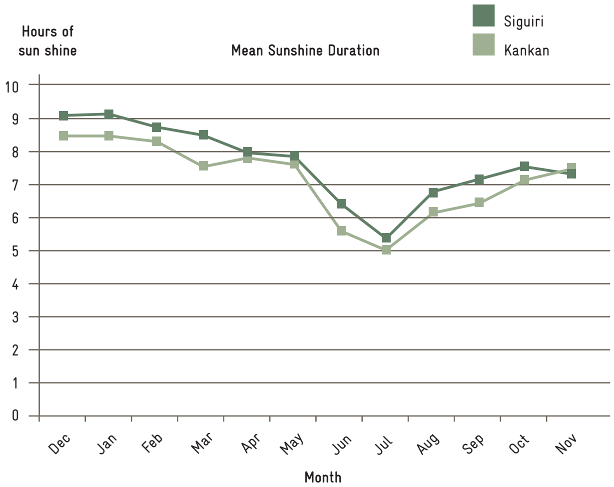
The biomass potential in Guinea is essentially based on wood energy. Despite the high predominance of fuel woods (wood and charcoal) in the energy balance of the country, its actual potential remains unknown. No comprehensive studies covering the whole national territory were conducted to assess the available potential. According to various estimations[12], the accessible volume is about 8.5 million to 14 million m³.

4.2 SOLAR ENERGY

The assessment of the Guinean solar power potential lacks a systematic and concise approach and structure. The information available indicates an average annual insolation at the rate of 4.8 kWh/m² per day and a mean sunshine duration of 2,700 hours per year (as almost encountered at the location of Kankan in High Guinea). The figures clearly demonstrate that the solar potential is considerable throughout the territory. Figure 10 provides information on the specific sunshine duration of Guinea.

FIGURE 10

Sunshine Duration in Guinea



Source: DNE/Bah, as of 2007

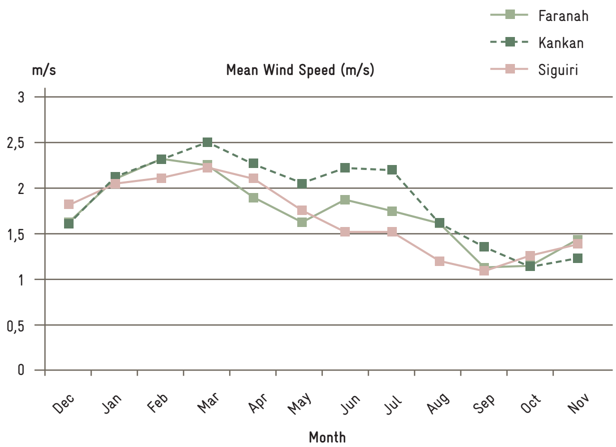
12 WORLD BANK/RPTES REPORT AND OTHERS

4.3 WIND POWER

The assessment of the Guinean wind power potential likewise lacks a systematic and concise approach. The data indicating the average annual wind velocity range from 2 to 4 m/s in Maritime Guinea and Middle Guinea. Such poor potential does not allow for overall exploitation. It is, however, possible to use wind energy for pumping systems using mechanic windmills. Figure 11 indicates the mean wind speed at different sites.

FIGURE 11

Mean Wind Speed (m/s)



Source: DNE/Bah, as of 2007

4.4 HYDRO POWER

Guinea has a considerable Hydro Power potential of about 6,000 MW that corresponds to an annual ensured production capacity of 19.300 GWh. Up to now, only 2 % of the available potential is being exploited. The regional distribution of the national Hydro Power potential is presented in Table 10. Table 11 presents the distribution of actual Hydro Power production sites. Figure 12 indicates the location of Hydro Power production sites.

TABLE 10

Regional Distribution of the Hydro Power Potential

REGION	CAPACITY (MW)	%
Maritime Guinea	2,800	47 %
Middle Guinea	2,600	43 %
High Guinea	500	8 %
Forested Guinea	100	2 %
Total	6,000	100 %

Source: LPDSE, as of 2008

The Hydro Power potential is high throughout the whole of Guinea. Potential sites are classified below according to their related expected productive power:

- Four sites with a potential productive power exceeding 200 MW: Amaria (665 MW), Souapiti (515 MW), Koukoutamba (281 MW), Kaleta (240 MW)
- Three sites with a potential power of 150 MW to 200 MW
- Ten sites with a potential power of 100 to 150 MW

- Sixteen sites with a potential power of 50 to 100 MW
- Forty-eight sites with a potential power of 10 and to MW
- Thirty-seven sites with a potential power under 10 MW

TABLE 11
Distribution of Hydro Power Production Sites

REGION	NUMBER OF SITES	TOTAL CAPACITY (kW)
Middle Guinea	53	18,510
Forested Guinea	33	19,150
Maritime Guinea	28	15,610
High Guinea	16	4,220
Total	130	54,490

Source: LPDSE, as of 2008

5 MARKET RISKS AND BARRIERS

The lack of appropriate institutional framework is one of the major risks constraining the development of the RE market. At present, the sector's development remains highly dependent on the establishment of an intervention framework promoting private operators' involvement. Consequently, approval of a new LPDSE taking into account the whole of the current reference frameworks (PSRP, MDGs, PDE, ECOWAS, etc.) is a must to secure the sector's future. In addition, the political stability of the country also represents a risk constraining the country's economic growth in general and the energy sector's growth in particular. The development of the RE market is constrained by several factors:

- Institutional constraints: The energy sector's institutional frame does not authoritatively take RE into account. It is, however, expected that its current development will overcome this constraint.
- Financial constraints: Due to the lack of appropriate financing mechanisms, access costs for RE, namely solar equipment (initial investment), remain very high.
- Fiscal constraints: Currently, there are no fiscal incentives supporting RE.
- Socioeconomic constraints: The overall income level is rather poor.

In order to promote and encourage investments in the major development objectives, Guinea has established an investment code (Law L/95/029/CTRN of 6/30/1995). This law stipulates that anybody is allowed to take up commercial, industrial, mining, farming and service provision activities in the territory of the Republic of Guinea as long as the activities comply with the laws and regulations of the Republic. With regard to exchange regulations, the code guarantees investors the possibility to transfer their profits in convertible currency to any destination of their choice. The investment code also protects private investments against any expropriation attempts for nationalization purposes. In addition to those guarantees offered to private investors, the code provides major fiscal benefits (e.g. exemption in the first year of investment, reduction of tax base etc.) for investments in priority fields and areas targeted by the code. Table 12 presents Guinea's position within the Ease of Doing Business ranking.

TABLE 12
Ease of Doing Business Ranking

SELECTED INDICATOR	RANKING
Doing business	171
Starting a business	177
Dealing with construction permits	162
Employing workers	114
Registering property	157
Getting credit	163
Protecting investors	170
Paying taxes	168
Trading across borders	110
Enforcing contracts	131
Closing a business	109

Source: World Bank Group/International Finance Corporation – IFC, as of 2009

FIGURE 12

Location of Hydro Power Production Sites

Source: LPDSE, Cartographies Potential Hydro Power Dams in Guinea, as of 2008

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

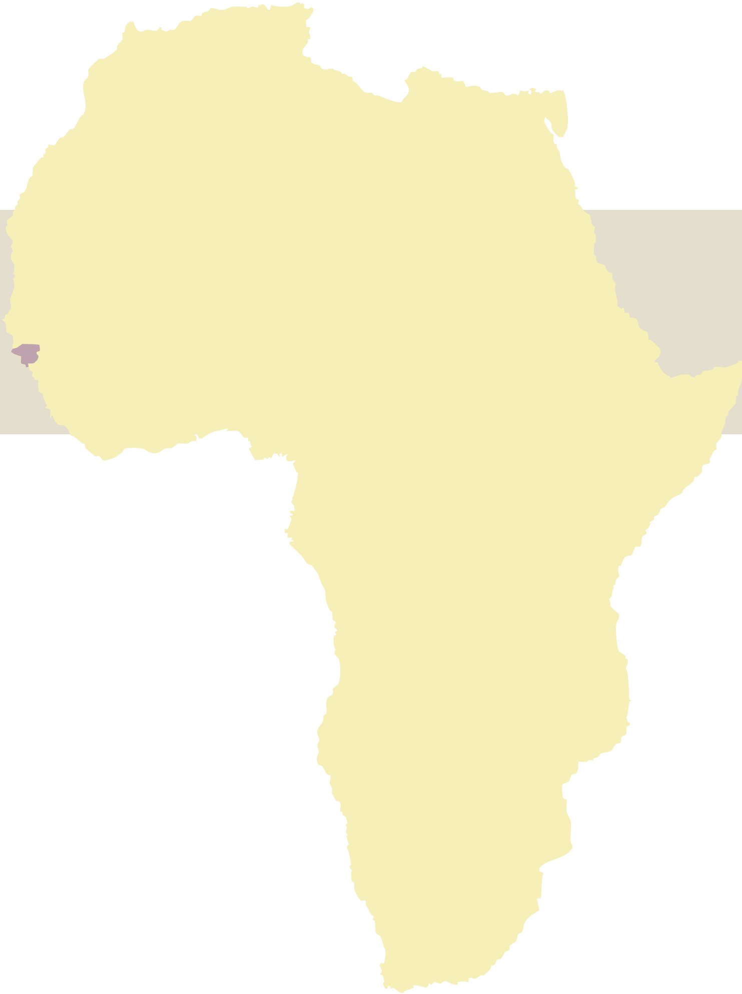
TABLE 13

Key Actors in the Field of Energy in Guinea

INSTITUTION	ADDRESS	PROFILE
Ministry of Hydraulics and Energy – MEH	BP 1217 Conakry, Guinea Phone: +224 30 45 10 65 Fax: +224 30 45 10 71	Administrative authority responsible for the institutional management of the entire energy sector
The Rural Electrification Decentralized Office – BERD	Villa 30 Cité des Nations BP 3186 Conakry, Guinea Phone: +224 30 43 14 98 Fax: +224 30 43 15 08 nava.toure@berd.org.gn	A project funded by the World Bank, the GEF and the Guinean Government designed to implement decentralized rural electrification strategies
Electricité de Guinée – EDG	B.P : 1463 Conakry, République de Guinée Tel : +224 – 60-59-88-28 ou 30-45-43-09 ou 60-25-75-23 ou 60-25-27-57 ou 60-25-31-20	Public corporation in charge of public electric power service throughout Guinea
SES	BP 2952, Conakry, Guinea Phone: +224 60 22 18 76 sesplus.guinee@yahoo.fr	Private company involved in solar equipment sale
Guinea Solar	n.a.	Private company involved in solar equipment sale
AGUIPER	n.a.	Guinean Association for the promotion of RE
TOPERGUI	n.a.	Rural electrification lease holder

7 BIBLIOGRAPHY

- CEDEAO (2005): Monographie Pays/Etude CEDEAO: Cas de la République de Guinée – Rapport Final, by Ousmane Bah (Conseiller à la DNE)
- Central Intelligence Agency – CIA (2009): World Fact Book. Guinea (www.cia.gov/library/publications/the-world-factbook)
- Direction Nationale de l'Energie – DNE(2007): Thème 4 – Les Énergies Renouvelables dans le Développement du Secteur Énergétique de la Guinée – Stage de Formation sur l'Utilisation des Énergies Renouvelables pour le Développement Durable, Conakry
- Direction Nationale de l'Energie – DNE (2006): Projet de Déclaration de Politique Générale de Développement du Secteur de l'Énergie de la République de Guinée
- Direction Nationale de l'Énergie – DNE (2005): Memorandum à l'Attention de Madame le Ministre de l'Hydraulique et de l'Énergie sur les Études du Plan Directeur d'Électrification et du Projet d'Électrification Rurale, by Fodé Moussa Soumah
- Direction Nationale de l'Énergie – DNE (2004): Evaluation Interne du Programme d'Appui National pour l'Économie du Bois Énergie – Avril 2004 – DP N°3 – Rapport Final, by Ousmane Bah
- Droit Afrique (2009): Guinée (www.droit-afrique.com/index.php/content/view/104/220)
- Électricité de Guinée – EDG (2005): Annual Report
- Government of Guinea (1995): Law L/95/029/CTRN of 6/30/1995
- IDEACONSULT (2008): LPDSE - Lettre de Politique de Développement du Secteur de l'Énergie
- International Monetary Fund – IMF/Guinean Government (2002): Poverty Reduction Strategy Paper: Republic of Guinea, January 2002 (www.imf.org/External/NP/prsp/2002/gin/01/013102.pdf)
- International Monetary Fund – IMF/Guinean Ministry of Economy, Finance and Planning – Permanent Secretariat on Poverty Reduction Strategy – SP-SRP (2007): Poverty Reduction Strategic Paper DSRP2 (2007–2010)
- Mody Amadou Oury Barry (2007): Évaluation des Besoins pour l'Atteinte des OMD en Guinée – Secteur Ciblé: ENERGIE – Rapport évaluation des Coûts
- United Nations Development Programm – UNDP (2003) Human Development Report 2003. Africa (www.africaaction.org/docs03/hdr0307.htm and www.undp.org/hdr2003)
- United Nations Development Programm - UNDP (2009): Human Development Report 2009. Guinea HDI Rank – 170 (http://hdrstats.undp.org/en/countries/data_sheets/cty_ds_GIN.html)
- United Nations Development Programm – UNDP (2004): Rapport National sur le Développement Humain (RNDH). Guinée.
- World Bank Regional Program on Traditional Energy Sector – RPTES (1998): Final Report Guinea
- THIAM (2006): Monographie – Pays (Guinée Conakry) – Draft Version.
- World Bank (2009): Guinea. All Projects (go: > Countries > Africa > Guinea > Projects & Programs > All Projects; or: http:// web.worldbank.org/external/default/main?menuPK=351830&pagePK=141143&piPK=399272&theSitePK=351795)
- World Bank Group/International Finance Corporation – IFC (2009): Doing Business. Measuring Business Regulations (www.doingbusiness.org)



COUNTRY CHAPTER: GUINEA-BISSAU

Author of Country Chapter
Louis Seck (MSc., DEA, MBA)

Coordination and Review of the Country Chapter
Anton Hofer, (MSE, Dipl.-Ing./FH, M.A.)
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS GUINEA-BISSAU

ACRONYMS AND ABBREVIATIONS

GUINEA-BISSAU

AD	Action for Development
AUDCG	Acte Uniforme Relatif au Droit Commercial General (Uniform Act on General Commercial Law)
BCEAO	Banque Centrale des États de l'Afrique de l'Ouest (Central Bank of West African States)
CFAF	CFA Franc (1 Euro = 655,957 CFAF)
DGE	Direction Générale de l'Énergie (General Direction of Energy)
EAGB	Electricidade e Águas de Guinea-Bissau (Electricity and Water Company of Guinea-Bissau)
GDP	Gross Domestic Product
INEC	Instituto Nacional de Estatística e Censos (National Institute of Statistics and Census)
LPG	Liquefied Petroleum Gas
OHADA	Organisation Pour l'Harmonisation en Afrique du Droit des Affaires (Organization for the Harmonization of Business Law in Africa)
PRS	Poverty Reduction Strategy
PV	Photovoltaic
RE	Renewable Energy
SIE	Système d'Information Énergetique (Energy Information System)
TEC	Common External Tariff
UEMOA	Union Économique et Monétaire Ouest Africaine (West African Economic and Monetary Union)

MEASUREMENTS

°C	degree Celsius
€	Euro (1 Euro = 655.957 Francs CFA)
GWh	gigawatt hour (1 GWh = 1,000,000 Kilowatt hours (kWh))
h	hours
km^2	Square kilometer
ktoe	kilotons of oil equivalent (= 1,000 toe)
kVAh	kilovolt ampere hour
kWh	kilowatt hour
kWp	kilowatt peak
m/s	meters per second
m^2	square meter
m^3	cubic meter
mm	millimeters
MW	megawatt (1 MW = 1,000 kW)
toe	tons of oil equivalent

SUMMARY

The Country Study of Guinea-Bissau is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Guinea-Bissau. The study is structured as follows:

Chapter one provides **Background Information on Guinea-Bissau.** This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Guinea Bissau.

Chapter two summarizes facts and figures of **Guinea-Bissau's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Guinea-Bissau. This includes an overview of support mechanisms for photovoltaic (PV) as well as already existing regulations, incentives and legislative framework conditions concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Guinea-Bissau.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

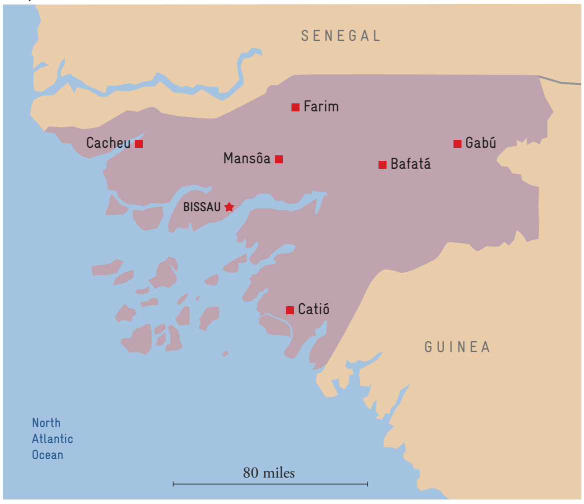
Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Guinea-Bissau.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Guinea-Bissau is located in West Africa and limited by the Atlantic Ocean, Senegal and the Republic of Guinea. The total area is 36,125 km² with approximately 28,000 km² constituting the continental part. Offshore, there are about sixty small islands of which the archipelago of Bissagos is the most important one.

FIGURE 1:
Map of Guinea-Bissau



With the exception of the islands, Guinea-Bissau is dominated by a marshy coastal plain. The relief rises gradually towards the East and forms a shelf culminating in 360 meters of altitude in the South East. Numerous rivers flow from West to South and form vast estuaries at their mouth. Many of them are navigable and constitute the principal means of transport. The country is subject to a hot and wet tropical climate, with annual average temperatures of around 25 °C. From one season to another, the variation of temperature is not very significant.

The rainy season lasts from June to November with wind blowing from South West; the annual average precipitation is around 1,200 mm. The dry season extends from December to May with Harmattan blowing from the North East.

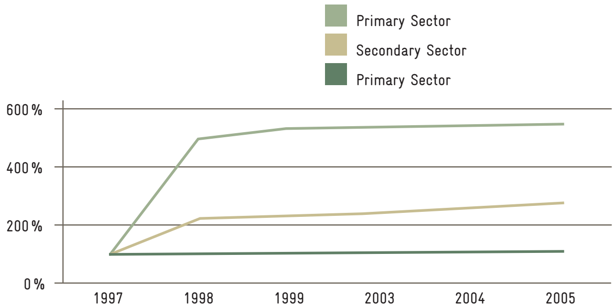
1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

The former Portuguese colony of Guinea-Bissau gained its independence in 1974. Since then, several political changes have occurred in the country. In order to comply with human rights, the National Assembly approved of a package of constitutional amendments in line with the guarantee of fundamental rights in February 1993. But respect for these rights by the elements in power is not always the case. In August 1991, the Guinean League of Human Rights was established.

According to the National Institute of Statistics and Census (INEC), the population of Guinea-Bissau is estimated at 1,366,412 inhabitants with a population density of 34 inhabitants per km². The country counts approximately 1,500 villages, mainly with dispersed habitat. Guinea-Bissau consists of five major ethnic groups. The Balantes represent approximately 30 % of the population, the Fula 20 %, the Mandjac 15 %, the Mandingo 13 % and the Pepels 8 %. The language mostly used in Guinea-Bissau is Portuguese Creole, however the official language is Portuguese.

The economy of Guinea-Bissau mainly depends on the primary sector. The agricultural potential of the country is enormous and accounts for almost 62 % of Gross Domestic Product (GDP). More than 90 % of the exports and the employment of 550,000 people are related to this important sector. Agriculture is dominated by the production of rice and cashews. Another important source of income is the fishing sector exporting about 500 million tons per year thus accounting for 7,500,000 Euro. Figure 2 illustrates the GDP development within the last few years.

FIGURE 2
GDP by Sector (in Mio €)



Source: National Institute of Statistics and BCEAO Guinea-Bissau, as of 2005

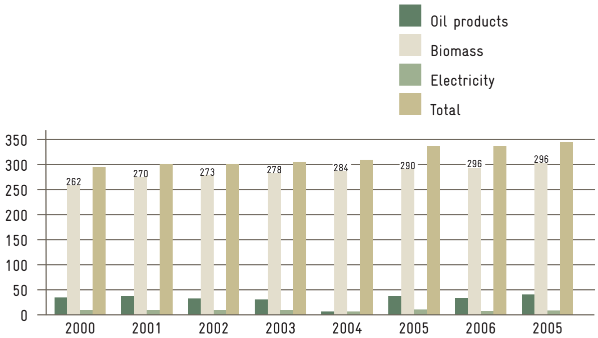
2 ENERGY MARKET IN GUINEA-BISSAU

2.1 OVERVIEW OF THE ENERGY SITUATION

The energy sector in Guinea-Bissau is divided in three parts, i. e. the electricity sub-sector, the petroleum sub-sector and the biomass sub-sector. In 2007, according to the Guinea-Bissau energy balance, the final total consumption of the country was 345,000 toe with biomass consumption as the dominant factor. Figure 3 presents the final energy consumption and the related energy sources.

FIGURE 3

Final Energy Consumption by Type of Energy (1,000 toe)



Source: SIE, Guinea-Bissau, as of 2008

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

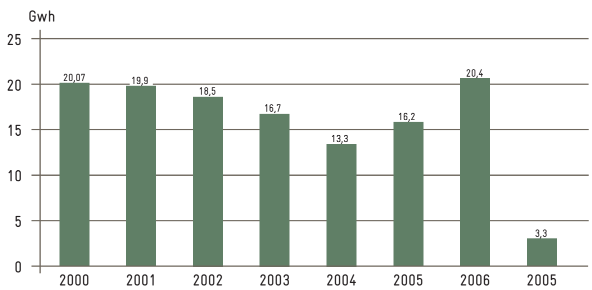
Guinea-Bissau's infrastructures of electricity production are in a bad state and the capacity is very insufficient. There is a considerable lack and malfunction of infrastructures for electricity production. The electricity production of Guinea-Bissau is thermal-based (diesel) and is based on a major thermal power plant in Bissau (with a capacity of 17.5 MW) as well as on secondary production centers (with a capacity of about 7 MW) operating in the center of the country. The peak capacity is estimated at 20 MW (figure 4). In 2006, the availability of the power station of Bissau did not exceed 3.9 MW. Today, the available capacity is 5.5 MW.

During 2002–2007, the electricity access rate decreased due to insufficient and disordered production and distribution infrastructures. Figure 5 presents the evolution of the electricity access rate.

As to electricity prices, Guinea-Bissau has the most expensive tariffs in the region. Current prices are indicated in Table 1.

FIGURE 4

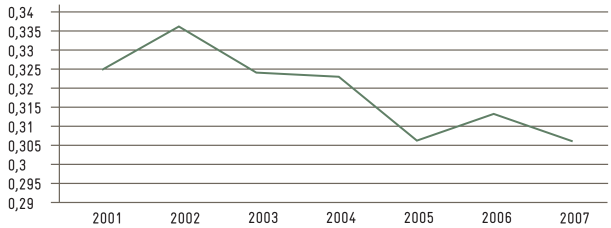
Electricity Production



Source: EAGB, as of 2007

FIGURE 5

Evolution of the Electricity Access Rate



Source: EAGB, as of 2007

TABLE 1

Electricity Tariffs

TARIFFS FOR HOUSEHOLDS				
Level	kWh	Price/kWh in CFAF (1 Euro = 655.957 CFAF)	Price/KVAH in CFAF	Power Tax CFAF
1	0–50	78		1,000
2	51–200	161		2,000
3	>200	322		2,100
TARIFFS FOR GOVERNMENTAL OFFICES, SHOPS, ETC.				
With meter	>0	255	48	6,400
Without meter	>0	320	48	6,400
TARIFFS FOR INDUSTRY				
Single	>0	165	50	50,000

Source: EAGB, as of 2008

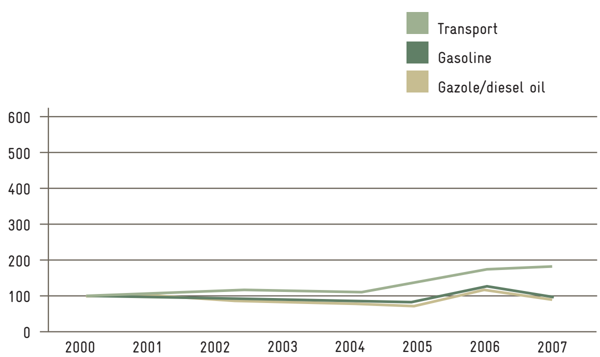
Petroleum Sector

Guinea-Bissau has not proven oil reserves. Therefore, all petroleum products are imported thus charging the country's economy with high expenses. According to the energy balance of 2007, the consumption of petroleum products is mainly dominated by the transport sector (40,614 ktoe), followed by electricity production (0.946 ktoe) and the residential sector (0.240 ktoe). The evolution of consumed petroleum products in the transport sector is presented in Figure 6.

Prices of petroleum products are determined by the Ministry of Energy and Industry and are to be revised on a monthly basis. Table 2 presents the prices of petroleum products.

FIGURE 6

Evolution of Petroleum Product Consumption in the Transport Sector



Source: SIE, Guinea-Bissau, as of 2008

TABLE 2

Prices of Petroleum Products (March 2008–February 2009)

As of:	PRODUCT (PRICES IN CFAF) (1 EURO = 655.957 CFAF)					
	Diesel	Diesel Electricity Generation	Gasoline	Kerosene	Gasoline	LPG
20/03/08	569	452	670	455	524	776
20/06/08	729	575	801	606	600	776
10/08/08	696	540	777	577	580	776
14/11/08	570	433	609	475	480	776
19/12/08	542	410	609	401	472	776
12/02/09	500	375	545	348	440	776

Source: Ad Hoc Committee for Oil Products Prices of the Ministry of Energy and Natural Resources,as of 2009

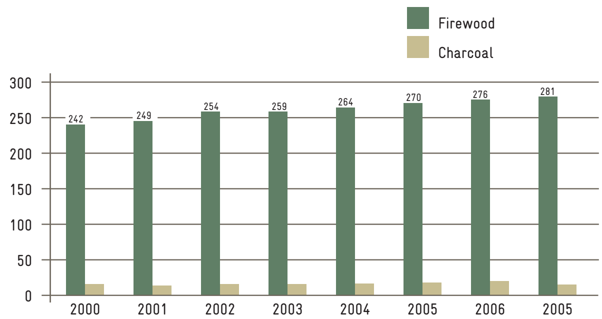
Biomass Sector

The biomass represents over 95 % of the total energy consumed by households in Guinea-Bissau. Wood is the dominant fuel with a demand that exceeds 500,000 tons per year, followed by charcoal being the most-used fuel in the capital. The quantity of the biomass used is around 738,000 tons.

The price of wood varies according to the demand and requested amount. Charcoal is sold by bag or measure for about 0.10 Euro.

FIGURE 7

Biomass Consumption (1,000 tons)



Source: SIE, Guinea-Bissau, as of 2008

2.3 MARKET ACTORS AND REGULATION STRUCTURES

In Guinea-Bissau, the energy sector is under the supervision of the Ministry for Trade, Energy, Industry and Environment also in charge of the definition of any policies in the overall sector and the promotion of RE.

A General Direction of Energy (DGE) is in charge of the execution of this policy. Its tasks are the elaboration of the legal and regulatory orders in the energy field and the control of their application. It is also entrusted with the realization of prospective studies, the promotion of new technologies and the follow-up of the studies of installation. Within the DGE, the service of RE is the executive body in charge of all activities related to these energy resources.

The electric system of Guinea-Bissau is managed by the Electricity and Water Company of Guinea-Bissau (Electricidade e Águas de Guinea-Bissau – EAGB). Within the existing market structure, there are several private energy producers in Guinea-Bissau. Self-sufficient producers of electricity are also feeding part of their production into the distribution network of EAGB.

As to forest resources and domestic fuels, the overall sector is controlled by the Directorate General of the Forests supervised by the Ministry for Rural Development and Agriculture.

The development of local energy resources is controlled by the National Institute on Research and Applied Technologies under the supervision of the Ministry for Natural Resources. At the regulatory level, the Ministry of Energy delivers import and export licenses for all types of energy products and technologies.

For the overall regulation aspects, a multisector regulation unit is currently being planned. This authority will control the telecommunication sector, harbor activities and the overall transport sector. In a next step, the integration of the electricity sector in this very unit is planned.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

Up to now, Guinea-Bissau does not have any explicit Renewable Energies (RE) policies. Even though a draft was developed by the Government as early as 2004, the document has not been adopted yet. Furthermore, a strategic plan for RE was elaborated during 2004–2008. Due to a lack of funds, it has not been implemented yet.

At the regional level, the Common External Tariff (TEC) of the West African Economic and Monetary Union (UEMOA) was established in 2000. Within this union, there is no promising tax incentive for RE yet. Recently, UEMOA started to review the situation and is now moving towards the implementation of tax incentives that are more favorable to the development of RE. UEMOA is committed to encouraging and developing the use of RE in all member states. Therefore, it is expected that UEMOA will establish various incentives to support the sustainable development of energy supply.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

Up to now, there are no regulations, incentives and legislative framework conditions that support the implementation of RE in Guinea-Bissau. As to rural electrification, it is planned to create ambitious regulations that allow private operators to conduct business in this sector thus offering promising opportunities for the utilization of RE.

The Governmental body in charge is the Directorate General for Energy. Up to now, however, all projects and incentives in the field of RE were realized by the investors without any involvement of the Ministry of Energy or the Directorate General for Energy. No permissions are currently required to develop RE projects. In terms of feed-in tariffs and other necessary regulations, there are no laws or regulations at all.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

The forest areas of Guinea-Bissau are estimated at about two million hectares. The available amount of biomass is about 48.3 million m^3. The annual consumption of wood for energy purposes is estimated at 625,000 m^3 and leads to a significant reduction of existing forest areas. The available biomass potential from agricultural products, wood processing residues and livestock manure is about 67,000 m^3 per year. In terms of bio fuel production, there is a potential of about 10,000 m^3 from cashew and about 20 hectares of jatropha plantations.

4.2 SOLAR ENERGY

Guinea-Bissau has an important solar radiation: 4.5 to 5.5 kWh/m^2/day over an average of 8 hours per day (3,000 h of insulation per year). In spite of this promising potential, up to now merely 450 kWp of PV installations are being used for communication networks, water pumping stations and house lighting. The Government plans to significantly increase the utilization of PV in order to cover up to 2 % of the overall energy consumption by 2015. Table 3 presents an overview of existing PV installations.

TABLE 3

Existing PV Installations in Guinea-Bissau

SITE	FUNDER	UTILIZATION
Bafata and Gabu	PRS	Pumping and lighting
Bafata and Gabu	PRSII	Pumping and lighting
Bissau Bissau/Hop.Raoul	PRSII	Lighting
Rural Area	PRSII	Lighting
Rural Area	PRSII	Pumping
Rural Area	PRSII	Pumping
Bissau	Guinean Telecom	Communication

Source: compiled by Julio Antonio and the author, as of 2008

4.3 WIND POWER

The average wind speed is estimated at 2.5 to 7 m/s along the coast and on some of the islands. Even though there is a very promising potential, there is no mentionable utilization of wind power in Guinea-Bissau so far.

4.4 HYDRO POWER

The available Hydro Power potential of Guinea-Bissau is estimated at about 184 MW from the rivers Corubal and Geba. Even though there is a very promising potential available, up to now there is no mentionable utilization of Hydro Power in Guinea-Bissau.

5 MARKET RISKS AND BARRIERS

The lack of consistent policies in the field of RE is the most critical of all existing market risks and barriers. Furthermore, the weakness of industrial and private sectors, together with a lack of clear direction and leadership from Governmental institutions is blocking the development of RE in Guinea-Bissau. Therefore, it is important to create a favorable environment for the private and industrial sector in order to enable them to operate effectively and encourage them to expand their investments in RE projects. The most critical technical barrier is the lack of accurate data on available RE resources.

As to necessary investments, Guinea-Bissau has no incentives or benefits in order to attract potential investors. The political instability after the civil war is still discouraging national and international investments. Other substantial risks and barriers include corruption, high costs, insufficient human resources and the absence of a coherent institutional and regulatory framework.

The foundation of a company in Guinea-Bissau is not very difficult. The OHADA Uniform Act on general commercial law (Acte Uniforme Relatif au Droit Commercial General – AUDCG) regulates the exploitation and trade of natural resources as well as intermediate operations. In the specific activities related to RE sub-sector, the exercise of commercial activities requires a license or a permit issued by the Government. This license is granted for a period of 10 years and it is automatically renewed as long as prerequisites are met. The granted period for the permit is 5 years following the same renewal conditions.

Concerning foreign investment, the Investment Code of Guinea-Bissau was created in 1991 and amended in 1996. Due to the Investment Code, individuals and legal entities from all nations around the world are invited to make investments in the country. The Investment Code of Guinea-Bissau guarantees that there are no restrictions for foreign investment and no obligation to employ local staff. Moreover, the equal treatment of companies, the freedom of commercial management and easy capital transfer procedures are guaranteed.

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

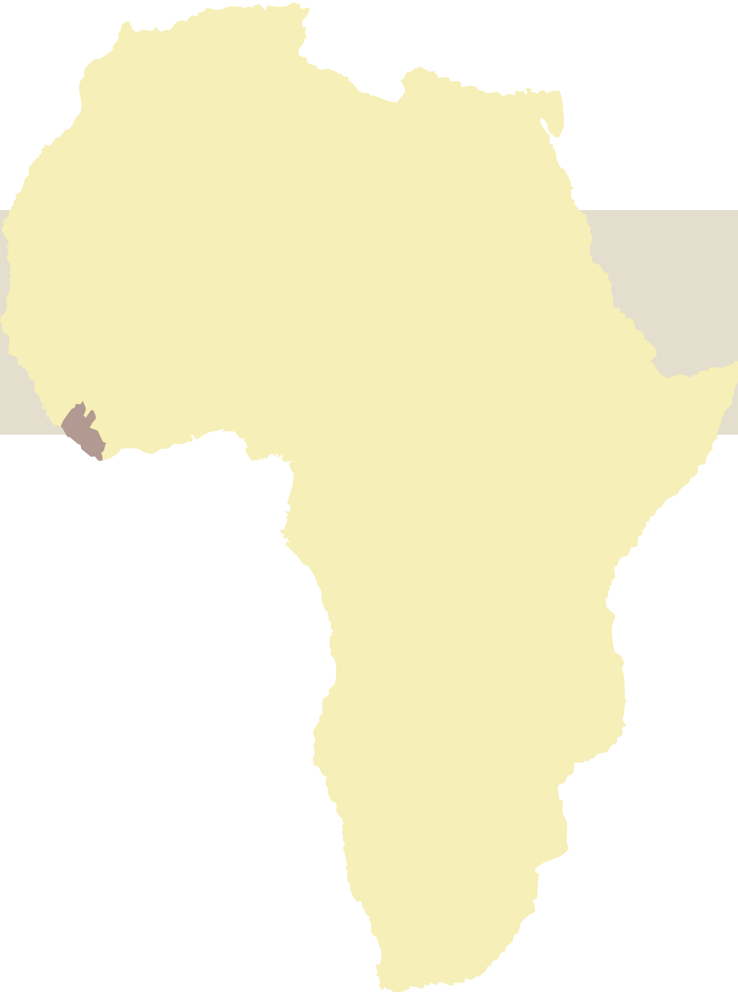
TABLE 4

Local Business and Trade Partners

NAME	ADDRESS	FIELD OF ACTIVITY
Associação Comercial, Industrial e Agrícola a Guiné-Bissau (Commercial Association of the Industrial and Agricultural Sector)	B. P. 88, Bissau Phone: +245 22 30 84	Commercialization of the industrial and agricultural sector
Action for Development (AD)	Phone: +245 251 365 ad@sol.gtelecom.gw	Promotion activities for solar energy
Direcção General dos Geologia e dos Minas (General Direction for Geology and Mines)	B. P. 399, Santa Luzia Phone: +245 222 329	Regulation of the mining sector
Direction Général de lÉnergie (DGE)	Phone: +245 664 43 47 Bissau	Energy policy
Electricidade e Águas de Guinea-Bissau (Electricity and Water Company of Guinea-Bissau – EAGB)	Rua Eduardo Mondlane Bissau Phone: +245 20 11 84	Production and distribution of electricity
Empresa Distribuidora de Combustivos e Lubrificantes	B. P. 3, Bissau Phone: +245 201 262	Distribution of fuels and lubricants
Institut National de la Recherche et Technologie Appliquée (National Institute on Research and Applied Technologies)	Rua da Guinea-Bissau Bissau Phone: +245 22 20 80	Research
Ministry of Agriculture and Rural Development	B. P. 71, Bissau Phone: +245 221 200	Domestic energy policy management
Ministry of Energy and Industry	B. P. 311, Bissau Phone: +245 21 5659 245	Regulation of the energy and industry sector
Secretaria de Estado da Energia, dos Recursos Naturais e do Ambiente (State Secretary for Energy, Natural Resources and Environment)	B. P. 399, Bissau Phone: +245 22 19 25	Energy, environment and natural resources

7 BIBLIOGRAPHY

- BCEAO, Guinea-Bissau (2005): Various publications
- International Monetary Fund – IMF/Ministry of Economy, Republic of Guinea Bissau (2007): Guinea-Bissau: Poverty Reduction Strategy Paper (PRSP)
- C. Boccaletti, G. Fabbri, J. Marco, E. Santini (2008): An Overview on Renewable Energy Technologies for Developing Countries: The Case of Guinea-Bissau (www.icrepq.com/icrepq-08/295-boccaletti.pdf)
- DGI/Guinea-Bissau (2004–2008): Strategic Plan on Energy Sector
- Direction General of Energy of Guinea-Bissau (years unknown): Various documents of projects and programs, rapports and texts
- ECOWAS (2005): White Paper on Access to Energy Services
- Encyclopédie Microsoft Encarta (2004): Guinée-Bissau, Pour la Partie Historique
- ENDA (2005): Country monograph
- ENDERS, Armelle (1994): Histoire de l'Afrique Lusophone, Paris, Éditions Chandeigne
- Energy Information Administration (2006): West Africa (ECOWAS)
- Issa Mare DIAW (2004): Situation et Évolution du Secteur de l'Énergie en Afrique de l'Ouest/Régulation dans le Contexte du Système d'Échanges d'Énergie Électrique Ouest Africain", 2nd Global Regulatory Network Conference Bamako, Mali, 26–27 July 2004
- Ministry of Environment (1999): Initial National Communication on Climatic Changes
- Ministerio das Finança, Gabinete do Ministro (2007): Despacho No. 48/07
- M. Boubacar Issa Abdourhamane (without year): Politique Institutionnelle en Guinée-Bissau, CEAN, IEP Université Montesquieu-Bordeaux IV (last viewed in August 2009 (www.etat.sciencespobordeaux.fr/institutionnel/gbissau.html)
- National Institute of Statistics (2005): Various publications
- Ogunalde Davidson (2008): Scaling Up Market for Renewable Energy in Africa, Thematic Background Paper for International Conference on Renewable Energy in Africa, Dakar, Senegal
- Orlando MENDES (2007): Agro Climatologie de la Production de l'Anacardier en Guinée-Bissau, Agrhymet
- Performance Management Consulting (2008): Rapport Définitif sur l'Étude pour l'Élaboration d'une Stratégie Durable de la Résolution de la Crise Électrique au Sein des États Membres de l'UEMOA
- PREDAS (2004): Stratégie Energie Domestique de Guinée-Bissau, Bissau
- Rapport National d'Investissement Guinée-Bissau (2008): Conférence de Haut Niveau sur l'Eau pour l'Agriculture et l'Énergie en Afrique: Les Défis du Changement Climatique, Syrte, Jamahiriya Arabe Libyenne, 15–17 Décembre 2008
- RECIPES: Developing Renewables (2006): Country Energy Information, Guinea-Bissau
- Réunion Annuelle ICA (2008): Point sur la Production de l'Énergie Électrique en Afrique
- Tabucci, Antonio (2000): Suspecte Lusophonie, Le Monde, Paris
- Bernard Krief Consultants (2006): Country Profile Guinea-Bisseau. Investment Conference in Construction & Civil Engineering Central & West Africa (www.africonstruct.org/.../studies/Sector_Profile_Guinea_Bissau.pd)



COUNTRY CHAPTER:
LIBERIA

Author of Country Chapter
Augustus V. Goanue
(MSc. Reg. Sc., BA Eng.)

Coordination and Review of the Country Chapter
Anton Hofer, (MSE, Dipl.-Ing./FH, M.A.)
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS LIBERIA

ACRONYMS AND ABBREVIATIONS

LIBERIA

CBL	Central Bank of Liberia
CPA	Comprehensive Peace Agreement
EC	European Commission
EE	Energy Efficiency
EPA	Environmental Protection Agency
EPP	Emergency Power Program
FDA	Forestry Development Authority
GDP	Gross Domestic Product
GEF	Global Environment Facility
GoL	Government of Liberia
IMC	Inter-Ministerial Committee
IMPTC	Inter-Ministerial Petroleum Technical Committee
IPRS	Interim Poverty Reduction Strategy
LACC	Liberia Anticorruption Commission
LCC	Liberia Chamber of Commerce
LEAP	Liberia Energy Assistance Program
LEC	Liberia Electricity Corporation
LIBA	Liberia Business Association
LPG	Liquefied Petroleum Gas
LPRC	Liberia Petroleum Refining Company
MIC	Ministry of Industry & Commerce
MLME	Ministry of Lands, Mines and Energy
NEP	National Energy Policy
NIC	National Investment Commission
NTGL	National Transitional Government of Liberia
PPP	Public-Private Partnership
PRS	Poverty Reduction Strategy
PST	Petroleum Storage Terminal
PV	photovoltaic
RE	Renewable Energy
RESCos	Rural Energy Service Companies
RFTF	Results Focused Transitional Framework
RREA	Rural and Renewable Energy Agency
SME	Small and Medium Enterprise
UN	United Nations
UNDP	United Nations Development Program
USD	United States Dollars
WAPP	West African Power Pool

MEASUREMENTS

°C	degree Celsius
dam^3	cubic decameter (1 dam^3 = 1000 m^3)
GWh	gigawatt hour
Kg	kilogramm
km	kilometer
km^2	square kilometer
kVA	kilovolt ampere
kW	kilowatt
kWh	kilowatt hour
kWp	kilowatt peak
m^2	square meter
m^3	cubic meter
mm	millimeter
MW	megawatt
yr	year

SUMMARY

The Country Study of Liberia is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Liberia. The study is structured as follows:

Chapter one provides **Background Information on Liberia**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Liberia.

Chapter two summarizes facts and figures of **Liberia's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Liberia. This includes an overview of support mechanisms for photovoltaic (PV) as well as already existing regulations, incentives and legislative framework conditions for other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Liberia.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Liberia.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Liberia is situated on the southwestern corner of the West Coast of Africa between longitudes 7°30' and 11°30' West and latitudes 4°18' and 8°30' North. The country is bounded by the Atlantic Ocean in the South, by Côte d'Ivoire in the East, by the Republic of Guinea in the North and by the Republic of Sierra Leone in the West. Liberia covers an area of 111,370 km^2 split into 15,050 km^2 of water and 96,320 km^2 of land. The total land boundaries extend to 1,585 km (Guinea 563 km, Côte d'Ivoire 716 km and Sierra Leone 306 km).

There are four tropical regions each with its own distinct physical features and height above sea level. The Coastal Plain stretches along the seacoast for 563 km. It consists of an almost unbroken sand strip rising up to 30 meters above sea level. The Coastal Plain flanked by a belt of flooded plateaus followed by a belt of high lands and rolling hills in the North and Northwest. The maximum elevation of Liberia is Mount Wutivi in the Northern highlands with a height of 1,350 meters. The average annual rainfall along the coastal belt is over 4,000 mm and declines to 1,300 mm at the forest/savanna boundary in the North. The relative humidity is generally high throughout the country.

FIGURE 1

Map of Liberia

There are four tropical regions each with its own distinct physical features and height above sea level. The Coastal Plain stretches along the seacoast for 563 km. It consists of an almost unbroken sand strip rising up to 30 meters above sea level. The Coastal Plain flanked by a belt of flooded plateaus followed by a belt of high lands and rolling hills in the North and Northwest. The maximum elevation of Liberia is Mount Wutivi in the Northern highlands with a height of 1,350 meters. The average annual rainfall along the coastal belt is over 4,000 mm and declines to 1,300 mm at the forest/savanna boundary in the North. The relative humidity is generally high throughout the country.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

After winning the 1997 presidential elections following an eight-year civil war, former President Charles Taylor did not manage to keep rebel groups from trying to oust him by force. Rebel attacks in Monrovia, coupled with two years of sanctions imposed by the UN crippled the Taylor-led Government, thus prompting Taylor's handing over power to his successor in August 2003. A transitional Government – composed of rebel factions, government, political parties and civil society groups – took control in October 2003 after the signing of the Accra Comprehensive Peace Agreement (CPA). Gyude Bryant, who had a two-year mandate to coordinate efforts to restore peace and rebuild Liberia, headed the transitional Government as its Chairman. Since then, Liberia has steadily been making progress towards political stability in conditions of peace and security. Successful multiparty presidential and legislative elections, held in October and November 2005, culminated in the formal inauguration of President Ellen Johnson Sirleaf and a new 94 member legislative body constituted by 14 political parties and 8 independent candidates in January 2006. Thanks to uninterrupted political and civil stability, the Government of Liberia (GoL) has been able to vigorously pursue an agenda of reconstructing post-war Liberia since 2006.

Liberia has a population of 3.5 million people. With a GDP of about 190 USD[1] per capita, Liberia is one of the poorest countries in the world. Poverty is pervasive, and is particularly acute in rural and remote areas of the country. 63.8% of the country's population live below the poverty line[2]. Poverty has many dimensions, including low levels of income and consumption, poor nutrition and food security, low health and education indicators as well as inadequate infrastructure. It is reinforced by inequities, especially in access to juridical and economic opportunities.

The Government of Liberia has embarked on a number of national development initiatives with external assistance. These development initiatives have been structured around the Results Focused Transitional Framework (RFTF)[3] of February 2004–January 2006, the 150 Day Deliverables or Action Plan of February–June 2006 and the Interim Poverty Reduction Strategy (IPRS) of July 2006–June 2008[4], offering guidance to donor interventions as an addition to continuing programs and activities previously initiated on an emergency relief scope employing short-term recovery strategies.

In April 2008, the Government of Liberia finalized the Poverty Reduction Strategy (PRS) as a macro-economic policy framework document to guide socio-economic development activities and national reconstruction between 1 July 2008 and 30 June 2011. The PRS was designed around four major objectives: (i) consolidating peace and security, (ii) revitalizing the economy, (iii) strengthening governance and the validity of law and (iv) rehabilitating infrastructure and delivering basic services.

1 PRS, AS OF 2008
2 LISGIS, CWIQ, AS OF 2007
3 SEE ALSO UNITED NATIONS/WORLD BANK, AS OF 2005
4 IMF, AS OF 2007

The Liberian economy is characterized by a structural imbalance between a modern enclave and the traditional sector. The modern sector basically depends on foreign investment and technological skill and is geared towards mining, rubber and forest products. Before the war, this sector accounted for 70 % of export earnings and almost 50 % of the Gross Domestic Product (GDP). The traditional sector, on the other hand, is rural based and relies in general on indigenous capital and rudimentary technology for subsistence agriculture supports and comprises nearly 70 % of the population. There is no connection between the two sectors whatsoever. The modern sector's link to the rest of the economy is generally weak and exists mainly in the form of profit sharing with the Government, the payment of royalties, income tax levied on employers and duties on imported materials in some instances.

2 ENERGY MARKET IN LIBERIA

2.1 OVERVIEW OF THE ENERGY SITUATION

The current energy market in Liberia is dominated by petroleum products imported in refined forms and traditional wood biomass consumed primarily for cooking and heating as in most Sub-Sahara African countries. The market for petroleum products is considered as formally institutionalized, while that of wood biomass is rather informal. Currently, there are no sufficient disaggregated data on the overall energy mix of Liberia in view of production and consumption.

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

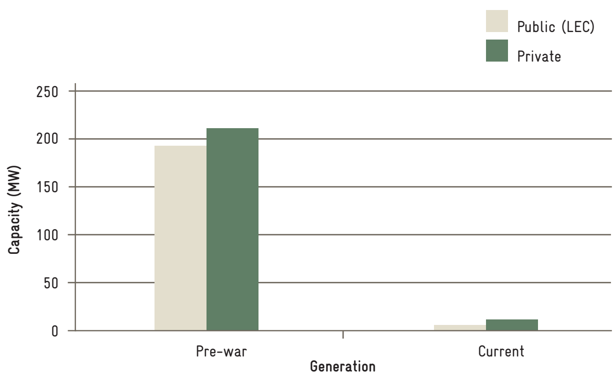
Electricity Sector

Before the civil war, the total installed electricity generation capacity – including the private sector – was about 412 MW. The Liberia Electricity Corporation (LEC) provided approximately 191 MW, while the concessionaires delivered 212 MW. The installed capacity of the rural electrification program totaled 13 MW and consisted of small isolated rural systems powered by plants ranging from 300 to 1,300 kW. All facilities were completely damaged during the 14-year civil war. Figure 2 presents the available electricity generation capacities before and after the civil war.

The LEC small scale operations started in late November 2003 after the inauguration of the National Transitional Government (NTGL) with the financial and fuel supply support of the European Commission (EC). They ended by the first week of April 2004 as a result of the LEC's inability to finance the fuel oil supply component of its operation. The high electricity theft rate in the LEC distribution network was the main reason for the utility's inability to sustain its operations. 22.6 % of the energy production could not be accounted for during the period January 1 to 31 March 2004[5].
Launched in 2006, the Emergency Power Program (EPP) was designed to re-establish public power supply in Monrovia and its immediate environs. The EPP initially installed a total power of 2.5 MW, which has now been increased to 9.6 MW. There is no generation capacity outside Monrovia besides privately owned generators and scattered donor-funded solar power pilot projects. A very large number of diesel generating units (ranging from 15–250 kVA) are in everyday use throughout the country. All institutions, agencies, commercial entities and a large number of private households generate their own electrical power. A combined capacity of small diesel units is conservatively estimated to be over 15 MW. There are no reliable data on the overall electrical energy consumption in Liberia as there are numerous privately owned generators of various capacities scattered across the country. Recently obtained production and consumption data from the LEC are presented in Table 1.

The current electricity tariff is fixed irrespective of consumer type (residential, commercial or industrial). Although only laid out to cover operational and maintenance costs, the current electricity prices are relatively high. Due to dependence on fossil fuel and fuel price instability, electricity tariffs have been ranging between 0.34 USD and 0.60 USD per kWh (based on fuel adjustment costs) since the inception of the EPP. Current tariffs stand at 0.43 USD per kWh. This price, however, is lower than the cost of self-generation, which is estimated at a minimum of 0.75 USD per kWh. Currently, there are no tariffs for RE implemented as RE projects still are in a rudimentary and non-commercial stage.

FIGURE 2
Pre-War vs. Post-War Electricity Generation (MW)



Source: Liberia Electricity Corporation (LEC), as of 2004-2008

TABLE 1
Annual Electrical Energy Production and Consumption (GWh)

Year	Energy Production	Energy Consumption
2004	1.95	1.51
2005	0.00	0.00
2006	2.05	1.64
2007	8.23	6.70
2008	11.25	9.16

Source: Liberia Electricity Corporation, as of 2004–2008

5 LEC ANNUAL REPORT, AS OF 2004

Petroleum Sector

Yearly volumetric imports of approximately 35.2 million US gallons consist mainly of gasoline, diesel fuel and to a lesser extent jet fuel and kerosene. Presently, a number of large and small vendors hold licenses to import and distribute petroleum products. Although the Liberia Petroleum Refining Company (LPRC) is the major player in the downstream petroleum sector, the wholesale and retail business is dominated by the private sector, namely West Oil Investment, Monrovia Oil Trading Company, Aminata & Sons, SRIMEX Enterprise, Origin Oil & Gas, TOTAL International, Gulf Trading Company and LIB-AFRIC. West Oil is the leading importer with a market share of about 34 % . Table 2 presents an overview of imports in the petroleum sector.

Local pricing of petroleum products in Liberia is subject to external fluctuations in the price of oil on the world market. Import tariffs, port handling charges and storage fees also affect the price of petroleum products. The current pump prices of gasoline, diesel and kerosene are 2.50 USD, 3.00 USD and 2.90 USD per US gallon respectively. Table 3 provides wholesale, distributor and pump prices of petroleum products between 1997 and 2005.

The use of kerosene and Liquefied Petroleum Gas (LPG) for heating and cooking is limited to a very small number of expatriate workers and wealthy Liberians who reside in Monrovia. The price per kg of LPG is about 2.5 USD.

TABLE 2

Annual Petroleum Imports in US Gallons

YEAR	GASOLINE	DIESEL	KEROSENE	JET-A1
2000	11,528,818	15,089,206	456,408	1,472,509
2001	9,961,590	15,299,071	260,011	1,119,020
2002	8,837,731	12,290,039	328,047	1,535,958
2003	7,209,339	10,797,827	435,446	2,025,402
2004	13,170,250	21,595,384	640,862	6,381,150
2005	17,107,913	24,657,097	644,046	6,115,622
2006	20,487,703	30,678,151	1,054,258	5,156,645

Source: Liberia Petroleum Refining Company (LPRC), as of 2006

TABLE 3

Comparative Petroleum Product Prices per US Gallon, 1997–2005

YEAR	GASOLINE			DIESEL			KEROSENE		
	Whole-sale	Distributor Price	Pump Price	Whole-sale	Distributor Price	Pump Price	Whol-sale	Distributor Price	Pump Price
2005	3.02	3.07	3.25	3.12	3.17	3.25	2.49	2.55	2.70
2004	2.39	2.45	2.60	2.44	2.50	2.65	2.49	2.55	2.70
2003	No data available								
2002	No data available								
2001	2.79	2.85	3.00	2.69	2.75	2.90	2.49	2.55	2.70
2000	2.12	2.18	2.30	2.12	2.18	2.30	2.12	2.18	2.30
1999	1.89	1.88	2.00	1.82	1.88	2.00	1.82	1.80	2.00
1998	1.58	1.64	1.75	1.58	1.64	1.75	1.58	1.64	1.75
1997	1.33	1.39	1.50	1.33	1.39	1.50	1.33	1.39	1.50

Source: LPRC Petroleum Storage Terminal (PST) Status Report, as of 2007

Biomass Sector

Traditional wood biomass (firewood and charcoal) is the primary energy source for cooking and heating. In 2004, it was estimated that over 95 % of the population relied on firewood, charcoal and palm oil for their energy needs[7]. According to the Central Bank of Liberia (CBL), the charcoal production amounted to 255,600 kilograms in 1999. Data obtained from the National Charcoal Union of Liberia (NACUL) in 2005 revealed that 36,500,000 kg (36,500 tons) of charcoal were produced per annum. Though there are no reliable data on firewood consumption in Liberia, forecasts for the country estimate an annual increase in demand of about 0.6 m^3 per household[8].

6 LPRC ANNUAL REPORT, 2006

7 CSET, AS OF 2004

8 CSET, AS OF 2004

2.3 MARKET ACTORS AND REGULATION STRUCTURES

Electricity Sector

Under the current legislation, the Liberia Electricity Corporation is the only institution responsible for the generation, transmission, distribution and sale of electricity under policy guidance of the Ministry of Lands, Mines and Energy (MLME). LEC used to supply the major cities and towns connected to the grid or with stand-alone diesel plants. Additional power was produced within the various mining and agricultural concessions. Due to the LEC monopoly, private investments have not been attracted to the electricity sub-sector. The draft National Energy Policy (NEP), however, has stressed the need for the liberalization of the electricity market.

Petroleum Sector

The Government's institutional framework for the petroleum sector comprises an office responsible for hydrocarbons in the MLME and two state-owned enterprises dedicated to upstream and downstream operations. NOCAL and LPRC are the two Government institutions established by law to administer and regulate the petroleum sector of Liberia under the policy guidance and supervision of the MLME. NOCAL is responsible for the upstream petroleum sector, while the downstream petroleum is under the jurisdiction of the LPRC. In the upstream sub-sector, petroleum exploration and development is one of the Liberia's top priorities. Although the current law does not provide for separation of policy-setting, monitoring and operation roles, in practice the MLME is involved in policy-setting in the upstream sector as it chairs the Inter-Ministerial Petroleum Technical Committee (IMPTC) in charge of analyzing applications for licenses and negotiating concession agreements. The IMPTC is the executive body of the Inter-Ministerial Committee (IMC) chaired by the Minister. In accordance with regulations and procedures, it decides on the granting of licenses and concessions. NOCAL receives applications from interested investors, submits them to the IMPTC (to which it provides technical advice) and then supervises the implementation of the resultant concession agreements. In the downstream sub-sector, the LPRC is responsible for the importation, refining, storage and distribution of petroleum products. At present, there is no operational refinery in the country. All of the country's refined products are imported by companies licensed by the LPRC and through LPRC's offloading and storage facilities. Even though there is no detailed study currently available indicating whether the refinery can be retrofitted or not, it is obvious that the requisite financial resources for any restorations are not available, even if it made sense from an economic point of view.

Biomass Sector

Although there is no public entity established by law to plan and regulate the biomass sector where charcoal and firewood predominate, the Forestry Development Authority (FDA), a Government entity created by law in 1976, is responsible for the regulation and management of the forestry sector. One of the FDA's objectives is to stop waste and destruction of forests and the associated natural resources by bringing about the profitable harvesting of all forest products while assuring that supplies of these products are perpetuated. However, FDA's mandate does not include any explicit policy and regulatory oversight for the biomass energy sector. The already mentioned National Charcoal Union of Liberia (NACUL), a holding group of commercial charcoal producers established in 2005, is working closely with the FDA in order to coordinate the production and sale of charcoal in the sector.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The formulation of Liberia's first NEP started in early 2006 with provisions in the 150 Day Plan deliverables, followed by a National Energy Stakeholders Forum in October 2006, the publication of the National Energy Sector White Paper, the interim Poverty Reduction Strategy Process and the final Poverty Reduction Strategy. NEP contains Liberia's national vision for the energy sector from the emergency phase, which is nearing completion, to the capacity building and development phases. As part of its policy and strategy, the Government is considering various international models based on best practices in order to develop and ensure that its poverty reduction policy is fully supported by the provision of sustainable energy services to all consumers. The Government believes that the private sector and Public-Private Partnership (PPP) arrangements will play a key role in the medium to long-term development of the energy sector. The Government began to transform the National Energy Sector White Paper into a National Energy Policy in mid 2007. The Renewable Energy (RE) and Energy Efficiency (EE) Policy and Action Plan for Liberia is to:

- Establish a legal/regulatory framework for the development of RE & EE sub-sector in Liberia
- Attract private investment to the RE sub-sector through fiscal and tax incentives
- Develop and expand the RE market in Liberia through PPP
- Transfer technology and build local capacity in the RE & EE sub-sector through training

Following the drafting of the RE and EE Policy and Action Plan of Liberia, the Government embarked on the formulation of the broader National Energy Policy, which comprehensively addresses key policy issues needed to reform the overall energy sector of Liberia. NEP addresses access, quality, cost and institutional framework as the major strategic issues implied in the principal policy objective for energy supply. These issues refer to the overall necessity for energy products and services to be available, acceptable, affordable and adequate.

NEP reaffirms the Government's conviction that economic development is impossible without access to reliable, accessible, affordable and environmentally friendly energy. Increased commercial energy access and use will contribute to the growth of Liberia's economy. According to the NEP, the Government shall establish by legislation the appropriate institutional framework and special incentives and financing mechanisms to facilitate the availability of affordable electricity supplies in remote and low-income rural communities. The development and growth of private and community-owned rural energy service companies (RESCOs) shall be supported. The Government also recognizes the need to provide efficient non-electric energy resources or off-grid electricity for those communities that cannot be connected to the grid in the near future due to affordability and resource constraints. Examples of potential non-electric energy resources include high-efficiency charcoal or biomass stoves for cooking. Low-cost but highly efficient solar lights will be promoted. To generate employment and help to raise incomes for such communities, the Government – according to NEP – will prioritize the use of modern energy services for productive activities. With increased incomes, the demand for modern energy services ensuring a better quality of life will also grow.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

There has been no explicit regulation/legislation for facilitating the development of RE in Liberia. Legislative framework for rural electrification is restricted to the Government-owned LEC, which has never been able to provide sufficient capital to develop RE technologies.

To facilitate RE development and rural electrification, the NEP proposes to establish a Rural and Renewable Energy Agency (RREA) by law to facilitate the economic transformation of rural Liberia through the development of RE technologies. The RREA will be complemented by a Rural Energy Fund designed to support all economically sensible, socially acceptable and environmentally friendly rural energy projects and programs regardless of financial viability. The focus on RE is due to the fact that off-grid and RE technologies offer the best solution for remote communities and will complement the targeted subsidies that will address the issue of affordability.

In this regard, a Bill to Adopt Liberia's Energy Law has been drafted for submission to the National Legislature for enactment. The Draft Energy Law highlights the regulation promotion and development of the RE sub-sector and to establish the RREA and the Rural Energy Fund. Given that RE development is still generally in its basic stage as most of its resources have not been recently assessed on the scale needed for national development, the NEP highlights the need to conduct resource assessments and a National Energy Strategy and Master Plan. This will direct the future course for RE development in Liberia as highlighted in Table 4.

TABLE 4

Phases of Renewable Energy Development in Liberia

PHASE	PERIOD	COMMENT
Emergency/pilot	2006–2008	Launched in 2006 and ended in 2008 with the finalization of the NEP
Capacity building	2009–2015	Building of local capacity for implementation of the National Energy Policy
Development	Beyond 2015	Developing the achievements of the capacity building phase to scale up RE development on a sustainable basis

Source: National Energy Policy of Liberia, as of 2008

Major developments for the use of RE are expected in the areas of hydro- and biomass power systems. In the case of the former, the long-term program involves Hydro Power for domestic consumption and interconnection with WAPP for export. The most promising site is the St. Paul River Basin, which has the potential to produce 824 MW. The planned rehabilitation of the Mount Coffee plant, which is part of the St. Paul River Basin, aims to produce 100 MW within 7–10 years. Moreover, the GoL has signed a concession agreement with Buchanan Renewable Energies for the construction of a 35 MW rubber wood-fired power plant (biomass power plant) to supply Monrovia and other nearby communities. Additionally, solar power systems for health, education and Small and Medium Enterprise (SME) development also form part of the medium term program.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

Generally, the development of RE is still at a low level in Liberia. There has been no previously defined long-term target for RE in the overall energy supply mix. The NEP, however, declares that by 2015, the share of RE in the overall energy consumption shall account for 30 % of the electricity production, 10 % of the overall energy consumption, and 5 % of the biofuels used for transport. There is no topical inventory of RE resources and no specific technology targets have been set. In addition, no evaluation of the RE utilization rate has been conducted. Regulatory and market/economic incentives for RE are non-existent.

4.1 BIOMASS/BIOGAS

Liberia is endowed with abundant biomass resources – rich forest, rubber plantations, oil palm, cassava, sugarcane, rice, and other crop residues. Wood biomass is the primary energy source used for domestic cooking and heating. More than 95 % of the population (most of whom are rural inhabitants) rely on firewood, charcoal and palm oil for their energy needs. Recently, the Liberia Energy Assistance Program (LEAP), funded by the United States Agency for International Development (USAID), initiated a biomass resource assessment in July 2008. The only biogas digester in Liberia, which was destroyed during the civil conflict, was located in Galai (Suakoko District, Bong County), just a few miles from the Cuttington University campus.

The recent USAID funded biomass resource assessment revealed that a variety of biomass resources exist in the country in large quantities and with opportunities for expansion. It states that these resources are more than enough to cover the country's annual electricity consumption of 297 GWh and oil consumption of 206 dam^3. The study further estimates that of the total cropland in Liberia, only 6 % is currently cultivated and that the remaining cropland amounts to some 3 million hectares. While the contribution of food crop residues, animal manure and municipal solid waste is small in comparison to other resources within the country, they could still play a valuable role in stand-alone electricity applications and be particularly effective for households in remote rural areas. On the other hand, cash crop and forest residues, resulting mainly from medium and large enterprises, provide opportunities for large-scale centralized power generation. Table 5 provides an overview of existing and potential biomass resources.

TABLE 5

Biopower and Bio Fuels from Existing and Potential Biomass Resources

EXISTING RESOURCES	BIOPOWER (GWH/YR)	BIODIESEL (DAM^3/YR)	ETHANOL (DAM^3/YR)
Food crop residues	188	–	–
Cash crop residues	5,889	–	–
Biogas from animal manure	219	–	–
Forest residues	15,248	–	–
MSW (biogenic material only)	52	–	–
Total	21,596	–	–
POTENTIAL RESOURCES			
Vegetable oils*	4,946	2,473	–
Sugarcane**	–	–	1,527
Crop residues***	21,923	–	5,385

Sources: Assessment of Biomass Resources in Liberia, as of 2008

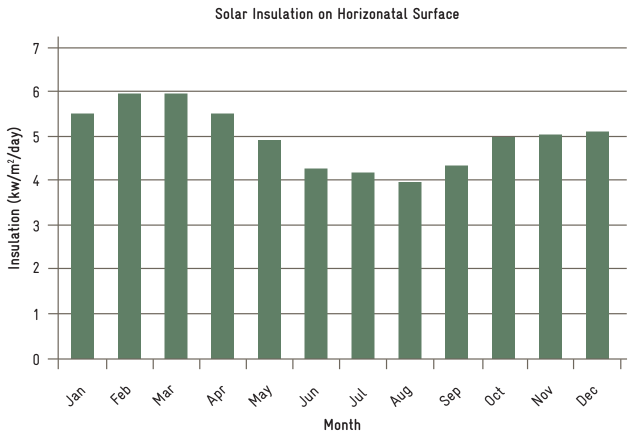
4.2 SOLAR ENERGY

Liberia is endowed with solar resources that could be used for the benefit of the entire population. Due to the country's equatorial position, Liberia receives vertical radiation at noon throughout the year giving rise to intensive insulation in all parts of the country with little monthly variations. Although Liberia has high rainfall, the annual solar insulation shows good prospects for the application of solar technologies. The global solar insulation map shows that the average solar radiation on horizontal surfaces in Liberia is between 4.0 and 6.0 kWh/m^2/day. Figure 3 visualizes the available solar insulation throughout the year.

The current solar energy applications in Liberia are limited to donor-funded pilot projects with small-scale solar power systems for schools, health centers and small businesses. Table 6 presents an overview of the current use of PV installations.

FIGURE 3

Solar Insulation per Month



Source: Solar Technology, Inc., Monrovia, as of 2007

TABLE 6

Current Use of PV Installations

CAPACITY	INSTALLATIONS	APPLICATION
29.22 kWp	50	Electricity for health clinics, schools, community centers, local Government offices, street lighting, small businesses, homes and entertainment
59.04 kWp	246	Refrigeration
0.96 kWp	3	Water pumping

Source: Center for Sustainable Energy Technology, as of 2008

4.3 WIND POWER

There is little or no data available on wind speeds in Liberia as no formal assessment has been performed to date. Liberia, however, is situated in a low wind region, and except for mountainous and coastal areas, wind resources are expected to be relatively insignificant in most rural areas. Observations along the coastal regions have indicated good prospects for the development of wind power. Unlike in the case of solar energy, no wind energy pilot project has been conducted in the country so far.

4.4 HYDRO POWER

Liberia has six major rivers running 66 % of the country's water, namely the Mano, St. Paul, Lofa, St. John, Cestos and Cavalla Rivers. Before the Liberian civil war, there were three operational hydroelectric power plants in the country: Mount Coffee Hydro Power plant on the St. Paul River 27 km North East of Monrovia (64 MW); Firestone Rubber Plantation in Harbel (4 MW) and Yandahun, a community microhydro in Lofa County (30 kW). Apart from the privately owned 4 MW plant in Harbel, there is currently no working Hydro Power plant in the country. The United States Government funded a Feasibility Study for the rehabilitation of the Mount Coffee Hydro Power Plant. The long-term plan is to generate electricity for domestic consumption and export through the West African Power Pool (WAPP). Moreover, the United Nations Development Program (UNDP) and the GoL have signed a Memorandum of Understanding to conduct a feasibility study for the development of small Hydro Power plants in rural Liberia. In addition, within the framework of the Global Environment Facility (GEF) and its new "Regional Programmatic Approach to Climate Change in Focal Areas of West Africa", support is expected for small Hydro Power development in rural Liberia. Several pre-feasibility studies were conducted before the war identifying a number of potential Hydro Power sites as shown in Table 7.

TABLE 7

Potential Hydro Power Sites

RIVER BASIN	REGION	SITE NAME AND CODE	DESIGN FLOW m^3/SEC	HEAD (m)	POTENTIAL kW
Mano	Grand Cape Mount, Gbarpolu and Lofa	Mano River 1	10.4	30.0	2,474
		Mano River 2	9.47	30.1	2,252
		Mano River 3	8.09	25.0	1,603
		Mano River 4	3.61	20.0	572
		Mano River 5	2.43	12.0	231
Lofa	Lofa, Gbarpolu and Grand Cape Mount	Lofa River 1	55.7	17.0	7,508
		Lofa River 2	37.10	20.0	5,884
		Lofa River 3	3.48	55.0	1,517
		Lofa River 4	3.42	10.0	271
		Lofa River 5	3.35	7.0	186
		Lofa River 6	3.25	6.0	153
Farmington	Margibi	Farmington River 1	16.90	15.0	20,100
St. John	Bassa, Bong and Nimba	St. John River 1	60.40	33.0	15,806
		St. John River 2	57.50	28.0	12,767
		St. John River 3	37.70	28.0	8,370
		St. John River 4	2.32	25.0	460
Timbo	Rivercess	Timbo River 1	6.51	12.0	619
Cestos	Grand Gedeh and Nimba	Cestos River 1	8.30	12.0	789
		Cestos River 2	7.35	10.0	582
		Cestos River 3	6.51	15.0	774
Senkweh	Grand Kru	Senkwen River 1	5.78	12.0	550
		Senkwen River 2	3.47	12.0	330
Buto	Grand Kru	Buto River 1	0.26	20.0	44
Cavalla	River Gee	Cavalla River 1	0.66	25.0	130

Source: GEOSCIENCE srl., as of 1998

5 MARKET RISKS AND BARRIERS

The stagnation of the Liberian economy due to the prolonged internal conflict has created numerous impediments to investment and market development. The lack of energy policy and infrastructure (especially electricity), roads and good transport systems are major barriers for investment and trade. Moreover, the current monopoly of the National Power Utility continues to be an obstacle to private investment in the power sector. And last, but not least, endemic corruption on all levels of the society continues to be a major risk for the national market. The establishment of the Liberia Anti-Corruption Commission (LACC) by law designed to fight corruption within both the public and private sector demonstrates the government's commitment to fight corruption within the society.

The National Investment Commission (NIC) is the Government's institution holding the mandate to promote and coordinate all investment-related activities in all sectors of Liberia's economy. The Investment Code of Liberia defines all economic activities the Government wishes to encourage as well as the types of incentives it will offer to investors engaged in the defined industrial activities. According to the Code, the Government of Liberia encourages industrial enterprises which:

- Utilize Liberian manpower at all levels and contribute to advancing their skills through training schemes (on-the-job) and other incentives to the highest possible extent
- Utilize raw materials and products of Liberian origin to the highest possible extent
- Utilize ancillary activities available in the productive and service sectors of the Liberian economy to the highest possible extent
- Contribute to make Liberia independent of imports of basic goods to the extent of being economically feasible, thus saving foreign exchange
- Contribute to the extension and diversification of Liberia's exports
- Contribute to increased employment all over the country

Both domestic and foreign investors may invest and participate in any business enterprise in Liberia unless explicitly prohibited. Foreign investors may buy the shares of any Liberian business. Any individuals or companies desiring to engage in commercial and/or industrial activities in Liberia should be registered with the Ministry of Commerce and Industry before taking up business operations.

Liberia's Investment Laws are globally competitive. The country offers 100 % repatriation of funds and no currency exchange restrictions e. g. profits and dividends (net of taxes), remittance of money (net of taxes) in the event of the sale or liquidation of the business, repayments of loans acquired from foreign banks etc. There is an overwhelming local acceptance of RE technologies. The major limitation is the low level of awareness and the limited number of trained local experts. The two main local universities (University of Liberia and Cuttington University) along with the Stella Maris Polytechnic plan to cooperate with local and international re-

search institutes and other private institutions to promote and develop RE technologies.
Liberian business law does not restrict business establishment but provides the basis for a range of businesses managed by both local and international investors. Business organizations include partnerships and sole proprietorships, joint stock and limited liability corporations as well as holding companies. A new business may be incorporated locally or abroad, its ownership can be a combination of foreign and local ownership or foreign-owned.

Liberia has signed several international conventions on the protection of intellectual and industrial property rights. The act adopting the New Copyright Law of Liberia, approved on 23 July 1997, provides the legal and administrative framework for the effective implementation of programs intended to protect intellectual and industrial property rights in Liberia. Depending on the amount of capital, the sector and the location of the investment, investors may be eligible for investment incentives offered by the NIC.

The Customs and Revenue Code of Liberia provides the regulatory regime for custom duties and standards. Duties on imported goods range from 2.5 to 25 %. Import duties on RE equipment are about 2.5 to 10 %. In order to minimize the time it takes to clear goods from various ports of entries, businesses are requested to acquire a pre-shipment inspection certificate.

In the 2009 “Doing Business” assessment of the World Bank and the International Finance Corporation, Liberia ranks 157 out of 181 in the respect of “ease of doing business”. This is a positive indicator as Liberia was ranked 167 out of 181 in the previous year. All countries are assessed based on local regulations that govern different stages of setting up a business. Table 8 presents Liberia’s ranking and its corresponding shift for 2008 and 2009.

TABLE 8

Ease of Doing Business in Liberia

INDICATOR	RANK		CHANGE IN RANK
	2009	2008	
Doing business (overall)	157	167	+10
Starting a business	88	145	+57
Dealing with construction permit	177	179	+2
Employing workers	105	105	0
Registering property	172	170	–2
Getting credit	131	141	+10
Protecting investors	142	141	–1
Paying taxes	59	51	–8
Trading across borders	115	108	–7
Enforcing contracts	165	166	+1
Closing a business	146	147	+1

Source: World Bank/IFC, Doing Business, as of 2009

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 9

Local Business Related Institutions

NAME	CONTACT INFO	PROFILE
Ministry of Commerce & Industry (MCI)	Ashmun Street, P.O. Box 9041 Monrovia, Liberia	A GoL ministry responsible for issuing policies and regulating the commerce and industry sector
Ministry of Lands, Mines and Energy (MLME)	Capitol Hill, P. Box 9024 Monrovia, Liberia	A GoL ministry responsible for issuing policies and regulating the land, mineral and energy sector of Liberia
National Investment Commission (NIC)	Sinkor 12th Street Tubman Boulevard, P.O. Box 9043 Monrovia, Liberia info@nic.gov.lr	A GoL institution promoting and coordinating investment-related activities in all sectors of the Liberian economy
Liberia Business Association (LIBA)	C/o Corina Hotel 24th Street Sinkor Tubman Boulevard Monrovia, Liberia	A consortium of small and medium Liberian businesses
Liberia Chamber of Commerce (LCC)	Capitol Hill, P.O. Box 9 Monrovia, Liberia Phone: +231-77857-805 www.liberiachamber.com	An institution seeking to promote trade and investment in Liberia and ensure that businesses get fair treatment in their dealings with the government
Liberia Petroleum Refining Company (LPRC)	Bushrod Island Monrovia, Liberia	A Government owned company with the mandate to import and refine crude oil for distribution of the products on the Liberian market
Liberia Electricity Corporation (LEC)	Francis Cooper Chairman, LEC P.O. Box 10-165 Waterside-1000 Monrovia 10 Monrovia-Liberia Telephone: .+231-6971934 e-mail: fbcoopersr@gmail.com	A Government owned company with the mandate to generate, transmit, distribute and sell electrical energy
National Oil Company of Liberia (NOCAL)	Episcopal Plaza Randall Street Monrovia, Liberia www.nocal-lr.com/	A Government owned company with the mandate to administer petroleum exploration program in Liberia
Environmental Protection Agency (EPA)	4th Street Sinkor Tubman Boulevard Monrovia, Liberia www.epa.gov.lr/	A Government agency with the mandate to manage and regulate the environment

Source: Center for Sustainable Energy Technology, as of 2008

TABLE 10

Government Projects and Programs

PROGRAM/PROJECT	CONTACT	COLLABORATING INSTITUTION	ROLE
Emergency Power Project (EPP)	MLME/LEC	Governments of Liberia, Ghana, USA, and Norway, the European Union, and the World Bank	A multilateral project restoring grid electricity to Monrovia and its environs
Liberia Energy Assistance Program (LEAP)	MLME/LEC	Governments of Liberia and the US Government	A bilateral program aiming to facilitate access to energy services and support to transparent energy sector reform and regulatory regimes

Source: data compiled by the author

TABLE 11

Contact Information of Businesses Involved in the Renewable Energy Sector

NAME OF BUSINESS	CONTACT INFO	CONTACT PERSON
Solar Technology Inc.	Old Peugeot Garage Phone: +231 653 959 1 reggiegardiner@yahoo.com	Reginald Gardiner
Alternative Energy, Inc.	Randall Street Monrovia, Liberia Phone: +231 652 650 9 aeliberia@yahoo.com	Thomas Kpoto
Center For Sustainable Energy Technology	8th Street Sinkor Tubman Boulevard Monrovia, Liberia Phone: +231 655 926 6 gusgoanue@yahoo.com	Augustus Goanue
Premier Solar	9th Street Sinkor Opposite LISGIS Monrovia, Liberia Phone: +231 651 994 3 natereeves1234@yahoo.com	Nathan Reeves
Quantum Logistics	Adj. 101 Gas Station Pynesville City, Liberia Phone: +231 621 338 6 info@quantumgroup-lib.com	Ronald Mitchell
Solar Electricity for Health clinic	Randall Street Monrovia, Liberia www.energyforopportunity.org/ projects/health-electricity-for- rural-health-centres/	Momo S. Kpoto
Equatorial Palm Oil	UN Drive Monrovia Phone:+231 561 221 6 ebfliberia@qahoo.com	David Parker
Buchanan Renewable Energy	Buchanan House Congo Town Tubman Boulevard Monrovia Phone: +217 779 841 7 joelstrickland@ buchananrenewables.com	Joel Strickland

Source: Center for Sustainable Energy Technology, as of 2008

7 BIBLIOGRAPHY

- Bongers, F., Poorter, L., Van Rompaey, R. S. A. R and Parren, M. P. E. (1999): Distribution of Twelve Moist Forest Canopy Trees Species in Liberia and La Cote d'Ivoire: Response Curves to a Climatic Gradients, IAVS; Opolus Press, Sweden
- Center for Sustainable Energy Technology (2004): Bridging the Energy Gap in Post-war Liberia: The Need for Alternative Energy Services
- Center for Sustainable Energy Technology (2008): Renewable Energy and Energy Efficiency Policy and Action Plan of Liberia
- DECON – Dutch Energy Consultant (1983): Pre-feasibility Study on the Development of Power in the Liberian Rural Areas
- Department of Energy, Ministry of Lands, Mines & Energy, Republic of Liberia (2002): Unpublished Energy Sector Report
- GEOSCIENCE srl. (1998): Electricity Supply in Liberia; Project LBR/7ACP/21–16. European Commission Aid Coordination Office in Liberia
- Liberia Electricity Corporation (2004–2007): Annual Reports
- Liberia Institute of Statistics and Geo-information Services (2007): Core Welfare Indicator Questionnaire
- Liberia Institute for Statistics and Geo-information Services (2008): Preliminary Results of 2008 National Population and Housing Census
- Liberia Petroleum Refining Company (2003–2006): Annual Reports
- Mattick, R. E. (1982): Assessment of the Petroleum, Coal and Geothermal Resources of the Economic Community of West African states (ECOWAS) Region. U.S. Geological Survey
- Milbrandt, Anelia (2008): Assessment of Biomass Resources in Liberia. US National Renewable Energy Laboratory
- Ministry of Lands, Mines and Energy (2008): Proceedings of the National Energy Policy Validation Workshops
- Ministry of Lands, Mines and Energy (2006 & 2007): Annual Reports
- National Investment Commission (2008): Investor's Guide to Liberia (www.nic.gov.lr)
- Republic of Liberia (2001): Customs Revenue Code and Harmonized Description and Coding System of the Customs Tariff Schedules of Liberia Act of 2000
- Republic of Liberia (2004): National Biodiversity Strategy and Action Plan
- Republic of Liberia (2007): Draft Action Plan and Rationale for Renewable Energy and Rural Development
- Republic of Liberia (2008): Draft Final National Energy Policy: An Agenda for Action and Economic and Social Development
- Government of Liberia (2006): 150 Day Action Plan. A Working Document for a New Liberia (www.allafrica.com/peaceafrica/resources/view/00010785.pdf)
- Republic of Liberia (2008): Poverty Reduction Strategy
- International Monetary Fund/Republic of Liberia (2007): Liberia. Interim Poverty Reduction Strategy Paper. Breaking with the Past – From Conflict to Development; IMF Country Report No. 07/60 (www.imf.org/external/pubs/ft/scr/2007/cr0760.pdf)
- National Renewable Energy Laboratory (1998): International Programs Brochure: Global Solar Resource Map, (www.nrel.gov).
- United Nations/World Bank (2005): Liberia. National Transitional Government of Liberia. Results Focused Transitional Framework Revision (www.reliefweb.int/library/documents/2005/ntgl-lib-30apr.pdf)
- World Bank/IFC (2009): Doing Business 2009 (www.doingbusiness.org)

COUNTRY CHAPTER: MALI

Author of Country Chapter
Souleymane Diallo (Dr. Ing. Eng.)

Coordination and Review of the Country Chapter
Anton Hofer, (MSE, Dipl.-Ing./FH, M.A.)
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS MALI

ACRONYMS AND ABBREVIATIONS

MALI

AMADER	Agence Malienne pour le Développement de l'Énergie (Malian Agency for the Development of Domestic Energy and Rural Electrification)
AMARAP	Agence Malienne de Radioprotection (Malian Agency for Radioprotection)
AUREP	Autorité pour la Promotion de la Recherche Pétrolière au Mali (Authority for Oil Exploration)
CdR-ER	frame of reference for the development of rural electrification
CEWR	Commission of Electricity and Water Regulation
CFAF	CFA Franc (1 Euro = 655,957 CFAF)
CILSS	Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel (Interstate Committee for Fight against the Drought in the Sahel)
CNESOLER	Centre National de l'Énergie Solaire et des Énergies Renouvelables (National Center of Solar Energy and Renewable Energies)
CREE	Commission de Régulation de l'Electricité et de l'Eau (Commission of Electricity and Water Regulation)
DGD	Direction Générale des Douanes (Directorate General of Customs)
DNCC	Direction Nationale du Commerce et de la Concurrence (National Directorate of Trade and Competition)
DNT	Direction Nationale du Transport (National Directorate of Transport)
DNGM	Direction Nationale de la Géologie et des Mines de la République du Mali (National Direction of Geology and Mines)
DSF	Decentralized Services Firms
ECOWAS	Economic Community of West African States
EDM – SA	Énergie du Mali (Malian utility)
GDP	Gross Domestic Product
GPP	Groupement Professionnel des Pétroliers du Mali (Oil Industry Professionals Group)
IN	Interconnected Network
KfW	Kreditanstalt für Wiederaufbau (German Banking Group including KfW Entwicklungsbank/German Development Bank)
LEP	Local Electrification Plan
LV	low voltage
MEA	Ministre de l'Environnement et de l'Assainissement (Ministry of Environment and Sanitation)
MEIT	Ministry of Economy, Industry and Trade
MEMW	Ministry of Energy, Mines and Water
MF	Ministry of Finance
MV	medium voltage
NGO	Non-governmental Organization
OMVS	Organisation pour la Mise en Valeur du Fleuve Sénégal (Organization for the Valorization of the Senegal River)
ONAP	L'Office National des Produits Pétroliers (National Office of Petroleum Products)
PCASER	Projets de Candidatures Spontanées d'Electrification Rurale (Projects of Spontaneous Candidacy for Rural Electrification)
PPER	Programme Prioritaire du Electrification Rural (Rural Electrification Priority Programs)
PRODER	Programme Decennial du Electrification Rural (Decennial Program of Rural Electrification)
PV	Photovoltaic
RE	Renewable Energy
REF	Rural Electrification Fund
SHS	Solar Home Systems
SOGEM	Société de Gestion de l'Énergie de Manantali (Manantali Energy Management Company)
SSD	Societe de Services Decentralises (Decentralized Service Companies)
USD	United States Dollar
VAT	Value Added Tax

MEASUREMENTS

GWh	gigawatt hours
ha	hectare
kg	kilogram
km^2	square kilometer
kWp	kilowatt peak
mm	millimeter
m^3	cubic meter
MW	megawatt
MWh	megawatt hours
TOE	tons of oil equivalent
°C	degree Celsius

SUMMARY

The Country Study of Mali is to provide an overview of the country's energy market and to support decision-making for private investments for the renewable energy (RE) sector in Mali. The study is structured as follows:

Chapter one provides **Background Information on Mali**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Mali.

Chapter two summarizes facts and figures of **Mali's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Mali. This includes an overview of support mechanisms for photovoltaic (PV) as well as already existing regulations, incentives and legislative framework conditions.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Mali.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Mali.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Mali, a vast landlocked country in the heart of West Africa, is situated between latitudes 10° and 25° North and between longitudes 4° East and 12° West. It covers a total area of 1,241,238 km^2 and has 7,000 km of frontiers bordering seven countries, i.e. Senegal, Mauritania, Algeria, Niger, Burkina Faso, Côte d'Ivoire and Guinea.

The climate is tropical dry and is divided in four different zones: a Saharan climate (desert) in the North (annual rainfall less than 200 mm), Sahel in the middle (annual rainfall between 200 mm and 600 mm), Sudanian (annual rainfall between 600 mm and 1,000 mm) and Sudano-Guinean in the South (rainfall > 1,000 mm). The temperatures are high and the average rainfall is low. The average maximum temperature varies between 34 and 37 °C, the average minimum between 21 and 23 °C. The maximum relative humidity oscillates between 31 and 75 %, the minimum between 11 and 38 %. Mali has two alternating seasons:

- A dry season varying from a nine month period in the North (October to June) to a six month period in the South (November to April)
- A rainy season lasting from May to October in the South and from July to September in the North adjourned by more or less intense inter-seasons with "neither rainy, nor dry" periods.

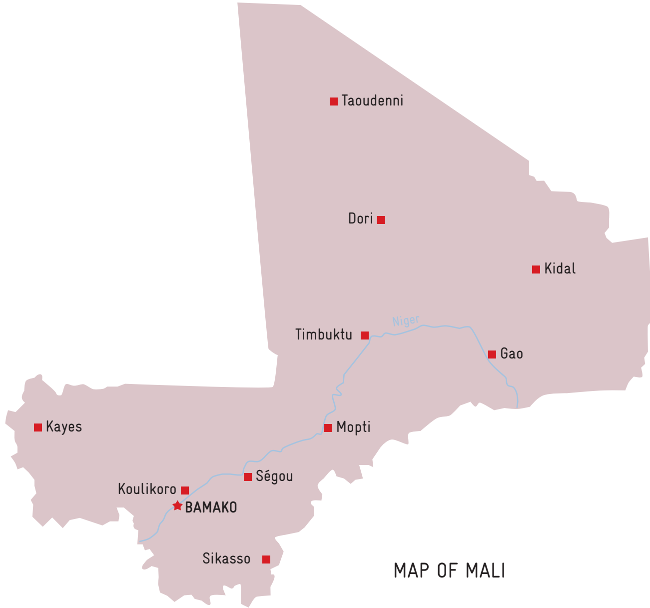
Mali's geography is the reason why the country's economy is largely rural based and explains the central role of hydrology in the energy sector.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

Mali gained its independence in September 1960. The route to democracy, however, has been a long and difficult quest occasionally marked by violent outbreaks. Political pluralism was introduced in March 1991 under challenging circumstances. The Constitution provides the creation of eight Republican institutions and guarantees their independence through a predefined balance of power and the respective means of control. The Government, reigned by the Prime Minister, sets out and conducts the nation's policies and directs the armed forces. The Parliament, comprising of a single chamber, is called the National Assembly.

In 2007, Mali's population was estimated at 13.9 million inhabitants. The northern region of the country (Tombouctou, Gao and Kidal), which covers more than 60 % of the territory, houses only 10 % of the total population. The overall population growth rate is about 3 %, whereas the urban population is increasing at a rate of 5.2 % due to rural exodus. The majority of Malians, however, are still living in rural areas (70 %).

According to the 2007/2008 Human Development Report, Mali ranks at 173 out of 177 (South Africa: 121, Guinea: 160, Chad: 170 and Central African Republic: 171).



MAP OF MALI

The Gross Domestic Product (GDP) per capita increased from USD 260 in 2000 to 500 in 2007. The Gross National Income per capita based on purchasing power per capita rose from USD 750 in 2000 to USD 1,040 in 2007.

Mali's potential wealth lies in mining and the production of agricultural products, livestock and fish. In 2006, cotton, gold and livestock made up 80–90 % of Mali's total export earnings. Small-scale traditional farming dominates the agricultural sector. About 90 % of the 1.4 million hectares (3.4 million acres) are under cultivation mainly for the subsistence farming of cereals, primarily sorghum, millet, and corn. Mali's economy is largely dominated by agriculture (employing 83.4 % of the active population) followed by industry and service sectors (employing 4.1 % respectively 12.5 %).

The real growth rate of the GDP has experienced an uneven evolution reflecting amongst other determinants the climate factor and the difficulty to access maritime ports of neighboring countries. Table 1 presents the evolution of the GDP and the growth rate.

TABLE 1
Evolution of the GDP and the Growth Rate

	2002	2003	2004	2005	2006	2007
GDP (billions of CFAF)	2,223	2,454	2,632	2,893	3,125	3,356.5
Real growth rate in %	4.3	7.6	2.3	6.1	5.0	5.4

Source: Commission de l'UEMOA, Comité de Convergence et BCEAO, as of April 2007

2 ENERGY MARKET IN MALI

2.1 OVERVIEW OF THE ENERGY SITUATION

The total energy consumption of Mali was 3,212,560 toe in 2002, mainly based on consumption of wood and charcoal (81 %), followed by oil products (16 %) and electricity (3 %). The sector-based use of energy is separated in descending order of their significance as follows: households (approx. 86 %), transportation (nearly 10 %), industry (approx. 3 %, half of which is being used for mining) and agriculture (less than 1 %). This energy shares based on source and sector vary but little from one year to another. RE (solar, wind, Hydro Power etc.) is currently used at a rate insignificant to the energy balance. There is no liquid or gaseous biomass energy as part of the official supply in Mali (only solid biomass such as wood).

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

The electricity industry was state owned up to the year 2000 when reforms in the sector transferred 60 % of the property to the so called "strategic partners" consisting of SAUR International and IPS West Africa. After five years of private operation, SAUR International gave up its ownership of properties by selling shares to the Government of Mali (by October 2005). IPS West Africa is now holding 34 % of the Malian utility "Énergie du Mali" (EDM–SA). The majority of shares, however, are in the hand of the State of Mali. The reforms mentioned above lead to the foundation of the Malian Agency for the Development of Domestic Energy and Rural Electrification (AMADER). Its major objective is to handle rural electrification by dealing with private operators. According to the National Directorate of Energy (DNE), the rate of access to electricity in 2007 was estimated at 17 % on the national scale and 5 % in rural areas (as compared to merely 1 % in 2000 before reforms).

The total installed capacity of power supply of the Interconnected Network (IN), consisting of three hydroelectric power stations and two thermal power stations, was 130.49 MW in 2007 (not including the Manantali site, which jointly belongs to Mali, Mauritania and Senegal). In addition to the IN facilities, EDM–SA operates nineteen insulated centers equipped with diesel generators and two centers supplied by a network from Côte d'Ivoire. The total installed capacity of power supply of the insulated centers rose from 31.5 MW in 2005 to 38.3 MW in 2006 following the strengthening of the output in various centers including Mopti and Sikasso. Table 2 presents the evolution of power generation. Figure 2 illustrates the energy mix in the electricity sector of Mali.

EDM–SA's gross electricity production increased by 8.9 % from 865.8 GWh in 2006 to 942.5 GWh in 2007. The purchase of energy originating from the hydroelectric power station of Manantali contributed with more than one third of the production on the IN equaling 294.4 GWh (35.4 %). The evolution of the thermal component in the total production of the system was subject to fluctuations during the last five years. It decreased from 26.7 % in 2002 (with the start up of Manantali) to 16.6 % in 2003 before increasing again to 19.2 % in 2004, 20.1 % in 2005, 22.8 % in 2006 and 40.7 % in 2007 (see Figure 3).

TABLE 2

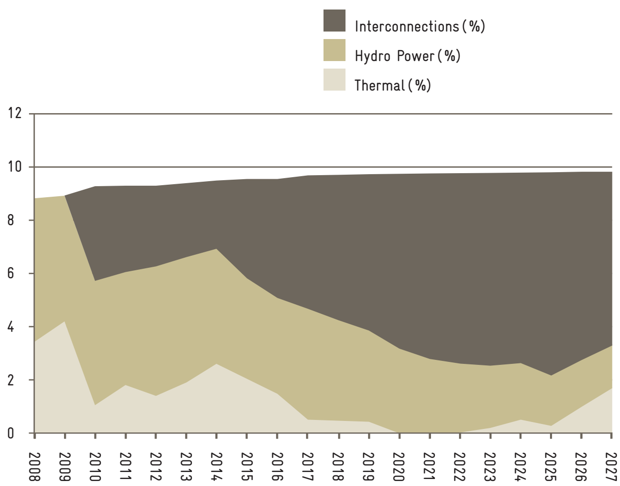
Evolution of Power Generation Capacity

		2001	2002	2003	2004	2005	2006	Growth rate
Total installed capacity including:	MW	146	249	248	251	245	255	4.3 %
Interconnected Network (IN)	MW	115	117	109	109	109	113	3.4 %
Manantali	MW		104	104	104	104	104	
Insulated centers	MW	31	29	35	38	32	38	21,6 %
Peak capacity of the IN	MW	82	87	98	111	123	133	7.5 %

Source: Énergie du Mali, 2005, 2006 and 2007 reports

FIGURE 2

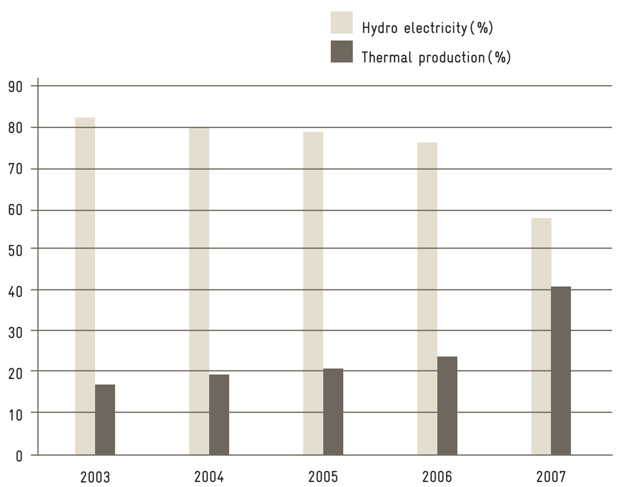
Energy Mix of the Electricity Sector



Source: graph compiled by the author with data from EDM–SA, as of 2008

FIGURE 3

Share of Hydro Power and Thermal Power for the Electricity Production



Source: Energie du Mali, 2005, 2006 and 2007 reports

The total energy consumption between January and December 2007 was 730.7 GWh, as opposed to 666.4 GWh in 2006. This corresponds to an increase of 9.7 %. Low voltage sales for the whole EDM–SA were 424.7 GWh 2007 as opposed to 373.5 GWh in 2006, equalling an increase of 13.7 %. Table 3 summarizes the overall electricity consumption of Mali.

The Interconnected Network had 151,324 consumers (LV + MV) in 2007 as opposed to 140,968 in 2006 equaling an increase of 7.3 %. IN & Insulated Centers together supplied 151,377 LV and 1,003 MV consumers in 2007, as opposed to 140,043 LV and 925 MV consumers in 2006. Table 4 presents the numeral evolution of individual electricity clients.

In spite of existing investment-related difficulties, a high growth rate can be observed in the sector of electricity and the distribution network in particular. The consumption of energy is growing at the same rate as the country's economical growth. The power supply in particular is constantly challenged to meet a faster growing demand. To avoid critical situations for the economy caused by energy shortage, a Watching Commission has been set up. Between 2006 and 2007, the total installed capacity of the interconnected network increased by 16 %, but still could not fully meet to the actual needs. Electricity production on the whole increases by 8.9 % per year, while EDM–SA's sales of LV and MV have increased by 13.7 % and 4.5 % thus leaving a considerable demand unsatisfied. In fact, the average coverage rate of the major electrified city is only about 50 %. This situation is due to the difficulties of investing in the distribution networks for an environment characterized both by the low density of consumer locations and the weak income level throughout the population.

The electricity company EDM–SA is strongly supported by the Government in the respect of tariffs for oil products and the existing tax and customs system. In order to limit the increase in the effective EDM–SA tariffs (by reducing the expenses of the company), the Government has been granting exemptions on the purchases of fuels intended for the production of electricity since 2002. The current procedure is to refund the related customs duties and taxes as discharged by EDM–SA. Since June 2002, however, EDM–SA has been benefiting from the mode of the Mining Code[1] granting exemptions of taxation at source for purchase of fuels; thus saving the company a considerable amount of money. Moreover, within the framework of a rehabilitating program, EDM–SA is benefiting from an indistinct tax system with regard to its investment plan 1995–2005 implying both external financial resources and self-financing. The tax considers both big projects and spare parts intended for the reconditioning of generators, networks materials and means of operation. In 2001 and 2002, the prices were increased. The increase of 2001 was partially cushioned by the Government through a compensation of more than 10 billion CFAF. In 2003, there was a first tariff decrease, and the missing revenues resulting from the tariff decrease were entirely compensated by the Government (up to 7.2 billion CFAF). In 2004, the Regulation Commission decided on a price reduction. Tariffs remained steady up to 2008. The evolution of electricity tariffs between 2001 and 2007 is presented in Table 5.

TABLE 3
Electricity Consumption

		2001	2002	2003	2004	2005	2006	Growth rate
Total consumption of electricity	MWh	377,682	432,326	484,198	541,102	616,230	662,510	7,5 %
of that								
Medium voltage	MWh	177,041	199,333	206,867	242,420	272,545	289,017	6,0 %
Low voltage	MWh	200,641	232,993	257,329	298,682	343,685	373,494	8,7 %

Source: Énergie du Mali, 2005, 2006 and 2007 reports

TABLE 4
Number of Electricity Clients

RATE OF USING ELECTRICITY		2001	2002	2003	2004	2005	2006	Growth rate
Total number of users		90,953	112,703	131,029	145,479	160,201	174,152	8,7 %
of that								
Medium voltage		712	771	884	951	1,019	1,109	8,8 %
Low voltage		90,241	111,932	130,145	144,528	159,182	173,043	8,7 %

Source: Énergie du Mali, 2005, 2006 and 2007 reports

TABLE 5
Evolution of Electricity Tariffs[2]

	2001	2002	2003	2004	2005	2006	2007
CFAF	96.49	103.98	95.7	85.16	84.67	84.16	85.42
Eurocent	14.73	15.87	14.62	13.00	12.93	12.85	13.04

Source: Énergie du Mali, 2005, 2006 and 2007 reports

1 LE PRÉSIDENT DE LA RÉPUBLIQUE MALI, 1999)
2 CURRENT CONVERSION RATE: 1 EURO = 655,95F CFAF, DEC. 2009

In 2004, the Commission of Electricity and Water Regulation (CREE) decided on a price reduction without compensation by the client. Since then, prices have remained steady in spite of the huge rise in international market prices for oil products and the continuous increase in the share of thermal production. The principles determining the prices in the field of rural electrification are (i) freedom of tariffs for entities being subject to various authorizations and declarations and (ii) regulated prices for licenses in compliance with the contracts signed with clients.

AMADER ensures that prices for entities being subject to various authorizations and declarations remain compatible and that incentive measures are taken to avoid that operators under a monopoly situation achieve unjustified profits.

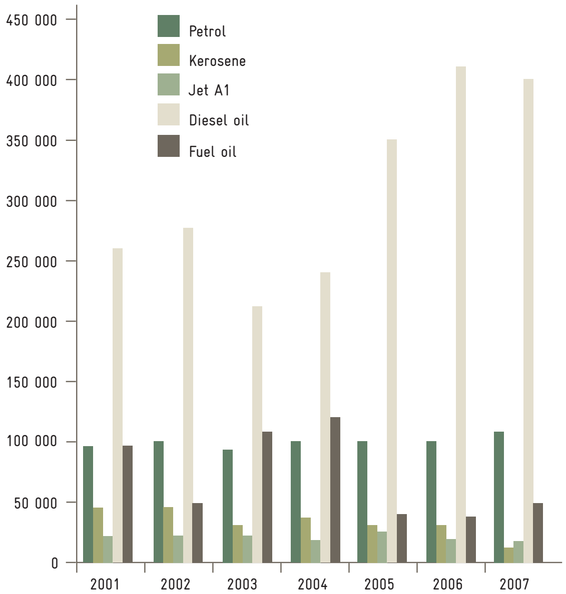
The sales within concession systems benefiting from a situation of exclusiveness or natural monopoly are subject to a price regulation by directive of CREE. Taking into account the variations of costs according to the demand, the regulated prices are defined per tariff period and are revised according to the directives of the Regulation Commission CREE. Within the conceded perimeter there is equalization of tariffs.

Petroleum Sector

Mali does not produce petroleum and has no refinery. Therefore, all petroleum products are imported trough principal trunk roads leading to the West African ports, i.e. Abidjan (Côte d'Ivoire), Cotonou (Benin), Dakar (Senegal), Lome (Togo), and Tema (Ghana). The consumption is dominated by diesel oil. Table 8 shows the volume of petroleum imported between 2001 and 2007. Some of the oil imports in the far North of the country may have been obtained informally from Algeria. Figure 4 indicates the evolution of imported petroleum products.

FIGURE 4

Evolution of Petroleum Imports (2001–2007)



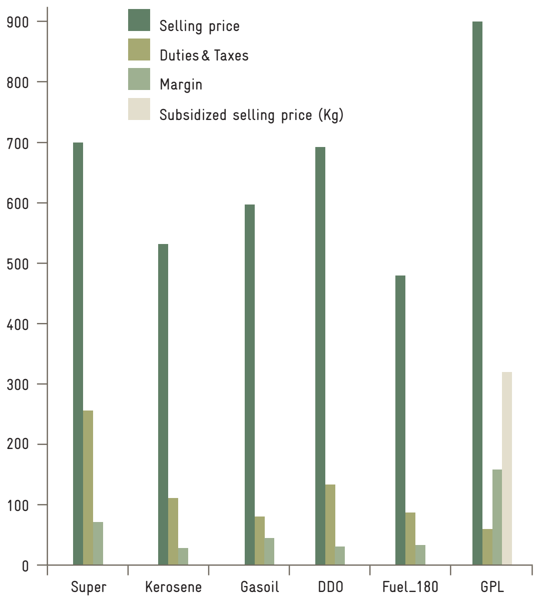
Source: graph compiled by the author with data from ONAP, as of 2008

The consumption of petroleum products is mainly divides into the following sectors: transport (70 %), industry (20 %), household: (8 %) and agriculture (2 %). Diesel oil is by far the most used fuel (see graph above). The storage capacities are mainly located in the capital city of Bamako, but some private operators are running tanks in the western region about 90 km from the Senegal border. Many mining companies are directly served from these storage capacities in the city of Kayes.

Petroleum products are strategic goods because of the dependencies that occur in a landlocked country to import them. The share in the energy mix and their respective contribution to the customs revenues increased from 31.6 % in 2000 to 37,6 % in 2004. The oil bill, however, rose to 242 billion CFAF in 2006 without any chance to raise the fiscal receipts at the same rate. The current price fixing system of oil products was established in July 2001 and entails a monthly change of the prices at pump stations. The tariffs follow the development of the international market prices and based on the average off these prices. The price structure in Mali is determined according to the mentioned import of petroleum products via principal trunk roads connected to West African ports (see above). Butane in cylinders of 2.75 kg and 6 kg is being subsidized by the Government of Mali in order to promote the substitution of fuel wood and charcoal. The pricing structure of petroleum products is presented in Figure 5.

FIGURE 5

Pricing Structure of Petroleum Products



Source: graph compiled by the author with ONAP data, as of 2008

The taxation of the oil sector is based on the Principle of Taxing Oil Products proposed by the Economic and Monetary Union of West Africa – UEMOA/ECOWAS. The overall taxing includes customs duties, the statistical royalty, ECOWAS Community Tax, the inland duty on oil products and VAT. Current price information (updates available at www.onapmali.com) on the most prominent fuels is presented in Table 6.

TABLE 6

Current Price Information of Fuels[3]

PRODUCT	CFAF PER LITER/KG (LPG ONLY)
Petrol	635
Kerosene	450
Gasoil/diesel oil	545
Fuel oil	352
Jet A1	Free
LPG (with subsidy; bottles 2.7 kg & 6 kg)	320
LPG (without subsidy)	739

Source: table compiled by the author with ONAP data, as of 2009

Biomass Sector

As in most developing countries, especially in Sub-Saharan Africa, wood energy remains the most common fuel used in Malian households. The yearly consumption is approximately 6 million metrictons. Considering the relative prices of alternative sources of energy, the existing practices and the traditions of the population using wood energy, this situation is likely to remain unchanged. The wood energy consumed primarily comes from natural forests. The organized rural market meets an increasing share in the supply of urban centers as does the uncontrolled/informal operating system. A slow but sure transition from crude wood to charcoal as well as an increase in the requirements for primary energy sources can be registered.

2.3 MARKET ACTORS AND REGULATION STRUCTURES

Responsibilities of the multiple energy issues are shared among four ministries, one Regulation body and eight public or paragovernmental technical arms in Mali.

The Ministry of Energy, Mines and Water (MEMW) is in charge of defining the energy policy and general energy planning (demand and supply), as well as of the control and monitoring of the electricity (thermal and hydro) and renewable energies sectors, and only partly petroleum products. The MEMW also supervises several institutions:

The National Direction of Energy – it's role is to evaluate the potential of energy resources and ensure their valorisation; to study, control and supervise the energy production and to ensure compliance with technical specifications and safety requirements; to take part in co-operation projects in the fields of energy, to process the issuance of licenses for the realization of energy infrastructures by self producers, paragovernmental and private operators, decentralized communities and others.

The National Center of Solar Energy and Renewable Energies (CNESOLER): As a division of the National Direction of Energy, the CNESOLER is in charge of the research and promotion of RE equipments, i.e. in the fields of biomass, micro-Hydro Power, solar and wind energies (aero generators and wind mills for water pumping systems).

The Malian Agency for the Development of Domestic Energy and Rural Electrification (AMADER) that is funded by the World Bank. The role of AMADER is to reduce the household energy consumption through energy efficiency and substitution programmes. Furthermore, it is in charge of the development of access to modern energy services in rural and periurban areas.

The Malian Agency for Radioprotection (AMARAP) is in charge of pacific use of nuclear energy and protection against harmful ionizing radiations.

The National Direction of Geology and Mines (DNGM) in charge of oil geology, geophysics and exploration through the Authority for Oil Exploration (AUREP). DNGM also hosts the laboratories aiming to control the quality of all petroleum consumed in the country (all imported for now).

The Ministry of Environment and Sanitation (MEA) handles the biomass energy supply (particularly fuel wood and charcoal) through the forestry department. This department has one specialist working at AMADER in order to harmonize views, policies and practices.

The Ministry of Finance (MF) is the key body in the import and storage of petroleum products through the National Office of Petroleum Products (ONAP).

The Ministry of Economy, Industry and Trade (MEIT) is in charge of setting prices and regulating concurrence for petroleum products through the ONAP. Trade and Economy used to be in the same department than the Finance. ONAP is therefore in between the two ministries MF and MEIT.

The Commission of Electricity and Water Regulation (CEWR) is independent from government operators and has juridical personality and financial autonomy. CEWR is in charge of the regulation of the sector of electricity and potable water. More specifically, CEWR ensures the application of tariff policies and regulates public services of electricity in urban areas. Furthermore, it is in charge of the development of public services, consumer protection, quality management and the approval and controlling of tariffs.

Electricity Sector

As already indicated the MEMW supervises the entire electricity policy and planning activities. A deep reform of the sector undertaken from 1998 to 2000 primarily resulted in:

- The privatization of the utility "Energie du Mali (EDM - SA)" on December 21, 2000.
- The creation of the Commission of Electricity and Water Regulation (CREE), on March, 2000.
- The establishment of a legislative and regulatory scope for the organization of the electricity sector on March 2000.
- The streamlining of the role of the Government concerning policy, regulation, planning and coordination of the electricity sector.
- The disengagement of the Government from operational activities of electricity industry, in particular production, transmission, and distribution.
- The opening of the electricity sector to private operators of any origin.

3 CURRENT CONVERSION RATE: 1 EURO = 655,95F CFAF, DEC. 2009

Today, a few operators of the private sector provide the public service of electricity, the most significant of which is Energie du Mali (EDM-SA) as a licensee for electricity public service in 38 urban localities. On the other hand, forty small companies got authorization of public service of electricity in rural zones (starting in 2004) including two Decentralized Services Firms (DSF). Other actors are made up of sub-regional entities:

- Société de Gestion de l'Energie de Manantali - SOGEM (Trust company of Manantali Energy), public corporation of estate created by the Member States of the Organization for the Valorization of the Senegal River (OMVS), which include Mali, Mauritania and Senegal.
- ESKOM Energie de Manantali (ESKOM Energy of Manantali), Malian subsidiary of ESKOM Corporations (South Africa), in charge, on behalf of SOGEM, of operating and maintaining the dam, producing and transporting the energy of the hydroelectric power station of Manantali to the three countries.

Petroleum Sector

The petroleum sector falls under different ministries (Finance, Economy-Industry and Trade, as well as Energy). A reform of the sub-sector undertaken in 1992 resulted in the withdrawal of the State from any commercial activity (distribution, storage and marketing) at the profit of private operators. The State limited its role to fundamental missions for supply planning and regulating the whole supply-delivery chain. These missions are ensured through its technical departments which are:

- The National Office of the Petroleum products (O.N.A.P).
- The National Directorate of the Trade and Competition (D.N.C.C).
- The National Directorate of Transport (D.N.T).
- The Directorate-General of Customs (D.G.D).

In 2003, there were twenty five agreed private oil operators were including the members of the "Oil Industry Professionals Group (GPP)" who are local subsidiaries of the multinational companies (Mobil, Shell, and Total-Mali). At present, there are almost sixty private oil operators. Mali counts five sedimentary basins covering about 900.000 square kilometers. From 1960 to 1968, the petroleum exploration was conducted by the national company «SONAREM». From 1968 to 1985, the first petroleum Code was adopted. At that time, the sedimentary basins were opened to all potential investors. The permits were granted to five petroleum companies (Texaco, Sun, Murphy, Elf and Esso). The perimeters of the permits were mainly situated in the Taoudenit basin and the Gao basin (1970-1985). Up to 2005, the history of petroleum exploration in Mali clearly indicates that the sedimentary basins of the country are under explored with a very low level of seismic coverage and a very little number of exploration wells (in average one well per basin). In total, five wells were drilled in the five sedimentary basins. To promote exploration during the last four years, the Government of Mali undertook some major activities:

- A review of the petroleum code. The new code has been adopted by the National Assembly on August 2004 and was proposed to the potential investors.
- The creation of the ''Authority for the Petroleum Exploration Promotion in Mali (AUREP) in September 2004.

Biomass Sector

Biomass-energy is under the supervision of MEA – respectively under its forestry department (see chapter 2.3) all aspects related to the supply, while the MEMW manages the demand aspects including also efficiency and substitution policies. Among the strategies implemented, one can quote the attempt to formalize the wood-energy business, the empowerment of rural communities' through the creation of rural markets, the improvement of the institutional and legal framework of the natural forests management and the promotion of alternative energy sources such as LPG. New forestry framework allows putting in place a better regulation and a more coherent legislation aiming at a sustainable management of forest resources, particularly with regards to household energy issues which need:

- A good wood-fuel supply to urban centers at optimal cost to the consumer and the community surrounding the forest.
- A sustainable management of the wood resources as a significant contribution to the fight against the desertification.
- The new legislation put in place comprises two laws and one decree:
- Law 95-004 of January 18, 1995 fixing the conditions of forest stock management.
- Law 95-003 of January 18, 1995 organizing exploitation, transport and trade of wood fuels.
- Decree 422/P-RM of December 5, 1995 fixing the rates and the distribution of taxes to be perceived during the exploitation of forest resources, replaced by decree N (402/P-RM of December 17, 1998 fixing the rates, modalities of recovering and distributing taxes perceived when harvesting state owned forested areas.

The adoption of this new legislation led to the set up of a National Strategy of Household Energy in Mali (1996) and eased:

- Decentralization of management, tax perception and delivery of transport documents.
- Reinforcement of professional activities in the field of transport and trade of wood energy.
- Constraint to the payment of tax and fees on wood – broad access to energy.
- Rate of tax according to the origin or the mode of exploitation of wood energy.
- Self-reliance of the rural sector in financing issues, forestation and reforestation initiatives.

The decree fixing the rates and the distribution of the taxes is favorable to managed forests where the tax is the lowest, compared to other areas which are not under control. It shares the benefits of taxes between the State and the decentralized Communities. The laws allows thus among populations, communities and the Government to generate incomes within the framework of a concerted and sustainable management of forest resources.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The overall objective of the energy policy of Mali (enacted by the Government in March 2006) is to contribute to the sustainable development of the country, through the supply of energy services accessible to the highest possible number of the population at low cost, and supporting the promotion of socio-economic activities. Its specific objectives are to:

- Fulfil the energy needs of the country in quality, quantity and at low cost.
- Ensure protection of people, property and environment.
- Build capacities in orientation, management, control and strategic monitoring of the energy sector.
- Maximize the advantages of international co-operation for the country in the field of energy.
- The strategic paths include, among other, the valorization of national energy resources and the research for sustainable solutions and lower cost for the implementation and utilization of energy services (production, conveying, distribution, use, and maintenance).

In other words, both the described specific objectives and the strategic paths of the national energy policy indicate the importance attached to the valorization of the RE potentials sources (RE) that the country abounds in the form of sun radiation, wind conditions, hydraulic resources and biomass. The integration of RE in the energy policy of Mali was concretized through institutional and regulatory measures, and also through the practical achievements mentioned further on in this document.

Mali doesn't have a structured renewable energy market. The RE sub-sector still appears mainly as informal. However, Mali has always had a proactive policy with regard to renewable energies, which was concretized by the creation of the „Laboratory of solar energy" in 1964. More recently, a national strategy for the development of RE was worked out and adopted in January 2006. The integration of RE in the energy policy of Mali was concretized through institutional, legislative and regulatory measures including:

- Taking into account the fight against poverty, thus echoed in the energy policy through the objective of satisfying the highest possible number of people with energy services; from that follows the creation of AMADER intended for rural areas, the creation of funds for rural electrification, strategies and research in progress for reducing the impact of energy consumption on households, and from which also results the adoption of adequate systems of environmental protection, etc.).
- Taking into account the new reality of decentralization to better involve local authorities in energy services (delegation of the duties of client to the decentralized communities).
- In the field of decentralized electrification, the Frame of Reference for the Development of Rural Electrification (CdR-ER) constitutes an inventory of the major principles which will guide the set up of the regulation in the sector of rural electrification.
- From a fiscal point of view, the willingness to promote RE is expressed by the Government's renunciation to certain taxes through:
- The Decree 02-026/P-RM of January 30, 2002 stating suspension of the collection of VAT, import duties and taxes on solar and RE equipment is a result of this willingness to promote renewable energies.
- The order 04-1360/MEF-SG of July 12, 2004 defining the tax and customs system applicable to the markets and contracts fulfilled under the responsibility of the AMADER.

The Rural Electrification Fund (REF) plays a key role in this policy for facilitating access to energy services which are based mainly on RE technologies. The Fund is made up of Government endowment, subsidies from development partners, donors, gifts and legacy, loans, 25 % of sales incomes or renewal of authorizations whose holders benefitted from the subsidy provided by AMADER. Its management as ensured by AMADER must be directed in priority towards the operational funding objectives of the investments. It must also reinforce the particular risks relating to the amount invested in the private sector through guarantee mechanisms.

REF is intended to have three types of accounts. Its Subsidy Account is the principal source of funding investment operations in the sector of rural electrification. It is the only one implemented to date. The Guarantee Account of REF should be set up for private operators in order to provide them with guarantees from banks and decentralized finance companies. The Account of Credit, which is the third account type of the REF, is to create long-term sources of financing for operators of the RE sector, by placing long term financial resources at the disposal of banks and decentralized finance companies to ensure adequacy between incomes and expenditures.

Producers and distributors (private operators) regulate their status through a request for authorization or a declaration filed at AMADER. This regulation is a necessary condition before private operators can apply for funding from the REF for the development of their project, and – through this – enjoy exclusive title of exploitation on the area covered by the declaration or authorization.

In order to promote the establishment of the private sector as a major factor in rural electrification within the framework of a public/private partnership, AMADER launched with the assistance of the World Bank and KfW (Kreditanstalt fuer Wiederaufbau – Entwicklungsbank/German Development Bank) the Decennial Program of Rural Electrification (PRODER). The implementation of this program includes two operating modes: the Rural Electrification Priority Programs (PPER) which constitutes the top-down procedure of PRODER and the Projects of Spontaneous Candidacy for Rural Electrification (PCASER) which constitutes the bottom-up procedure besides the central programming of PPERs.

The top-down procedure relates to 10 zones of electrification which cover the whole Malian territory. Each zone, which has a Local Electrification Plan (LEP), will be assigned a permit holder following a competitive bidding organized by AMADER. This permit holder will enjoy exclusiveness in the electrification of the area covered by the permit. The LEP developed in eight Multisectoral Electrification Zones envisage the initial electrification of 136 localities with a population of about 500,000 inhabitants in 2008. The PACSER can be implemented by local communities, groupings of ultimate consumers, NGOs and private investors.

The law provides that when an operator is assigned a Multisectoral Electrification Zone where there are preexisting Projects of Spontaneous Candidacy for Rural Electrification (PCASER), the PCASER actors and the permit holders can make agreements so that the latter could resume the project for a compensation whose amount will be defined during negotiations under the aegis of AMADER.

Decentralized Service Companies (SSD) are added to these PCASERs, operating either at the level of a locality or several localities of a commune. They have a monopoly on the territories which are conceded to them. The first two are a) the SSD of Yeelen Kura which operates in the area of Koutiala and which currently proposes primarily domestic services using photovoltaic kits, and b) the SSD of Koraye Kurumba, which electrified four administrative centers of commune in the area of Kayes, using LV networks and diesel power stations working five hours a day.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

In the field of RE most activities and entrepreneurships relate to trade of equipments. Recent investments and businesses relate especially to the opportunities offered by AMADER in the field of rural electrification and the almost feverish passion for biofuels. Small Hydro Power generating systems and solar energy are offering recent opportunities through the procedures of licensing at AMADER. There are certainly official engineering departments and achievements, but also much of informal trade of RE technologies. The following has been achieved so far:

- Renewable energies adjusted to the concern of end-users.
- Nearly 700 solar PV pumps installed.
- More than 50,000 individual lighting systems are under operation.
- Telecommunications using intensively photovoltaic equipments for the power supply of insulated sites, more than 750 kWp installed.
- A significant decrease of the price of photovoltaic equipments: for example, the price of installed peak Watt decreased from 20,000 CFA Francs as at the beginning of the Eighties to approximately 6,000 (in 2008/2009).

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

The ecological diversity of Mali results in a very contrasted forest situation between shrubby savannas in the North of the country (covers less than 10m^3/ha), striped bush with stem wood volumes sometimes reaching 20 to 40 m^3/ha (covers 25 % of the southern part of the country), then forests of the Sudanian Guinean zone (covering between 50 and 80 m^3/ha), and the forests galleries of the West of the country (which sometimes cover even more than 100 m^3/ha). The national forest estate is approximately 100 million ha for a production of approximately 21 million ha. The surface with controlled exploitation is more than 350,000 ha. Forest surfaces and their productivity are in perpetual regression. According to various studies, 100,000 to 400,000 ha are lost every year due to anthropogenic actions (such as deforestation, clear cuts etc.) and climatic variations. This regressive evolution of the forests occurring these last decades is - on the one hand - due to the climatic changes. Biomass represents nearly 90 % of the domestic energy source of the country, proving that the other conventional products still have a marginal role in the field.

The potential of animal wastes and plant residues is high and well distributed on the whole territory. Agricultural residues (straw, rice husk, stalks of cotton, millet, sorghum, corn, etc.) are significant almost everywhere except, of course, in the Saharan northern part of the country. The biomass is available, in particular around the agro-industrial units installed in some areas (Office du Niger, Office Riz Segou, Office Riz Mopti and Office de la Haute Vallée du Niger). The enormous potential of biomass energy cultivation in the country (jatropha, sugar canes) would allow the production of vegetable oils and alcohols that can be used as fuels in substitution to hydrocarbons.

The quantity of stems of cotton plant produced per annum is estimated at 400,000 tons in Mali. The potential production of waste from rice production is more interesting. As an example, the potential of biomass from the cultivation of rice in two areas of the region of Ségou is about 265,000 tons of straw and 55,000 tons of husk. In a study entitled “From the Rice husk to Energy”, realized in 2005 by an American company, it is specified that with a current annual production of 800.000 tons rice paddy, the production of rice straw would be approximately 168.000 tons and would make it possible to produce (126 GWh). The study pointed out that the availability of the rice husk could be limited. This limitation is mainly due to the disappearance of large mills which, following the privatization of the industry and the trade of rice at the beginning of the 90s, were closed for various reasons and were replaced by decentralized small systems run by village associations. Raw materials are dispersed within a very extended area, resulting in high collection and transport cost to any energy plant. This study stresses that the only active large mill in the town of Ségou currently produces 2.000 tons of rice husk per annum, while in a group of villages located in the zone of Niono, 10 mills with a capacity of two tons per hour (each) produce approximately 15.000 tons of rice husk per annum.

These mills, which are located in a radius of 10-15 km, should be supplemented by 10 other mills of similar capacity, which would raise the total availability of husk to 30,000 tons per annum. In this context, the study specifies that a capacity of 15,000 tons per annum would make it possible to operate a unit of co-generation of 1.2 MW (consuming 45 tons of husk per day during 330 days per annum). Two other regions, Mopti and Tombouctou, produce enough rice husk which could feed co-generation units that can operate for base load and reduce considerably fossil fuel consumption in EDM – SA power stations of these two towns that are far from being connected to the national grid.

With regards to further biomass applications, so far Mali does not have any significant liquid or gaseous biomass based plant or equipment under utilization. In the past, however, the rice agro-industry[4] had experimented with two 100 kW power plants based on producing methane from rice husk for feeding a diesel engine. This equipment, a Chinese technology, did not overcome the experimental stage. In the same area, the sugar cane industry tested some engines using alcohol, but this small-scale experiment was never expanded. The only biomass based liquid energy producer is Mali Biocarburant. Since 2008, a small-scale bio diesel plant has been extracting jatropha oil and transforming it into biodiesel through an etherification process. The production is expected to reach about 4,500 tons per year. Further information is available at www.malibiocarburant.com.

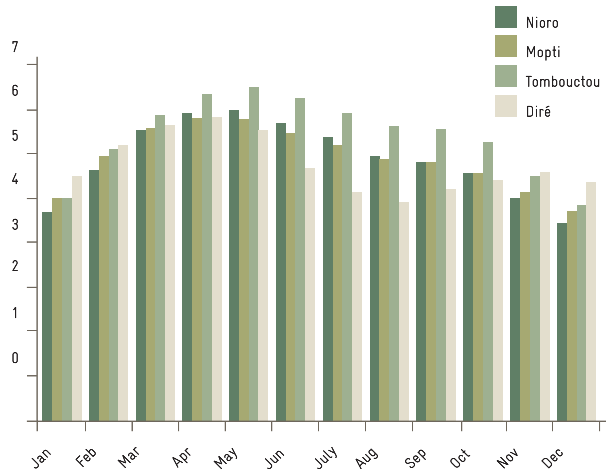
4.2 SOLAR ENERGY

The average solar radiation is 6 kWh/m² per day. The average daily duration of sun lighting varies between 7 and 10 hours. With a little more than 700 PV solar pumping units, more than 50,000 Solar Home Systems (SHS), hundreds of household solar water heating installations solar drying system – the latter mainly used by women for food processing small businesses -, Mali has sufficient experience today to appreciate the root barriers in changing the scale in harnessing RE sources. However, other niches such as solar air-conditioning are experiencing a rather slow development compared to the local potentialities. The most relevant prediction may lie on forecasting electricity generation in isolated cities. The most recent significant RE investment in Mali is a centralized 75 kW PV plant aimed to supply electricity to Kimparana, a village situated in the central part of the country at up to 525 km from the capital city. Other investments in rural electrification, using RE technologies are under preparation.

As a forecasting, there are a lot of possibilities of self generation (solar energy, bio-fuels, etc.), which allow the production of small quantities of electricity to those clients, invoiced on contractual basis, and ensure profitability of the operations. For example, EDM-SA is feeding remote medium sized cities with diesel engines reaching a total of 100 MW. A little share of 20 to 40 % of solar PV make a forecast of almost 27 to 54 MWp of PV panels. These prospects attract a lot of investors. Thus, on January 21, 2008 AMADER was able to sign agreements for a total of 3.2 billion CFA F. Of that amount 2.3 billion were provided by AMADER (under World Bank funding), and 927 million by local private operators. The agency indicated that out of the 30 operators that had expressed their interest for the subsidies, nine tenders of business plans were retained. These projects were subsidized at 65–75 % and 6,154 electrical connected consumers (households and small businesses) will benefit from these projects of rural electrification.

FIGURE 6

Average Solar Insulation in 4 Cities of Mali (KWh/m²/day)



Source: Graph compiled by the author S. Diallo – 2009 (Data from NASA Surface meteorology and Solar Energy Data Set)

4.3 WIND POWER

From 2001 to 2004, GTZ supported the Direction de l'Energie (DNE) within the Ministry of Energy in Mali (MMEE) in appraising a project aiming to integrate wind turbines into the diesel-fuelled isolated grid supplying the provincial capital city of Gao in the northeast of the country. Results of wind measurements (March 2001 - October 2003) showed a relatively low wind potential. Mean wind velocities are 5.3 m/s at a height of 41 m and 4.7 m/s at a height of 26 m. Based on these measurements and with the assistance of DNE and the power utility Energie du Mali (EDM), GTZ undertook a technical and economic feasibility study[5] conducted by Lahmeyer. The study was finalised in July 2004 and showed a positive result. Total investment for a 900 kW wind farm is estimated at EUR 1,7 million. The relatively high level of feed-in tariffs that will be necessary for the wind turbine generating systems (roughly 18 €-cent/ kWh) can be justified on economic grounds, however, as this is below the cost of diesel generation (at the time of the study: approx. 21 €-cent/ kWh). The high cost of diesel is due above all to the expensive and lengthy transport route for the fuel. The study, though, worked on the assumption of an average crude oil price of USD 25 per barrel as applicable in 2004, so the costs of electricity generation from diesel in Gao are likely to be considerably higher by now.

4 OFFICE DU NIGER, AS OF 1969
5 GTZ, AS OF 2004

An exhaustive review shows that more than 150 wind pumps and more than 10 aero-wind pumps (for the production of electricity) were installed throughout Mali, especially in the Sahelian area. The energy services provided by these wind mills were mainly used for supply of drinking water and creation of income generating activities (gardening/truck farming, etc.) as well as for pastoral hydraulics.

TABLE 7

Speed and Frequency of Wind: Series of Measurements in Gao (2003)

Direction (°)	0	30	60	90	120	150	180	210	240	270	300	330
Wind (m/s)	5.3	5.0	5.7	5.8	5.5	4.9	4.8	4.8	5.2	4.6	4.0	5.3
Frequency (%)	12.	9.6	15.2	10.9	5.6	5.0	8.4	7.2	8.9	6.7	3.8	6.4

Source: Direction Nationale de l'Energie, 2003

4.4 HYDRO POWER

A hydroelectric potential of about 1,050 GW and 5,000 GWh of average production is identified for the principal rivers and their tributaries: Out of this national hydroelectric potential, less than 15 % are currently exploited. Table 8 presents the hydro power sites currently in operation, Table 9 indicates the estimated capacity of potential sites for micro Hydro Power Generation.

TABLE 8

Hydro Power Site in Operation

SITES UNDER OPERATION				
N°	Name	River	Capacity MW	Producible GWh
1	Sotuba I	Niger	5.4	40
2	Felo I	Sénégal	0.6	3
3	Sélingué	Sankarani	44	180
4	Manantali	Bafing	200	800
Total			244	1023

Source: Direction Nationale de l'Energie, 2006

TABLE 9

Potential Sites for Micro Hydro Power Generation

N°	Name of the site	River or Region	Fall (H) in meters	Estimated Capacity (KW)
1	Seuil de Talo	Bani	4,5	2400
2	Seuil de Djenné	Bani	2/5	1000
3	Farako 1	Sikasso	7	50
4	Farako 2	Sikasso	15	25
5	Sirakorobougou	Sikasso	7	3
6	Mimbougou	Sikasso	3	8
7	Woroni	Sikasso	60	350
8	Kéniéto	Kéniébal/Kayes	90	250

Source: Direction Nationale de l'Energie, 2006

5 MARKET RISKS AND BARRIERS

The main risk for the RE market development in Mali is the lack of the enforcement of the existing energy policy. Some merchants with a general license of trade could sell RE technologies without any feedback for maintenance and other services, deserving the image of the energy source and/or technologies. There is no dedicated body for quality control at the borders of the country aiming to select good comparative standards for the market.

Investments in RE in Mali are not easily quantifiable because activities in this field are generally built-in as part of multi sector programs (including issues on health, education and energy), and it is often difficult to precisely evaluate the energy share of these projects. Until now, the most active segment of the solar market is for water pumping which received important support from the CILSS (Inter-states Committee for Fight against the Drought in the Sahel) with funds of the European Union. Domestic" and "Community" segments "(the latter being mainly a market for refrigeration) are not very active compared to physical conditions and/or technical potential.

The segment of the professional energy applications offers many opportunities. However, the energy choice made by the national telecom operator was directed, so far, towards the diesel generators. A private company started at the beginning of the 1990s to install 18 solar PV systems (with an average power output of about 2.5 kWp) for telecom relays.

The Code of Investments in Mali established a privileged tax system in order to promote the investments of private (national and foreign) capital for production activities and service deliveries. It offers the necessary guarantee to secure the investments made by the national and foreign operators intervening in the exploration, exploitation, conveyance and refining of liquid or gas hydrocarbons. A survey of entrepreneurs and investors in Mali has identified the stable political climate, safety, costs of various factors (especially labor) and an advantageous tax regime as significant attractions for foreign investors. The survey also emphasized that the institutional reforms and the new regulatory environment were encouraging a climate of trust. Only with respect to the judicial system the survey noted a wish/recommendation for more transparent decision-making processes. This new phase of development presents interesting investment opportunities in specific sectors such as mining, energy, infrastructure and service development (especially in the context of privatization), and cotton.

Any Malian or foreign corporation or individual may acquire or create a commercial, industrial, or banking and financial company in Mali. The Constitution guarantees free enterprise and property rights in Mali. There are no specific restrictions on access to various investment areas or on the creation of companies. And Malian legislation does not oblige foreign investors to make the Malian Government or a Malian person or corporation a partner in their companies, except in the mining and petroleum industries, where the Malian Government reserves a minority interest of approximately 20 %.

The conditions of approval for the creation of a company are defined in Order 95-159/P-RM dated 12 April 1995. In order to minimize formalities, a structure known as the "Guichet Unique" ("single window concept") was created by the Direction Nationale des Industries (National Directorate of Industries). The Guichet Unique is under the Ministry of Economy, Industry and Trade and is responsible for informing, advising and assisting investors concerning the procedures they must take. It has four sections: Registration; Manufacturing and Agricultural Activities; Buildings, Public Works and Real Estate; and Service Activities.

All areas of activity are covered by the Guichet Unique, except health care, education, communications, audiovisual, print media, purely commercial activities, petroleum and mine prospecting and exploitation, which are governed by other laws. The Guichet Unique is an ideal contact for project promoters, acting as their interface with the administration.

Recently, Mali sped up property registration by decentralizing and reorganizing their registries. The country also reformed business start-ups by introducing a single company identification number. Mali has also cut the time for start-up processes. However, the country's rank is still very low in the "World Bank doing business profile" (166 out of 181 countries). The results are presented in Table 10.

Further information regarding potential investments could be obtained at the "Agence pour la Promotion des Investissements au Mali"[6].

TABLE 10

Ease of Doing Business Ranking of Mali

SELECTED INDICATORS	
Ease of doing business	166
Starting a business	162
Dealing with construction permis	106
Employing workers	94
Registering property	94
Getting credit	145
Protecting invastors	150
Paying t???	156
Trading across boarders	166
Enforcing contracts	158
Closing a business	114

Source: World Bank, The Doing Business Project, 2008

6 SEE ALSO WEBSITE OF THE AGENCY: WWW.APIMALI.GOV.ML

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACT

TABLE 11

Governmental Institutions

NAME	ADDRESS & TEL	FIELD OF ACTIVITY	EMAIL
Ministry of Energy, Mines and Water	Colline de Badalabougou BP 19 Bamako - ex CRES	Policy and general planning (demand and supply)	www.mmee.gov.ml
National Direction of Energy	Badalabougou BP 134 Bamako – ex CRES	Evaluation of the potential of energy resources and ensuring of their valori-zation	dne@afribone.net.ml
The National Center of Solar Energy and Renewable Energies (CNESOLER)	Badalabougou BP 19 Bamako - ex CRES	Research and promotion of RE	cnesoler@yahoo.fr
National Engeneering School (ENI)	BP 242 Bamako - Mali	Training on energy issues	eni@spider.toolnet.org
The Malian Agency for the Development of Domestic Energy and Rural Electrification (AMADER)	Badalabougou BP E 715 Bamako - Mali	Household energy substitution programs and access to electricity in rural and peri-urban areas	amader@amadermali.net
National Office of Petroleum Products (ONAP)	Quartier du fleuve, Bamako	Pricing and regulation for petroleum products	onapmali@afribone.ml.net
National Representative of the Organization for the Valorization of the Senegal River (OMVS)	Zone industrielle-Route de Sotuba - Rue 851 Porte 407 BP E 2618 BAMAKO - MALI	Valorization of the Senegal River in coope-ration with Mali, Mauritania and Senegal	cnomvsmali@omvs-mali.org
Trust Company of Manantali Energy (SOGEM)	ACI 2000 - BP E 4015 BAMAKO - MALI Tel:20298350/20290422	Public corporation of estate created by the member states of the OMVS	sogem@sogem-omvs.com
Énergie du Mali (EDM-SA)	Square Patrice LUMUMBA BP 69 BAMAKO - MALI	Licensee for electricity public service	edm@edm-sa.com.ml/edm@edmsa.net
ESKOM Energy Manantali SA (ESKOM)	Hyppodrome - Avenue Al Quods - Immeuble Boubacar Koïta - BAMAKO - MALI	Operation and the maintenance of the dam, production and transport of energy of the hydroelectric power station of Manantali	eskom@eskom-mali.com
The Malian Agency for Radioprotection (AMARAP)	Badalabougou ex – CRES BAMAKO - MALI	Pacific use of nuclear energy and protec-tion against harmful ionizing radiations	amarap@buroticservices.net.ml
The National Direction of Geology and Mines (DNGM)	Route de Sotuba, Bamako Tel: +223 221 78 81/Fax: +223 221 02 31	Oil geology, geophysics and exploration/ quality control of petroleum products	www.dngm.net
The Commission of Electricity and Water Regulation (CEWR)	Rue 23/23 B.P. 115 Bamako	Regulatory body of the sector of electricity and potable water	cree@creemali.org

TABLE 12

Commercial Partners in the Field of Renewable Energies

NAME	ADDRESS & TEL	FIELD OF ACTIVITY	EMAIL
Ministry of Energy, Mines and Water	Colline de Badalabougou BP 19 Bamako- ex CRES	Policy and general planning (demand and supply)	www.mmee.gov.ml
National Direction of Energy	Badalabougou BP 134 Bamako- ex CRES	Evaluation of the potential of energy resources and ensuring of their valorization	dne@afribone.net.ml
The National Center of Solar Energy and Renewable Energies (CNESOLER)	Badalabougou BP 19 Bamako- ex CRES	Research and promotion of RE	cnesoler@yahoo.fr
National Engeneering School (ENI)	BP 242 Bamako - Mali	Training on energy issues	eni@spider.toolnet.org
The Malian Agency for the Development of Domestic Energy and Rural Electrification (AMADER)	Badalabougou BP E 715 Bamako- Mali	Household energy substitution programs and access to electricity in rural and peri-urban areas	amader@amadermali.net
National Office of Petroleum Products (ONAP)	Quartier du fleuve, Bamako	Pricing and regulation for petroleum products	onapmali@afribone.ml.net
National Representative of the Organization for the Valorization of the Senegal River (OMVS)	Zone industrielle-Route de Sotuba - Rue 851 Porte 407 BP E 2618 BAMAKO - MALI	Valorization of the Senegal River in cooperation with Mali, Mauritania and Senegal	cnomvsmali@omvs-mali.org
Trust Company of Manantali Energy (SOGEM)	ACI 2000 - BP E 4015 BAMAKO - MALI Tel:20298350/20290422	Public corporation of estate created by the member states of the OMVS	sogem@sogem-omvs.com
Énergie du Mali (EDM-SA)	Square Patrice LUMUMBA BP 69 BAMAKO - MALI	Licensee for electricity public service	edm@edm-sa.com.ml/edm@edmsa.net
ESKOM Energy Manantali SA (ESKOM)	Hyppodrome - Avenue Al Quods - Immeuble Boubacar Koïta - BAMAKO - MALI	Operation and the maintenance of the dam, production and transport of energy of the hydroelectric power station of Manantali	eskom@eskom-mali.com
The Malian Agency for Radioprotection (AMARAP)	Badalabougou ex – CRES BAMAKO - MALI	Pacific use of nuclear energy and protection against harmful ionizing radiations	amarap@buroticservices.net.ml
The National Direction of Geology and Mines (DNGM)	Route de Sotuba, Bamako Tel: +223 221 78 81/Fax: +223 221 02 31	Oil geology, geophysics and exploration/quality control of petroleum products	www.dngm.net
The Commission of Electricity and Water Regulation (CEWR)	Rue 23/23 B.P. 115 Bamako	Regulatory body of the sector of electricity and potable water	cree@creemali.org

Source: Table compiled by the author S. Diallo, 2009 (data from various documents&address books)

7 BIBLIOGRAPHY

- Direction Nationale de l'Energie (2006): Sites de Microcentrales.
- ECOWAS, EMUWA (2004). Country Profile Mali: Access to the energy services in rural and peri-urban area to achieve the Millennium Development Goals.
- Energie du Mali-SA (2002-2007): Rapports annuels.
- GTZ (2004): Wind energy in Mali. Feasibility study (WWW.GTZ.DE/DE/DOKUMENTE/EN-WINDENERGY-MALI-FEASIBILITY-STUDY-GAO-2004.PDF)
- L'Observatoire des énergies renouvelables (2008): www.energies-renouvelables.org.
- Malian Agency for Domestic Energies and Rural Electrification - AMADER (2004/2005): Textes de creation, manuel de procedures de l'AMADER.
- Ministry of Energy, Mines and Water (2006): Document de politique énergétique.
- Ministry of Energy, Mines and Water/Direction of Energy (2005): Multisector Committee of follow-up of the European Initiative.
- Ministry of Finance/Project Coordinating Unit (2004): Annual Report of First Year implementation of the Strategic Framework of Fight against Poverty, CSLP.
- Ministry of Finance (2003): Ex-post evaluation Report on the results obtained within the framework of programs FASR/FRPC of the IMF.
- Ministry of National Education of Mali (2000): Document of the „Decennial Education Project (PRODEC).
- Ministry of Public Health: Document of the „Decennial Health Project (PRODES)".
- NASA (2008): Surface Meteorology and solar Energy Data Set (http://eosweb.larc.nasa.gov/sse).
- National Center for Solar and Renewable Energies (CNESOLER)/UNDP Country Office Mali (2001): Reinforcement of the role of women in the promotion of Renewable energies/Impact studies on new and renewable energy technologies.
- Office National des Produits Petroliers (2008): Structure indicative des Prix des Carburants.
- Office National des Produits Pétroliers (2008): Valeurs en douane des produits pétroliers au titre des importations.
- Plan National d'accès à l'Eau potable – PNAEP 2004-2015.
- UEMOA (2007): Rapport du Comité de Convergence.
- UNCTAD (2001): An Investment Guide to MALI: Opportunities and Conditions.
- UNDP Country Office Mali (2002): Project Document titled „Adoption of New and Renewable Energies on broad scale in Mali.
- UNDP Country Office Mali (2004): Report of Follow-up of Implementation of the Millennium Development Goals (MDGs).
- UNDP/Project PTF (2004): Improve living conditions in rural areas through access to energy/A review of the multipurpose platform in Mali.

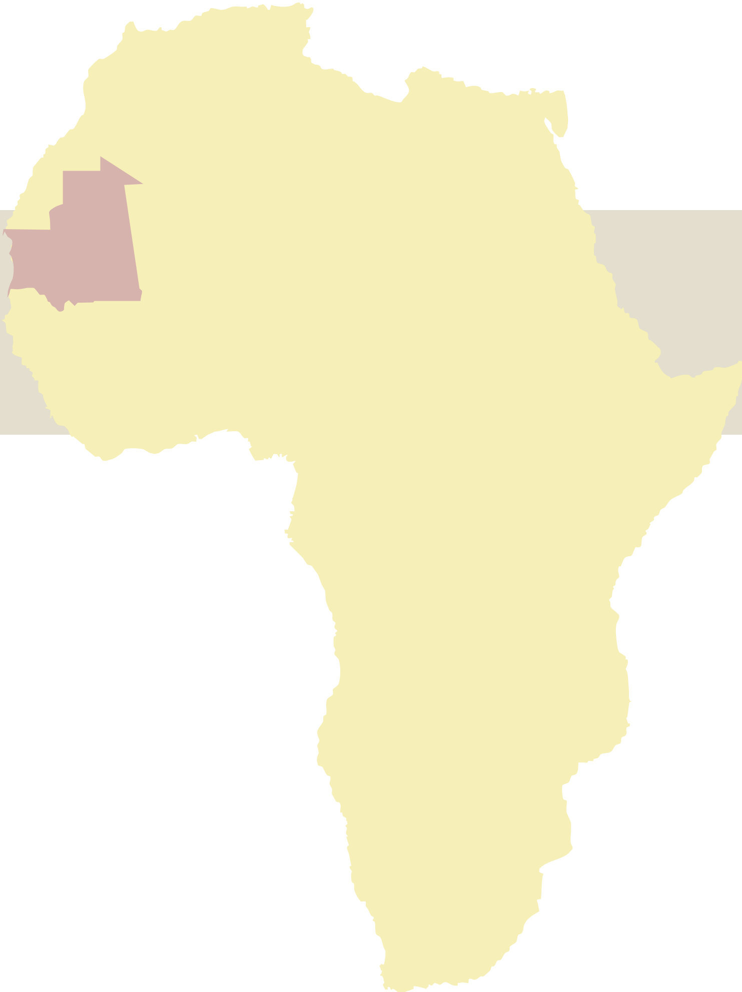
8 ANNEX

TABLE 13

Evolution of Petroleum Imports (2001–2007)

	VOLUME OF PETROLEUM PRODUCTS IMPORTED IN MALI (TONS)						
	2001	2002	2003	2004	2005	2006	2007
Petrol	99.339	105.455	94.818	103.729	103.472	102.726	117.664
Kerosene	45.027	44.396	28.763	36.166	31.267	31.650	16.129
Jet A1	24.494	21.114	20.319	19.758	23.875	20.245	21.790
Diesel	268.180	277.668	21.6066	239.533	354.467	410.356	405.769
Full Oil	98.820	57.126	110.987	121.275	40.378	36.369	52.721

Source: Graph compiled by the author S.Diallo, Data from ONAP, 2008



COUNTRY CHAPTER: MAURITANIA

Author of Country Chapter
Mohamed Elhacen Ould Khouna (Dipl. Eng.)
revised version by **Louis Seck** (MSc., DEA, MBA)

Coordination and Review of the Country Chapter
Anton Hofer, (MSE, Dipl.-Ing./FH, M.A.)
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS MAURITANIA

ACRONYMS AND ABBREVIATIONS

MAURITANIA

ADER	Agence du Électrification Rural (Rural Electrification Agency)
ARM	Agence de Régulation Multisectoriel (Multisector Regulation Agency)
AU	African Union
CFPT	Centre de Formation Professionnel et Technique (Center for Professional and Techical Training)
CSLP	Cadre Stratégique de Lutte Contre la Pauvreté (The Strategic Framework of Fight against Poverty)
DRSP	Document de la Stratégie de Réduction de la Pauvreté (Poverty Reduction Strategy Paper)
EAM	Enquête Auprès des Ménages (Census of households)
ECOWAS	Economic Community Of West African States
EEC	European Economic Community
EPCV	Enquête Permanente sur les Conditions de Vie des Ménages (The Permanent Investigations into the Living Conditions of Households)
ESAF	Enhanced Structural Adjustment Facility
FLM	Federation Lutherans Mondale (Lutheran World Federation)
FOB	Free One Board
GDP	Gross Domestic Product
GRET	Groupe de Recherche et d'Échanges Technologiques (Research Groupe on Technolgy Exchange)
IPPTE	Initiative en Faveur des Pays Pauvres Très Endettés (Initiative of the Heavily in Debt Poor Countries)
IMF	International Monetary Fund
IPP	Independent Power Producer
LPG	Liquified Petroleum Gas
MDG	Millinium Developement Goal
MEP	Ministry of Energy and Power
MTEF	Medium Term Expenditure Framework
NTIC	New Technologies of Information and Communication
PREDAS	Programme Régional de Promotion des Énergies Domestiques et Alternatives au Sahel (Regional Programme for the Promotion of Domestic and Alternative Energies of the Sahel Region)
PRS	Programme Régional Solaire (Regional Solar Programme)
PRSP	Poverty Reduction Strategy Paper
PSAE	Projet d'Énergie Solaire Photovoltaïque (Project of Photovoltaic Solar Energy)
RE	Renewable Energy
RPTES	Regional Program for the Traditional Energy Sector
SHS	Système Solaire Photovoltaïque (Solar Home Systeme)
SNDE	Société Nationale Des Eaux (National Water Society)
SOMAGAZ	Société Mauritanienne des Gaz (The Mauritanian Gas Company)
SOMELEC	Société Mauritanienne d'Électricité (state owned national power company)
TER	Technologie d'Energie Renouvelable (Renewable Energy Technology)
UNDP	United Nations Development Programme
USD	United States Dollar
WAEMU	West African Economic and Monetary Union

MEASUREMENTS

GWh	gigawatt hour (1 GWh = 1,000,000 Kilowatt hours (kWh))
kg	kilogramm
km^2	square kilometer
ktoe	kilotons of oil equivalent (= 1,000 toe)
kWh	kilowatt hour
kV	kilovolt
m/s	meters per second
m^3	cubic meter
mm	millimeters
Mtoe	million tons of oil equivalent (1 Mtoe = 1,000,000 tons of oil equivalent)
MW	megawatt (1 MW = 1,000 kW)
toe	tons of oil equivalent
°C	degree Celsius

SUMMARY

The Country Study of Mauritania is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Mauritania. The study is structured as follows:

Chapter one provides **Background Information on Mauritania**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Mauritania.

Chapter two summarizes facts and figures of **Mauritania's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Mauritania. This includes an overview of support mechanisms mainly for PV as well as already existing regulations, incentives and legislative framework conditions also for other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Mauritania.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Mauritania

MAP OF MAURITANIA

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Mauritania is located in the Sahara Desert belt of West Africa and shares borders with Morocco, Algeria, Mali and Senegal. The capital city and major port is Nouakchott, other major cities are Kaedi and Zouerate and the port of Nouadhibou. The country has a total area of 1,030,700 km² and possesses a 700 km Atlantic coastline; approximately 75 % of Mauritania is desert or semi-desert area. Due to the desert in the North and the Sahelien in the South, the climate of Mauritania is characterized by a continuous regression of precipitations, which shows great interannual variations that can exceed an 80 % deficit as compared to the normal.

The climate is generally hot and dry with mild and short winters (3 months). Rainfall varies between less than 50 mm in North and more than 450 mm in the South (see the chart of the isohyets for the period of 1961 to 1990 above). In most areas, the temperatures often exceed 40 °C during the hot season. The coercive and random climatic conditions are likely to predispose the country with the instability and the degradation of the natural resources.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

The Constitution of the Islamic Republic of Mauritania was approved of in 1991, providing for a multi-party system with an elected president, comparable to the French presidential model. The national economy is dominated by animal breeding, agriculture, fishing and mining activities. Mauritania's major export industries are iron ore, fish and fish products, while it's most important imports are machinery and equipment, petroleum products, capital goods, food and some consumer goods. Mauritania has only limited agrarian resources, but the country has remarkable mineral deposits of iron, copper and gold. Some crude oil reserves were discovered in various offshore oil fields in 2001.

The majority of Mauritania's population still depends on agriculture and livestock, even though most of the rural inhabitants were forced into the cities by recurrent droughts in the 1970s and 1980s. In recent years, drought and economic mismanagement have resulted in a build-up of foreign debt. In March 1999, the Government signed an agreement with a joint World Bank – International Monetary Fund (IMF) mission on a USD 54 million Enhanced Structural Adjustment Facility (ESAF). The economic objectives have been set for 1999–2002. Privatization remains one of the key issues. Mauritania is unlikely to meet ESAF's annual GDP growth objectives of 4–5 %.

Mauritania has transformed from a country with limited economic base and poor social indicators to a highly urbanized and increasingly market-driven economy. However, the rural sector still employs about 40 % of the labor force. Due to the recent stabilization and new revenues, the per capita income was about USD 938 in 2007. The average economic growth of Mauritania was 4.8 % between 2001 and 2004, reaching 5.4 % in 2005 and increasing to 11.4 % in 2006, mainly due to the start of oil production (non-oil GDP growth was 4.1 %).

Besides existing natural resources, the economic growth was mainly accomplished by the expansion of the secondary and tertiary sectors of the economy. The national economy, however, still suffers from high costs, underdeveloped financial markets, low human resources and lack of appropriate infrastructures. Despite the recent socio-economic progress, Mauritania ranked at position 137 (out of 177 countries) in the Human Development Index (HDI) of 2008[1]. Since 1994, several programs and strategies of fight against poverty have been implemented. The Strategic Framework of Fight against Poverty (CSLP) worked out by the Mauritanian Government in 2000 summarizes the main trends and is based on interdependent sector strategies. As a matter of fact, the strategy of fight against poverty consists of four major objectives: (i) the acceleration of the economic growth and its

1 UNDP, 2008

2 ÉNERGIE ET PAUVRETÉ, TAMCHIR THIAM, 2004

anchoring in the sphere of the poor; (ii) the development of human resources; (iii) the expansion of the basic services and (iv)the promotion of an institutional development and good governance.

2 ENERGY MARKET IN MAURITANIA

2.1 OVERVIEW OF THE ENERGY SITUATION

Based on figures of the Cellule de Contrôle de l'Énergie, the per capita energy consumption in Mauritania is estimated at 0.3 toe (0.17 toe without biomass) and 190 kWh of electricity. The energy balance of the Mauritania is composed of about 67 % of biomass (firewood and charcoal), followed by various petroleum products (33 %). The detailed energy consumption figures are presented in Table 1.

According to various investigations made from 1990 by the Regional Program for the Traditional Energy Sector (RPTES), the dominance of wood fuel (firewood and charcoal) was evident in the national energy balance. The wood energy (firewood and charcoal) accounted for 93 % in meeting the needs of cooking in households and more than 50 % in final energy consumption in the residential sector (59.5 % for charcoal and 27.5 % for firewood) against 9 % for butane gas, 3.4 % for electricity and 0.4 % for kerosene and for insignificant traces of RE such as solar and wind power2.

The energy sector of Mauritania is characterized by an increasingly significant demand for domestic energy. The total consumption is more than the energy produced due to the high need of consumption of electricity in various sectors, which are estimated at 35–39 %. The energy sector is divided in three parts, i. e. the electricity sector, the petroleum sector and the biomass sector.

TABLE 1

Energy Consumption in Mauritania

PRODUCT	CONSUMPTION (ktoe)
Gasoline	47.566
Jet fuel	79.054
Fuel oil	23.260
Gas oil	446.124
LPG	30.0866
Kerosene	13.650
Total consumption – petroleum products	626.228
Firewood	902.8
Charcoal	361.120
Total consumption – biomass	1,263.392
Total energy consumption	1,890.148

Source: Cellule de Contrôle de l'Énergie (reviewed by the author), as of 2004

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

Between 1960 and 1997, the country's total installed and operating electricity-generating capacity was about 130 MW from 13 power stations all over the country driven by diesel engine generator units. In 2009, the state owned national power company (SOMELEC) evaluated the current total installed capacity excluding auto-producers (mining, industrial and commercial) at about 200 MW of which 49 MW are located in Nouakchott.

SOMELEC is exclusively responsible for the distribution and commercialization of electricity in Mauritania. The company manages the electric utilities in 20 urban centers with a total capacity of 93.6 MW (against 75 MW in 2005) and 18 power stations in the center of the country. The net production is 402 GWh in 2006 (against 374 GWh in 2005). Due to the high demand for energy, total consumption exceeds the national energy production with about 35–39 %. In 2000, the per capita electrical energy consumption was 190 kWh. Consumption increased to 320 kWh in 2002 and decreased gradually to 190 kWh in 2006. Even though there are several self-sufficient energy producers in the country (with an estimated capacity of 40 MW), the majority of mining companies, industrial, commercial and domestic consumers continue to be customers of SOMELEC.

The continuous decline of electricity generation by SOMELEC in Mauritania towards the end of 2007 can be explained by the appearance of Independent Power Producers (IPP) in the country. Moreover, the currently installed capacities are not sufficient to meet the national demand, and some production capacities are not interconnected. Concerning the overall electrification rate, the proportion of the households connected to the electric network passed from 22 % in 2000 to 24 % in 2004 (with a rate of 47 % in wealthy areas). At the national level, the principal source of lighting for households remains nevertheless the torch, (51.2 %), while in urban areas 57.6 % of the households used electricity in 2004 (as compared to 49 % in 2000). In the capital of Nouatchott, this rate reaches 62.5 %, whereas it amounts to 64.6 % for Nouadhibou and more than 89.1 % for Zouerate.

The electricity provided by the SOMELEC is currently sold according to an official price fixed on 1 January 2002 by the Government (Multisector Regulation Agency (ARM). Table 2 presents the pricing structure of electricity in Mauritania. The Government of Mauritania intends to diversify the electricity production and plans to set up appropriate regulations (technical issues and feed-in tariffs) for electricity from RE.

TABLE 2

Electricity Prices

CONSUMPTION KWH/MONTH	FIXED COSTS/MONTH	PRICE/KWH
Up to 25	1.850 Euro	0.137 Euro
Between 25 and 120	4.550 Euro	0.213 Euro
More than 120	20.100 Euro	0.237 Euro

Source: M. Ahmedou Ould Mohamed Mahmoud, Chef de Service ADER, Dakar Workshop on CDM, as of 2009

Petroleum Sector

Due to recent discoveries of oil resources, Mauritania is receiving increased international attention as a new player in the global oil industry. First supplies from the Chinguetti field started to flow in 2006, followed by the conducting of successful offshore explorations. Up to now however, the energy consumption of petroleum products is mainly covered by imported fuels.

In 2004, the utilization of LPG for cooking purposes reached a total of 35 %. Even though there was an increase of about 7 % (compared to 2000), the difference is still considerable between the different social strata. In urban areas, about 62.8 % of the households are cooking with LPG as compared to only 16.2 % of the households in rural areas. Kerosene is mainly used for lighting purposes. The consumption, however, remains more or less static due to the extension of the electrical network and the existence of other energy sources for lighting purposes. Table 3 presents the evolution of energy consumption by type of fuel. Figure 2 visualizes the figures.

According to Ordinance No. 2002–2005[3] of 28 March 2002, Mauritania's prices for petroleum products are set by the individual distribution companies according to their actual economic costs. The liberalization of prices, the information requirements of users faced by distribution companies and the information to be regularly communicated to the competent authorities and to the National Commission of Hydrocarbons is specified by decree on the proposal of the Ministry of Energy and Power (MEP). As specified in Article 21, the National Commission of Hydrocarbons is in charge of monitoring the market prices on the basis of a determination system. This ensures free competition, high quality and just service standards as well as a market with fair prices and the protection of customers.

The selling price of LPG is fixed by a joint decree of the Ministries of Energy and Power and the Ministry for Trade and Industry (MTI). Since 1987, the price is given on the basis of quotation FOB (Free One Board) of the international market. The elements of the price are fixed by decree N 089.118 of 6 September 1989. In theory, the price for LPG is fixed every month according to the fluctuation of spot market prices; the prices, however, have not been modified since 18 July 2001. Table 4 presents an overview of current prices for petroleum products.

TABLE 3

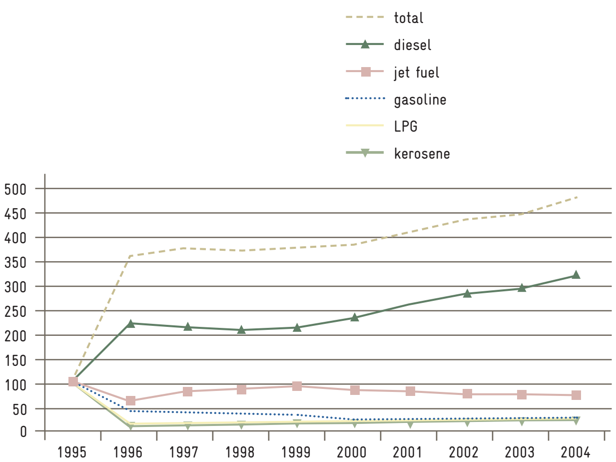
Consumption of Petroleum Products (10^3 metric tons)

PRODUCT	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Gasoline	42.16	41.66	38.33	37.90	33.63	26.18	23.31	27.40	26.61	27.98
Jet fuel	60.02	61.31	85.52	87.48	89.12	87.20	81.77	76.86	76.51	75.29
Kerosene	12.17	15.22	15.76	17.41	19.15	20.63	20.31	20.09	22.95	24.23
Diesel	207.34	220.90	214.78	206.48	210.57	228.64	258.52	280.26	290.49	318.66
LPG	13.99	16.76	17.03	14.76	19.07	17.84	18.72	20.72	22.58	26.62

Source: Direction de l'Approvisionnement, Ministère Chargé de l'Énergie, as of 2006

FIGURE 2

Consumption of Petroleum Products (103 metric tons)



Source: Direction Provisioning, Ministry of Energy, as of 2006

TABLE 4

Price of Petroleum Products

PRODUCT	PRICE
Gasoline	0.676 Euro/liter
Diesel	0.594 Euro/liter
Kerosene	0.119 Euro/liter
LPG	12.196 Euro/38 kg bottle
	4.013 Euro/12.5 kg bottle
	1.700 Euro/6 kg bottle
	0.724 Euro/2.5 kg bottle

Source: market research by the author, as of 2009

3 DROIT AFRIQUE, 2005

Biomass sector

Wood remains the first source of energy for cooking purposes with a total of about 44.6 %, while charcoal accounts for about 19.1 %. Table 5 and Figure 3 present an overview of consumption figures.

The prices of firewood and charcoal are freely determined by the market. The MEP and the MTI, however, have fixed the general price structure. The most recent price structure with the final selling price is presented in Table 6.

TABLE 5

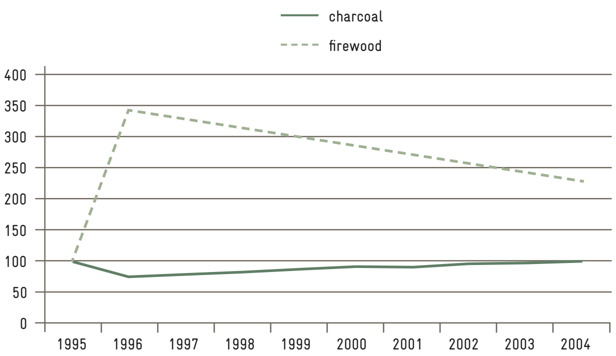
Consumption of Firewood and Charcoal (10^3 metric tons)

PRODUCT	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Firewood	348.8	340.0	326.9	312.0	296.9	284.0	270.9	252.6	240.6	225.7
Charcoal	72.5	74.9	78.8	82.4	86.9	89.9	90.5	95.2	97.8	98.6

Source: Direction of Environment, as of 2008

FIGURE 3

Consumption of Firewood and Charcoal



Source: Direction of Environment, as of 2008

TABLE 6

Price Structure of Firewood and Charcoal

PRICE ELEMENT	EURO/kg
Forest tax	0.0042
Communal tax	0.0004
Remuneration of the	0.0200
Loading	0.0022
Transport	0.0150
Renewal bag	0.0010
Unloading	0.0009
Tax placing on tip	0.0004
Stroke owner	0.0430
Stroke wholesaler	0.0220
Price returned deposit	0.1090
Conditioning	0.0135
Remuneration of the retailer	0.0354
Final selling price	0.2670

Source: Direction of Environment, as of 2008

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The Ministry of Energy and Power (MEP) is the governmental authority in charge of the energy and water sector. Its mandate includes dedicated policy formulation as well as sector planning and coordination. The MEP focuses on the electric power supply, including RE matters like Hydro Power, solar and wind energy.

The Ministry of Agriculture (MA) is in charge of all biomass issues (plant as well as animal derived matter) with special focus on wood. The overall market for petroleum products is coordinated by the Ministry of Trade and Industry (MTI) with participation of the Ministry of Finance (MF) playing a significant role in the import and storage of petroleum products. The ongoing and planned oil exploration and extraction is part of the responsibility of a Presidential Petroleum Commission. The Ministry of Mineral Resources (MMR) deals with the exploitation of minerals.

It is interesting to note that the special duties of every ministry are listed in the 2001 Local Government Regulations. For the MEP, however, only the specific fields of "rural water supply", "community ownership of wells", "bulk supply of water" (except where privatized) and "sanitation" are considered and listed. There is no specific focus on energy and electricity provision for local communities under these regulations.

SOMELEC is the monopoly supplier of electricity in Mauritania. The company is exclusively responsible for power generation, transmission, distribution and supply in Mauritania.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

Up to now, there is no adequate set of policy instruments to address the specific energy issues in Mauritania. The following overview presents the facts and figures available.

In 2001, the World Bank provided a dedicated funding to Mauritania to be used for the formulation of a national energy policy. Furthermore, the Government of Mauritania adopted a law that is to open up the electricity market for broad competition. Another action was the release of the first Poverty Reduction Strategy Paper (PRSP) for the period of 2005–2007. Its objective is to strengthen the energy sector and to expand the access to modern energy services while improving the overall supply reliability. The draft energy policy document of Mauritania aims to provide an electricity access rate of 35 % for the country's entire population by 2015. In view of RE, the key elements pointed out are:

- Establishment of appropriate institutions in order to manage the RE sector
- Consideration of tax reduction for RE equipment
- Investments in and promotion of national production of RE technologies

In order to successfully reach these goals, it will be necessary to facilitate adequate financing schemes for RE by establishing sustainable financing mechanisms. Furthermore, it is necessary to establish appropriate norms, codes of practice, guidelines and standards for the overall RE sector.

Today, the Government of Mauritania is in the process of building a set of policies and strategies for the promotion of RE. The regulatory and legislative frameworks need to facilitate rural electrification with strong contribution from RE. This reconstruction process is currently being developed. The main targets are to increase the rural electrification rate from 3 % in 2001 to 40 % in 2020. Furthermore, the contribution of RE to the national energy mix is to be increased to 15 % in 2015 and 20 % in 2020.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

As already mentioned, the focus within the electricity sector is the increase of the rural electrification rate. Up to now, only about 1 % of the rural population has access to electricity mainly coming from fossil energy. The rural electrification framework of Mauritania is regulated by the MEP, the Regulatory Authority, the Agency for the Promotion of Universal Access to Regulated Services and the Rural Electrification Development Agency. While the MEP determines the sector development policy including standards and decentralized electrification strategy, the Regulatory Authority prepares related laws and regulations. Furthermore, it provides licenses and amends proposals on the regulatory authority. The Rural Electrification Development Agency deals with programs and investment incentives for rural electrification. Recently, Mauritania joined the International Renewable Energy Agency (IRENA).

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

In general, Mauritania offers a broad variety of biomass resources. Formerly, about 556,000 tons of crop waste (rice husk, rice straw, etc.) were produced annually and offered an energy potential of about 3.7 GWh. Due to the ten year civil war (1991–2001) and the drastic interruption of the country's agricultural output, these former estimates are not valid anymore and therefore need to be revised for a more accurate assessment of the energy potential of crop wastes. In 2006, the Direction of Energy presented figures that estimate the available land area to 3.5 million hectares (3.5 % of the overall territory), leading to a total output of about 100,000 m^3.

4.2 SOLAR ENERGY

The solar energy potential of Mauritania is significant and offers around 4 to 6 $kWh/m^2/day$ with an average sunshine duration of 8 hours per day. Up to now, there is no detailed assessment of existing solar energy installations in Mauritania. Due to the significant solar energy potential, the implementation of PV installations is highly promising. Table 7 presents an overview of the available solar energy potential at different sites.

4.3 WIND POWER

According to data of the National Company of Meteorology of Mauritania, the wind potential of Mauritania is considerable, with an annual average of 5–8 m/s. A study of potential wind energy production capacities was conducted by the Department of Energy and the Electric Alizés project. Results show that two areas offer very high wind energy potential (Nouadhibou and the Marine Band Trarza between Nouakchott and the Senegal River) with wind speeds of more than 7 m/s. Another promising area for wind energy is located around the eastern border of Mauritania, offering average wind speeds of 6 m/s. As for the rest of the country, the average wind speed is around 3 m/s. In general, Mauritania offers a significant potential for small and medium wind power installations, especially in rural areas and in the North of the country.

4.4 HYDRO POWER

The hydroelectric network ensures an interconnection of the regional network of the Manantali dam that has been supplying the major cities of the valley (Rosso, Boghé and Kaédi) and the town of Nouakchott since 2002. The Manatali Hydro Power project was completed in 2003 and comprises of a 200 MW power station and a network of 1,300 km connecting the capitals of Mali, Mauritania and Senegal.

TABLE 7

Solar Energy Potential (kWh/m²/day)

	NOUAKCHOTT	ATAR	BIR-MORGHREIN	KIFFA	NEMA	NOUADHIBOU	TIDJIKJ	MINIMUM	MAXIMUM	AVERAGE
January	4.61	4.56	4.01	4.88	4.88	4.36	4.71	4.01	4.88	4.57
February	5.21	5.23	4.89	5.59	5.60	5.01	5.41	4.89	5.60	5.28
March	5.91	6.02	5.80	5.47	5.97	5.80	6.12	5.47	6.12	5.87
April	6.45	6.62	6.61	6.37	6.37	6.19	6.65	6.19	6.65	6.47
May	6.38	6.73	6.86	5.90	5.90	6.24	6.48	5.90	6.86	6.36
June	6.04	6.58	6.87	5.84	5.84	6.19	5.96	5.84	6.87	6.19
July	5.91	6.48	6.59	6.11	6.11	5.71	6.43	5.71	6.59	6.19
August	5.81	6.22	6.31	6.04	6.04	5.83	6.25	5.81	6.31	6.07
September	5.71	5.55	5.76	5.82	5.82	5.50	5.82	5.50	5.82	5.71
October	5.12	5.07	5.61	5.88	5.88	4.93	5.43	4.93	5.88	5.42
November	4.78	4.65	4.17	4.89	4.89	4.40	4.76	4.17	4.89	4.65
December	4.51	4.31	3.93	4.71	4.71	4.17	4.53	3.93	4.71	4.41
Minimum	4.51	4.31	3.93	4.71	4.71	4.17	4.53	3.93	4.71	4.41
Maximum	6.45	6.73	6.87	6.37	6.37	6.24	6.65	6.24	6.87	6.53
Average	5.54	5.67	5.62	5.63	5.67	5.36	5.71	5.36	5.71	5.60

Source: SEMIS, as of 2003/2004

5 MARKET RISKS AND BARRIERS

The lack of adequate policies and an appropriate legal and regulatory framework are the most significant barriers for the broad implementation or RE and the increased electricity access rate. Up to now, there is no energy policy that allows and supports private sector investments in the energy sector in general and RE in particular. The existing uncertainties for potential investors strongly ask for a commitment of the Government to liberalize the overall power sector of Mauritania. Some of the issues relating to the development of entrepreneurship for rural electricity supply and grid connection projects remain totally unclear.

Another critical barrier is the lack of financing and funding mechanisms. Up to now, there is only very little interest in the exploitation of RE, as funding and collaboration is one of the main challenges. Operators and investors wanting to get involved in the sector have often abandoned their activities because of the lack of sufficient support mechanisms.

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

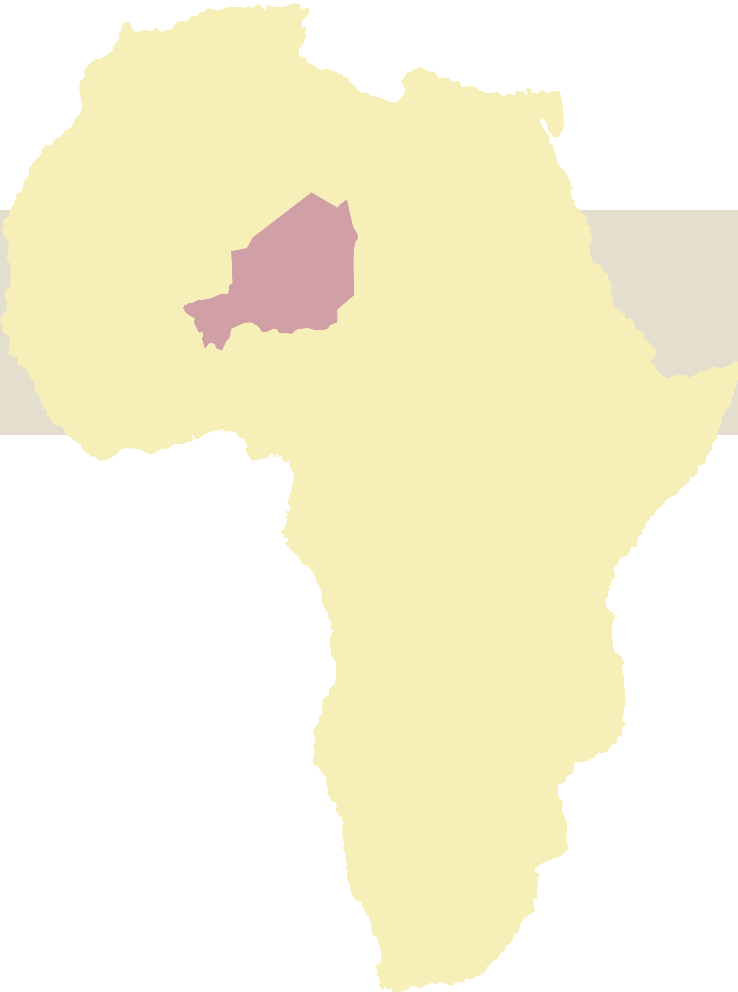
TABLE 8

Relevant Institutions in Mauritania

INSTITUTION	PROFILE	CONTACT
Ministry of Energy and Petrol (MEP)	Electricity sector policy formulation, planning and coordination	BP 335 Nouakchott Phone: +222 5252699
Ministry of Economic Affairs and Development	Economic affairs and development sector policy formulation, planning and coordination	BP 238, Nouakchott Phone: +222 5290435
Ministry of Finance	Sector policy formulation, planning and coordination	BP 197, Nouakchott Phone: +222 5253080
Ministry of Rural Development and Environment	Rural development and environment policy formulation, planning and coordination	BP 333, Nouakchott Phone: +222 5251500
Ministry of Equipment and Transport	Policy formulation, planning and coordination of the transport sector	BP 237, Nouakchott Phone: +222 5255640
Ministry of Mining and Industry	Policies, planning and coordination of the mining and industry sector	BP 199, Nouakchott Phone: +222 5253582
Société Mauritanienne de l'Électricité (SOMELEC)	National company for water and electricity supply	BP 335, Nouakchott Phone: +222 5256783

7 BIBLIOGRAPHY

- APERE (2003/2004): Développement des Énergies Renouvelables en Mauritanie, renouvelle n°8 6–7, 4e trimestre 2003 – 1er trimestre 2004 (www.apere.org/doc/0608-ER_mauritanie.pdf)
- Cellule de Contrôle de l'Énergie (2004): various data reviewed by author
- CIA – Central Intelligence Agency (2009): World Fact Book (www.cia.gov/library/publications/the-world-factbook)
- CIE (2007): Les Énergies Renouvelables en Mauritanie
- République de Maurétanie (2001): Code de l'Électricité 25/01/2001 Loi n° 2001 – 19/ Portant 2001
- Direction de l'Approvisionnement, Ministère en Chargé de l'Energie (2006): various publications (www.mauritania.mr/fr/index.php?niveau=6&coderub=4&codsoussous=124&codesousrub=9&codsoussous1=145)
- Direction of Environment (2008): various publications (www.mauritania.mr/fr/index.php?niveau=6&coderub=4&codsoussous=124&codesousrub=9&codsoussous1=138)
- Droit Afrique (2005): Mauretanie (WWW.DROIT-AFRIQUE.COM/IMAGES/TExTES/MAURITAnIE/MAURITAnIE)
- %20-%20PETROLE%20AVAL.PD
- N. N. (1999–2002): Document Tallies of Economic Policy of Universal Access
- Fall Mamadou (2002): SEMIS – Traditional Energy Use in the Sahel in ESI Africa
- FAO (without year): FOSA Document National de Prospective, par la FAO, Département des Forêts (www.fao.org/docrep/004/ab591f/AB591F09.htm)
- Government of IRM (2002): Letter of Intent, Memorandum of Economic and Financial Policies, and Technical Memorandum of Understanding – IMF
- Helimax Energie Inc (2004): Strategic Study of Wind Energy Deployment in Africa – Strategic Plan for Wind Energy Deployment in Africa (Executive Summary)
- IMF (2007): Poverty Reduction Strategy Paper, January 2007, IMF Country Report No. 07/40
- IMF (2003): Poverty Reduction Strategy Paper Progress Report, IMF, Country Report No.03/316
- IMF (2002): Mauritania. Letter of Intent, Memorandum of Economic and Financial Policies and Technical Memorandum of Understanding published by International Monetary Fund
- Institut de l'Énergie et de l'Environnement de la Francophonie – IEPF (2006): various publications (www.iepf.org/ressources/ressources.php)
- Islamic Republic of Mauritania (2002): Poverty Reduction Strategy Paper Implementation Report
- Kazadi Beneki TSHIBINGU (2004): Eskom Energie Manantali Presentation to NARUC
- Ministry of Water and Energy (2004): Sustainable Energy Management Program
- Ministère des Affaires Economiques et du Développement (2006): Rapport sur la Mise en Œuvre du Programme d'Action de Bruxelles (2001–2010) en Faveur de Pays les Moins Avancés (PMA)
- SEMIS (2003/2004): Plan d'Investissement pour l'Électrification Rurale en Mauritanie
- SOMELEC (2005): Statistiques de Consommation Énergétique de SOMELEC
- SOMELEC (2003): Coût des Facteurs de Production MAED
- N. N. (2003): Synthetic Note on the Strategy of Universal Access to the Basic Services in 2003
- UNCTAD (2006): Least Developed Countries Report 2006. Part II Chapter 5
- UNDP (2005): Human Development Report 2005 – International Cooperation at a Crossroad. Aid, Trade and Security in an Unequal World, United Nations, New York
- UNDP/International Institute for Sustainable Development (2005): Connecting Poverty and Ecosystem Services: Focus on Mauritania
- UNDP (2008): Human Development Index 2008 (HTTP://HDR.UnDP.ORG/En/STATISTICS)
- UNFPA (2005): State of World Population 2005 – The Promise of Equality. Gender, Equity, Reproductive Health and the Millennium Development Goals
- UNIDO: Les Énergies Renouvelables et le MDP en Mauritanie:
- (www.unido.org/fileadmin/import/ 42703_Mauritanie.pdf).
- US Department of State (2006): Background Note Mauritania
- World Bank: Mauritania Power and Water Sector Reform – Technical Assistance Project Vol. 1



COUNTRY CHAPTER: NIGER

Author of Country Chapter
Safiatou Alzouma (MSc. Eng.)

Coordination and Review of the Country Chapter
Anton Hofer, (MSE, Dipl.-Ing./FH, M.A.)
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS NIGER

ACRONYMS AND ABBREVIATIONS

NIGER

AIPO	African Intellectual Property Organization
ALG	Autorité du Liptako Gourma (Authority for Integrated Development of the Liptako Gourma Region)
ANDP	Alliance Nationale pour la Démocratie et le Progrès (National Alliance for Democracy and Progress)
ARM	Autorité de Régulation Multisectorielle (Authority of Multisector-based Regulation)
BIRD	Banque Internationale pour la Reconstruction et le Développement (International Bank for Development and Reconstruction)
CDM	Clean Development Mechanism
CDS	Convention Démocratique et Sociale (Social and Democratic Convention)
CFC	Companies Formalities Center
CILSS	Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel (Interstate Committee for Fight Against the Drought in the Sahel)
CNPG	Centre National de Perfectionnement et de Gestion (National Center for Perfection in Management)
CNEDD	Conseil National de l'Environnement pour un Développement Durable (National Environmental Council for a Sustainable Development)
CNIP	Conseil National des Investissements Privés (Private Investors National Council)
CNL	Conseil National de Liaison (National Connection Council)
ECOWAS	Economic Community of Western Africa States
GDP	Gross Domestic Product
GEF	Global Environmental Facility
LPG	Liquefied Petroleum Gas
MDG	Millennium Development Goals
MFP	Multifunctional Platforms Project
MNSD	Mouvement National pour la Société de Développement (National Movement for a Development Society)
NDA	National Designated Authority
NIGELEC	Société Nigérienne d'Électricité (Nigerian Electricity Society)
PAC	Programme d'Actions Communautaires (Community Actions Program)
PEC	Politique Énergétique Commune (Common Energy Policy)
PRASE	Programme de Référence d'Accès aux Services Énergétiques (Reference Program of Access to Energies Services)
PRBE	Programme Régional Biomasse Énergie (Regional Biomass Energy Programm)
PREDAS	Programme Régional de Promotion des Énergies Domestiques et Alternatives au Sahel (Regional Programm for Promotion of Domestic and Alternative Energies in the Sahel)
PV	Photovoltaic
RAF	Resource Allocation Framework
RE	Renewable Energy
RSD	Rassemblement Social et Démocrate (Social Democritic Assembly)
RDP	Rassemblement pour la Démocratie et le Progrès (Assembly for Democracy and Progress)
SDR	Stratégie du Développement Rural (Strategy of Rural Development)
SDRP	Stratégie du Développement Accéléré et de la Réduction de la Pauvreté (Strategy for Accelerated Development and Poverty Alleviation)
SNASEM	Stratégie Nationale d'Accès aux Services Énergétiques Modernes (National Strategy Access to Modern Energy)
SNCC	Société Nationale de Carbonisation du Charbon Minéral (National Company of Carbonization of Mineral Coal)
SONICHAR	Société Nigérienne de Charbon (National Coal Company of Anou Araren)
SONIDEP	Société Nigérienne des Produits Pétroliers (Nigerien Society of Petrol Products)
SONIHY	Société Nigérienne des Hydrocarbures (Gas Company Niger)
SNER	Stratégie Nationale sur les Énergies Renouvelables (National Renewable Energies Strategy)
SNED	Stratégie Nationale des Énergies Domestiques (National Strategy for Domestic Energies)
UNDP	United Nations Development Program
VAT	Value Added Tax
WIPO	World Intellectual Property Organization
UEMOA	Union Économique et Monétaire Ouest Africaine (West African Economic and Monetary Union)

MEASUREMENTS

km	kilometer
mm	millimeter
kg	kilogram
t	tons
m^3	cubic meter
m^2	square meter
kWh	kilowatt hours
kWp	kilowatt peak
m/s	meter per second
MW	megawatt (1 MW = 1,000 kW)

SUMMARY

The Country Study of Niger is to provide an overview of the country's energy market and to support decision-making for private investments for the renewable energy sector in Niger. The study is structured as follows:

Chapter one provides **Background Information on Niger**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Niger.

Chapter two summarizes facts and figures of **Niger's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Niger. This includes an overview of support mechanisms for PV as well as already existing regulations, incentives and legislative framework conditions.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Niger.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on Renewable Energies.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Niger.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

The Republic of Niger is an enclosed West African country, the nearest coast is about 600 km away. It is situated between longitudes 0° 16' East and 16° East and latitudes 11° 1' North and 23° 17' North. The country is limited by Algeria and Libya in the North, by Nigeria and Benin in the South, by Chad in the East and by Mali and Burkina Faso in the West.

FIGURE1

Map of the Republic of Niger

The territory is divided into 8 areas, 36 provinces and 265 districts. The country is crossed by the Niger River, the country's only permanent river, covering a length of 550 km. Niger covers a surface area of 1,267,000 km² two-thirds of which are desert. According to the last population census of 2001, Niger's population is estimated at 11,060,291 inhabitants with an annual average population growth of 3.1 %. In 2006, the population was estimated at approximately 13 million inhabitants equaling 4.7 % of the Economic Community of Western Africa States (ECOWAS) population estimated at over 270 million people. About 47.6 % of Niger's population is under 15 years, and 83 % are living in rural areas.

Three quarters of the population live in the southern part of the country, representing 25 % of the total surface area of the country. The environmental constraints (decrease and bad repartition of rainfalls) were followed by a progressive decrease of the agricultural areas representing only 12 % of the national territory today. The climate is of Sahelian type characterized by two main seasons: a long dry season lasting up to nine months and a rainy season covering three to four months. The country has four agro climatic zones:

- The Sahelo-Sudanese zone representing approximately 1 % of the total surface area of the country with up to 600 to 800 mm of rain during a normal year
- The Sahelian zone covering 10 % of the country with 350 to 600 mm of rain
- The Sahelo-Saharan zone representing 12 % of the total surface area of the country with 150 to 350 mm of rain per year
- The Saharan zone covering 77 % of the country with less than 150 mm of rain

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

The Republic of Niger was a former French colony that gained its independence in August 1960. Since 1993, the country has been a multiparty democratic sovereign state with a semi-presidential government system where the deputies are elected democratically. The current President is Mr. Tandja Mamadou from the MNSD (Mouvement National pour la Société de Développement – National Movement for a Development Society), the dominant political party of the country. The parliament counts 113 deputies from seven political parties. The Government includes ministers from the CDS (Convention Démocratique et Sociale – Social and Democratic Convention), RSD (Rassemblement Social et Démocrate – Social Democratic Assembly), RDP (Rassemblement pour la Démocratie et le Progrès – Assembly for Democracy and Progress) and ANDP (Alliance Nationale pour la Démocratie et le Progrès – National Alliance for Democracy and Progress) which were in coalition with the MNSD during the run-off election in 2004.

Classified as one of the poorest countries in the world, Niger's Republic Gross Domestic Product (GDP) per capita was 216 Euro in 2006, representing 1.83 % of the GDP in the ECOWAS zone. All parameters related to the poverty level evaluation show that poverty still exerts high impact on the country. Poverty lines corresponding to a minimal annual spending of 220 Euro in urban areas and 161 Euro in rural areas indicate that 62.1 % of Nigerians are poor (as of 2005 and without significant improvement up to now). In the household sector, the impact of poverty is estimated at 53 %, about 66 % of the households consider themselves as relatively poor, while 20 % of them perceive themselves as being extremely poor. The relation is similar in both, rural and urban areas. Today, the struggle against poverty and the research for sustainable and steady economic growth are the most important issues for Niger.

Against this background, the SDRP (Stratégie du Développement accéléré et de la Réduction de la Pauvreté – Strategy for Accelerated Development and Poverty Alleviation) was adopted by the Government and approved of by the development partners for financial issues in 2007. The SDRP has seriously taken into account the fact that the reduction of poverty goes along with a strong and sustained growth of resources and creation of employment, notably in the sphere of people considered as poor and in rural areas, by guaranteeing an overall cross-linking of the existing sector-based programs and strategies.

The economy of Niger is dominated by the agro-pastoral sector representing 36 % of the GDP (with 42 % of the earnings resulting from exportations) and employing 85 % of the population. In 2006, Niger's exports within the ECOWAS came to about 147,765 tons (consisting mainly of agro-pastoral and forest-related products) with earnings of 58 million Euros. Niger's major export customers are Nigeria (50.7 %), Ghana (29.3 %) and Côte d'Ivoire (11 %). The imports come to about 454,366 tons with spendings of 150 million Euros. 33.5 % of the exports come from Benin, 16 % from Nigeria, 14.7 % from Togo and 13.34 % from Côte d'Ivoire. The volume of exports and imports of the country (2.58 % of the whole ECOWAS) is much smaller than in the other countries in the region.

The mining sector constitutes an important pillar of the country's economy. Uranium still represents one of the main resources of the country (55 % of GDP in 2004) with Niger being the No. 1 producer of uranium in the third world. With the renewed international demand for uranium, the national economy experienced a considerable increase in the years 2006 to 2008.

With the current rate of economic and social development of the country, it will be very difficult to achieve the Millennium Development Goals (MDGs) until 2015. The improved access to energy services appears as an option to achieve the MDG for the social basic sectors (health, education, water supply). The Government of Niger adopted an energy policy statement in 2004 with focus on:

- The increase of accessibility for households to energy source, particularly in rural areas
- The promotion of energies substituting wood energy
- The securing of energy supplies
- The evaluation of the national energy resources
- The promotion of environmental protection
- The control of the energy-related statistical data
- The intensification and development of cooperation within the energy sector

This statement corresponds to the ECOWAS regional energy policy, namely the White Paper[1] adopted in January 2006 in Niger by the 29th Summit of the Authority of Heads States and Government. The White Paper aims at engaging ECOWAS member states and the region in an ambitious regional policy towards the increment of access to modern energy services. Its objective is to establish electrification for at least half of the population in rural and peri-urban areas by the year 2015, i.e. enabling 36 million more households and 49,000 extra localities to access modern energy services.

On the basis of the white paper directives a Multisectoral Energy Committee was created in Niger. It aims at developing synergies between the energy sector and other strategic sectors, to support cooperations in order to integrate energy objectives in their projects and programs and to increase access to energy within the social infrastructures. In order to achieve the regional policy global objective, the committee has prepared the SNASEM (Stratégie Nationale d'Accès aux Services Energétiques Modernes – National Strategy Access to Modern Energy). The PRASE (Programme de Référence d'Accès aux Services Energétiques – Reference Program of Access to Energies Services) was set up to implement the White Paper objectives in the National Policy framework. The program is meant to bridge the existing gap between the current effective access rate to energy services and the necessary access to energy rates in order to achieve the MDG. The program focuses on the access to energy facilities for social and productive sectors (health, education, agriculture and water) through:

- Access to modern fuels for cooking (mineral coal, butane gas, biogas)
- Access to motive power (solar multi-functional platforms, wind energy)
- Access to electricity

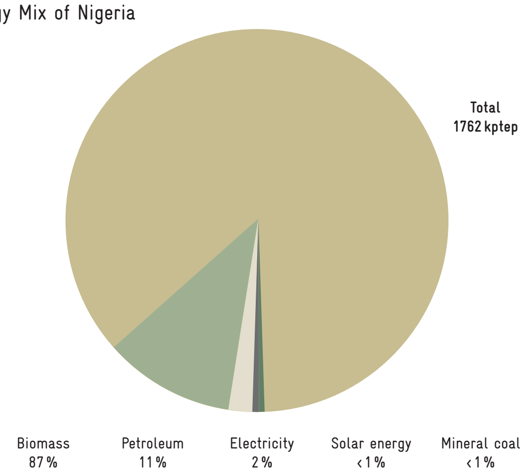
2 ENERGY MARKET IN NIGER

2.1 OVERVIEW OF THE ENERGY SITUATION

The overall energy situation of Niger can be divided into two aspects. The first aspect deals with the modern energies inter alia conventional electricity, oil products and renewable energies (RE). In Niger, 87 % of the electricity is imported from Nigeria through an interconnecting network. The local thermal coal and diesel production represents 13 %. Oil products, essentially gasoline, diesel oil, kerosene and LPG, are imported from Persian Gulf Countries and Nigeria. Figure 2 visualizes the energy mix of Niger.

FIGURE 2

Energy Mix of Nigeria



Source: SIE, as of 2006

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

As already stated, about 87 % of the electricity are imported from Nigeria. The local production (thermal power from coal and diesel) contributes but 13 %. Table 1 presents an overview of the electricity sector key facts. The current price of electrical power is indicated in table 2.

Petroleum Sector

The petroleum sector mainly depends on imports. Gasoline, diesel oil, kerosene and LPG are almost exclusively imported from Persian Gulf Countries and Nigeria. Table 3 indicates the imports and investments in the petroleum sector of Niger. Current prices are presented in table 4.

1 ECOWAS/UEMOA, 2005

TABLE 1
Consumption and Investment in the Electricity Sector

	2000	2001	2002	2003	2004	2005	2006
Production Sonichar (GWh)	134.870	134.400	143.670	148.830	154.750	158.470	167.500
Production Nigelec (GWh)	64.280	39.723	40.666	42.642	45.856	43.166	26.300
Total Production (GWh)	199.150	174.123	184.336	191.472	200.606	201.636	193.800
Imports (GWh)	203.826	219.882	210.995	234.766	295.340	339.002	356.590
Consumption	402.976	394.005	395.331	426.238	495.946	540.638	550.390
Investments (Euro)	3,810,996	7,454,159	10,113,288	7,650,690	13,156,298	18,420,650	13,595,391

Source: Ministry of Mines and Energy and Ministry of Trade, Industry and Normalization, as of 2008

TABLE 2
Electricity Prices

DOMESTIC USE	INDUSTRIAL USE
0.122 Euro/kWh	0.084 Euro/kWh

Source: Ministry of Mines and Energy and Ministry of Trade, Industry and Normalization, as of 2008

TABLE 3
Imports and Investments in the Petroleum Sector of Niger

TYPE OF FUEL	2000	2001	2002	2003	2004	2005
Kerosene (m^3)	11,892	8,912	11,009	13,589	13,995	8,802
Gasoline (m^3)	66,000	97,934	96,387	105,365	98,385	96,148
Jet (m^3)	17,755	9,256	12,057	12,566	14,430	15,665
Diesel (m^3)	72,466	70,061	85,210	90,500	96,616	105,818
Heavy fuel (m^3)	10,832	8,288	5,511	9,974	11,544	3,658
Jet (t)	350	141	197	96	75	45
Lubricant (t)	2,829	3,853	3,496	2,966	391	3,123
Bitumen (t)	137	829	7,232	11,004	15,159	4,373
Investments (Million Euro)	78	69	74	84	98	115

Source: SONIDEP, as of 2007

TABLE 4
Price of Petroleum Products

DIESEL	GASOLINE	KEROSENE	LPG
1.021 Euro/liter	0.983 Euro/liter	0.633 Euro/liter	0.671 Euro/kg

Source: Ministry of Mines and Energy and Ministry of Trade, Industry and Normalization, as of 2008

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The import, transport, distribution and production of electricity and oil products are controlled by the Ministry of Mining and Energy (MME), the Ministry of Trade, Industry and Normalization through numerous laws and their decree of implementation in collaboration with the ARM (Autorité de Régulation Multisectorielle – Authority of Multisector-Based Regulation). The Ministry of Environment and the MME are responsible for the management of traditional energies, respectively the matching of demand and supply. The legislation is governed by an order that regulates the organization of the marketing and the transport of firewood in big cities, the applied tax system and the detailed guidelines.

Like other UEMOA/ECOWAS countries, Niger is subject to the Common Legislative System stipulating the free movement of people and materials and the application of the Common External Tariff for importation within the Community.

The Ministry of Mining and Energy (MME) is in charge of sector-based policy and defines the legislative and statutory frame of the activities for production, transport, import, export and distribution of energy in Niger.

The Ministry of Environment and Struggle Against the Desertification is in charge of the management of the supply of the wood energy.

The Ministry of Trade, Industry and Normalization is in charge of the regulation of trade issues.

The CNEDD (Conseil National de l'Environnement pour un Développement Durable – National Environmental Council for a Sustainable Development) created by the Government in January 1996 defines the orientation and coordination of environmental policies related to sustainable development.

The ARM (Autorité de Régulation Multisectorielle – Authority of Multisector-Based Regulation) was created in 1999 and regulates the sectors of energy, telecommunication, transport and water.

The CNES (Centre National de l'Énergie Solaire – National Center of Solar Energy) is a public administrative structure created in 1998. It conducts research work and is in charge of the realization of prospective and diagnostic studies as well as of the involvement of the training and promotion of the distribution of equipments in the field of RE.

NIGELEC, a national electrical company created in 1968, has the monopoly of the transport and distribution of the electricity power supply nationwide.

SONICHAR, the national coal company of Anou Araren created in 1975, produces electricity from coal and provides it to mining companies and the neighboring towns.

SONIDEP was created in 1977 in order to assure the continuity and safety of hydrocarbons and sub-products supply in the country, notably in terms of the constitution and the inventory control of safety in association with the other existing companies.

SNCC (Société Nationale de Carbonisation du Charbon Minéral – National Company of Carbonization of Mineral Coal) was created in 2004 and aims at the promotion of mineral coal as energy for cooking in households.

Activities related to the import and distribution of LGP are carried out by the three local companies of **SONIHY, Niger Gas and Total Gas**.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The statement for energy policy adopted by the Government in 2004 has been followed by many strategies and action plans for the promotion of RE. In the following, a brief overview of this policy is presented.

SNER (Stratégie Nationale sur les Énergies Renouvelables – National Renewable Energies Strategy) aims at the increased contribution of RE to the national energy balance from less than 0.1 % in 2003 to 10 % by 2020 by:

- Facilitating the promotion of supply systems based on RE
- Alleviating women's domestic tasks
- Reducing the impact on forest resources and reforestation of natural resources
- Promoting rural electrification on the basis of RE resources
- Promoting education, training, research and the development related to RE technologies

SNASEM aims to improve the supply of a higher percentage of the population with modern energies by 2015 through granting:

- Access to modern fuels for cooking
- Access to motive power for villages with 1,000–2,000 inhabitants
- Access to electricity for rural and peri-urban populations to reach a cover rate of 66 %

SNED (Stratégie Nationale des Energies Domestiques – National Strategy for Domestic Energies) aims at the creation of a global and coherent frame for intervention in the subsector of domestic energies by:

- Assuring a sustainable use of forest resources and better reforestation
- Promoting alternative sources of energy (other than wood) and improving the efficiency of the appliances
- Strengthening the capacity of the main actors for a better management of the sector and setting up an adequate frame of operation
- Setting up an adequate frame of communication to inform and educate the actors on issues related to the production and use of domestic energies

RE programs have been described in the major reference documents for the development of the country. The SDRP, as stated above, plans to endow the country with economic infrastructures through its "Development of Infrastructures". It is intended to stimulate the growth and to facilitate the access to social facilities by promoting RE. SDR (Stratégie du Développement Rural – Strategy of Rural Development) with its sub-program "4–4 – Renewable Energy and Rural Electrification" considers the access to electricity to help rural communities in developing their local economy and the improvement of their living conditions. The same strategy plans in its program „10 – Environmental Protection" the use of alternative sources of energy for the substitution of wood.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

Up to now, RE is not subject to any legislative text of Niger. A law on renewable energy, however, is currently being formulated. Through this law, the Government can provide support in the form of loans, subsidies, fiscal advantages etc. in order to promote the increased utilization of RE. This is very important because PRASE grants (see page 9) a privilege for RE projects.

Companies importing RE equipment can benefit from incentive measures facilitating the acquisition. At present, imported RE equipment is rated and taxed as electronic material. The new law intends to exonerate all imported equipment used in the field of rural electrification and rural water pumping from taxes. It also aims to create a national rural electrification fund.

Quite a number of sub-sectors are in charge of the implementation of projects regarding the CDM (Clean Development Mechanism). As the national focal point of three "Post-Rio" Conventions, CNEDD was appointed as National Designated Authority (NDA) of the CDM in Niger on 5 June 2006. As such, the CNEDD registered and approved the first MDP project of the Niger "Initiative Bio-Carbon of the PAC" (Programme d'Actions Communautaires – Community Actions Program). This project is financed by the World Bank[2] One of its objectives is the restoration of land through the plantation of 23,000 trees (acacia senegal) throughout the whole territory.

RE attract increasing interest due to their advantages as compared to fossil fuel. Therefore, many financing mechanisms for promoting RE are being started on regional and international level. In Niger, the following actions have so far been taken:

- Technical and Financial Partners' Round Table for PRASE Financing in 2009
- Resource Allocation Framework (RAF 4) of the Global Environmental Facility (GEF) Program
- European Union Energy Facility
- Clean Development Mechanism (CDM)
- Small Grant Program of GEF for the RE Promotion
- The Regional Program for the Promotion of Household and Alternative Energies in the Sahel of the Permanent Inter States Committee for Drought Control in the Sahel
- Regional Biomass Energy Program of UEMOA/ECOWAS
- Regional Program Energy Against Poverty of UNDP

Locally, the UNDP representation grants institutional support and finances pilot projects in order to promote the use of the RE within the framework of its annual Country Program Support.

Governmental Projects and Programs

The Special Energy Program, which ended in 2001, is the last German RE program conducted in Niger. In 2004, during the Bonn International Conference for Renewable Energies (renewables 2004), Germany has emphasized its interest to support the implementation of an RE strategy for Niger adopted by the Government in January. Just after this meeting, the RE sector was integrated into the Niger/Germany bilateral cooperation.

The Programme Régional de Promotion des Énergies Domestiques et Alternatives au Sahel (PREDAS) is implemented by the CILSS and the state members with financial support of the EU and the German Development Cooperation. It aims at helping the country members to organize sustainable supply and rational use of domestic energies by the inhabitants of Sahelian zone avoiding harmful impact on the environment.

The Programme Régional Biomasse Énergie (PRBE) is implemented by the ECOWAS/UEMOA with the financial support of the Netherlands. This program joins the framework of the implemented PEC (Politique Energétique Commune – Common Energy Policy) of the UEMOA and contributes to the long-term management of biomass energy in a policy to fight poverty and promote environmental protection.

ALG (Autorité du Liptako Gourma – Authority for Integrated Development of Liptako Gourma Region) has elaborated a plan for developing the energy sector in this region (located between Burkina Faso, Mali and Niger) from 2007 to 2025. This plan aims to fight poverty and contribute to a harmonious and integrated development of the region through the introduction of modern forms of energy (electricity, mobility) and the reduction of harmful environmental influences.

PRASE is part of the program to reduce poverty in Niger. The program focuses on the access to energy facilities for social and productive activities (cooking, motive power and electricity) for the entire population of Niger in order to achieve the MDG.

The GEF has accorded 1,525,000 Euro for the development of RE projects through its Resource Allocation Framework (RAF). Also GEF is financing some demonstrative projects for the promotion of RE through its Small Grant Program.

The Multi-Functional Platforms Project (MFP) aims at bringing motive power to rural areas. The project was initiated in Mali in 1996 with the backing of UNDP and UNIDO and has since then been extended to Senegal, Burkina Faso, Ghana, Nigeria and Guinea. Its goal is poverty reduction in general, but specifically poverty of rural women, by enabling them to create income generating opportunities through the supply of energy services.

2 BANQUE MONDIALE/WORLD BANK,2009

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

The potential for energy from biomass is substantial in Niger. Table 5 presents the technical potential for energy from biomass. Biogas is only used at experimental scale. Currently, about 10 small-scale biodigesters (dome type) are in operation.

TABLE 5

Technical Potential for Energy from Biomass

TYPE	POTENTIAL	EXPLOITED	LOCALIZATION	DETAILS
Forest Animal waste Agricultural waste	9.9 million ha 55,018,000 tons 4,084,200 tons	3.52 million ha 50,180 tons 40,842 tons	all over Niger	Used for cooking purposes
Biofuels	999,451 ha	100 ha	South of Niger	Jatropha

Source: Inventory 2006 CNES, as of 2006

4.2 SOLAR ENERGY

The average solar energy potential ranges between 5–7 kW/m² per day, while the average period of sunshine varies between 7 and 10 hours per day. In 2006, the power installed in the sector of solar photovoltaic (PV) was estimated at 1,170 kWp. The current use of solar thermal energy (hot water) accounts for about 2,000 m² of absorbers. The use of solar cooking and drying is very low. Table 6 presents an overview of solar energy technologies already implemented in Niger.

TABLE 6

Solar Energy Technologies in Niger

TECHNOLOGY	INSTALLATIONS	UTILIZATION PURPOSE
Solar drying	31	Industrial drying of meat, cereals, fruit etc.
Solar water heating	600	Household use, industrial water heating
PV Systems	no data available	Lighting, ventilation, water pumping, refrigeration etc.

Source: CNES Inventory, as of 2006

4.3 WIND POWER

The average wind speed is 5 m/s in the northern part of the country and about 2.5 m/s in the South. Currently, about 30 small-scale installations are used for water pumping purposes.

4.4 HYDRO POWER

Niger has more than 270 MW of economic Hydro Power potential that is only partially developed up to now. Potential and already exploited Hydro Power capacities are summarized in Table 7.

TABLE 7

Hydro Power Potential of Niger

POTENTIAL	EXPLOITED	LOCALIZATION	DETAILS
125.0 MW	125.0 MW	Kandadji Niger River	since 2008
122.5 MW	–	Gambou Niger River	not exploited yet
26.0 MW	–	Dyondounga Affluant Niger River	not exploited yet

Source: CNES Inventory, as of 2006

5 MARKET RISKS AND BARRIERS

In view of administrative, economic and political issues, there are almost no risks for investments in Niger. In the promotion of the private sector, the legal security of business is a major objective aiming at the implementation of business jurisdiction. The Chamber of Trade, Agriculture, Industry and Crafts is establishing a Center of Promotion and Reference as a specialized institution for the promotion of business in Niger consisting of:

- The CNPG (Centre National de Perfectionnement et de Gestion – National Center for Perfection in Management) for the intensification of the managing capacities of the human resources
- The CFC (Companies Formalities Center) assisting companies and individuals in dealing with formalities and official statements of all relevant regulations in the legal, administrative, social, fiscal and statistical sector
- The Center for Investments Promotion supporting potential investors and providing orientation, advice and assistance as stated by the private investment promotion policy of Niger

As to scientific work, Niger applies the WIPO (World Intellectual Property Organization) and AIPO (African Intellectual Property Organization) legislation in a systematic way. The national office related to the Federal Ministry of Commerce represents the African Intellectual Property Organization of CNL (Conseil National de Liaison – National Connection Council). This office is in charge of the application of the administrative procedures and the recordings at national level. In general, the rights of property are granted and guaranteed. Professional activity is based on the principle of free enterprise complying with the liberalization of the economy. Only some activities related to the sectors of bars, cattle and meat, leather and skins as well as mining and oil exploitation are governed by legislative and statutory documents or a specific organization. Investments are encouraged and put down by the implementation of the CNIP (Conseil National des Investissements Privés – Private Investors National Council) proposing measures for the elimination of problems inhibiting the creation and exploitation of companies. In order to fulfill the requirements for efficient commercial activities, the investment code defines the conditions for the implementation of the investments and specifies guarantees and favors as well as the obligations involved.

In article 2, the code stipulates that the Republic of Niger guarantees a constant legal and judicial protection to all private investments in the realization of economic and social development programs. Article 7states that the Republic of Niger Republic guaranties to existing or future enterprises not to undertake any act of expropriation or nationalization, except such cases that are of public use and at the same time covered by the law. If – in the latter case - measures of expropriation or nationalization are carried out compensation for the private actors concerned is also covered by the law. Article 6 of the same code states: "The settlement of problems related to the validity, interpretation or implementation of the agreement act and the eventual determination of the allowance due to the ignorance or no respect to the commitment will be solved through a legal procedure established within the agreement act", i. e.:

- The implementation of collegial referees
- The possibility for citizens to appeal to the International Center of Jurisdictional Court related to the investments created by the International Bank for Development and Reconstruction (BIRD, Banque Internationale pour la Reconstruction et le Développement)

According to article 9, the present code applies to both, physical persons and companies of all nationalities operating or intending to operate on the following sectors:

a. Agricultural activities
  - Industrial agriculture
  - Activities related to vegetal or animal products
  - Animal breeding, fishing etc. for exportation

b. Manufacturing/production activities
c. Energy production
d. Exploitation of mineral products and substances as well as the transformation, except those that are already governed by the mineral law and petroleum cod
e. Social habitation implementation program in the propose of selling or inheriting
f. Industrial equipment maintenance activities
g. Air transportation
h. Hotel construction and equipment
i. Telecommunication (telephone and internet)

Finally, the code allows three privileged regimes:

1. Regime A, related to promotional objectives, for investments of less than 76,220 Euro during a period of 5 years; according to this regime, the enterprise in step of investment has a total exoneration on:

   - Duty and tax excluding VAT on the statistics royalties
   - Duty and tax with VAT of the services offering, services related to the investment program

2. Regime B, related to priority objectives, for investments ranging from about 76,220 to 152,440 Euro; in this regime, the enterprises have the followings advantages (tax exemptions):

   - Duty and tax with VAT of the services offering, services related to the investment program
   - Duty and tax excluding VAT on the statistics royalties

But, in case of availability of an equivalent product, the importation of materials and equipments is not entitled to exoneration. In the course of the implementation, a total exoneration is given to:

- License
- Tax on real estate
- Landowner tax
- Tax on industrial and commercial benefit
- The minimum basic allocation tax

3. Regime C, relating to conventional objectives, obtained after a convention signed between the Government of Niger and the company concerned. In this regime, other advantages in addition to that of regime A and B are considered, as the reduction of 50 % of the tax (tax exemption) on fuel and energies used in the related process.

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 8
List of Local Business Partners

NAME	ADDRESS	FIELD of Activity
BETP	P.O. Box: 2272 Niamey/Niger Phone: +227 20 73 54 15 Fax: +227 20 73 80 48 betp@intnet.ne	Telecommunication, electricity, electronics
Sahel Energy	P.O. Box: 45 Filingué/Niger Phone: +227 96 96 26 10 seolien@yahoo.fr	Wind energy installations
Solaris	P.O. Box: 12 040 Niamey/Niger Phone: +227 20 72 21 90 ernstzippel@hippos.de	Renewable energy
SIC Solar COM	P.O. Box: 13 643 Niamey/Niger Phone: +227 20 35 04 18 sic-int@intnet.ne	Renewable energy, Hydraulics and Telecommunication
TOUTHYDRO-Niger	P.O. Box: 13 613 Niamey/Niger Phone: +227 20 74 01 73 Fax: +227 20 74 02 91 thn@intnet.ne	Water, electricity, solar energy
Entreprise Electro-mécanique (ENTRELEC)	P.O. Box: 10 830 Niamey/Niger Phone: +227 20 73 45 03 Fax: +227 20 73 32 83 entrelec@intnet.ne	Mechanical and electrical industries
Société Nigérienne d'Energie Solaire (SONIES)	P.O. Box: 631 Niamey/Niger sonies@intnet.ne	Import of solar energy equipment
Manutention Africaine-SA	P.O. Box: 10387 Niamey/Niger Phone: +227 20 73 36 10 Fax: +227 20 73 33 48 maniger@intnet.ne	Solar energy equipment and training
Total Fina Elf Niger	P.O. Box: 10349 Niamey/Niger Phone: +227 20 74 27 67 Fax: +227 20 74 26 92 totelfdg@intnet.ne	Distribution of petroleum products
Nigerian Enterprise of Electricity (ENGE)	P.O. Box: 12517 Niamey/Niger Phone: +227 20 74 30 86 Fax +227 20 74 34 23 enge@intnet.ne	Electricity, electrical equipment, solar energy
Toutelec Niger-SA	P.O. Box: 12755 Niamey/Niger Phone: +227 20 74 01 15 Fax: +227 20 74 07 84 toutelec@intnet.ne	Supply and maintenance of telecommunication equipment
AMI Services Plus	P.O. Box: 12602 Niamey/Niger Phone: +227 20 73 35 32 Fax: +227 20 73 20 17	Electricity supply and solar energy equipment
BATIMAT	P.O. Box: 2968 Niamey/Niger Phone: +227 20 73 42 12 Fax: +227 20 73 41 99 batimat@intnet.ne	Electrical and PV equipment
Nigerian Group of Electricity	P.O. Box: Niamey/Niger Phone: +227 20 73 49 44	Electrical and PV equipment

Technical Enterprise of Electromechanical Equipment	P.O. Box: 12096 Niamey/Niger Phone: +227 20 74 17 71 atembym@intnet.ne	Installation, maintenance and repair of electrical equipment
KBC	P.O. Box: 10541 Niamey/Niger Phone: +227 20 74 12 25 Fax: +227 74 11 09	Electrical and PV equipment
CFAO Niger	P.O. Box: 204 Niamey/Niger Phone: +227 20 74 01 58 Fax: +227 20 74 28 87 cfaongr@intnet.ne	Air Conditioning and refrigeration
SNS	P.O. Box: 11512 Niamey/Niger Phone: +227 20 310123	Hydraulics and solar equipment

TABLE 9

List of Local Experts

NAME	ADDRESS	Field of Activity
DOGARI Ingenierie	P.O. Box: 10470 Niamey/Niger Phone: +227 20 74 07 98 dogari@intnet.ne	Engineering of solar energy and hydraulics
SCP Agence ARCHI Plus	P.O. Box: 638 Niamey/Niger Phone:+227 20 73 41 25 Fax: +227 20 73 65 19 archi-pl@intnet.ne	Engineering of solar energy, hydraulics and civil building
Techni-Consult	P.O. Box: 11732 Niamey/Niger Phone: +227 20 73 80 04 Fax: +227 20 73 81 23 tconsult@intnet.ne	Engineering of hydraulics and civil building
NAMOSOLAR sarl	P.O. Box: 11489 Niamey/Niger Phone: +227 96 99 70 88 namosolar@yahoo.fr	Hydraulics engineering, civil engineering
KRB	P.O. Box: 10265 Niamey/Niger Phone: +227 20 73 47 53 Fax +227 20 73 53 83 krb@intnet.ne	Hydraulics engineering, civil engineering, engineering in solar energy
BS RA	P.O. Box 13646 Niamey/Niger Phone: +227 20 73 99 15 bsira niger@yahoo.fr	Hydraulics engineering, civil engineering, engineering in solar energy, biofuels
I3EA	P.O. Box: 10209 Niamey/Niger Phone: +227 20 34 02 97 ibrah04@yahoo.fr	Engineering, water, energy and environment

Source: UNESCO, Étude sur l'Identification des Centres d'Excellence en Énergies Renouvelables au Niger; as of 2007

TABLE 10

List of Public Institutions

NAME	ADDRESS	FIELD OF ACTIVITY
Ministry of the Mines and Energy-MME	P.O. Box: 11 700, Niamey/Niger Phone: +227 20 73 45 82 Fax: +227 20 73 27 59 mme@intnet.ne	Mining, geology, energy
Direction of Renewable Energies and Domestic Energies-DERED/ mmE	P.O. Box: 11 700 Niamey/Niger Phone: +227 20 73 65 30 Fax: +227 20 73 27 59 mme@intnet.ne	Renewable energies and domestic energies
Energy Information System SIE-Niger	P.O. Box: 11 700 Niamey/Niger Phone: +227 20 73 97 87 zmouhou@yahoo.fr	Management of energy information
MME Rural Electrification Cellule	P.O. Box 11 700 Niamey/Niger Phone: +227 96 53 48 37 mme@intnet.ne	Strategy of rural electrification
Ministry of Hydraulics and Environment	P.O. Box: 257 Niamey/Niger Phone: +227 20 72 38 89 dregef@intnet.ne	Environment and struggle against the desertification
Ministry of the Trade, Industry and Promotion of the Private Sector	Phone: +227 20 73 69 46 Fax: +227 20 73 21 50	Trade, industry and promotion of the private sector
Ministry of Local Communities Development	Phone: +227 20 72 53 22	Communities development
Ministry of the Population and Social Action	Phone: +227 20 72 23 30 Fax: +227 20 73 61 65	Population and social aspects
Ministry of Economy&Finance	Phone: +227 20 72 23 74	Economy and finance
Ministry of Transport	Phone: +227 20 73 47 82 Fax:+227 20 73 54 89	Transport
National Council of Environment and Sustainable Development-CNEDD	P.O. Box: 10193 Niamey/Niger Phone: +227 20 72 25 59 Fax: +227 20 72 29 81 biocnedd@intnet.ne	Environment, renewable energy, domestic energy

Source: UNESCO, Étude sur l'Identification des Centres d'Excellence en Énergies Renouvelables au Niger, as of 2007

TABLE 11

List of Research Institutes

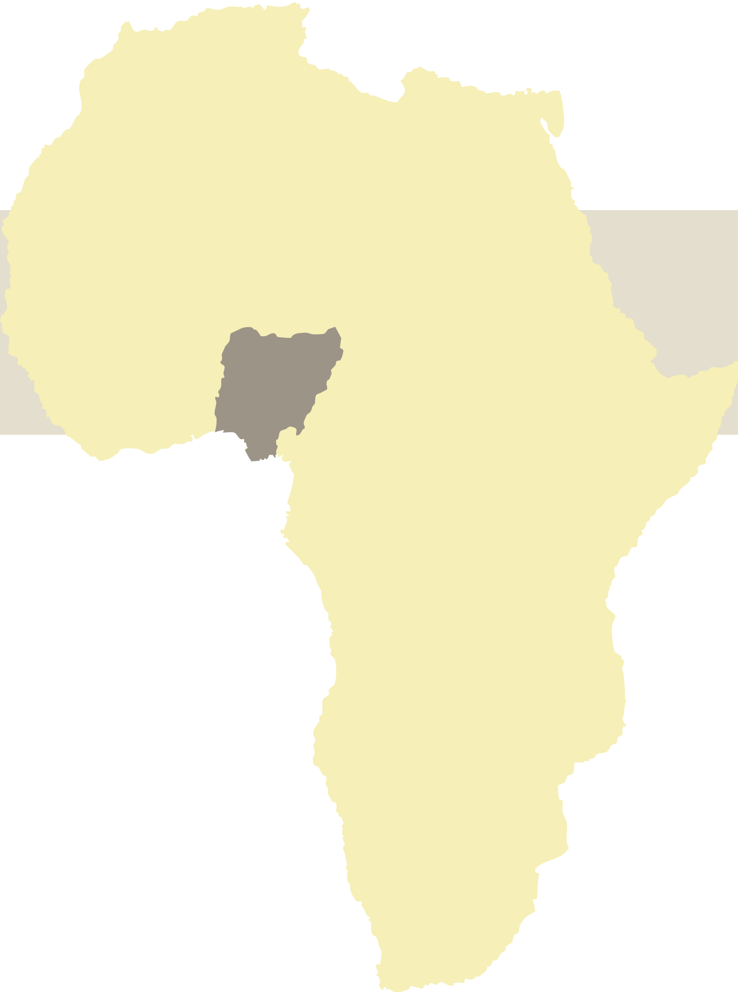
NAME	ADDRESS	FIELD OF ACTIVITY
Abdou Moumouni University of Niamey-UAM	P.O. Box: 237/10896 Niamey/Niger Phone: +227 20 73 25 31 Fax : +227 20 73 38 62 ilimi@uam.ne	Research on energy, environment, hydraulics, health, education, agronomy, social science etc.
National Center of Solar Energy-CNES	P.O. Box: 621 Niamey/Niger Phone: +227 20 72 39 23 Fax: +227 20 72 55 60 cnes@intnet.ne	Renewable energies, energy efficiency research of solar energies
National Institute of Agronomic Research-INRAN Niger	P.O. Box: 429 Niamey/Niger Phone: +227 20 72 27 14 Fax: +227 20 72 34 34 inran@intnet.ne	Research on solar energy, food conservation, agronomy and environmental aspects
School of Mining and Geology-EMIG	P.O. Box: 732 Niamey/Niger Phone: +227 20 31 51 00 Fax: +227 20 73 37 97 emig@intnet.ne	School of engineering, training, research on solar energy, education, engineering, environment etc.
Regional Center of AGRHYMET-CRA	P.O. Box: 11 011 Niamey/Niger Phone: +227 20 73 31 16 Fax: +227 20 73 24 35 admin@sahel.agrhymet.ne	School of engineering, training, research on solar energy, food security, climatology, energies

7 BIBLIOGRAPHY

- ANCR (2006): Étude sur l'Évaluation des Capacités à Renforcer
- Banque Mondiale/World Bank (2009): Programme d'actions communautaires (http://go.worldbank.org/42CLOX67G0)
- Cabinet du Premier Ministre (2007): Stratégie de Développement Accéléré et de Réduction de la Pauvreté (SDRP)
- CNEDD (2006): Inventaire des Gaz à Effet de Serre „Secteur de l'Energie"
- CNEDD (2001): Réactualisation Bilan Diagnostic des stratégies programme et projets passés en cours et en attente dans le domaine des ER au Niger
- CNEDD (2007): Seconde Communication Nationale, Inventaire des Gaz à Effet de Serre, Utilisation des Terres, Changement Affectation des Terres et Foresterie
- CNEDD (2006): Etat des Lieux en Besoins de Renforcement des Capacités dans le Cadre de la Convention Cadre des Nations Unies sur les Changements Climatiques
- CNES (2006): Inventaire des Installations Solaires
- Centre de Promotion des Investissements/Sis à la Chambre de Commerce d'Agriculture,
- d'Industrie et d'Artisanat du Niger (2009): Conditions et Opportunités d'Investissement au Niger (www.investir-au-niger.org/oportunites.htm)
- Centre de Promotion des Investissements/Sis à la Chambre de Commerce d'Agriculture,
- d'Industrie et d'Atisanat du Niger (2009): Code Douanier du Niger (www.investir-au-niger.org)
- ECOWAS/UEMEOA (2005): White Paper for a regional policy (www.gm.undp.org/Reports/ECOWAS%20energy%20white%20paper.pdf)
- Ministère des Mines et de l'Énergie (2006): Étude sur la Définition d'une Stratégie et Élaboration d'un Plan d'Actions en Énergies Domestiques
  Ministère des Mines et de l'Énergie (2006): Stratégie Nationale d'Accès aux Services Énergétiques Modernes
- Ministère des Mines et de l'Énergie (2005): Code de l'Électricité (www.sie-niger.ne)
- Ministère des Mines et de l'Énergie (2004): Déclaration de Politique Énergétique
- Ministère des Mines et de l'Énergie (2003): Stratégie Nationale et Plan d'Actions sur les Énergies Renouvelables
- Ministère des Mines et de l'Énergie (2006): Stratégie du Développement Minier
- Nigelec (2008): various data and information
- Société Nigérienne des Produits Pétroliers - Sonidep (2007): various publications (www.sonidep.com)
- N. N. (2007) : Rapport d'Activités de la Direction des Energies Renouvelables et des Energies Domestiques
- UNESCO (2007): Étude sur l'Identification des Centres d'Éxcellence en Énergies Renouvelables au Niger

Websites

- Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel, CILSS: www.cilss.bf
- Economic Community of Western Africa States, ECOWAS: www.ecowas.int
- Système d'Information Énergétique Niger, SIE: www.sie-niger.ne
- Union Économique et Monétaire Ouest Africaine – UEMOA : www.uemoa.int



COUNTRY CHAPTER: NIGERIA

Authors of Country Chapter
Prof. Anthony O. Adegbulugbe
Dr. Adeola Adenikinju

Coordination and Review of the Country Chapter
Anton Hofer, (MSE, Dipl.-Ing./FH, M.A.)
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS NIGERIA

ACRONYMS AND ABBREVIATIONS

NIGERIA

AES	Applied Energy Services
CAC	Corporate Affairs Commission
CDM	Clean Development Mechanism
ECN	Energy Commission of Nigeria
ECOWAS	Economic Community of West African States
EPSR	Electric Power Sector Reforms
FDI	Foreign Direct Investment
FIIRO	Federal Institute of Industrial Research Oshodi
FOTE	Friends of the Environment
GDP	Gross Development Product
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
IMF	International Monetary Fund
IPP	Independent Power Producer
IPPA	Investment Promotion and Protection Agreement
ITCZ	Inter-Tropical Convergence Zone
JV	Joint Venture
LGHQs	Local Government Headquaters
LPG	Liquefied Petroleum Gas
N	Nigerian Naira (currency of Nigeria, also NGN)
NAPEP	National Poverty Eradication Program
NBRRI	Nigerian Building and Road Research Institute
NCC	National Coal Corporation
NDA	Niger Dam Authority
NEEDS	National Economic Empowerment and Development Strategy
NEPA	Nigerian Electricity Power Authority
NERC	Nigerian Electricity Regulatory Commission
NESCO	Nigeria Electricity Supply Company
NGC	Nigerian Gas Company
NGOs	Non Governmental Organizations
NIMET	Nigeria Meteorological Services
NIPC	Nigerian Investment Promotion Commission
NNPC	Nigerian National Petroleum Corporation
NNRA	Nigerian Nuclear Regulatory Authority
NREMP	National Renewable Energy Master Plan
PHCN	Power Holding Company of Nigeria
PRODA	Project Development Agency
R&D	Research and Development
REA	Rural Electrification Agency
REF	Rural Electrification Fund
REMP	Renewable Energy Master Plan
SESN	Solar Energy Society of Nigeria
SHP	Small Hydro Power
TCN	Transmission Company of Nigeria
UNIDO	United Nations Industrial Development Organization
USD	United States Dollars
VAT	Value Added Tax

MEASUREMENTS

GWh	gigawatt hour
kg	kilogram
km	kilometer
kV	kilovolt ampere
kVA	kilovolt
kWh	kilowatt hour
kWp	kilowatt peak
m	meter
m^2	square meter
/	meters per second
MJ	megajoule
MVA	megavolt ampere
MW	megawatt (1 MW = 1,000 kW)
MWh	megawatt hour
PJ	petajoule (1 PJ = ca. 277,778 million kWh)
scf	standard cubic feet
yr	year

SUMMARY

The Country Study of Nigeria is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Nigeria. The study is structured as follows:

Chapter one provides **Background Information on Nigeria.** This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Nigeria.

Chapter two summarizes facts and figures of **Nigeria's Energy Market** including stakeholders and market actors and involved as well as related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Nigeria. This includes an overview of support mechanisms for photovoltaic (PV) as well as already existing regulations, incentives and legislative framework conditions, concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Nigeria.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Nigeria.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Nigeria covers a total area of 923,768 km². With over 140 million people (as of 2008), Nigeria is the most populated country in Africa and the ninth populated country in the world. About 45 % of the inhabitants live in urban areas; nearly 42 % of the population is under 14 years. The fertility rate in 2008 was 5.01 and the population growth rate about 2.03 %. Life expectancy rate in 2008 was estimated at 46.5 years, while adult literacy is 68 %.[1] In 2003, 5.4 % of adults lived with HIV/AIDS. Infant mortality in 2008 remained very high with 95.78 deaths per thousand live births[2]. Nigeria is divided in the geographical regions North, South, the Central Region and the Guinea coastlands.

FIGURE 1
Map of Nigeria

Because of its location just north of the equator, Nigeria enjoys a truly tropical climate characterized by the hot and wet conditions associated with the movement of the Inter-Tropical Convergence Zone (ITCZ) north and south of the equator. It is important to note that the climatic conditions of the country vary considerably due to its close proximity to the Equator and the Tropic of Cancer. There are two main seasons prevalent in Nigeria. One is the rainy season from May to September in the northern part of Nigeria and from March to November in the southern part. The dry season, also known the Harmattan season in Nigeria, lasts from December till January.

The country experiences consistently high temperatures all year round. The seasonal pattern of climatic conditions over Nigeria gives rise to four seasons in the South and two in the North. This is the result of annual total rainfall occurrence and distribution, which is more predominant in the South than in the North.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

Nigeria became an independent country on 1 October 1960 and a republic on 1 October 1963. The country operates as a federal system of governments, consisting of the Federal Government, 36 State Governments and 774 Local Governments. While the country has been governed by a succession of military and civilian governments, Nigeria is currently experiencing the longest period of democracy since becoming an independent nation. The Fourth Republic started on 29 May 1999 with the election of President Olusegun Obasanjo. Obasanjo was followed by the current President Umaru Musa Yar'Adua who was elected on 29 May 2007. While Nigeria operated a Parliamentary System of Government when it gained its independence, the country currently operates a Presidential System of Government with three tiers of Government, i. e. executive, legislative and judiciary.

Nigeria's population consists of about 250 ethnic groups speaking 500 indigenous languages and following two major religious, i.e. Islam and Christianity. The largest ethnic groups are the Hausa-Fulani, the Yorubas and the Igbos. Nigeria's economy is primarily driven by oil and gas. Oil and gas account for 25 % of the country's Gross Development Product of 115.4 billion USD (as of 2006) measured at current prices. Oil and gas account for over 80 % of governmental revenues and more than 95 % of total export earnings in 2006[3]. GDP per capita has recently risen considerably to 858 USD as opposed to 350 USD in 2000. The Nigerian economy is experiencing the fastest growth in over two decades due to the development in the energy sector, especially the oil and gas sub-sector. Growth averaged 5.7 per cent annually between 2000 and 2005, picking up across a broad range of sectors[4]. Nigeria's vision is to become one of the 20 largest economies by the year 2020.

However, in spite of the massive revenue from oil (estimated at over 600 billion USD since 1970), the standard of living is still very low, poverty is widespread and income distribution is highly skewed. Over 70 % of the population lives on less than 1 USD a day and 91 % live on less than 2 USD a day according to a 1990–2001 poverty study. Income distribution is highly skewed with the poorest 10 % of the population controlling just 1.6 % of the wealth, while the richest 10 % control 40.8 % of total wealth.[5] The Gini index stands at 50.6 %. Nigeria with a Human Development Index of 0.461 was classified among the countries with low human development by the United Nations. The International Monetary Fund (IMF) ranked Nigeria at 165 out of 179 countries in terms of per capita income in 2006. The major causes for poverty in Nigeria are bad governance, neglect of the agricultural sector, inadequate social and economic infrastructure and unstable policy environment.

1 CIA, AS OF 2009
2 CIA, AS OF 2009
3 CBN, AS OF 2007
4 KWAKWA ET AL., AS OF 2008
5 NBS, AS OF 2005

2 ENERGY MARKET IN NIGERIA

2.1 OVERVIEW OF THE ENERGY SITUATION

Nearly 60 % of the country's 140 million people have no reliable access to electricity from the national energy grid. Most people rely on lighting with kerosene lanterns, candles, torches etc. Nigeria has a National Energy Policy as well as a draft National Energy Master Plan and Renewable Energy Master Plan. The most important legislation guiding the power sector is contained in the Electric Power Sector Reforms (EPSR) Act of 2005. In 2008, the Government also approved of a new oil and gas policy.

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Nigeria is fortunate to have huge energy resources enabling the country to transform its economy and the lives of its citizens. Nigeria sits astride of over 36 billion barrels of oil, 187 trillion cubic feet of gas, 4 billion metric tons of coal and lignite as well as huge reserves of tar sands, Hydro Power and solar radiation. An overview of Nigeria's energy reserves is presented in table 1.

TABLE 1

Energy Reserves and Potential of Nigeria

Crude oil	35.2 billion barrels
Natural gas	187.44 trillion scf
Tar sands	30 billion barrels of oil equivalent
Coal & lignite	4 billion tons
Large Hydro Power	11,250 MW
Small Hydro Power	3,500 MW
Fuel wood	13,071,464 hectares
Animal waste	61 million tons/year
Crop residue	83 million tons/year
Solar radiation	3.5–7.0 kWh/m^2/day
Wind	2–4 / at 10 m height

Source: Sambo, as of 2008

The energy mix of Nigeria is dominated by oil which accounts for about 57 %, followed by natural gas (36 %) and hydroelectricity (7 %) as of 2005. Other energy sources such as coal, nuclear and renewable energies currently play no significant role in the country's energy consumption mix. Between 1980 and 2005, the share of oil in energy mix decreased from 82 % to 56 %. Natural gas consumption increased from 9 % to 35 %. Hydroelectricity experienced a slight increase from 6.6 % to about 7 %.

Over the period of 1989–2005, the share of non-commercial energy in total energy consumption fluctuated within the range of 30–40 %. About 95 % of total fuel wood consumption falls to households for cooking and domestic industrial activities, which are closely related to household activities. A smaller proportion of the fuel wood and charcoal consumed are used in the service sector.

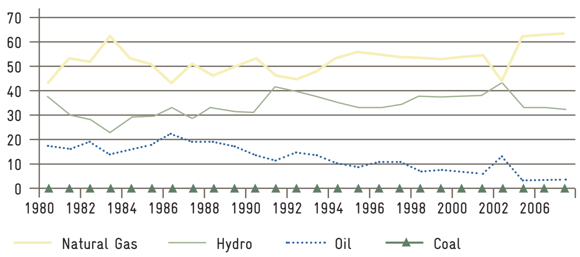
Electricity Sector

Electricity in Nigeria is supplied through large-scale thermal power and hydroelectric power plants and a 330 kV and 132 kV nationwide transmission network through the Power Holding Company of Nigeria (PHCN). Power demand developed from 3,233 MW in 2002 to 3,479 MW in 2003 and 3,403 MW in 2004. The maximum power demand in 2003 exceeded the available capacity of 3,477 MW in 2005. The Government has clearly fallen short of the national targets defined in the National Economic Empowerment and Development Strategy (NEEDS) in order to increase the generation capacity of power facilities to 10,000 MW, the transmission capacity to 9,340 MVA and the distribution capacities to 15,165 MVA by the year 2007. Most of the generating facilities are old and outdated, yet cannot be overhauled due to the lack of reserve capacity. This situation was caused by insufficient maintenance, the suspension of new investments and the high rate of auto-generation as a result of frequent large-scale blackouts.

The residential sector accounted for 63 % of the total electricity consumption in 2005, followed by the commercial sector (27 %) and the industrial sector (10 %). Natural gas dominates the electricity generation mix, accounting for an average of 63 % of the total power generation. After natural gas, hydro is also a significant factor in power generation, though its contribution has decreased. Figure 2 presents the evolution of the total power generation shares by type of fuel.

FIGURE 2

Share of Energy Sources in Total Power Generation (%)



Source: World Bank, as of 2006

Meanwhile, the contribution of oil, though marginal since 1980, has also drastically decreased contributing as little as 3 % to the total power generation in 2004. In Nigeria, the problems in the Niger Delta have often affected the supply of gas to the power stations leading to major disruptions in electricity generation. Occasional low levels of water in the hydrostations together with the gas disruptions lead to blackouts in most parts of the country. Energy prices in Nigeria are very low compared to other countries and relative to the marginal cost of production. The average electricity tariff in Nigeria is about 6.75 N per kWh (approximately 5 €-Cents per kWh). It is estimated that the generation cost of electricity from winds power in Nigeria is about 8–10 Euro Cent per kWh. The current electricity prices (as of November 2008) vary between 3 and 5 €-Cents per kWh.

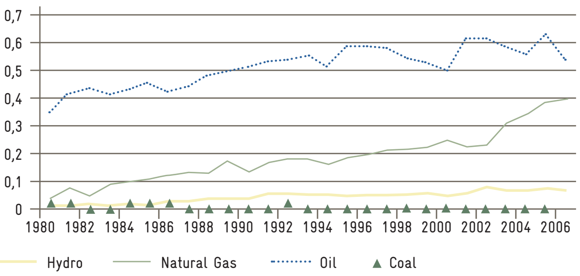
Petroleum Sector

The commercial energy consumption mix in Nigeria is dominated by oil accounting for about 57 %, followed by natural gas (36 %). Besides hydroelectricity (7 %) and very little utilization of coal, other energy resources play no significant role in the country's energy consumption mix. Figure 3 presents an overview of the country's energy mix with main contributions from oil and natural gas.

Refined petroleum products can be classified into two categories, namely those whose prices are still regulated (i.e. gasoline and kerosene) and those whose prices are fully deregulated (i.e. diesel and LPG). Due to the poor state of local refineries, nearly 70 % of total consumption of refined products in Nigeria are imported. The current prices of petroleum products (as of November 2008) are presented in table 3.

FIGURE 3

Evolution of the Energy Consumption Mix in Nigeria (1980–2006) (Quadrillion Btu)



Source: EIA, as of 2009

TABLE 3

Overview of Prices for Selected Petroleum Products

TYPE OF FUEL	PRICE
Gasoline	0.46 Euro per liter
Diesel	0.92 Euro per liter
Kerosene	0.33 Euro per liter
LPG	17.71 Euro per 12.5 kg bottle

Source: market research conducted by the authors, as of November 2008

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The Federal Ministry of Energy oversees the administration of the energy sector in Nigeria primarily through its two main executive bodies, namely the Nigerian National Petroleum Corporation (NNPC) and the PHCN. The NNPC's primary function is to oversee the regulation of the Nigerian oil industry while also being responsible for upstream and downstream developments. The Nigerian Electricity Power Authority (NEPA) was established in 1972 as a result of the merger of the former Electricity Company of Nigeria and the Niger Dam Authority (NDA). NEPA was structured as a vertically integrated monopoly with responsibility to generate, transmit and distribute electricity throughout the country. The NEPA Act was further amended in 1990 and 1998 to pave way for further liberalization of the electricity industry.

One of the major institutional and legislative reforms in the power sector in recent years was the Electric Power Sector Reform (EPSR) in 2005. The EPSR introduced important regulatory changes, which involve dismantling the monopoly of NEPA. It aimed at encouraging competition and efficiency through private participation, especially in the generation and distribution of electricity. The EPSR provided for the division of NEPA into 18 autonomous companies consisting of 6 generating companies, 1 transmission company and 11 distributing companies. The Act also provided for the creation of an independent regulatory agency, i.e. the Nigerian Electricity Regulatory Commission (NERC), and the Rural Electrification Agency (REA) to oversee the extension of electricity to rural and peri-urban areas. The REA is supervised by the Federal Ministry of Energy. The Act also provided for the establishment of a Rural Electrification Fund to promote access of rural dwellers to electricity. In some areas, electricity supply is provided by the REBs of state governments or through an Independent Power Producer (IPP)) system such as NESCO (Nigeria Electricity Supply Company) or the AES Corporation.

There is, however, no agency with direct control of the RE sector in Nigeria. The responsibilities for RE objectives are shared between various Ministries, Departments and Agencies of the Government, e. g. the Energy Commission of Nigeria (ECN), REA, NNPC and the National Poverty Eradication Program (NAPEP). The ECN exercises jurisdiction over RE-related institutions in Nsukka and Sokoto, implements pilot projects on both, technology utilizing solar heat and PV generation, and promotes the introduction of these RE technologies. Silicon is mined in Nigeria and research and development on the domestic manufacturing of PV modules is being planned.

Other key actors in the energy sector are the Nigerian Gas Company (NGC), the Nigerian Nuclear Regulatory Authority (NNRA) and the National Coal Corporation (NCC). The Ministry of Science and Technology is responsible of planning and policy matters related to research and development in the field of science and technology including energy. Other agencies and NGOs also considering RE include the Federal Institute of Industrial Research Oshodi (FIIRO), the Project Development Agency (PRODA), Friends of the Environment (FOTE), the Solar Energy Society of Nigeria (SESN) to mention but a few.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The NEP was drafted in 1993 by the ECN and represents a comprehensive energy policy that covers all energy sectors. The key objectives and targets for the power sector are:

- To expand electricity access to 75 % of the population by 2020
- To provide electricity supply for all 774 local government headquarters and other cities by 2010
- (only 660 LGHQs have been electrified so far)
- To promote private sector participation
- The key elements in the national policy position on the development and application of RE and its technologies are:
- To develop and promote the country's RE resources and include all viable ones into the national energy mix
- To promote decentralized energy supply, especially in rural areas, based on RE resources
- To discourage the use of wood as fuel
- To promote efficient methods in the use of biomass energy resources
- To keep abreast of international developments in RE technologies and applications

At present, there are no special incentives for distributors, manufacturers and users of RE systems, also due to the huge subsidies granted for conventional energy, in particular conventionally generated electricity and petroleum products. The country is also yet to provide a PPA for developers of RE based electricity projects. The only RE sector that attracts special incentives is the biofuel industry. These incentives include (i) the granting of a pioneer status to all registered businesses engaged in activities related to the production of biofuels or the production of feed stocks for biofuel production and cogeneration, (ii) exemptions from withholding tax and capital gains tax; (iii) exemptions from the payment of customs duties, taxes and other charges of similar nature on biofuels imports and exports, imports of inputs and machineries, (iv) waivers on VAT payments on all products and services consumed by biofuel companies and (v) access to preferential loan arrangements with the Bank of Industry, the Nigerian Export and Import Bank, commercial banks, agriculture banks and other development finance agencies.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

Most RE technologies are imported, as there is virtually no manufacturing capacity in the country. In Nigeria, customs tariffs for ordinary electrical products are applied for PV-related equipment resulting in high tariffs which are lacking any incentives and are discouraging the country's PV business. ECN has submitted an "Importation of Renewable Energy Equipment" bill to the Nigerian Senate in 2002, asking for tax exemptions for the import duty of PV equipment.

The Nigerian Government allows for 100 % foreign ownership or joint ventures (JV) with Nigerian partners in all sectors of the economy including the PV sub-sector. The Government has also effected an Investment Promotion and Protection Agreement (IPPA) which guarantees investors adequate and prompt payments in the event of expropriation, free transfer of funds as well as provisions for international arbitration in the event of disputes. This agreement is to facilitate the attraction of Foreign Direct Investment (FDI) to the economy and protect investments in all sectors including the RE sub-sector. Additional incentives to encourage industrialists and investors in all sectors of the economy including the RE sub-sector provide:

- Five years tax holiday for pioneer products and industries
- Tax-free dividend for a period of three years
- 95 % capital allowance for replacement investment
- Elimination of double taxation
- Abolition of excise duty

All excise duties were abolished with effect from 1 January 1999. It should also be mentioned that any investments in the energy sector are rated as pioneer initiatives entitled to a tax holiday of 5–7 year.

The EPSR Act provided for the establishment of the Rural Electrification Agency. The Federal Government has set a target for increasing electricity access in rural areas from currently 40 % to 75 % by 2015. The rural electrification strategy and plan aim at the expansion of the main grid, the development of isolated and mini-grid systems, the creation of an enabling environment to promote investments in RE power generation and the fostering of public and private sectors partnerships designed to supply electricity for the rural population. The targets against which these policies will be measured are: (i) ensuring that 75 % of the rural population has electricity by 2010, (ii) providing electricity to all the 774 local government headquarters and other strategic towns by 2010 and (iii) reducing cost per connection of rural electricity schemes on a sustainable basis. The strategies being contemplated by REA for expanding energy access comprise two elements: pilot projects aimed at testing innovative approaches to expanding rural electricity and activities related to implementation support for the National Renewable Energy Master Plan (NREMP).

To encourage the private sector for investing in rural electrification, governmental subsidy is set at a 304.5 N/month flat rate. The REA and the Rural Electrification Fund (REF) were established in March 2006. Any organization intending to start a rural electrification project can do so by obtaining a business license from the REA without providing or being related to an existing distribution company in the relevant area. The REA will approve of the proposed site for a rural electrification project and allot funds for the REF in accordance with fair and transparent rules. The REA will also formulate and establish minimum safety regulations, technical standards and criteria for the services level.

The NERC is a regulatory and supervisory organ for electric power entities (including private companies) working in power generation, transmission and distribution projects in general. Although rural electrification projects fall under the authority of NERC, projects with less than 1 MW generating facilities and 100 kW distribution facilities are not subject to their regulation, so off-grid rural electrification projects are not included for the time being.

In general there is no restriction for foreign companies and investors doing business in Nigeria. They must, however, incorporate a local vehicle before commencing business. All companies are approved and regulated by the Corporate Affairs Commission (CAC). Decree No. 16 pf (as of 1995) of the Nigerian Investment Promotion Commission (NIPC) allows for 100 % foreign participation in Nigerian businesses. It also allows for repatriation of capital and dividend without any inhibition from the Government. The NIPC is a one-stop office for dealing with all requirements for investments in the country. The Companies and Allied Matters Act 1990 (The Companies Act) is the principal law regulating the incorporation of businesses in Nigeria.

The approval procedures for foreign investors in Nigeria can be stated as follows: The first port of call is the NIPC office for enquiries about investment opportunities and procedures in Nigeria. Second step is the registration of the company with the CAC. Third is to notify the Industrial Inspectorate Department of the Federal Ministry of Industries of the intended capital expenditure. Next step is to ask for approval of location with the Federal Ministry of Industries. Moreover, approval or a proper business permit with or without expatriate quota allocation must be sought in writing from the Ministry of Internal Affairs. Finally, to know whether the company will obtain pioneer status, it must apply to the Federal Ministry of Industry. The same Ministry also approves the user licenses.

There is an opportunity in the Nigerian power sector to leverage carbon finance from the energy loss reduction and efficiency program embarked upon recently with the assistance of the World Bank. The Transmission Company of Nigeria (TCN) is currently finalizing the Emission Reduction Purchase Agreement. The conversion to a High Voltage Distribution System lead to technical loss and therefore a substantial reduction of carbon emissions due to avoided generation. This represents the first step for the Nigerian power sector in accessing the benefits of Clean Development Mechanism (CDM) under the Kyoto Protocol.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

An overview of the status (as of 2005) and future potential (outlook by 2025) for RE is presented in Table 4.

The Renewable Energy Master Plan (REMP) envisages to aggregate the electrification demand of 14,000 MW by 2015 of which RE will constitute about 5 % (701 MW). In 2025, the electricity demand is projected to increase to 29,000 MW with new RE satisfying up 10 % of the country's overall energy demand. The mix of RE making up the 10 % is projected as follows: small Hydro Power 66 %, PV 17 %, biomass 14 %, wind 1.3 % and solar thermal 0.7 %. The REMP estimated the cost of REMP implementation up to 2025 at 4.8 billion USD. Table 5 presents the targets for electricity generation in Nigeria.

TABLE 4

Technical Potential for Renewable Energy in Nigeria

ENERGY SOURCE	ESTIMATED POTENTIAL	CURRENT UTILIZATION	SHARE OF ELECTRICITY SUPPLY (%) UP TO 2005	SHARE OF ELECTRICITY SUPPLY BY 2025 (%)
Large Hydro Power	14,750 MW	1,930 MW	29.30	25.00
Small Hydro Power	734 MW	30 MW	0.46	9.90
Fuel wood, animal waste and crop residue	144 million tons/		0	0.41
Solar radiation	3.5–7.0 kWh/m^2/day	marginal	0	0.26
Wind	2–4 /	marginal	0	0.02

Sources: ECN, Renewable Energy Master Plan, as of 2005/ECN, Energy Demand Projection Document, as of 2004

TABLE 5

Targets for Electricity Generation (MW)

RESOURCE	SHORT-TERM (2005–2007)	MEDIUM-TERM (2008–2015)	LONG-TERM (2016–2025)
Large Hydro Power	1,930	5,230	48,000
Small Hydro Power	100	3,500	19,000
Solar PV	5	120	500
Solar thermal	–	1	5
Biomass	1	100	800
Wind	1	20	40
All renewables	2,036	6,905	68,345
All energy resources	15,920	30,210	192,000
% of renewables	13 %	23 %	36 %

Source: Energy Commission of Nigeria, as of 2007

4.1 BIOMASS/BIOGAS

The biomass resources of Nigeria consist of wood, forage, grass and shrubs, animal wastes arising from forestry, agricultural, municipal and industrial activities as well as aquatic biomass. Biomass remains a leading source of energy for Nigeria contributing an estimated 37 % of total energy demand and being the energy of choice for the vast majority of rural dwellers and the urban poor. The country's biomass energy resources are estimated at 144 million tons per year. Nigeria currently consumes 43.4 billion kg (equivalent 43.4* 109 kg) of fuel wood annually. The average daily consumption is about 0.5–1.0 kg of dry fuel wood per person. The rate of consumption hardly matches the rate of reforestation.

4.2 SOLAR ENERGY

Nigeria is situated in a belt of high sunshine. The solar radiation is fairly well distributed throughout the country. The annual average of total solar radiation varies from about 12.6 $MJ/m^2/day$ (equivalent 3.5 $kWh/m^2/day$) in the coastal latitudes to about 25.2 $MJ/m^2/day$ (equivalent 7.0 $kWh/m^2/day$) in the far North. This equals an average annual solar energy intensity of 1,934.5 $kWh/m^2/$. Thus, over a whole year, an average of 6,372,613 PJ/year (1,770 thousand TWh/year) of solar energy falls on the entire land area of Nigeria. The national average is 5.5 $kWh/m^2/day$ and the average solar radiation time is 6 hours/day, which are favorable conditions for PV power generation.

The only survey on the business units dealing with solar business in Nigeria shows that a total of 44 companies and 2 research centers were active in the importation and/or installation of PV systems. 30 of them were located in Lagos (68 %) and 14 in the rest of the country (32 %). Among the 27 respondents in the survey, 22 (81 %) were involved in solar business. The bulk of the companies were either consultants, vendors or contractors. Many of the existing companies claimed to be distributors for one foreign company or the other. The survey identified only one manufacturer of solar PV components or systems, namely Solar Electric systems, based in Jos. It assembled solar-PV refrigerators and manufactured solar cookers and solar heaters.

The PV components which are marketed in the country include modules, batteries, inverters, converters, charge controllers, bulb/tubes, refrigerators, lighting systems, solar lanterns, solar lamps, and junction boxes. The total module installation for 1999 was estimated at 264 kWp. The REMP estimated the PV modules installation in 2005 at 800 kWp. Most of the distributors of solar PV components and systems in Nigeria obtain their products from America (49 %), Germany (13.7 %) and Britain (21.5 %). Recently, the Asian countries of India and China have taken over increasing shares of the market. One of the emerging issues in the Nigerian solar market, however, is product quality. The country is yet to establish product standards. Presently, there are no capacities to actually test the products that are brought into the country.

Solar PV technologies are being more and more accepted in Nigeria. Despite improvements in local R&D efforts, however, the knowledge of these technologies and their market potentials is considerably inadequate. Presently, all the PV modules in the Nigerian market are imported. Solar PV systems are being extensively used for a wide range of electrical energy requirements including solar home systems, water pumping, refrigeration and telecommunication.

4.3 WIND POWER

Wind speeds in Nigeria range from 1.4 to 3.0 m/s in the southern areas and 4.0 to 5.12 / in the extreme North. Wind speeds in Nigeria are generally weak in the South except for the coastal regions and offshore locations. In Nigeria, peak wind speeds generally occur between April and August on most sites. Initial studies show that the actual total exploitable wind energy reserve at a height of 10 m may vary from 8 MWh/ in Yola to 51 MWh/ in the mountainous areas of Jos plateau and rise to 97 MWh/ in Sokoto. Hence, Nigeria has poor to moderate wind conditions.

Wind energy utilization in Nigeria is practically minimal. The hundreds of wind pumps scattered all over the country are badly maintained and some have been abandoned altogether. Some state governments like Jigawa and Kano are making an effort to install new wind pumps. There is one pilot wind electricity project in operation, namely the 5 kWp Sayya Gidan Gada wind electricity project at Sokoto. Moreover, a 0.75 kWp wind electricity project in the center of the town is being run on an experimental basis to prove the viability of wind farming in the area.

4.4 HYDRO POWER

According to NEPA's most recent estimate, the country's gross hydro potential is approximately 14,750 MW. On the basis of a 1980 survey of 12 of the old states of the federation, it was assessed that some 734 MW of small Hydro Power (SHP) could be harnessed from 277 sites. Unfortunately, the database on SHP in Nigeria is limited, incomplete and substantially obsolete. No new surveys have been conducted since those undertaken in only three states over 20 years ago to confirm or verify the data. The REMP, however, estimates that SHP potential is about 3,500 MW. More detailed information can be found in the Annex of this report.

Hydrogen, Marine, Ocean and Geothermal Energy

Hydrogen, marine, ocean and geothermal energy are important in the long-term vision of providing secure, abundant, cost effective and clean sources of energy for Nigeria. Their impact, however, is still negligible at present. The Nigerian Energy Policy seeks to promote capacities to enable Nigeria to include these new energy sources in the country's future energy mix. Nigeria has an Atlantic Ocean coastline stretching over 800 km from Badagry to Bakassi. Tides in the coastal areas have a height range of 100–300 cm and an incursion of 30–40 km on the average. With respect to geothermal energy, there are two known geothermal resources in Nigeria: Ikogosi Warm Springs in Ondo State and the Wikki Warm Spring in Bauchi. Moreover, high geothermal gradient trends have been identified in the Lagos sub-basin, the Okitipupa ridge, the Auchi-Agbede within the Benin flank/hinge line as well as in the Abakaliki anticlinorium.

5 MARKET RISKS AND BARRIERS

Price distortions, poor regulatory environment and inadequate infrastructure define the current energy market conditions in Nigeria reducing the scope for competition, growth and innovation in the market. The Nigerian business environment is characterized by weak infrastructure, poorly implemented incentives (especially fiscal and tariff regimes), massive smuggling, counterfeiting and dumping of products, lack of standardization required for international competitiveness, unfavorable international trade rules, a national trade policy stance which is endemically unpredictable (especially in the application of tariffs and exemptions), high transaction costs at ports, complicated customs clearance procedures, tariffs and non-tariff barriers which on the average exceed those of other ECOWAS countries and high level of official corruption.

The 2009 Report on "Doing Business Index" jointly authored by the World Bank and the International Finance Corporation shows that Nigeria dropped from position 108 out of 178 in 2008 to position 118 out of 181 in 2009. Nigeria slides down on most of the scales used to measure efficiency of business transactions. While the number of procedures required for obtaining licenses reduced from 18 to 16, the number of the days required in concluding the process increased from 350 to 360 days. Similarly, while the number of payments in business taxes reduced from 35 to 32, the percentage of the tax (related to the company profit) rose from 29.9%to 32.2%. Nigeria, however, recorded some improvements such as the reduction of the number of procedures for registering a business from 9 to 8 or the reduction of the number of days required for the process from 34 to 31. The costs for registering a new business in Nigeria however raised from 56.6% in the 2008 Report to 90.1% in the 2009 Report (indicated as percentage of per capita income). Employers have high flexibility to hire and fire employees.

Moreover, there are no clear and consistent institutional structures helping to overcome barriers and create expanded opportunities for RE. Some of the current initiatives of various actors are rather spontaneous and lacking systematic approaches. The Government's Agencies and Ministries active in the RE sector include the Energy Commission of Nigeria (through two of its renewable energy centers located at Sokoto and Nsukka), the Nigeria Meteorological Services (NIMET), the Nigerian Building and Road Research Institute (NBRRI), the Project Development Institute (PRODA), the Federal Institute of Industrial Research Oshodi (FIIRO), REA, the Federal Ministry of Environment, the Federal Ministry of Science and Technology, the Federal Ministry of Energy as well as some of Nigeria's universities and polytechnics.

There is a need to create a level playing field in the energy market by removing all price distortions, by granting special incentives to market operators for the introduction of RE technology systems and by encouraging consumers to access RE products.

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 6

Local Business Partners

NAME	ADDRESS	BUSINESS FOCUS
Jon Paca Investments Ltd.	Suite 38, Kogi Street, Garki, Abuja Phone: +234 803 703 490 6	Solar water pumping systems, solar street lighting
Aero Systems & Tech Nig. Ltd.	Plot 7, Durban Street Wuse 2, Abuja Phone: +234 806 602 033 3	PV systems, batteries, inverters, solar charge controllers, solar water pumping systems
Solarec Engineering Ltd.	2nd Floor, 6A Ahmadu Bello Way, Kaduna Phone: +234 301 568 05	PV modules, inverters, DC lighting, charge controllers, solar water pumping systems
Afri-Asia Global Services Ltd.	1, Ilesanmi Idowu, Ogudu GRA, Ogudu, Ojota, Lagos Phone: +224 806 008 651 2 www.afasglobal.com	Hydroenergy system components, solar street lighting, solar water pumping systems, wind energy system components
EastWind Laboratories	8, Lagere Road, Ile-ife, Osun State Phone: +234 803 455 154 6 Web: www.eastwindlabs.com	Solar electric power systems, battery charge controllers, PV module components, inverters
Pamtronics Nigeria Ltd.	Suite C3 Royal Plaza, Area 3 Junction, Garki, Abuja Phone: +234 803 701 270 3 Web: www.pamtronics.com	Solar electric power systems, batteries deep cycle, DC to AC power inverters sine wave, DC lighting, modules
Borodo & Co. Ltd.	P.O. Box 7328, Kano Phone: +234 803 587 005 8	Solar electric power systems, lead acid batteries, solar modules, inverters
Cedicon Ltd.	13th Floor, Zenon House, No.2 Ajose Adeogun St., Victoria Island, Lagos Phone: +234 806 572 208 5	Solar electric power systems, wind power plants, inverters
Rubitec Nigeria Ltd.	72 Adeniyi Jones Avenue, Ikeja, Lagos Phone: +234 803 449 967 0	Solar lighting systems, solar water pumping systems, power inverters, water filtering and purification systems, wind systems and small Hydro Power
Royal Power and Energy Ltd.	Plot 10b, 2 Ashabi Adewale Close, Off Chief Harmann St., Lekki Phase 1, Lagos Phone: +234 176 096 83 www.rpeltd.com	Solar and wind power batteries, UPS and surge protectors
Solar Energy Services Ltd.	No. 14, Muri Okunola St., Suite 2, Victoria Island, Lagos Phone: +234 146 133 56	Solar streetlights, park lights, solar lighting
KXN Nig, Ltd.	3B, Ribadu Road, Ikoyi, Lagos Phone: +234 177 478 87 kxn@solarsolve.com	Solar PV modules, refrigeration, batteries, controllers, water pumping, small home systems
OEIE Nig. Ltd.	14 Woji Road, Eugene Plaza, Rumuogba, Port Harcourt Phone: +234 846 100 452	Solar water borehole system, refrigeration, solar panels, streetlight billboards
Berekotry Detergents Ltd.	KM 1, Oremoje Rd., Iseyin, Oyo State Phone: +234 803 422 244 8	Biodiesel, bioplastics, cooking stoves

TABLE 7

Local Business Institutions

NAME	ADDRESS	BUSINESS FOCUS
Lagos Chamber of Commerce and Industry	1 Idowu Taylor St., Victoria Island Phone: +234 177 466 17 Fax: +234 127 010 09 www.lagoschamberng.com	Pioneer Chamber of Commerce and Industry in Nigeria
Manufacturers Association of Nigeria	MAN House, Ikeja, P.O. Box 3835, Lagos Phone: +234 149 742 403 Fax: +234 149 742 47 www.manufacturersnigeria.org	Umbrella body for all local manufacturers in Nigeria
Kaduna Chamber of Commerce and Industry	Kaduna International Trade and Investment Centre, Km 4, Kaduna-Zaria Rd., P.O. Box. 728, Kaduna Phone: +234 623 187 94 Fax: +234 623 187 94 www.kadunachamberofcommerce.org	One of the leading chambers of commerce and industry in the North
Kano Chamber of Commerce and Industry	Trade Fair Complex, Zoo Road, P.O. Box 10, Kano City, Kano Phone: +234 646 671 38 Fax: +234 646 671 38 kaccima@hotmail.com	One of the leading chambers of commerce and industry in the North
Enugu Chamber of Commerce, Industry, Mines and Agriculture	Trade Fair Complex, Abakaliki Road, P.O. Box 734, Enugu Phone: +234 422 505 75 Fax: +234 422 521 86 www.enuguchambers.net	One of the leading chambers of Commerce and Industry in the South East
Onitsha Chamber of Commerce and Industry	Achike House, 38, Ogota Road, P.O. Box 2578, Onitsha, Anambra State Phone: +234 464 141 40 Fax: +234 462 511 34 oniccima02@yahoo.co.uk	One of the leading chambers of Commerce and Industry in the South East
Abuja Chambers of Commerce and Industry	Abuja International Trade Fair Complex, Km8, Airport Road, P.M.B 86, Garki, Abuja Phone: +234 967 072 18	Leading chamber of commerce and Industry in the Federal Capital

TABLE 8

Relevant Governmental Institutions and Agencies

NAME	ADDRESS	AREA OF FOCUS
Energy Commission of Nigeria (ECN)	Plot 701C, 358, Garki, Abuja, Nigeria dg@energy.gov.ng www.energy.gov.ng	Strategic energy planning, coordination and performance, laying down guidelines on the utilization of energy types for specific purposes
Sokoto Energy Research Centre, Sokoto	Uthman Dan fodio University, Sokoto www.edusok.edu.ng	Mandate for research of RE and implementation of relevant pilot programs
National Centre for Energy Research and Development	University of Nigeria, Nsukka, Enugu State	Mandate for research in renewable energy with a number of completed pilot projects
Rural Electrification Agency (REA)	No. 16, Gwani Street, off IBB Way, Wuse Zone 4, PMB, 5072, Wuse, Abuja www.reang.ng	Provision of reliable and affordable electricity supply to all rural dwellers using both grid and non-grid options
UNIDO Regional Center for Small Hydro Power	WAEC Building, Plot 10 (2nd Floor), Zambezi Crescent, Maitama, PMB 175, Garki, Abuja www.unidorc.org/nigerian	Established in Abuja for the promotion and acceleration of SHP in the region; development of cost effective technologies, capacity building and training
Renewable Energy Section (NNPC)	Block B, NNPC Towers, Central Business District, P.M.B. 190, Garki, Abuja www.nnpcgroup.com	National secretariat for biofuel policies and implementation

7 BIBLIOGRAPHY

- Business Day (2008): Achieving a Sustainable Source of Energy (special report)
- Central Bank of Nigeria (2006): Annual Report and Statement of Accounts
- Central Bank of Nigeria (2006): Statistical Bulletin, Vol. 17, Abuja
- Corporate Affairs Commission (without year): (www.cacnigeria.org)
- Energy Commission of Nigeria (2004): Energy Demand Projection Document, Mimeo
- Energy Commission of Nigeria (2005): Renewable Energy Master Plan (final draft report)
- Energy Commission of Nigeria (2007): National Energy Databank: Compendium of Renewable Energy Systems Deployed in Nigeria
- Energy Commission of Nigeria (2007): Draft National Energy Master Plan
- Energy Information Agency (2009): Annual Report
- Energy Information Agency (without year): Energy Annual 1980–2005 (www.eia.doe.gov/international)
- Iloeje, O. C. (2002): Report of Business Activities in Solar PV in Nigeria, Technical Report No .ECN/EPA/02/3, Energy Commission of Nigeria
- JICA (2006): The Federal Republic of Nigeria Master Plan Study for Utilization of Solar Energy (Interim Report)
- Kwakwa, V. A., Adenikinju, P., Mousley and Owusu-Gyamfi, M. (2008): Binding Constraints to Growth in Nigeria (published in "Economic Policy Options for a Prosperous Nigeria", Palgrave Macmillan, New York)
- Maigida, S. (2008): Power Sector Infrastructural Development by 2020: Issues and Challenges (paper presented at the 1st International Conference of NAEE/IAEE)
- National Bureau of Statistics (2005): The Nigerian Statistical Fact Sheets on Economic Development, Lagos
- Nigerian Investment Promotion Corporation (without year): (www.nipc.gov.ng)
- Oke, C. A. (2008): Resuscitating and Sustaining the Nigerian Power Sector (paper presented to the Nigerian Association for Energy Economics)
- Power Holding Company of Nigeria (2008): (www.phcnonline.com/my tariffs)
- Sambo, A. S. (2008): Proposed National Master Plan for Nigeria (paper presented at the 1st International Conference of NAEE/IAEE)
- Theodora (2007): Maps of Nigeria (www.theodora.com/maps, revised March, 28th 2007)
- World Bank (2007): World Development Indicators (CD-Rom)

8 ANNEX

FIGURE 4

Map of Existing Transmission Lines in Nigeria

Source: Oke, as of 2008

TABLE 9

Installed Power Generating Capacity on the Nigerian Grid (2006)

TYPE	INSTALLED CAPACITY (MW)	%
Hydro		
Kanji	760	28.9
Jebba	540	
Shiroro	600	
Gas turbines		
Sapele	300	40.0
Afam	920	
Delta	840	
AES	270	
AGIP	300	
Steam turbines		
Egbin	1,320	31.1
Sapele	720	
Total capacity	6,570	100

Source: Oke, as of 2008

TABLE 10

Electricity Tariffs in Nigeria

RESIDENTIAL CLASS						
Class	Demand Level	Demand Charge/KVA	Max. Charge/Month	Fixed Charge	Meter Maintenance Charge/Month	Energy Charge/KWH
R1	< 5 kVA	–	–	20	100.00	1.2
R2	< 5–15 kVA	–	–	30	100.00	4.0
R3	< 15–45 kVA	–	–	120	500.00	6.0
R4(MD)	LV: < 45–500 kVA	–	5,000.00	120	1,600.00	8.5
R5(MD)	HV: < 500 kVA – 20 MVA	–	31,250.00	–	2,200.00	8.5

COMMERCIAL CLASS						
Class	Demand Level	Demand Charge/KVA	Max. Charge/Month	Fixed Charge	Meter Main Charge/Month	Energy Charge/KWH
C1	< 5–15 kVA			90	500.00	8.5
C2	< 15–45 kVA			120	1,600.00	8.5
C3(MD)	LV:<45–500 kVA	230,00	5,000.00	240	2,200.00	8.5
C4(MD)	HV: < 500 kVA – 20 MVA	230,00	31,250.00			

INDUSTRIAL CLASS						
Class	Demand Level	Demand Charge/KVA	Max Charge /Month	Fixed Charge	Meter Main Charge/Month	Energy Charge /KWH
D1	< 5–15 kVA	–	–	90	100.00	6.5
D2	< 15–45 kVA	–	–	120	500.00	8.5
D3	LV: < 45–500 kVA	230	5,000.00	240	1,600.00	8.5
D4	HV: < 500 kVA – 20 MVA	250	31,250.00		2,200.00	8.5
D5	> 20 MVA	270	–	1.5 M	2,200.00	8.5

PREPAYMENT CLASS			
Tariff Index	Rate	Meter Maintenance Fee	Fixed Charge
Residential 3 phase (R3) index 2	6.0	500	120
Commercial 3 phase (C2) index 5	8.5	500	120
Commercial 3 phase (C3) index 6	8.5	1,600	240
Residential single phase (R2) index 1	4.0	100	30
Commercial single phase (C1) index 4	6.5	100	90

Source: PHCN, as of 2008

TABLE 11

NEPA Estimate of Current Exploitable Hydro Power Sites in Nigeria

LOCATION	RIVER	POTENTIAL CAPACITY (MW)
Donka	Niger	225
Zungeru II	Kaduna	450
Zungery I	Kaduna	500
Zurubu	Kaduna	20
Gwaram	Jamaare	30
Izom	Gurara	10
Gudi	Mada	40
Kafanchan	Kongum	5
Kurra II	Sanga	25
Kurra I	Sanga	15
Richa II	Daffo	25
Richa I	Mosari	35
Mistakuku	Kurra	20
Korubo	Gongola	35
Kiri	Gongola	40
Yola	Benue	360
Karamti	Kam	115
Beli	Taraba	240
Garin Dali	Taraba	135
Sarkin Danko	Suntai	45
Gembu	Dongu	130
Kasimbila	Kasina Ala	30
Katsina Ala	Katsina Ala	260
Makurdi	Benue	1,060
Lokoja	Niger	1,950
Onitsha	Niger	1,050
Ifon	Osse	30
Ikom	Cross	730
Afokpo	Cross	180
Atan	Cross	180
Gurara	Gurara	300
Mambilla	Danga	3,960
Total		12,220

Source: ECN, Renewable Energy Master Plan, as of 2005

TABLE 12

Small Hydro Potential in Surveyed States of Nigeria

STATE (PRE 1980)	RIVER BASIN	TOTAL SITES	TOTAL CAPACITY (MW)
Sokoto	Sokoto-Rima	22	30.6
Katsina	Sokoto-Rima	11	8.0
Niger	Niger	30	117.6
Kaduna	Niger	19	59.2
Kwara	Niger	12	38.8
Kano	Hadeija-Jamaare	28	46.2
Borno	Chad	28	20.8
Bauchi	Upper Benue	20	42.6
Gongola	Upper Benue	38	162.7
Plateau	Lower Benue	32	110.4
Benue	Lower benue	19	69.2
Rivers	Cross River	18	258.1
Total		277	734.2

Source: ECN, Renewable Energy Master Plan, as of 2005

TABLE 13

Existing Small Hydro Schemes in Nigeria

RIVER	STATE	INSTALLED CAPACITY (MW)
Bagel I	Plateau	1
Bagel II	Plateau	2
Ouree	Plateau	2
Kurra	Plateau	8
Lere I	Plateau	4
Lere II	Plateau	4
Bakalori	Sokoto	3
Tiga	Kano	6

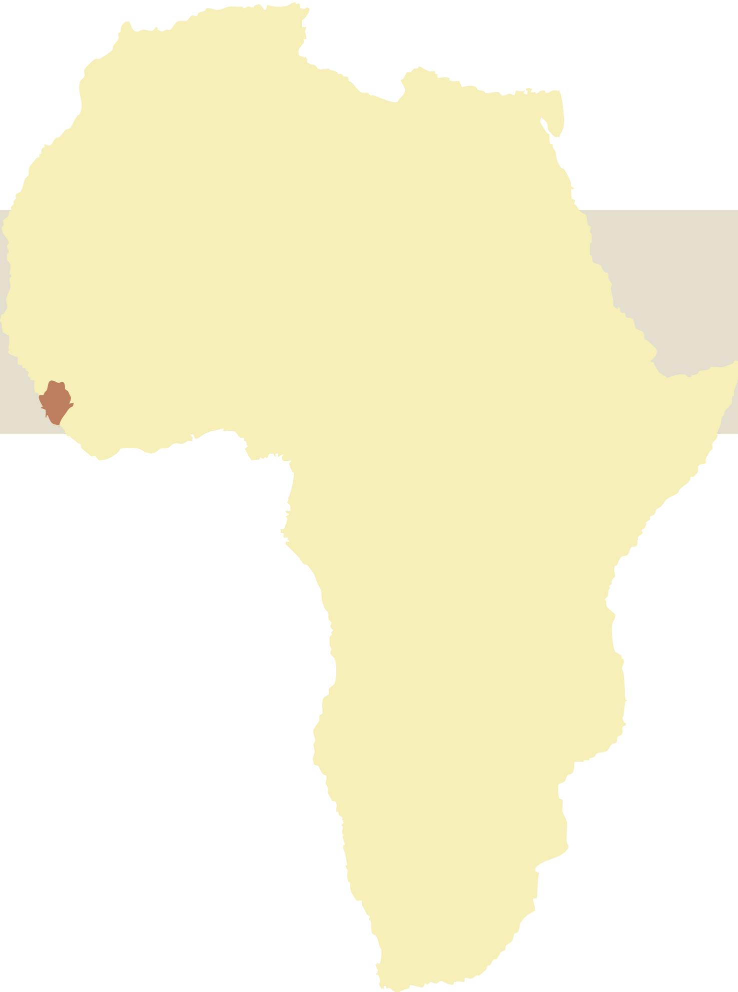
Source: ECN, Renewable Energy Master Plan, as of 2005

COUNTRY CHAPTER: SENEGAL

The Regional Report "Renewable Energies in West Africa" does not include a separate Country Chapter for the ECOWAS country Senegal, as key information on the Senegalese RE market is already available by two other studies edited and compiled by GTZ on behalf of the German Government:

GTZ / TERNA (2009):
Energy policy Framework Conditions for Electricity Markets and Renewable Energies – 16 Country Analyses, part Senegal (in English)
›› http://www.gtz.de/de/dokumente/gtz2009-en-terna-senegal.pdf

GTZ / Owsianowski, R.-P. (2007): Projekterschließung Senegal
Erneuerbare Energien und ländliche Elektrifizierung.
Länderreport & Marktanalyse
›› http://www.gtz.de/de/dokumente/de-projekterschliessung-senegal-laenderreport.pdf



COUNTRY CHAPTER: SIERRA LEONE

Author of Country Chapter
Michael A. Conteh (MSc. Eng.)

Coordination and Review of the Country Chapter
Anton Hofer, (MSE, Dipl.-Ing./FH, M.A.)
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS SIERRA LEONE

ACRONYMS AND ABBREVIATIONS

SIERRA LEONE

APC	All People's Congress
BADEA	Arab bank for economic development in Africa)
BHEP	Bumbuna Hydroelectric Project
BKPS	Bo-Kenema Power Services
CFL	Compact Fluorescent Lamp
DANIDA	Danish International Development Agency
DC	Direct Current
EFA	Environmental Foundation for Africa
e.g.	ex gregie/for example
FOB	Free of Board
GDP	Gross Domestic Product
GoSL	Government of Sierra Leone
GTG	Global Trading Group
HDI	Human Development Index
IEL	Income Electrix Limited
IPP	Independent Power Producer
JICA	Japan International Cooperation Agency
KPS	Kingtom Power Station
Le	Leone (Sierra Leonean currency)
LPG	Liquefied Petroleum Gas
MAFS	Ministry of Agriculture and Food Security
MEP	Ministry of Energy and Power
MF	Ministry of Finance
MFO	Marine Fuel Oil
MLIRSS	Ministry of Labor, Industrial Relations and Social Security
MMR	Ministry of Mineral Resources
MoU	Memorandum of Understanding
MTI	Ministry of Trade and Industry
NCP	National Commission for Privatization
NP	National Petroleum Company
NPA	National Power Authority
PIU	Project Implementation Unit
PPP	Public-Private Partnerships
PSP	Private Sector Participation
PU	Petroleum Unit
PV	Photovoltaic
RE	Renewable Energy
SDF	Saudi Development Fund
SHS	Solar Home System
SLEDIC	Sierra Leone Export Development and Investment Corporation
UNAMSIL	United Nations Mission in Sierra Leone
UNECA	United Nations Economic Commission for Africa
UNIDO	United Nations Industrial Development Organization
USD	United States Dollar

MEASUREMENTS

GWh	gigawatt hour (1 GWh = 1,000,000 Kilowatt hours (kWh))
kg	kilogram
km^2	square kilometer
kWh	kilowatt hour
kVA	kilovolt-ampere
m/s	meters per second
m^3	cubic meters
mm	millimeter
MW	megawatt (1 MW = 1,000 kW)
MWh	megawatt hour
MT	million tons
toe	tons of oil equivalent
yr	year
t	ton
W	Watt
Wp	Watt-peak
°C	degree Celsius
€	Euro (1 Euro = 4,233.01 Le)

SUMMARY

The Country Study of Sierra Leone is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Sierra Leone. The study is structured as follows:

Chapter one provides **Background Information on Sierra Leone.** This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Sierra Leone.

Chapter two summarizes facts and figures of **Sierra Leone's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Sierra Leone. This includes an overview of support mechanisms for RE technologies as well as other already existing regulations, incentives and legislative framework conditions.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Sierra Leone.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Sierra Leone.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Sierra Leone is a tropical country that stretches along the West coast of Africa between latitudes 7° North and 10° North, and longitudes 13°30' West and 10°30' West. It has a total surface area of 72,000 km² (≈ 28,000 square miles). Its borders are the Atlantic Ocean with a coastline of approximately 340 km (≈ 210 miles) in the West, Guinea in the North West and East and Liberia in the South East.

For administrative purposes, the country is divided into three Provinces (Northern Province, Southern Province and Eastern Province) and one Area (Western Area that houses the capital city of Freetown). The Provinces are further divided into twelve districts. The western area is divided into the Western Rural District and the Western Urban District. The Western Rural District consists of the following wards: Koya, Mountain rural, Waterloo and York rural, while the Western Urban consists of Central 1 and 2, East 1, 2 and 3 and West 1, 2 and 3.

FIGURE1:
Map of Sierra Leone

The climate of Sierra Leone is tropical with constantly high temperatures and marked wet and dry seasons. The daily average temperature varies but little throughout the year. The lowest average temperatures occur in the mid-wet seasonal months of July and August with thickest cloud cover. The highest temperatures occur in March and April when insulation is high and cloud cover low. Sierra Leone's mean temperature throughout the year is about 27 °C. The country has a fairly high rainfall; it records an average of about 2,950 mm of rainfall in 2003 making it one of the wettest countries in West Africa.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

The Republic of Sierra Leone was a former British colony that gained its independence in April 1961. It is a multi-party democratic sovereign state that has just got over a ten-year rebel conflict, which devastated the country's physical and social infrastructures. According to the 1991 constitution, the three arms of the Government are the Executive, the Parliament, and the Judicial. The current president is Dr. Ernest Bai Koroma (as to 2009). He is the leader of the All People's Congress (APC), which is the dominant political party in the country.

For over two decades, the institution of local governments was on hold. In 2004, however, local governance was once again reinstated through an Act of Parliament. 19 Local Councils (LCs) were established, covering all districts and town centers in Sierra Leone, including the capital of Freetown. According to section 20 (1) of the Act, the LCs are the highest political authority in their localities. They have legislative and executive power to be exercised in accordance with the Act or any other enactment. The LCs are responsible for promoting the development of their localities and the welfare of the people and are entitled to use any resources at their disposal including resources and capacities they can obtain from the central government and its agencies, national and international organizations and the private sector.

The LCs are financed through revenue collections of their own, by central Government grants for devolved functions and by transfers for services delegated from Government ministries. In terms of political stability, civil liberties, and political rights, Sierra Leone is now comparable to the average of the West African region. According to the 2004 census, the current population of Sierra Leone is 5,473,530 million with a growth rate of about 2.6 %. Women account for about 51 % of the population. The population is youthful; those in the age range of 15–64 years account for about 52 %. Over the years, the urban population has increased at a faster rate than the rural, largely due to rural neglect and the civil conflict. However, at least 65 % of the population still live in rural areas and are mostly engaged in agricultural, mining and other non-farm activities.

Table 1 shows the projected national population. The country's population is expected to reach about 6.5 million by 2015. Future percentage of the rural population is envisaged to decrease over the years due to migration to the urban areas for better life.

TABLE 1
Projected Demographic Indicators for Sierra Leone (2006–2016)

INDICATOR	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Population (x 1000)	5,217	5,343	5,474	5,610	5,747	5,189	6,038	6,190	6,348	6,506

Source: SSL, as of 2005

Though the country is endowed with substantial mineral resources – diamonds, rutile, bauxite, gold and iron ore as well as rich agricultural and marine resources (which are the major sources of its export earnings) – it is one of the least developed countries in the world. This is largely due to the undeveloped economic and social infrastructures, serious social disorders and the ten-year civil conflict that continues to hinder economic activities. As stated in the CIA World Fact Book 2008[1], the 2007 estimations show the country's low level of social development: life expectancy is only 43 years, infant mortality is 15.6 %, about 64 % of those over 15 years are illiterate and about 93 % of the population have no access to electricity.

Sierra Leone's economy is predominated by agriculture, followed by the service sector and industry. Agriculture accounts for about 45 % of the Gross Domestic Product (GDP) (see Fig 2), 61 % of employment and 12 % of export earnings. The service sector constitutes about 35 % of the GDP while industry accounts for about 8 %. Before the civil conflict in 1991, mining was the second most important economic activity in the country, accounting for about 10 % of GDP, 14 % of total employment and 85 % of exports. Currently, alluvial and kimberlite diamond mining are the major sources of hard currency earnings. Manufacturing consists mainly of the processing of raw materials and of light manufacturing for the domestic market.

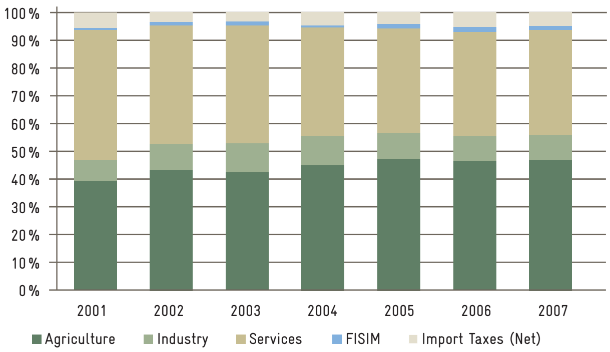
Figure 3 shows the nation's GDP at constant market prices in 2001 and inflation from 2001–2007. The average growth rate (year-to-year) of the GDP is over 10 %. There was a steady increase in the economy over the period under consideration. Inflation in 2004 was the highest, equaling about 14 %, while the current inflation rate is about 8 %. The high inflation rates adversely affect the poor (representing the majority of people) by reducing their purchasing power.

Sierra Leone is a poor African country with tremendous inequality in income distribution. According to the 2007/2008 Human Development Report[2], the country ranked 177 out of 177 with a Human Development Index (HDI) of 0.336 and a GDP per capita of 806 USD based on purchasing power parity.

The GINI index[3] reveals the wide gap between the rich and the poor in Sierra Leone. Table 2 illustrates the levels of poverty in Freetown, rural areas, other urban areas and on the national level. On the national level, about 26 % of the population are poor in food meaning that they cannot afford adequate daily nutrition. When non-food basic needs are also taken into account, the total rate of poor people rises to about 70 %.

FIGURE 2

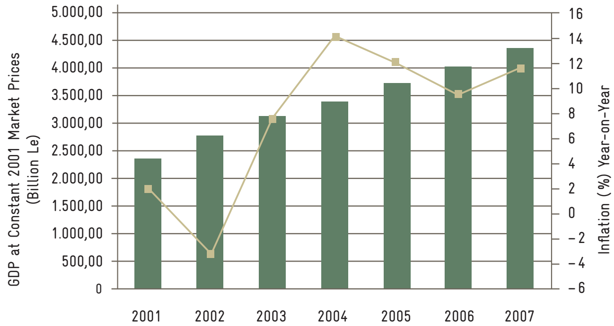
Sectoral Composition of GDP



Source: Bank of Sierra Leone, as of 2001–2007

FIGURE 3

GDP and Inflation (2001–2007)



Source: Bank of Sierra Leone, as of 2008

TABLE 2

Incidence, Depth and Severity of Poverty by Area

AREAS	SHARE OF SAMPLE (%)	FOOD POOR (%)	TOTAL POOR P0 (%)	POVERTY GAP INDEX P1 (%)	POVERTY SEVERITY INDEX P2 (%)	PROPORTION OF SIERRA LEONE'S POOR (%)	INCOME GAP RATIO (P1/P0)
Freetown	10.4	2.0	15.0	4.0	4.0	2.2	27.0
Rural areas	64.4	33.0	79.0	34.0	19.0	72.8	43.0
Other urban areas	25.1	20.0	70.0	26.0	14.0	25.1	37.0
National	100.0	26.0	70.0	29.0	16.0	100.0	41.0

Source: Sierra Leone PRSP, as of 2005

1 CIA, 2008
2 UNDP, 2007/2008
3 THE GINI COEFFICIENT IS A MEASURE OF STATISTICAL DISPERSION DEVELOPED BY THE ITALIAN STATISTICIAN CORRADO GINI AND PUBLISHED IN HIS 1912 PAPER „VARIABILITY AND MUTABILITY". IT IS COMMONLY USED AS A MEASURE OF INEQUALITY OF INCOME OR WEALTH.

2 ENERGY MARKET IN SIERRA LEONE

2.1 OVERVIEW OF THE ENERGY SITUATION

Over the last 20 years, the supply of electricity has steadily decreased in Sierra Leone. During the civil war, most of the production units and distribution infrastructure were destroyed. Sierra Leone is slowly emerging from the protracted civil war, yet the rebuilding of energy infrastructure takes more time than expected.

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

The electricity industry consists of the Western Area grid centered in Freetown and the provincial systems. The provincial systems originally consisted of 12 isolated systems located in the headquarter towns. Due to the destruction during the civil conflict, all systems are beyond sensible economic repair except for the Bo-Kenema Power Services (BKPS) system. In general, the country's power systems are operated by the National Power Authority (NPA) and BKPS.

In 2007, the electricity generation in Freetown was very unsatisfactory; it declined continuously and the available generating capacity by the end of the year was about 6 MW. As a result of the low available generating capacity, the electricity market was opened to the private sector. Therefore, the Government of Sierra Leone (GoSL) engaged two Independent Power Providers: the Global Trading Group (GTG) for the provision of 15 MW at Kingtom for one year (December 2007 to December 2008) and the Income Electrix Limited (IEL) for the provision of a total of 25 MW to be installed at Blackhall Road and other locations in Freetown to salvage the electricity supply crisis.

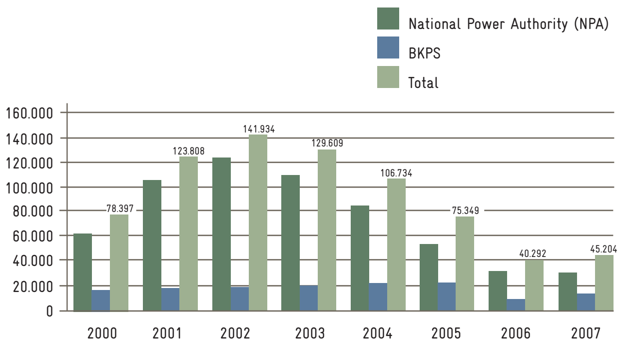
Between 1960 and 1995, the country's total installed and operating electricity generating capacity was about 42 MW with 13 power stations located all over the country using diesel engine generator units. Owing to the poor performance and the civil conflict, almost all the provincial thermal plants (except for Bonthe and Moyamba) have either deteriorated beyond sensible economic repair or have been completely destroyed. The current total installed capacity excluding auto-producers (from the mining, industrial and commercial sector) is about 41 MW with 33.14 MW in Freetown and the original capacities in Bo and Moyamba.

The national electricity production (by NPA and BKPS) between 2000 and 2007 was not satisfactory (see Figure 4). It peaked in 2002 with an annual generation of 142 GWh and drastically declined to 40 GWh in 2006 and 45 GWh in 2007. The peak generation in 2002 was due to the change in the NPA management in 2000 and the increased generating capacity (3 x 1.28 MW Caterpillar generating sets and the 6.3 MW Mirrless generating set). In 2003, another management was instituted, and due to its poor management there was a continuous decline in electricity generation between 2003 and 2007. Within this period, the use of imported petrol/diesel generators became the only alternative for households as well as private and public sector businesses. The estimated national private generation is in the order of 80 MW. The insecurity of power supply coupled with the inadequate distribution capacity of the NPA has forced most businesses to rely on an energy generation of their own in spite of its high costs. This has led to high production costs, which, among other reasons, has limited the competitiveness and growth of the manufacturing sector.

Figure 5 shows the electricity consumption pattern by the various sectors. The total consumption is less than the energy produced due to the high system losses, which are estimated at 30–38 %. In 2000, the per capita electrical energy consumption was 17 kWh. This increased to 30 kWh in 2002 and fell gradually to 7.7 kWh in 2006.This is far from being satisfactory, especially when compared to Ghana that had a per capita consumption of approximately 420 kWh in 2006.

FIGURE 4

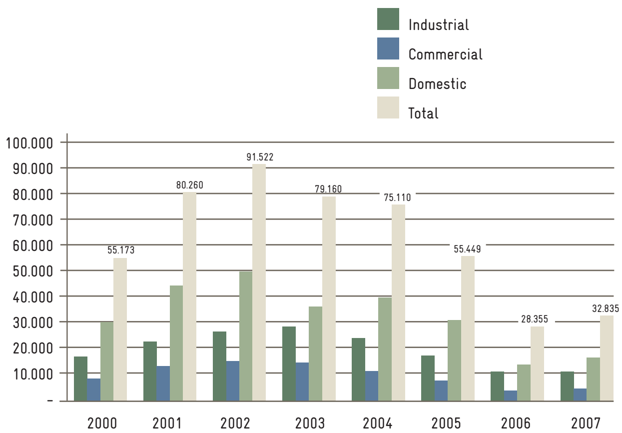
National Electricity Production (MWh; 2000–2007)



Source: National Power Authority (NPA) & Bo-Kenema Power Services (BKPS), as of 2008

FIGURE 5

Electricity Consumption Pattern by Sector



Source: NPA & BKPS, as of 2008

The electricity tariffs over the years 1996–2005 are given in Table 3 with the corresponding dollar exchange rates (as of 2000–2007) depicted in Table 4. Up to 2000 there was a difference in tariffs between state-run and private institutions. Presently there is no such distinction. The utility serves about 45,000 customers in the Western Area and about 10,000 in the BKPS region. The overall consumer base in Sierra Leone is about 7 % with the provincial towns and rural areas accounting for between 2–3 %. Due to the under-performance of the NPA, the sale of imported generators[6] has become a very vibrant business in the country. The general cost is around 300 USD/kVA depending on the brand. There is a cheap brand of generators producing at a cost of about 100 USD/kVA, which has become very popular especially for consumers with essential needs on the low load level, such as for lighting.

There are a number of auto producers meeting their own demand. They include the mining companies, industrial, commercial and domestic consumers who continue to be customers of the NPA and BKPS. It is estimated that their self-generation capacity is over 40 MW.

TABLE 3

Electricity Tariffs (1996–2005)

TARIFF STRUCTURE	ENERGY CONSUMPTION LEVELS (UNITS[7])	ENERGY CHARGE (LE/KWH)				
		1996	1998	2000	2003	2005
Tariff 1	Domestic					
	0–30	90	117	205	287	373
	31–150	110	143	293	410	533
	Above 150	130	169	389	545	709
	Min. charge	2,500	3,250	6,143	8,600	11,180
Tariff 2	Non-domestic (commercial)					
	0–30	100	130	358	501	651
	31–150	120	156	429	601	781
	Above 150	130	169	465	651	846
	Min. charge	3,000	3,900	10,725	15,015	19,520
Tariff 3	State-run institutions					
	All units	100	130	429	601	781
	Min. charge	5,000	2,600	17,875	25,025	32,533
Tariff 3A	Others					
	All units	120	156			
	Min. charge	5,000	6,500			
Tariff 4	Industry					
	All units	150	195	517	724	941
	Min. charge	50,000	65,000	65,000	91,000	118,300
Tariff 5	Street lighting					
	All units	120	156	435	609	792
	Min. charge	7,500	9,750	796	20,475	26,618
Tariff 6	Temporary supplies					
	All units	200	260	–	700	910
	Min. charge	5,000	6,500	–	8,680	11,284
Tariff 7	Welders					
	All units	200	260	546	764	993
	Min. charge	10,000	13,000	19,500	27,300	35,490

Source: National Power Authority (NPA), as of 2006[8]

6 THESE GENERATORS ARE IMPORTED MAINLY FROM DUBAI AND EUROPEAN COUNTRIES.
7 THE UNIT OF ENERGY CONSUMED EQUALS 1 KWH.
8 1 EURO = 4,23301 LE

Petroleum Sector

Petroleum products (petrol, diesel and Marine Fuel Oil (MFO)) consumed in the country are imported in refined form. The annual average volume of imported petroleum products is about 200,000 metric tons, but this figure declined significantly during and after the war. Table 4 shows the volumes imported between 2000 and 2007.

The petroleum marketing and sales in the country are executed by Petro Leone, Sierra Leone National Petroleum Company (NP), Safecon, Total (formerly Mobil) and Leonoil. Though all companies import petroleum products, Petro Leone is the main importer and provider. Among the other four companies, NP dominates the market with 50 %, followed by Safecon (24 %), Total (23.5 %) and Leonoil (2.5 %). Prices for petroleum products are fixed due to an agreement that takes into consideration the trade price and the exchange rate (see Table 5). Allowances are made for various levies and distribution costs. The prices of the above mentioned petroleum products in the provinces vary due to varying transport distances from Freetown to the final destination. Due to the world market, the price of petrol, diesel and kerosene fluctuated between 14,000 Le and 16,500.00 Le (1 Euro = 4,233.01 Le) in 2008.

The industry is faced with a number of problems. Storage capacity is limited and this prevents huge quantities to be imported at any one given time. Also, foreign exchange is often not readily available and this has a far-reaching effect. The petroleum products are mainly imported from Côte d'Ivoire (Abidjan). Therefore, the oil companies experience some supply difficulties due to the unavailability of the products in Abidjan and bottlenecks in allocation or chartering of vessels. The procedures for procurement and delivery of products often cause long delays and unreliable supplies.

TABLE 4

Volumes of Petroleum Products Imported in Sierra Leone (2000–2007)

YEAR	PETROL (MT)	DIESEL (MT)	KEROSENE (MT)	JET A1 (MT)	MFO (MT)	NAPHTA (MT)	TOTAL (MT)
2000	29,874	39,561	39,981	–	15,607	–	125,023
2001	28,370	31,540	35,701	–	26,824	–	122,435
2002	36,524	49,462	54,786	–	26,433	–	167,205
2003	47,498	59,203	56,009	–	26,988	–	189,698
2004	54,880	68,663	21,480	31,132	34,432	–	210,587
2005	54,105	177,931	16,740	16,347	18,768	–	283,891
2006	59,317	160,902	14,503	13,586	18,825	3,524	270,657
2007	49,792	128,597	9,956	11,675	8,799	–	208,820

Source: Petroleum Unit–Sierra Leone, as of 2008

TABLE 5

Petroleum Product Pricing Formula (31st March 2005)

PRICE COMPONENT	PETROL	DIESEL	KEROSENE	MFO
Product Import–Platt FOB/USD/MT	512.92	449.93	535.23	237.77
Freight/USD/MT	33.26	40.00	30.00	35.00
C & F (Freetown)/USD/MT	546.18	489.93	565.23	272.77
Import duty 5 % C & F	27.31	24.50	28.26	13.64
Storage	4.70	4.70	4.70	4.70
Port charges	3.00	3.00	3.00	3.00
Demurrage	2.00	2.00	2.00	2.00
Freight levy	2.00	2.00	2.00	2.00
Other charges (transfer, agency fees etc.)	5.68	4.96	5.51	3.07
Landed cost–USD/MT	590.87	531.09	610.70	301.18
Conversion IG/MT	300.00	256.00	275.00	236.00
Landed cost–USD/IG	1.97	2.07	2.22	1.28
Exchange rate adjustment–Le/USD	2,950.00	2,950.00	2,950.00	2,950.00
Landed cost Le/IG	5,810.20	6,119.94	6,551.11	3,764.73
Distribution cost	1,311.63	1,217.70	1,358.85	596.33
Petroleum fund	15.00	15.00	15.00	–
Excise duty	1,613.17	1,397.36	575.04	238.98
Road user charge	750.00	750.00	–	–
Pump Price Le/IG (Freetown)	9,500.00	9,500.00	8,500.00	4,600.04

Source: Petroleum Unit–Sierra Leone, 2006

Liquified Petroleum Gas

This type of fuel is very important from an environmental point of view to phase out the production and use of wood and charcoal, but its use and hence its market is very small. Table 6 shows an estimate of the share of each energy source in household consumption. The percentage use of Liquefied Petroleum Gas (LPG) and electricity for cooking is almost negligible. The use of LPG in the near future will be zero if no policies are put in place to encourage its use. The LPG market is not well organized; individuals with the United Mission in Sierra Leone (UNAMSIL) import this energy source from neighboring countries. The National Petroleum Company and Shell did use to import LPG, but have almost stopped because of problems with availability, cost and the size of its market.

Table 7 shows the current prices for LPG in Freetown and in the provinces. LPG is sold in metal containers of different sizes. Affluent households, some hotels and restaurants and the marine industry use this energy source for cooking and heating.

Biomass Sector

Biomass has been a source of energy for centuries. Due to the recent increase of oil prices in the world market, bioenergy (in form of biofuels) has been seen as an alternative to deal with the oil supply constraint. Though it plays an important role in reducing greenhouse gas emission, the negative direct and indirect effects such as soil degradation, biodiversity loss, stress on water resources, trade-off with food supply etc. demand great attention. As far as Sierra Leone is concerned, little or almost nothing so far has been done in the direction of biofuel as an alternative to petroleum.

Fuel wood is the most widely used fuel in the country and is the most commonly used fuel for cooking and heating. Most households in the provinc es collect fuel wood from shrubs and forests, although a significant percentage (about 90 % of households in Freetown) have to buy it. According to Conteh (1997), 7,868 tons per annum of fuel wood reach Freetown (see Table 8). Charcoal and kerosene are also widely used, though far less than fuel wood.

The retail prices of fuel wood and charcoal vary throughout the country and according to the two seasons (meaning higher prices during rainy season). Fuel wood is sold in bundles with an average mass of 4 kg and charcoal is sold in 50 kg bags. In 2008, town prices of fuel wood ranged between 250–400 Le while farm gate and road prices range between 150–250 Le. Charcoal prices range between 11,000–15,000 Le in Freetown and other regions, roadside prices range between 6,000–8,000 Le.

TABLE 6

Petroleum Product Pricing Formula (31st March 2005)

FUEL WOOD	CHARCOAL	KEROSENE	LPG	ELECTRICITY
92.0 %	4.8 %	2.7 %	0.1 %	0.4 %

Source: National Energy Policy for Sierra Leone (final draft as of May 2004)

TABLE 7

LPG Prices for Different Containers

BOTTLE SIZE (LB)	4.41	14	28	33	50	86	120
PRICE (LE)	10,240	32,500	65,000	76,600	116,000	199,650	278,500

Source: market survey compiled by the author (as of 2004)[9]

TABLE 8

Estimations of Wood Products Consumption (1996–2002)

	1996	1997	1998	1999	2000	2001	2002
Fuel wood charcoal (m^3)	2,450,860	2,507,475	2,565,398	2,624,658	2,685,288	2,747,318	2,810,781
Fuel wood (m^3)	1,942,191	1,987,056	2,032,957	2,079,914	2,127,964	2,177,120	2,227,412
Wood for charcoal (m^3)	4,069,352	4,163,352	4,259,528	4,357,920	4,458,592	4,561,584	4,666,952
Charcoal (MT)	508,669	520,419	532,441	544,740	557,324	570,198	583,369

Source: Redwood-Sawyerr and Conteh, as of 2005

9 1EURO = 4,23301 LE, AS OF 2004; 5,66560, AS OF 2009

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The **Ministry of Energy and Power (MEP)** is the governmental authority responsible for the electricity and water sectors. Its mandate includes sector policy formulation, planning and coordination. Besides the electricity sub-sector, various other sub-sectors of the wider energy sector of the Sierra Leonean economy fall within the scope of responsibilities of various ministries. The MEP handles matters related to electric power supply, including hydroelectric schemes and, nominally, RE matters related to solar and wind energy. The **Ministry of Agriculture and Food Security (MAFS)** handles biomass issues (plant- and animal-derived matter), especially fuel wood. Petroleum marketing and sales are handled by the **Ministry of Trade and Industry (MTI)**; the **Ministry of Finance (MF)** also plays a significant role in the import and storage of petroleum products. Petroleum exploration and extraction is within the scope of responsibilities of a Presidential Petroleum Commission. The **Ministry of Mineral Resources (MMR)** deals with extraction of minerals, including energy related minerals.

It is interesting to note that the devolved functions of each ministry are listed in the 2004 Local Government Regulations. Only the rural water supply and community ownership of wells, bulk supply of water (except where privatized) and sanitation, however, are listed, however, for the MEP. There is no specific mention of energy and electricity provision for the local communities under the councils. This may, however, be subsumed under development issues counting as one the functions of the LCs.

Electricity Sector

The electricity industry in Sierra Leone is state owned and vertically integrated. It is operated by the NPA and the BKPS. The National Power Authority Act of 1982 established the NPA as the entity with the sole responsibility for carrying out power generation (including Hydro Power), transmission, distribution and supply in the country. The 2005 NPA (Amendment) Act stipulated additional governance duties for NPA.

BKPS was established in 1991 as a semi-autonomous body. It resulted from an agreement between the Danish International Development Agency (DANIDA), the GoSL and the NPA to operate with a certain degree of autonomy. It was formed as a result of an NPA Board decision and was subsequently established as an entity with its own Articles of Association. Formally, the BKPS is not an operating division of the NPA, but reports to the NPA Board through its Steering Committee.

The NPA is the sole supplier of electricity in the country. The BKPS, which is a semi-autonomous division of NPA, is responsible for the integrated supply of electricity for the townships of Bo and Kenema and their environs. The main legislative arrangements for the electricity sector are contained in the National Power Authority Act of 1982 and the National Power Authority (Amendment) Act of 2005.

The MEP is responsible for the entire electricity sector. This Ministry was created in 1974 for establishing and implementing the state policy for electricity and other energy related sub-sectors. Therefore, up until 2002, the electricity industry was sector regulated through the MEP. In 2002, the National Commission for Privatization (NCP) was created through an Act of Parliament. Its function, among others, is the privatization and reform of public enterprises with the NPA being part of the first schedule of public enterprises for divestiture. Therefore, operational oversight of NPA is now provided by a Board, which reports directly to the NCP in preparation for Private Sector Participation (PSP).

Though the ownership and supervisory role of the MEP for the NPA have been repealed and vested in the NCP, the MEP retains the overall responsibility for policy formulation, planning and coordination in the respect of the development and utilization of the country's energy resources. Currently, the lack of appropriate staff in the ministry is a major barrier in view of policy-making, planning, control and coordination.

The Project Implementation Unit (PIU) for the Bumbuna Hydroelectric Project (BHEP) reports to the MEP. The 1982 NPA Act defines the NPA's responsibilities and rights with respect to the development of hydroprojects in the country. The NPA forms part of the Steering Committee which supervises the PIU, it is, however, questionable if all duties can actually be performed.

Petroleum Sector

The Petroleum Unit (PU) was set up in June 1992 under GoSL's comprehensive Structural Adjustment Program for Macroeconomic Stabilization. This unit was meant to function as an independent coordinator between the GoSL, donor institutions and the petroleum industry in and outside of Sierra Leone. The PU is supervised by the MTI in close collaboration with the MF. The PU has been given a new mandate to serve as industry regulator/coordinator.

The petroleum exploration and production sector is regulated by the Petroleum Exploration and the Protection Act of 2001[10]. This act provides for the establishment of the Petroleum Resources Unit, which is under the authority of the President and headed by a general manager. This unit as the main administrative body was established to represent the state exclusively in negotiations with interested parties for the exploration, development or production of petroleum, to act on behalf of the state in petroleum agreements and to regulate the petroleum industry in Sierra Leone.

Biomass Sector

As to the supply of firewood to households in the country, no governance and/or regulatory authority exist to oversee the suppliers' activities. Producers and sellers of charcoal in the Western Area partially belong to the Coal Producers and Sellers Union, headquartered at Waterloo Street in the capital of Freetown. The union is registered with the Forestry Division of the MAFS. The Union is headed by a chairman, other members of the executive being the vice chairman, financial secretary, and secretary general. Membership in the Union is open to all coal producers and sellers for a minimal fee. The union pays annual taxes and dues to the Government.

10 LEXADIN/ THE WORLD LAW GUIDE, 2009

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

There used to be no policy instruments to address specific energy issues in Sierra Leone. Therefore, the United Nations Economic Commission for Africa (UNECA) provided funding to the GoSL in the first quarter of 2004 for a study leading to the formulation of a national energy policy for the country.

CEMMATS, a local consultancy firm, was contracted to carry out an overview study. Based on an assessment of the existing institutional framework as well as energy demand and supply patterns, a document draft entitled "The Energy Policy for Sierra Leone" containing policy statements on specific energy issues was produced. This document was presented for validation in a consultative session of stakeholders from 29–30 June 2004. It was also presented to the MEP, but up till now this document has not been ratified by the Parliament and thus established as a working document. As defined in the energy policy draft document, the main policy target for electricity is to provide access for 35 % of the population by 2015. Hence, no contribution of Renewable Energy to electricity was mentioned.

The following policy statements, however, relate to the promotion of RE:

- Appropriate financial and administrative institutions will be set up to manage RE
- Consideration of tax reductions and incentives for RE equipment
- Manufacturing of RE equipment to actively encourage promotion and provision of investments
- Facilitation of adequate financing schemes for RE technologies by establishing sustainable financing mechanisms to make them more accessible
- Ensuring that RE producers and importers ascribe to certified performance and technical standards
- Encouragement of solar water heating in hospitals, clinics, boarding homes etc. for sterilization and hygiene purposes
- Taking measures to allay the fear of using solar cookers in rural areas because of cultural and traditional practices
- Encouragement of co-operatives and energy service companies in order to facilitate the financing mechanism for sustainable and transparent RETs
- Establishment of appropriate norms, codes of practice, guidelines and standards for RE thus creating an enabling environment for sustainable development
- Encouragement of local manufacturing of RE generator systems

According to the Sierra Leone first Poverty Reduction Strategy Paper (PRSP) for 2005–2007[11], the Government's objective in the energy sector was to expand the population's access to reliable modern energy services while improving supply reliability. In this regard, the planned strategy was to encourage both public and private investments, to promote an energy mix with focus on RE resources and to improve the supply and demand management of traditional fuels.

Owing to the pronouncement of His Excellency the President, electricity is the topmost priority of his Government aiming to restore electricity in the country. Thus, apart from other existing projects, the current thinking of the MEP for rural electrification is to exploit the country's small hydro potential.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

Between 2006 and 2007, a number of offers by foreign private investors were made to the Government. A Memorandum of Understanding (MoU) was signed for some of these offers. Below is a list of some renewable energy related offers made to the Ministry:

- Elsfield Energy (Elsfield Holdings Ltd.), 28 Felipe Road Chafford Hundred Grays Essex, UK
- ENERGEON Inc., 2078 Willowbar Ct., Gold River, CA 95670, USA, by Prof. Balchandra, California: biomass power plant (medium- to long-term) of 100–500 MW capacity (biomass – such as tree branches, agricultural residues, municipal solid waste)
- Waste to Energy (energy production using residues) by Alternative Use plc
- 5.0 MW solar system of electricity generation by NAANOVO Energy Inc. (through Chief Gbondo)
- Biomass (Waste to Energy) project by Cinergex Solutions Ltd. (through David Donkor)
- Bikongo hydro project

None of the listed projects have been realized so far, while the energy situation (electricity in particular) has deteriorated drastically. Table 9 shows the current installed and available capacity of the generators at the Kingtom Power Station (KPS) in Freetown and their status. The rest of the country is almost completely without electricity except the Bo-Kenema region, where there is a mix of hydro and thermal plants.

Owing to the deplorable electricity situation towards the end of 2007, the current President – on assumption of office and in his first speech at the opening of Parliament – declared: "The utmost priority of my Government is the speedy provision of electricity supply." Hence, to actualize the presidential declaration, a presidential Energy Emergency Taskforce was created in order to develop a Strategic Plan/Road Map to address the energy crisis. This strategic plan is still being worked on. Due to the status of electricity in the country, the main policy goals of the MEP and the respective strategies are depicted below. The main objective is to encourage both public and private sector investments in the energy sector and to promote energy security through the encouragement of the sustainable exploitation of Sierra Leone's indigenous energy resources with focus on RE resources. The target areas to improve the current electricity supply are the Western Area and the provincial headquarter towns.

11 SIERRA LEONE PRSP, 2005–2007

TABLE 9

Installed and Available Generating Capacities at Kingtom Power Station–Freetown

GENERATOR	INSTALLED CAPACITY [MW]	AVAILABLE CAPACITY [MW]	REMARKS
Sulzer 4	9.2	–	Unavailable due to burnt alternator
Sulzer 5	9.2	7.5	Available
Mitsubishi	5.0	–	Unavailable due to crankshaft problem
Mirrlees 2	6.9	–	Unavailable due to cracks of cylinder heads
Mirrlees 3	6.3	–	Unavailable due to burst engine block
Caterpillar 1	1.28	–	Unavailable due to burst engine lock
Caterpillar 2	1.28	0.8	Available. Requires spare parts for overhauling as it has gone beyond the scheduled 9,000 hrs
Total	39.16	8.3	

Source: Ministry of Energy and Power, as of 2007

In order to deal with the declining power generation in Freetown (Western Area) towards the end of 2007, the Government engaged two Independent Power Producers (IPP): the Global Trading Group (GTG) and the Income Electrix Limited (IEL) for the provision of 15 MW and 25 MW respectively to salvage the electricity supply crisis. Currently, there is a slight improvement in the electricity supply in Freetown. In Addition to the emergency measures mentioned above, there are other projects in the pipeline for the improvement of electricity supply in Freetown. These are as follows:

- The repair of the Sulzer 4 (burnt alternator) and Mitsubishi (crankshaft problem) generators
- The implementation of the Arab Bank for Economic Development in Africa (BADEA) and the Saudi Development Fund (SDF) project for the installation of two 8.75 MW diesel generating units
- The implementation of the Japan International Cooperation Agency (JICA) project for the supply and installation of two 5 MW generating sets at the Kingtom Power Station with an expected commissioning by mid 2009

It is hoped that the completion of the Bumbuna hydroelectric project phase I (50 MW) will suffice for the supply of the Western Area and parts of the Northern Province. With the start of the Bumbuna hydroelectric project and the implementation of the other projects mentioned above, the available generating capacity is estimated at about 80 MW by 2010. The main challenge to receive and utilize such power is to install a transmission and distribution network. The current transport capacity of the network in Freetown is about 30 MW, but losses in the system are extremely high due to its age. Projects that are in progress for the expansion of the network are the Sierra Leone Power & Water Project (cr. 3945 – SL), the upgrading of the T&D network – 33 kV line as well as the construction of a sub-station at Regent by JICA with a 33 kV line from primary substation of Wilberforce toRegent and a 11 kV line from Kingtom Power Station to -Congo Cross Primary Substation and from there to Wilberforce. The Agency will also provide material for the 11 kV link between Falconbridge and Blackhall Road.

After the implementation of these projects, the transport capacity of the network will be strongly enhanced. Increased generation capacity in the Bo-Kenema region is the objective of the expansion of the Dodo Dam (Goma Hydro Power Station) and the repair of the thermal plant in Bo. Though the dam was upgraded from 4 MW to 6 MW by the Government of Sierra Leone in 2007, there is still room for a further upgrading of up to 12 MW. There are three generators with a total capacity of 5 MW installed at the Bo power station. Only one of them is functional with an available capacity of 0.7 MW. There is no further generation from the Bo power station due to lack of spares and fuel. Almost all other provincial electricity infrastructures are either in a state of disrepair or in an unsatisfactory state. Few towns, as for example Moyamba, Pujehun, Makeni, Bonthe, Koidu and Kabala, have rudimental, yet incomplete electricity infrastructure. Other towns, e.g. Kambia, Rokupr, Port Loko, Lunsar, Njala and Kailahun, have no electricity infrastructure at all. In order to address the supply of electricity in the provinces, the following strategic actions are being implemented:

- Connect towns along the Bumbuna transmission line (i.e. Magburaka, Makeni, Lunsar, Portloko and Masiaka) with the existing network
- Exploit the country's hydro potential with particular emphasis on small and mini hydro projects
- Explore the possibilities of alternative energy sources for power generation by engaging potential investors (IPPs) for biomass power, wind power and solar power
- Set up pilot/demonstration solar energy plants (Solar Home Systems – SHS) in selected rural areas

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

The biomass resources comprise residues from existing forests and deforested or otherwise degraded lands on which so-called energy plantations can be cultivated. Of the residues, 656,400 tons of crop waste (rice husk, rice straw, cocoa husk etc.) are being produced annually, with a total annual energy potential of 2,706 GWh. Table 10 provides an overview of estimated biomass production figures.

It should be noted that the 2,706 GWh per year energy potential of crop residues (as calculated for 1996) correspond to the nation's highest generation of electricity of 142 GWh per year in fiscal 2002. This gives an indication of the potential of a single biomass resource (e.g. crop residues) to adequately satisfy the country's basic demand for electricity, which, assuming an average per capita requirement for basic human needs of 100 W, would turn out to be 4,800 GWh per year for a population of 5 million people using the power 24 hours a day throughout the year. Of the existing forests in Sierra Leone, the estimated incremental growth is between 770 and 1,500 m^3 per year for closed high forests, 260 m^3 per year for secondary forests and between 7,700 and 11,000 m^3 per year for forest re-growth. Savannah woodland, coastal woodland and plantations account for the rest of the estimated 9,260–15,010 m^3 of wood obtained from the forested area of the country (i.e., 730–2,250 m^3 per year). Leaving out high and secondary forests, the rest of the forest types mentioned above can provide feedstock to biomass conversion technologies. Removal of the forest overgrowth in particular can increase the yields of the remaining high-quality wood. Deforestation in the country is estimated at 3,000 hectares per year. Deforested land can, however, be restored to productive use through the cultivation of energy crops. These energy plantations can also be established on the available savannah and coastal woodlands. It should be noted that for all three biomass resources mentioned in the foregoing (residues, existing forests and deforested or otherwise desolated land), an exhaustive quantitative assessment is a prerequisite to ensure an accurate overall assessment of their energy potential and a sustainable form of cultivation/forestation. Fuel wood and charcoal are the major renewable biomass energy forms used in Sierra Leone's households for cooking. About 87 % of the total energy demand in Sierra Leone are met by traditional energy resources. At the current deforestation rate and with 65 % of the population living in the rural areas, the harvesting of these traditional fuels can lead to serious environmental degradation entailing harmful health effects and other serious social impacts.

4.2 SOLAR ENERGY

The country experiences sunshine for most part of the year hence solar energy is available in abundance. A recent study estimated the average solar radiation at 1,460 to 1,800 kWh/m^2/y, which points out the huge potential for solar power of the country. These data need revision since calculations were made from temperature and humidity measurements carried out at only eight different sites across the country in 1996. The potential and economic feasibility of photovoltaic (PV) electricity generating costs needs to be further explored. Table 11 indicates figures before the civil war in Sierra Leone; now however, most of these PV installations are stolen or destroyed. Less than a quarter of these figures is based on information from the remote sites. The potential of redesigned installations can be estimated at a total power output of 20.1 kW and more – considering that currently diesel generators are being used to power some of the stations instead of PV facilities.

Exemplary solar lighting systems were presented in 4 hinterland villages by the Competence Centre for Renewable Energy at Allen Town, Freetown. The most recent solar power facility installed by Prof. J.A.S. Redwood-Sawyerr, Deputy Vice Chancellor of the University of Sierra Leone, at Tombo Village was commissioned by the Minister of Energy and Power, Haja Afsatu E. O. Kabba. Before the civil war, PV was used extensively in the telecommunication industry at repeater stations. Currently, repeater stations and cell sites are using diesel generators. Few SHS are used for lighting and entertainment, and one institution is using it for water pumping. The current installed capacity of solar PV in the country is about 25 kW with 60–80 % of this capacity being installed by the RCD Solar Company. It provides 120 W/4 kW solar systems for hospitals, secondary schools, domestic and commercial use. Significant work has also been done by the Environmental Foundation for Africa (EFA)[12].

TABLE 10

Estimation of Annual Biomass Production

	WASTE PRODUCED (1000 T/YR)	TOTAL ENERGY POTENTIAL (GWH/YR)
Rice husk	181.0	640
Rice straw	210.0	788
Cocoa husk	8.7	34
Coffee husk	30.5	130
Peanut shell	10.1	43
Palm kernel shell	75.9	346
Palm fruit fiber	47.5	306
Woody remains of palm fruit bunches	72.5	367
Bagasse	20.2	52
Total	656.4	2,706

Source: Swaray S.M and Keili A, as of August 2004

TABLE 11

PV Installations in Sierra Leone

APPLICATIONS	INSTALLATIONS	CAPACITY (KW)	OPERATING HOURS
Telecommunications only	38	13.36	24
Telecommunications and lighting	4	6.24	24
Lighting only	19	0.9	12
Lighting and refrigeration	3	1.2	24
Refrigeration only	10	2.0	24
Miscellaneous	7	1.5	–
Total	81	25.2	108

Source: Redwood-Sawyerr and Sillah, as of 1999

12 EFA, AS OF 2009

4.3 WIND POWER

Data on wind speeds across the country are rare. The existing data on wind velocities indicate a countrywide average speed of 3–5 m/s. However, wind speeds of up to 12 m/s seem to be possible in some areas of the country. Should this in fact be the case, wind power may offer very promising opportunities for the overall energy sector of Sierra Leone. The MEP is currently encouraging studies of sites around the country that may hold potential as economically exploitable resource bases. With wind turbines operated with low wind speed now on the market, there is a strong potential for these systems in the rural areas, especially the North of the country. There is currently no known wind energy system applied in Sierra Leone.

4.4 HYDRO POWER

The estimated hydroelectric potential of Sierra Leone is 1,513 MW from about 27 different sites. Nearly all of them, however, suffer from the enormous flow variation between the wet and dry seasons. According to the Lahmeyer International report (1996)[13], only two of the 27 sites studied in the Master Plan are deemed to provide Hydro Power at attractive costs and with annual flow regulation. Yiben II, Benkogor III, Kambatibo, Betmai III, Yiben I and Bumbuna Falls are the most promising plants in terms of generation cost. Presently, Sierra Leone has built two hydroelectric plants. These are the 2.4 MW Guma plant, installed in 1967 in the Western Area, which has been out of service since 1982 due to electrical and mechanical damages, and the only operational 6 MW run of the river type located in the Eastern Province, some 380 km from Freetown and 69 km from the headquarter town of Kenema. This plant is operated by the BKPS consortium and is connected to a regional grid linking thermal power plants in Bo and Kenema. The consortium is made up of Danish experts from DANIDA and a regional committee appointed by the Government.

One hydroelectric power plant has been under construction since 1990, i.e. the 50 MW Bumbuna Hydroelectric Power Plant. The Bumbuna HEP has been suffering from a protracted construction process and was further compounded by the political upheavals in the country. The source of generation is the Rokel Seli River. Transmission lines, transformers etc. had already been installed before the war, which resulted in the damage of some of the pylons and transmission lines. The 161 kV transmission lines pass through a number of towns including Binkolo, Makeni, Lunsar, Masiaka and Waterloo. The sub-station at Kingtom, which has already been constructed, is intended to be used for distribution. The Bumbuna HEP is about 95 % completed and is expected to generate 47.5 MW during the rainy season and less than 30 MW during the dry season. According to the NPA (Amendment) Act of 2005, a Special Purpose Company has been formed and registered to run the facility. It is also meant to form the backbone network for a national grid. The HEP's total potential is about 305 MW and plans are in progress to develop the second phase of the project.

Many of the rivers investigated suffice for only small to medium hydro systems (i.e. 1–100 MW) and there is also a potential for pico to mini hydro systems (5 kW to 1 MW). The Master Plan, however, neglects potential resources under 2 MW. Hydro Power is expected to be an area of huge potential for Public Private Partnerships (PPP) and wider investment by the private sector. Due to the lack of data from small capacities, the MEP (in collaboration with GTZ Sierra Leone) planned a basic study between 2006 and 2007 aimed at gathering hydrological data to feed into the design of small hydro projects with capacities of up to 1 MW. This study is yet to be executed. There exists a well-advanced plan for the construction of one Small Hydro Power Plant (1 MW) in Port Loko. The design has been completed and the project implementation will start soon. It is a project funded by the Chinese Government, UNIDO and GoSL.

5 MARKET RISKS AND BARRIERS

The lack of an energy sector policy as well as a legal and regulatory framework is a significant barrier to private sector entry in the electricity supply chain. As mentioned above, there is no legalized energy policy that creates a healthy environment for private sector investments in the energy sector and RE in particular. This creates some uncertainties for investors regarding the commitment of the Government to liberalize the power sector. Relevant issues for the development of entrepreneurship in rural electricity supply in general and grid connected projects in particular remain unclear.

The current financial situation in the power sector is very unsatisfactory. NPA's present tariffs for households are below production cost, and about 20 % of the consumption is not being paid for. Illegal connections and the lack of a proper customer census are some of the factors contributing to this situation. Though corruption is generally not very common, the amount of tips ensuring a smooth and successful business registration process is significant. Bureaucratic bottlenecks increase the cost of doing business e.g. in dealing with construction permits and registering property (see table 12).

The major risk of solar appliances for a private business is the slow pace of the buying, installation and maintenance process. This is mainly due to the high costs involved resulting from high import tariffs. Import tariffs for solar appliances are between 40–50 % of their cost. Adding the necessary shipping costs, solar appliances can easily cost about two to three times as much as in Europe or America. The cost of a good quality CFL, for instance, is around 4.5 USD, a DC CFL is approximately 17 USD, a solar lantern is about 75 USD, a 600 W power inverter is about 250 USD and an 80 Wp polycrystalline solar module is about 700 USD.

The main thrust of the Government's investment promotion policy is to eliminate the structural and physical difficulties potential investors are currently facing. One of the key strategies is the simplification of business registrations and transactions through the consolidation of the role of the Sierra Leone Export Development and Investment Corporation (SLEDIC) as a 'one stop shop'. Any investor, whether domestic or foreign, may invest in any legitimate form of enterprise and

13 LAHMEYER, 1996

obtains a business name registration certificate, certificate of incorporation, business registration certificate and business license certificate. Thus, any person who wishes to invest in a business enterprise in the country shall, on request, be assisted by SLEDIC to obtain the above documents.

According to the Investment Promotion Act of August 2004, remittance of profits after taxes earned by a foreign investor from a business enterprise is guaranteed and international transactions involving payments abroad shall be allowed without restriction. The Act also guarantees capital repatriation and loan remittance. No export license is required for the export of locally produced goods except gold, diamonds and selected other goods to be specified from time to time. A business enterprise requiring foreign labor should apply to the Ministry of Labor, Industrial Relations and Social Security (MLIRSS) for consideration in accordance with any enactment relating to labor matters. Foreign personnel with work permits are allowed to make remittances abroad through their commercial banks, as long as they pay their tax obligations as defined the Income Tax Act 2000[14].

In the case of a dispute between an investor and the state in respect of an investment business, the parties are obliged to settle their differences in accordance with the rules of procedure for arbitration of the United Nation Commission on International Trade Laws. If a dispute between an investor and a non-governmental body cannot not settled amicably, the matter shall be referred to the relevant legal authority within Sierra Leone in accordance with the law binding the transaction. Any person who, in the course of his official duties, transfers proprietary information obtained from an investor to any person to whom he is not authorized by any enactment commits an offence and is liable on conviction to a fine or imprisonment or both.

Apart from the hydroelectric projects, which the Government is implementing through the MEP, not many investments have been made in this sector. Few institutions and individuals are showing interest in the exploitation of RE in the country, but funding and collaboration is their main challenge. If any individual or institution intends to invest in this sector after registration of a company or NGO, the MEP helps to facilitate the implementation of any RE project. Since the Government intends to restore the electricity supply in the country, the MEP can intervene to facilitate the waiving of custom duties on imported machineries for electrification depending on the MoU signed between the investor and MEP.

In spite of a strong record of economic reforms, including those to promote private investment, Sierra Leone ranks low (at 163 out of 181 countries – as compared to Ghana at 82, Nigeria at 114, Gambia at 128 and Liberia at 167) on the World Bank's 2008 Ease of Doing Business Survey (see Table 12). However, the country ranks high (49) on protecting investors and satisfactory (94) on starting business.

TABLE 12

Sierra Leone–Ease of Doing Business 2008 Rankings

Ease of doing business	163
Starting a business	94
Dealing with construction permits	171
Employing workers	173
Registering property	175
Getting credit	141
Protecting investors	49
Paying taxes	154
Trading across borders	133
Enforcing contracts	139
Closing a business	144

Source: Ease of Doing Business, World Bank, as of 2008

14 THE PRESIDENT OF SIERRA LEONE, 2000

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

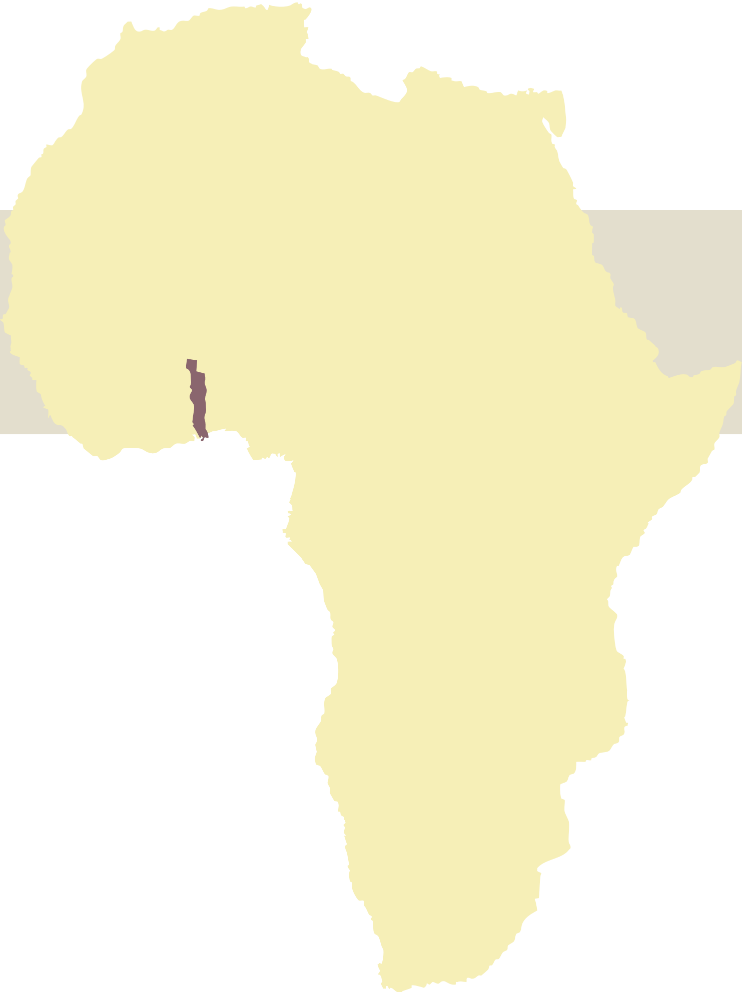
TABLE 13

Business Partners in Sierra Leone

INSTITUTION	ADDRESS	PROFILE
Ministry of Energy and Power (MEP)	4th Floor–Electricity House, 36 Siaka Stevens Street, Freetown Phone: +232 222 265 66 info@mep.gov.sl	Governmental authority responsible for the electricity and water sectors
Fourah Bay College, University of Sierra Leone	Fourah Bay College, Mount Aureol, University of Sierra Leone Phone:+232 302 070 65	College established in 1927
RCD Solar Company	64 Circular Road, Freetown General Manager, Mr Crispin Gray. Phone: +232 766 178 83	Company catering for the sustainable energy supply systems or as back-up system for institutions, commercial enterprises, rural communities and domestic or home set up. It is an outlet for the sale of solar equipment.
The Environmental Foundation for Africa (EFA)	1 Beach Road, Lakka, Freetown Peninsula, PMB 34 Phone: +232 766 114 10 info@efasl.org.uk	NGO aiming to protect and restore the environment in West Africa. For over 15 years, it has led environmental education and awareness raising campaigns, restored degraded lands and conserved pristine forests, minimized the impacts of civil war on the environment and its inhabitants, and equipped thousands of people with sustainable livelihood skills such as agro-forestry. In 2007, solar initiative is EFA's largest scale project; installing solar power systems in medical clinics, schools, visitor centers and training willing students and volunteers in the installation and maintenance of solar technologies.
Competence Centre for Renewable Energy	38 Safer Future Drive, Lower Allen Town, Freetown Phone: +232 766 079 90	NGO aiming to positively change the lives of young people. It is training young people in various trades including PV applications and had solar electrified four rural villages and also established a rural Electronic workshop at Safer Future farm.
Sonako International Services Limited	7 Percival Street, Freetown Phone +232 767 135 89	CDM Project Development

7 BIBLIOGRAPHY

- CEMMATS Group Ltd. (2004): Study on the Formulation of a National Energy Policy (Draft). On behalf of the Ministry of Energy and Power, Government of Sierra Leone
- Central Intelligence Agency – CIA (2008): World Fact Book – Sierra Leone (www.cia.gov/library/publications/the-world-factbook/geos/sl.html)
- Government of Sierra Leone (2005–2007): Sierra Leone Poverty Reduction Strategy Paper – PRSP (2005–2007): A National Program for Food Security, Job Creation and Good Governance
- Government of Sierra Leone (2005): The National Power Authority Amendment Act
- Government of Sierra Leone (2004): The Investment Promotion Act
- Government of Sierra Leone (2004): The Local Government Act
- Government of Sierra Leone (2002): The National Commission for Privatization Act
- The Environmental Foundation for Africa - EFA (2009): Novel and Practical Conservation Strategies Following Mining in Sierra Leone
- (www.efasl.org.uk/4_projects/mining.htm)
- Government of Sierra Leone (2001): The Petroleum Exploration and Production Act
- Government of Sierra Leone (1982): The National Power Authority Act
- Lahmeyer International (February 1996): Power Sector Master Plan – Sierra Leone. Appendix B, Vol. 1, Annex 10.2 (www.lahmeyer.de/en)
- Lexadin/The World Law Guide (2009): Legislation Sierra Leone (www.lexadin.nl/wlg/legis/nofr/oeur/lxwesle.htm)
- Massaquoi, J. G. M. Biomass Resource Assessment: A survey of Sierra Leone's Energy potential from Agricultural and Forestry wastes
- Redwood-Sawyerr J. A. S. and Conteh M. A. (2005): Sierra Leone's Country Report on Access to Energy Services for Rural and Peri-urban Population for the Achievement of the Millennium Development Goals
- Redwood-Sawyerr J. A. S. and Silla S. M. (1999): Distributed Electricity Services in Africa: The Sierra Leone Perspective, Forum on DES, Cape Town, South Africa, 1–5 June 1999
- Statistics Sierra Leone (2001): Annual Statistics Digest
- Statistics Sierra Leone (2005): Provisional Results, 2004 Population and Housing Census
- Swaray S. M. and Keili A. (August 2004): Sierra Leone Energy Sector Review; Poverty Alleviation Strategy Coordinating Office, African Development Bank, Final Report
- The President of Sierra Leone (2000): The Truth and ReconciliationCommission Act 2000 (http:// www.sierra-leone.org/Laws/2000-8s.pdf)
- UNDP (2007/2008): Human Development Report. Fighting Climate Change: Human Solidarity in a Divided World (http://hdr.undp.org/en/reports/global/hdr2007–2008)
- World Bank (2008): Ease of Doing Business (www.doingbusiness.org, viewed 18th Sept. 2008)



COUNTRY CHAPTER:
TOGO

Author of Country Chapter
Mawé Afo Aledjou (Dipl. Eng.)

Coordination and Review of the Country Chapter
Anton Hofer, (MSE, Dipl.-Ing./FH, M.A.)
WIP-Renewable Energies
www.wip-munich.de
Munich, Germany

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS TOGO

ACRONYMS AND ABBREVIATIONS

TOGO

ADB	African Development Bank
ARSE	Autorité de Réglementation du Secteur de l'Électricité (Regulation Authority of the Electricity Sector)
AU	African Union
CDM	Clean Development Mechanism
CEB	Communauté Électrique du Bénin (Electric Community of Benin)
CEET	Compagnie Énergie Électrique du Togo (Electric Energy Company of Togo)
DGE	Direction Générale de l'Énergie (General Directory for Energy)
CGD	Customs General Department
ECM	mechanical construction company operating in Togo
ECOWAS/CEDEAO	Economic Community of West African States (Communauté Économique Des États de l ,Afrique de l'Ouest)
CFAF	Franc de la Communauté Financière d'Afrique (1 Euro = 655,957 CFAF)
GDP	Gross Domestic Product
HDI	Human Development Index
IMF	International Monetary Fund
OAPI	Organisation Africaine de la Propriété Intellectuelle (African Organization of Intellectual Property)
OHADA	Organisation Pour l'Harmonisation en Afrique du Droit des Affaires (Organization for Harmonization of Business Rights in Africa)
PAIP	Priorities Actions Interim Program
PCHD	Poor Countries Heavily in Debt
PRSP-I	Poverty Reduction Strategy Paper Interim
PV	Photovoltaic
RE	Renewable Energy
STE	storage company operating in Togo
STSL	Société Togolaise de Stockage de Lomé (Togo Storage Company of Lomé)
UN	United Nations
WAEMU/UEMOA	West African Economic and Monetary Union (Union Économique et Monétaire Ouest Africaine)
WTO	World Trade Organization

MEASUREMENTS

€	Euro
GWh	gigawatt hour (1 GWh = 1,000,000 kilowatt hours (kWh))
kg	kilogram
km^2	square kilometer
kVA	kilovolt ampere
kWh	kilowatt hour
m/s	meters per second
m^2	square meter
m^3	cubic meter
mm	millimeter
MT	million tons
MW	megawatt (1 MW = 1,000 kW)
MWh	megawatt hour
°C	degree Celsius
t	ton
toe	tons of oil equivalent
W	Watt
Wp	Watt-peak
yr	year

SUMMARY

The Country Study of Togo is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Togo. The study is structured as follows:

Chapter one provides **Background Information on Togo**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Togo.

Chapter two summarizes facts and figures of **Togo's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Togo. This includes an overview of support mechanisms for photovoltaic (PV) as well as already existing regulations, incentives and legislative framework conditions concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Togo.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Togo.

1 COUNTRY INTRODUCTION

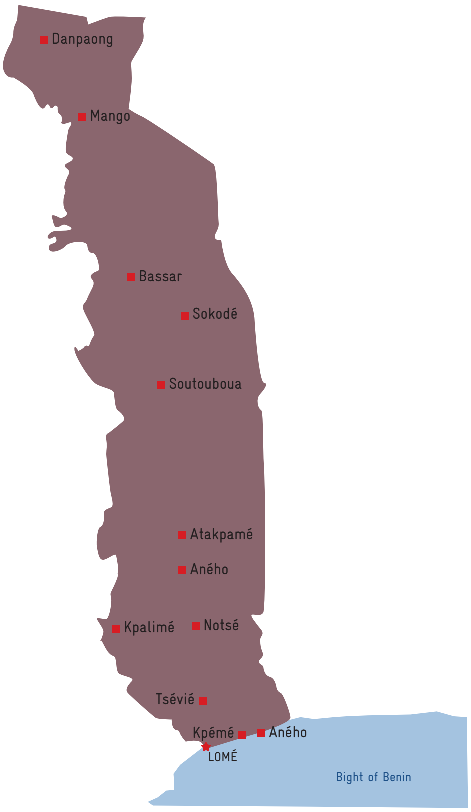
1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Located in the southern part of West Africa, the Republic of Togo covers 56,600 km². Direction-wise it stretches for almost 600 km to the North, 55 km along the seaside on the Guinea Gulf and has a maximum width of 120 km from East to West. With a longitudinal stripe form, Togo is limited by Ghana to the West, by Benin to the East, in the North by Burkina Faso and in the South by the Atlantic Ocean. Togo is located in the northern hemisphere in West Africa between latitudes 6 ° and 11 ° North and longitudes 0 ° 30' and 1 ° 30' East.

Togo is divided into five economic regions: the Savannah Region, the Kara Region, the Central Region, the Plateau Region and the Seaside Region. These regions are divided into 31 prefectures and four sub-prefectures. Country towns of prefectures are considered as urban commons.

FIGURE 1

Map of Togo



As to the climatic situation, Togo has a tropical climate, characterized by very different climatic zones and seasons. The South has four seasons (two dry seasons and two rainy seasons) with annual rainfalls between 800 and 1,500 mm. The North has one dry and one rainy season and is characterized by annual rainfalls of 1,000–1,500 mm. The medium temperatures in Togo vary from 22 °C to 28 °C.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

According to estimations of the general statistic department, the total population of Togo has reached 5,590,000 inhabitants in 2008 at an average population growth rate of about 2.4 %. The gross of the population is living in the rural areas of Togo (66 %). In Togo, the distribution of population is very unbalanced. A high population concentration exists in the South of the country, mainly in the Plateau Region.

Togo received its independence on 27 April 1960. Since 1992, the political system has been characterized by democratic elections. Togo is a member of many international, regional and sub-regional organizations such as the United Nations (UN), the African Union (AU), the World Trade Organization (WTO), the Organization for Harmonization of Business Rights in Africa, the African Organization of Intellectual Property, the Economic Community of West African States (ECOWAS/Communauté Économique Des États de l ‚Afrique de l'Ouest – CEDEAO), the West African Economic and Monetary Union (WAEMU/Union Économique et Monétaire Ouest Africaine – UEMOA) and the Electric Community of Benin (CEB).

The economic and social development of Togo is mainly based on the primary sector that represents about 40 % of the country's Gross Domestic Product. The economic growth rate reached 2.9 % during the period 2000–2004. The inflation rate of Togo corresponds with the average 3 % of the WAEMU countries, except in 2005 when the prices of basic products increased to about 6.7 %. Other important sectors such as the industry sector, electricity sector, water and gas sector or the building sector represent another 19 % of the GDP. The service sector contributes with about 26 %, the trade sector with 11.6 % to the GDP.

The socio-political crisis (1990–2005) has greatly affected public investment activities, which have decreased from 13.8 % of the GDP in 1990 to 3.3 % in 2005. It also affected the annual growth average of the GDP which has not exceeded 1.1 % since 1991. In 2006, Togo was classified as a less developed country and in 2008 as one of the Poor Countries Heavily in Debt (PCHD). Today, Togo ranks at 147 out of 177 countries in the Human Development Index (HDI).

As for the revenues, the rate of the fiscal pressure remains low at 14 % of GDP which is three points under the standard of 17 % fixed by the mechanism of multilateral supervision of the WAEMU in 2005. Public debt is split into 72.4 % of engagements towards the World Bank, the International Monetary Fund (IMF) and the African Development Bank (ADB) and 27.6 % of bilateral debts. The current external debts are estimated at 783 billion CFAF of which near one third are overdue payments (2006–2007). In 2006, the weight of the total debt with regard to the GDP reached 96 % as opposed to 70 % in 1992.

2 ENERGY MARKET IN TOGO

2.1 OVERVIEW OF THE ENERGY SITUATION

Togo mainly relies on the utilization of energy from biomass. In 2006, up to 75 % of the total energy consumption was covered by biomass energy. Due to the fact that Togo has no proven reserves, the total consumption of petrol products is covered by imports. The overall energy consumption per inhabitant was estimated at 0.27 toe in 2006, which is significantly less than the average of West African countries (0.45 toe).

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

The overall electricity production of Togo reached 221 GWh in 2006. The national production capacity includes thermal and Hydro Power installations under the management of the CEB, the Electric Energy Company of Togo (CEET) and some independent producers. The electricity production units of CEET include 17 thermal electric plants and one mini Hydro Power plant. The total amount of produced electricity reached 71 GWh in 2007. The second electricity producer CEB operates several gas turbines with an overall production of approximately 53 GWh (as of 2006). Furthermore, three mini Hydro Power plants contributed another 150 GWh to the electricity consumption. The overall contribution of small producers (mostly self-sufficient electricity generation in the industry sector) was estimated at 8 GWh in 2006. Additional imports of electricity origin from Ghana, Côte d'Ivoire and Nigeria. Overall electricity imports are estimated at 505 GWh at a total consumption of 726 GWh in 2005. Table 1 presents the prices of imported electricity while the current electricity tariffs are presented in Table 2.

Petroleum Sector

Togo is not a producer of petroleum products and therefore has to meet the final consumption by imports. In 2006, the overall import was estimated at 276,000 toe equaling 12 % of the total energy mix.

All imports are subject to be certified by the Ministry of Commerce and Transport. As far as hydrocarbons are concerned, Togo has total storage capacity of 255.315 m³, shared between the Togo Storage Company (STE) and the Togo Storage Company of Lomé (STSL). The price for petroleum products is presented in Table 3.

TABLE 1
Price of Imported Electric Energy and National Energy Production by Type

ORIGIN	CÔTE D'IVOIRE	GHANA	NIGERIA	TOGO				
				Hydro Power	Thermal	Gas Turbines	CEET Purchase	CEET Purchase and Sale
€/kWh	0.050	0.040	0.034	0.038	0.170	0.210	0.076	0.082 to 0.140

Source:CEB, as of 2008

Biomass Sector

In Togo, biomass energy comprises charcoal, wood and agricultural waste. The total biomass energy production was estimated at 2,031,000 toe in 2006. Traditional biomass is the most prominent source of energy for cooking and heating purposes in Togo. About 75 % of all households (mainly in rural areas) utilize wood energy, which causes an annual consumption of 347 kg per capita. Charcoal is the most prominent combustible of urban households with an annual consumption of 59 kg per capita. The annual consumption for household energy needs is estimated at about 1.63 million tons of wood and about 0.27 million tons of charcoal.

TABLE 2
Price of Electric Energy by Type of Use

TYPE OF USE	PRICE (€/kWh)
Professional Use	
slack period	0.08
full period	0.09
peak period	0.11
uni tariff	0.10
Public lighting	0.14
Free zone companies	0.08
Domestic Use	0.10 (<40 kWh) 0.11 (40–300 kWh) 0.14 (>300 kWh)

Source: Conceded electricity service rule to Togo Électricité, as of 2002

TABLE 3
Price of Petroleum Products

TYPE OF ENERGY	CHARCOAL €/KG	WOOD €/KG	KEROSENE €/KG	BUTANE €/L	GASOLINE €/L	DIESEL €/L
Price	0.04	0.13	0.82	0.43	0.66	0.71

Source: Ministry of Commerce, as of 2009

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The energy sector of Togo is very complex due to numerous institutions involved in the sector. The Ministry of Mines, Energy and Water develops and implements policies for the overall energy sector.[1] Moreover, it directs and coordinates relevant initiatives. The Ministry of Environmental and Forestry Resources develops and implements policies and regulations, monitors and controls the exploitation of forests and the production and supply of wood and charcoal. Many other institutions and organizations from private and public sector also participate in the overall management of this sector . This includes the CEB, the CEET and the Regulation Authority of the Electricity Sector (ARSE) as well as the STE and the STSL.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

In Togo, there are currently no dedicated policies for Renewable Energies. According to the Togo Poverty Reduction Strategy Paper Interim (PRSP-I) for 2006–2008, however, the Government pursues several objectives in the energy sector. This includes the implementation of policies for the promotion of RE, the increase of electricity supply of rural areas and the implementation of regulatory institutions.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

Based on a feasibility study on rural electrification, the implementation of a rural electrification master plan was recently initiated. In the framework of the Priorities Actions Interim Program (PAIP) and the PRSP-I, several priorities were formulated.

The first priority concerns institutional reforms and the regulation of the energy sector and schedules three actions: (i) strategic review and elaboration of reviewed energy policies, (ii) regulation and reduction of state electricity consumption by introducing energy-saving/-efficient measures in public buildings in accordance with Clean Development Mechanism (CDM) and (iii) capacity building by the general department of energy.

The second priority focuses on the rapid improvement of production capacities in order to end the energy crisis in a short time. Furthermore, capacity building in the electric energy production sector aims to promote the implementation of gas turbines and Hydro Power installations in different regions of the country.

The third priority proposes a framework for rural electrification and prepares an investment program likely to alleviate the high energy dependency of Togo. The restricted access to modern energy services forces the elaboration of the master plan of rural electrification that will fix realistic objectives for 2010 and 2015. It is planned to develop and implement goal-directed strategies with focus on institutional, technological and financial issues.

The fourth priority aims at activities in the field of RE and the hydrocarbon sector. This includes the implementation of legislative, institutional and regulation framework conditions, allowing the substitution of traditional energy sources. This should be done with tax exemptions for RE equipment, the definition of standards for rural electrification and the reduction of relevant costs.

In order to help the population through the energy crisis and to promote RE on a large scale, the Ministers' Council authorized the Customs General Department (CGD) on 8 April 1998 to issue a memorandum on import tax and VAT exemptions for generators and other energy equipment. This measure is in force till now.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

The biomass potential of Togo is estimated at 2.6 million toe and mainly consists of wood, charcoal, and vegetable waste. Table 4 provides an overview of the biomass consumption by region.

With regard to the production and utilization of biogas, there are significant resources available, mainly from agricultural waste (cotton, maize stem etc.) and livestock. Due to the lack of technology and knowledge, there are no existing biogas production sites in Togo up to now.

4.2 SOLAR ENERGY

The available solar radiation is between 4.4 and 4.5 kWh/m²/day.[2] Up to now, there are already some experiences with thermal solar energy and photovoltaic (PV) energy available. This includes solar water heating, solar cooking and PV systems for telecommunication services, water pumping, railway stations and some other small scale applications. In order to improve the access to modern energy services in rural areas of Togo, there is still a significant need to promote the utilization of solar energy.

4.4 HYDRO POWER

Togo has more than 50 rivers and waterfalls that offer abundant potential for mini- and micro-scale production of electricity. About 40 sites, located at the rivers of Mono and Oti, offer a potential overall production capacity of 224 MW. Up to now, however, there are only very few Hydro Power installations available for electricity generation. Table 5 presents an overview of the available Hydro Power potential of Togo.

1 SEE ALSO INSTITUTIONS MENTIONED IN CHAPTER 2.2
2 AS MEASURED BY LOMÉ UNIVERSITY AND THE NATIONAL METEOROLOGY DEPARTMENT

TABLE 4

Biomass Consumption by Region

REGION	TYPE	WOOD		CHARCOAL		VEGETABLE WASTE	
		Number of Households	%	Number of Households	%	Number of Households	%
Seaside	Whole	409	38.47	840	79,20	125	1.75
	Urban	65	10.20	586	91,70	21	3.30
	Rural	344	81.00	254	59,80	104	24.50
Plateau	Whole	578	77.79	379	51,00	83	11.17
	Urban	64	47.70	113	84,07	05	3.60
	Rural	514	84.40	266	43,06	78	12.80
Central	Whole	192	82.40	146	62,66	12	5.15
	Urban	42	57.40	59	81,90	n/a	n/a
	Rural	150	93.40	87	53,70	12	7.40
Kara	Whole	214	83.59	169	66,01	84	32.81
	Urban	66	62.20	103	96,70	15	14.40
	Rural	148	99.20	66	44,40	69	46.00
Savanna	Whole	253	94.75	164	61,42	95	35.58
	Urban	42	81.40	47	93,00	13	25.60
	Rural	211	97.80	117	54,40	82	84.10
Total	Whole	1,646	64.24	1,698	66,27	399	15.57
	Urban	279	27.81	908	90,52	54	5.38
	Rural	1,367	87.68	790	50,67	345	22.12

Source: DEF, as of 2008

TABLE 5

Available Hydro Power Potential

SITE NAME	RIVER	POWER (MW)
Djédrame	Danyi	3.000
Daye Konda Daye Konda Amou Oblo	Gban Hou1 Gban Hou2 Amou	5.000 10.000 3.000
Tététou	Mono	60.000
Nangbéto en aval du site	Mono	20.000
Sérégbané (Kougnohou)	Koroon	9.000
Bassar	Cascade Sika	1.000
Kpessi	Ogou	8.000
Dotékopé	Mono	9.000
Gboamoa	Amou	2.000
Gougou	Ogou	7.000
Ezimé (Cascade)	Koulassou	2.500
Langabou	Assou Koko	5.000
Tomégbé	Domi	8.000
Tomégbé	Sin sin	1.600
Soukourou	Souroukou	5.000
Sagada/Kpététa	Mono	8.000
Fazao	Kpaza	2.500
Bongoulou	Bassar	1.250
Bangan (Bassar)	Mô	6.000
Koueda	Kpaza	9.000
Landa-pozanda	Collège milit. Kara	17.000
Landa-pozanda	Kara	0.200
Tihaléa	Kara	9.000
Namon	Kara	n. a.
Titira	Kéran	12.000
Mongo-Kantè (Atigbé)	Kéran	5.000
Alokoegbé	Sio	0.125
Wonougba	Sio	0.165
Légouazeladè	Mô	0.100
Aklowa	Cascade	800.000
Landa-pozanda	Kara (Kpizindè)	0–110.000

Source: DGE, as of 2006

4 MARKET RISKS AND BARRIERS

The major obstacle within the RE market development is the lack of appropriate policies. Furthermore, there is a significant lack of regulatory instruments for private investments to the sector. Up to now, there are no mechanisms or incentives that are suitable to attract investors from the private sector. The regulation institution ARSE has no master plan in the field of RE. On top of that, Togo has no independent agency that is in charge of the RE sector including the rural electrification.

Since 2000, Togo has been applying uniformed acts of the African Harmonization Affairs Law Organization (OHADA). This is part of the overall liberalization process intended to implement codes, principles and comminatory rules of ECOWAS/WAMEU. The regional harmonization process was implemented by ECOWAS/WAMEU in September 2005 and has been in force since January 2006. The national legislation regulating competition has been replaced in 2003 by a comminatory legislation that includes the objectives of ECOWAS/WAMEU. The national commission for competition and consumption has been in operation since 2006.

Law 99-011 regulates the overall competition in Togo and aims at establishing successful and self-regulatory markets. Within this, the establishment of appropriate prices, properties and services should help to prevent market distortions and discriminatory practices. According to the PRST-I, the Government intends to elaborate national policies against corruption and towards equitable and transparent markets.

5 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 6

Local Partners

INSTITUTION	ADDRESS	PROFIL
Solaire Ingenierie	Phone: +228 320 63 82 Fax: +228 221 35 18 solaire.ingenierie@yahoo.fr	PV technology
Mechanic Construction Company (ECM)	P.O Box. 31277, Lomé Phone: +228 925 21 04 ecmpompes@yahoo.fr	Solar equipment and service provider
ESTN	Phone: +228 923 33 08	Solar equipment
Direction Générale de l'Energie (GE)	P.O Box 335, Lomé Phone: +228 223 14 39 Fax.+228 220 86 46	Stately institution
Action Communautaire pour le Développement Intégral et Solaire (ACDI SOLAR)	07 BP 128606, Lomé Phone: +228 966 25 67 Email: www.acdisolar06.blog.co.uk (www.riaed.net/IMG/pdf/ONG_ACDI_Solar_au_Togo_0507.pdf)	NGO for the promotion of solar energy
UL/ ENSI	P.O. Box. 1515, Lomé Phone: +228 902 86 07	Electric equipment
Lomé University Solar Energy Laboratory	P.O Box 1515, Lomé Phone: +228 901 25 18 www.ub.tg	Solar energy research
CFIT	Phone: + 228 999 88 65	Solar equipment and training
JVE Volunteers Youth for Environment	P.O Box 88236, Lomé Phone: +228 913 48 21	NGO
ENERGIA SOLAIRE	Phone: + 228 939 35 13	Solar equipment
Ministry of Mines, Energy and Water (Ministère des Mines et de l□Energie)	P.O Box 4227, Lomé Phone: +228 220 07 62 Fax: +228 220 08 05 energie@laposte.tg	Regulatory institution
Ministry of Economy and Finance, (Ministère de l'Economie et des Finances)	P.O Box 387, Lomé Phone: +228 221 09 05	Regulatory institution
Ministry of Environment and Forestry Resources (Ministère de l□Environnement et des Ressources forestière)	P.O Box 48235, Lomé Phone: +228 221 30 78 www.merf.tg	Regulatory institution

6 BIBLIOGRAPHY

- DEF (2008): Biomass Consumption by Economic Region
- Ministry of Trade (2007): Commercial Activities Paper
- CEB/CEET (2002): Decree N° 2002–075/PR on Energy Sale and Price Fixation in Togo
- Ministry of Economy and Finances (2007): Duties in Togo
- DGE (2007): Electric Energy Sector in Togo
- DGE (2008): Energy sector policies and projects/ current and future programs
- N. N. (2004): Ethic, Energy and Sustainable Development of LIAISON Energy-francophone N° 62–1fs term
- DGE, CEET, STSL, SIE (2008): Final Consumption Share by Source of Energy
- DGE (2008): Government Projects at PIAP
- DGE, STSL, SIE (2006): Households' Energy Consumption
- DGSCN (2006): Households' Percentage According to type of Energy Use
- DGE (2007): Infrastructures Access in Energy Service – Atlas Energy Togo
- AOIP Togo (2007): Intellectual Property Paper in Togo
- N. N. (2003): International Forum on Energy Market and the Role of Energy in Fight Against Poverty
- SIE (2007): Investigation Report Paper on Domestic Energy Consumption in Togo
- National Assembly (1999): Law on Competition Organization in Togo
- N. N. (without year): National Rapport on MDGs
- N. N. (2007): Interim Poverty Reduction Strategy Paper of 2007
- ARSE Office (2006): Relatives to Electricity Sector and its Application Decree
- African bulletin (2006): Poverty Reduction: Renewable Energies Can Truly Contribute
- University of Lomé (2006): Private Renewable Energies Fitting in Togo
- DGE (2007): Sustainable Development World Summit in 2002
- General Direction of Tax (2008): Tax Conditions in Togo
- Ministry of Plane (2008): Temporaries Programs Paper of Priorities Actions (PATP)
- UNDP (2007): UNDP Paper on Profile of Poverty and Vulnerability in Togo
- PNAE (2002): Wood Demand Growing in Togo – Biological Diversity Document
- LIAISON energy-francophone (2004): World's Solar Program of N° 46-1fs term

7 ANNEX

FIGURE 6

Electricity Network Map of Togo

Source: CEET, as of 2008

Renewable Energies in East Africa

Regional Report on Potentials and Marktes – 5 Country Analyses

Energy-policy Framework Papers,
Section »Energy and Transport«

gtz Promotion of Renewable Energies

On behalf of
Federal Ministry
for Economic Cooperation
and Development

IMPRINT

Authors of Country Chapters

Burundi	Godefroy Hakizimana (MSc. Eng.)
Kenya	Bernard Mutiso Osawa (MSc. RE, Phy.)
Rwanda	Emmanuel Kanigwa (MSc. Eng.)
Tanzania	Finias Magessa (Eng.)
Uganda	Dr. Eng. Mackay A.E. Okure

Review / Coordination

Dipl. Phys. Rafael Wiese
PSE AG
Freiburg, Germany
www.pse.de

Editor

Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1–5
65760 Eschborn, Germany
www.gtz.de

On behalf of

Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff

Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

FOREWORD

BACKGROUND

In recent years a large number of developing and emerging countries have changed the structure of their energy sectors, often accompanied by a liberalization of their markets. In many cases, **Renewable Energies (RE)** are a more and more important strategic component for the countries' diversification of their national energy supply.

A growing energy demand deriving from the increasing energy consumption of growing economies worldwide, accompanied by volatile prices for fossil fuels and by increasing environmental and climate challenges, boosts the demand for RE technologies. RE have a **competitive advantage** because they provide a long-term energy supply (for electricity, heating or cooling) based on locally available RE sources and thus help to reduce dependency on energy imports. In addition, RE provide appropriate technological solutions for the electrification of rural or semi-urban areas where they can be used independently from grid-connection. RE are a key for the provision of modern energy services in these areas and contribute to the local economic and social development.

While the technical potential for RE resources such as wind, solar, hydropower, biomass or geothermal energy is considered high in most developing and emerging countries, these regions are still faced with significant barriers for the development of commercially driven and sustainable RE markets. The lack of appropriate policies and the respective business environment are constraints that restrict the dissemination of RE in these countries. The success of comprehensive policy frameworks for the promotion of RE – such as RE feed-in-tariffs or incentive instruments like tax relieves – can be observed in more and more countries, for example Germany or France. However today, also developing countries and emerging markets such as South Africa, Kenya or the Philippines reveal the **significance of adequate policy frameworks for favorable market conditions**. Investments in RE markets, in particular by the private sector, very much depend on the existence of these national or regional framework conditions, incentives and financing options on the one hand, but also on sufficient **transparency and knowledge about these conditions**, which are thus part of the bottleneck for the deployment of RE.

OBJECTIVE

Current and accurate information and data availability are – as stated above - important prerequisites for the development of RE energy markets and a broader dissemination of commercial activities – particularly in markets where information is scarce and where framework conditions are under transition. **The Regional Reports on Renewable Energies comprising 30 country analyses on RE potentials and markets in West Africa, East Africa and Central Asia** are a substantial contribution to the dissemination of comprehensive and precise knowledge on RE markets and related investment options and thus help to further pave the way for the promotion of RE in these regions.

As such the publication **addresses potential businesses and investors** – including manufacturers, technology providers, wholesalers, suppliers, project developers, operators, services companies, planning offices, consultancy firms, as well as financing institutions. The Regional Reports are both meant for those who are already active in the assessed RE markets, but also for those exploring new markets for their business activities. Of course, the publication also serves as a database with country-specific insights into the assessed African and Central Asian regions for interested actors from the public and civil sector.

The **geographical scope** of this publication is twofold: the **Regional Reports on Renewable Energies** focus on **West Africa and East Africa** which are mainly represented by developing countries and economies, and on Central Asia as a region predominantly characterized by **countries in transition**. All of these regions are promising markets for the RE industry and for potential investors as they offer remarkable, but still largely untapped RE potentials. Although market conditions which spur the promising RE potentials still need to be improved in almost all of the assessed countries, positive trends for the promotion and deployment of RE can be observed in many cases. Even in those countries, where the policy level still needs to be convinced of RE, political reformers more and more commit to take action for RE on the rise.

DELIVERABLES

The **Regional Reports on Renewable Energies** showcase comprehensive, but still selective information on the specific characteristics of the energy sectors of the **30 assessed countries – 17 in West Africa, 5 in East Africa and 8 in Central Asia**. Key facts and figures on these energy markets and their RE potential is given in the **executive summary** of each regional report.

Each country analysis comprises an **introduction to the socio-economic, geographical and political background** of the country. It also includes an **overview** on the **national energy sectors**, including figures on power generation capacities, energy consumption and price levels as well as information on relevant market structures. This is followed by a presentation of the respective energy policy framework conditions. The chapter on **the status quo of RE** presents data on country-specific technical and economic RE potentials, as well as and on current RE investment projects and possible **RE business opportunities**. In addition, the report gives information on market challenges and risks. A snapshot of the **relevant actors of the energy sector** (private, as well as public, civil and scientific) is also included and serves as a source for identifying potential (business) partners for RE projects. Finally, each country analysis includes a **bibliography** and an **annex** containing additional graphs and figures on RE sources and technologies.

The presented regional reports series is part of the Energy-policy Framework Papers of the "Energy and Transport" section of Deutsche Gesellschaft für Technische Zusammenarbeit (gtz) GmbH.

The Regional Reports are also available for free of charge download on the GTZ website:
http://www.gtz.de › Themes › Sustainable Infrastructure › Energy › Renewable Energy › Further information › Downloads; or
http://www.gtz.de/de/themen/umwelt-infrastruktur/energie/4552.htm

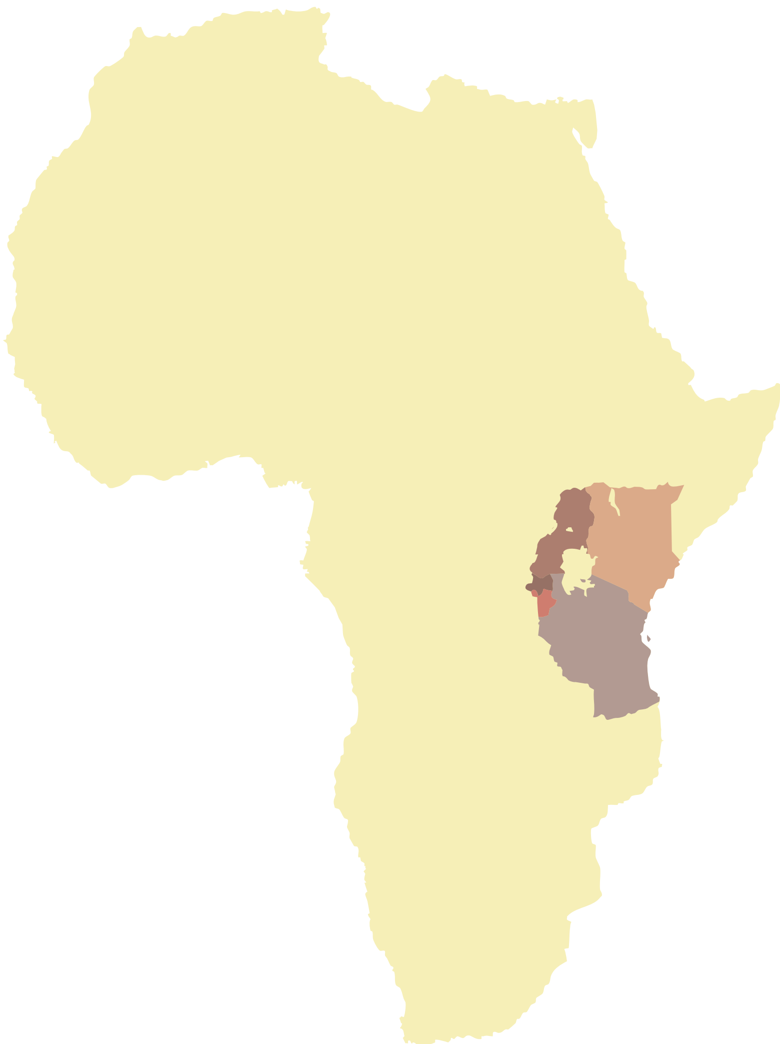
The editorial team – Eschborn, December 2009

ACKNOWLEDGEMENTS

The editorial team – also on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ) – would like to thank all contributors, in particular all authors and coordinators (especially Anton Hofer of WIP, Rafael Wiese of PSE AG and Dr. Klaus Jorde of Entec AG) who have contributed to this publication by sharing their valuable insights and experiences.

Special thanks also to Rolf-Peter Owsianowski for his efforts to identify appropriate local experts as authoring contributors, to Barbara Meder for editing of the reports and to "die Basis – Kommunikation. Ideenwerk. Design." for the design of the publication.

CONTENTS REGIONAL REPORT EAST AFRICA



REGIONAL REPORT SUMMARY – BASED ON THE 5 COUNTRY CHAPTERS BURUNDI, KENYA, RWANDA, TANZANIA, UGANDA

Author of the Regional Report Summary
Dipl. Phys. Rafael Wiese
PSE AG
Freiburg, Germany
www.pse.de

ACRONYMS AND ABBREVIATIONS
REGIONAL REPORT SUMMARY

ACP	African, Caribbean and Pacific Group of States
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe (Federal Institute for Geosciences and Natural Resources)
DGHER	Directorate General of Hydraulics and Renewable Energies
EAC	East African Community
ERA	Electricity Regulatory Authority
EU	European Union
GDP	Gross Domestic Product
IPP	Independent Power Producer
KenGEN	Kenya Electricity Generating Company
KPLC	Kenya Power and Lighting Company
MDG	Millennium Development Goals
MEM	Ministry of Energy and Minerals
PPP	Purchasing Power Parity
PREEEP	Promotion of Renewable Energy and Energy Efficiency Program
RE	Renewable Energy
REA	Rural Energy Agency
REF	Rural Energy Fund
REGIDESO	Régie de Production et de Distribution d'Eau et d'Électricité (Urban Burundian Electricity Utility)
RURA	Rwanda Utilities Regulatory Authority
SIDA	Swedish Development Agency
TANESCO	Tanzania Electric Supply Company Limited
UEB	Uganda Electricity Board
UETC	Uganda Electricity Transmission Company
USD	United States Dollar
VAT	Value Added Tax

MEASUREMENTS

GWH	gigawatt hour
KM^2	square kilometer
KWH	kilowatt hour
KWP	kilowatt peak
MW	megawatt
WP	Watt-peak

1 INTRODUCTION TO THE EAST AFRICAN COMMUNITY (EAC) REGION

1.1 REGIONAL STATISTICS EAST AFRICA COMMUNITY: GEOGRAPHY AND ECONOMICS[1]

The East African Community (EAC) is an intergovernmental organization comprising the five East African countries of Burundi, Kenya, Rwanda, Tanzania and Uganda. The East African region covers an area of 1.8 million square kilometers with an overall population of about 122 million (based on census in 2007) with an average annual growth rate of 3%. The annual child mortality in the region ranges from 103 to 137 per 1,000 births, while literacy rate is estimated between 62 and 74% (as of 2007).

The EAC countries established a Customs Union in 2005 and are working towards the establishment of a Common Market by 2010, a subsequent Monetary Union by 2012 and ultimately a Political Federation of the East African States.

The EAC recorded an overall average real growth of 6.8% in 2007. The per capita income varies between 119 USD in Burundi and 725 USD in Kenya. The average annual inflation rate increased to 7.6% in 2007. The highest increase was on food prices. On average, the main export products of the EAC region are coffee and tea. Coffee production in the region has been on the decline since 2003, while tea production has increased.

The heterogenic geographical and social situation between Rwanda and Burundi on the one hand and Kenya, Tanzania and Uganda on the other hand is reflected in the following statistics:

	BURUNDI	RWANDA	KENYA	TANZANIA	UGANDA
Population 2007 (million)	8.2	9.7	36.5	38.7	31.4
Total area (km²)	27,834	26,340	583,000	945,087	241,020
Density (km²)	280	369	64,7	41	130
Total households (million)	n.a.	1.7	7.2	7	5.1
Households – rural (%)	90%	83%	19%	82%	85%
Households – urban (%)	10%	17%	81%	18%	15%
Main export goods	Tea, coffee	Tea, coffee	Tea, coffee, horticulture	Gold, coffee, nuts	Coffee, fish
GDP 2007 (million USD)	864	1,973	19,842	10,154	9,123
GDP per capita 2007 – at PPP (USD)	346	813	1,700	1296	963
GDP growth rate 2007 (%)	3.6%	7.9%	7%	6,2%	9%
Poverty rate/persons living below 1 USD/day (MDG 30%, as of 2007)	60%	40%	48%	33,4%	35%
Infant mortality rate (MDG 36/1,000)	165 (2005)	83 (2008)	10 (2007)	77 (2007)	66 (2006)

1 SEE EAC, AS OF 2008

2 ENERGY MARKET OF THE EAST AFRICAN COMMUNITY REGION

2.1 ENERGY SITUATION OVERVIEW

The EAC region relies primarily on biomass. It is used in rural and urban settlements mainly for cooking purposes. The primary energy supply is based on 90 % or more of informally collected wood. Only Kenya has a significant share in primary energy by petroleum at 22 % and electricity at 9 %.

The electrification of rural areas in the EAC region stands very poor at a 1–5 % level. The urban electrification rate is above 30–50 %.[2]

The following tables give an overview on the general energy situation. The data are gathered from the five country reports as part of this overall study and based on own calculations or numbers found in the most recent EAC reports:[3]

2.2 ENERGY CAPACITIES, PRODUCTION AND CONSUMPTION

The total generated electricity in the EAC region is 12,849 GWh. Hydro power was accounting for 65 % of the produced electricity in 2007, while thermal power had a 28 % share. The electricity grid in all EAC countries suffers from high transmission and distribution losses.

The region is very much depended on rainwater. The 2001–2007 period has witnessed a decline in hydro power generation and an increase in thermopower generation. The following graph shows the correlation of hydro and thermal power of the EAC region.

Only Kenya is using geothermal power with a production of 989 GWh or 7,5 % of the electricity production in the EAC (as of 2007). In Kenya, Tanzania and Burundi, cogeneration power plants from the sugar cane industry are currently feeding into the national grid with a marginal electricity contribution. The feed-in tariff structure remains currently unregulated and is subject to bilateral negotiations.

TABLE 1

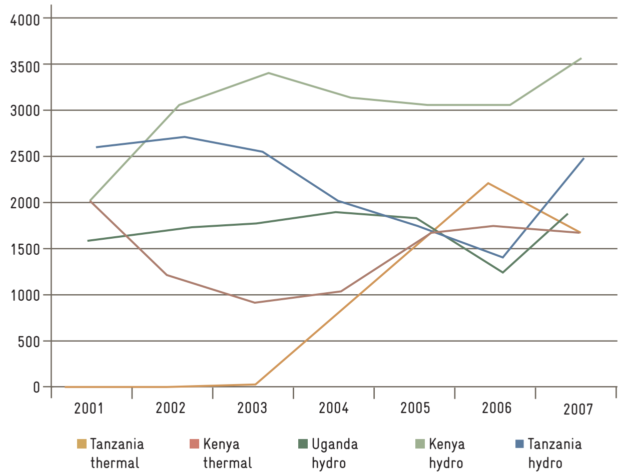
Energy Situation in the EAC Region

	BURUNDI	RWANDA	KENYA	TANZANIA	UGANDA
Main source of primary energy supply	Biomass 96 %	Biomass 95 %	Biomass 68 %	Biomass 90 %	Biomass 92 %
Main purpose	Cooking	Cooking	Cooking	Cooking	Cooking
Total electrification rate	1.0 %	6.0 %	15.4 %	10.8 %	11.0 %
Rural electrification rate	n. a.	1.0 %	4.0 %	2.0 %	5.0 %
Urban electrification rate	n. a.	35.0 %	51.0 %	30.0 %	42.0 %
Average electricity consumption per capita per year	17 kWh	19,5kWh (2005) 25,3 kWh (2006)	154 kWh	82 kWh	57 kWh

Source: table compiled by the author (PSE AG) based on data from EAC, as of 2008, and UNCTAD, as of 2005

FIGURE 1

Hydro and Thermal Electricity Generation in Kenya, Uganda and Tanzania



Source: graph compiled by the author (PSE AG)

2 SEE REFERENCES ON PRIMARY ENERGY SOURCES AND ELECTRIFICATION RATES GIVEN IN THE 5 COUNTRY CHAPTERS

3 SEE EAC, AS OF 2008, AND UNCTAD, AS OF 2005

TABLE 2

Electricity Capacities, Production and Consumption in the EAC Region

	BURUNDI	RWANDA	KENYA	TANZANIA	UGANDA
Total electricity consumption	188.0 GWh (2007)	210.0 GWh	5,067.0 GWh (2007)	3,288.0 GWh (2007)	1,797.0 GWh (2007)
Nationally produced electricity	94.0 GWh (2006)	138.0 GWh (2007)	6,868.8 GWh (2007)	4,156.0 GWh (2007)	1,609.0 GWh (2006)
Of which in 2007					
Hydro	117.0 GWh	96.6 GWh	3,592.0 GWh	2,576.0 GWh	1,190.0 GWh
Thermal	0	111.0 GWh	1,738.0 GWh	1,580.0 GWh	369.0 GWh
Geothermal	0	0	989.0 GWh	0	0
Capacity in operation	37.0 MW (2008)	54.0 MW (2007)	1,197.0 MW (2007)	1,226.0 MW (2007)	496.0 MW (2006)
Of which in 2007					
Hydro	37.0 MW	24.0 MW	677.0 MW	591.0 MW	380.0 MW
Thermal	0	30.0 MW	389.0 MW	658.0 MW	150.0 MW
Geothermal	0	0	128.0 MW	0	0
Other	0	0	4.0 MW solar 0.4 MW wind 2.0 MW bagasse cogeneration	0	16.0 MW small hydro 22.0 MW bagasse cogeneration

Source: table compiled by the author (PSE AG)

TABLE 3

Energy Prices in the EAC Region

	BURUNDI	RWANDA	KENYA	TANZANIA	UGANDA
Average Petroleum at filling station in €/l (2007)	Diesel 1.35	Kerosene 0.80	Diesel 0.69	Diesel 0.78	Diesel 0.92
Electricity residential tariff in € Cent/kWh (<1,000 kWh/year)	5.2	14.0	8.5	7.0	16.0

Source: table compiled by the author (PSE AG)[4]

2.3 ENERGY PRICES

All EAC countries depend on the international crude oil price fluctuations, but also on the exchange rates. Especially the landlocked countries are faced with high transport costs for petroleum fuels. Burundi diesel prices are twice as high as in Kenya. On the other hand, electricity prices in Burundi are only one third of the prices in Uganda. This indicates that the energy tariffs are still determined by political and social aspects which hinder a leveled playing field towards the use of Renewable Energies (RE). Power supply suffers from unreliability, forcing investors to maintain back-up generators which increase their costs of doing business.

Kenya

Electricity generation, transmission and distribution are handled by the two state companies of KenGEN and the Kenya Power and Lighting Company (KPLC). KenGEN deals with power generation, while KPLC deals with transmission and distribution. A few Independent Power Producers (IPPs) have been registered.

Tanzania

The electricity sub-sector is largely dominated by the state-owned Tanzania Electric Supply Company Limited (TANESCO), which has a vertically integrated monopoly in the generation, transmission and distribution of electricity in the country that is now being unbundled. Two independent IPP have been licensed: Independent Power Tanzania Ltd. and Songas Ltd.

Uganda

Generation, transmission and distribution were unbundled in 2001, ending the monopoly of the Uganda Electricity Board (UEB) with respect to these services. Generation and distribution were concessioned in 2003–2004, while transmission is still the responsibility of the state-owned Uganda Electricity Transmission Company (UETC). The Electricity Regulatory Authority (ERA) has also been created.

Rwanda

The public utility of ELECTROGAZ is entirely owned by the Government of Rwanda and offers all electricity services. The Rwanda Utilities Regulatory Authority (RURA) was established in 2001 for the regulation of certain public utilities including energy.

Burundi

The Urban Electricity Utility (REGIDESO) is the national power authority that owns all the country's power plants and operates the transmission distribution network. The Directorate General of Hydraulics and Renewable Energies (DGHER) is independently developing rural electrification projects.

4 NOTE: IN THE INDIVIDUAL COUNTRY CHAPTERS THE ENERGY PRICES ARE PARTLY INDICATED IN LOCAL CURRENCY (INSTEAD OF €).

3 RENEWABLE ENERGY POLICY FRAMEWORK CONDITIONS

All EAC countries are committed to facilitate the increased use of various types of RE as important sources in their energy mix. They aim to support the national development goals by increased access to energy in general and to RE in specific. So far, however, there is no clear roadmap or milestone definition in the EAC region to develop the RE sector.

3.1 DONOR AID ACTIVITIES AND GOVERNMENTAL RENEWABLE ENERGY PROGRAMS

Various RE support programs exist or are in planning stage. Some are driven by the national Governments, but most of them are funded by international donors. The following overview shows the business opportunities for RE companies.

RE Business Opportunity

TABLE 4

RE Promotion Programs in the EAC Region

PROGRAM	BURUNDI	RWANDA	KENYA	TANZANIA	UGANDA
Tax and duty	Zero custom duty, zero tax on imported RE equipment	Zero VAT on imported capital goods and raw material	Income tax holidays and exemption from tax and duty during implementation of RE projects; zero custom duty, zero tax on imported RE equipment	Zero import duty on wind and solar technology products	Zero import duty on unsealed solar deep cycle batteries
SIDA/MEM Project (2005–2010, 3 million €)				Business development services	
REA/REF				Subsidy of 2 USD/Wp	
ERT Phase II (2009–2011, 316 million USD)					Grants for small hydro power in independent grid; PV systems for 500 schools, 375 health centers and 15 water pumps
PREEEP (2008–2011, 5.9 million €)					Support of dissemination of improved stoves, micro hydro power and PV systems
ACP-EU Energy Facility (2009–2011)					Grants for PV systems in schools and clinics, 50 % grant for 10 sites small hydro

Source: table compiled by the author (PSE AG)[5]

5 DONOR ACTIVITIES/PROGRAMS ARE PARTLY INDICATED IN MORE DETAIL IN THE 5 COUNTRY CHAPTERS.

4 STATUS AND FUTURE OUTLOOK FOR RENEWABLE ENERGIES

In the following, only the most important existing business opportunities for private companies are highlighted. More detailed information can be found in the 5 country chapters.

4.1 BIOMASS / BIOGAS

It seems that cogeneration of bagasse in large sugar cane industries in Kenya, Tanzania and Uganda is becoming more viable. All industries have recently started to feed into the national grid as IPPs. The tariff structures are not clear or only fixed on a preliminary stage. They are subject to bilateral negotiations between the IPP and the national utility and/or regulator.

In some countries, research and tests with small biogas digesters were made, but with no commercial success was achieved so far. In Rwanda, biogas plants are used in prisons for example. Several private companies, which are planning to develop biofuel plantations, have recently purchased or rented land in Tanzania and Kenya.

4.3 WIND POWER

Wind energy is not exploited in the EAC region due to the lack of wind data or the non-compliance between resources and grid availability (especially in Kenya). 70 MW are under construction in two wind farms in Kenya.

4.4 GEOTHERMAL POWER

The huge potential of geothermal sources in the Rift valley is about to be explored, especially with the support of the German Development Cooperation and commissioned by the German Federal Institute for Geosciences and Natural Resources (BGR). Only Kenya is currently using 128 MW.

4.5 HYDRO POWER

The wide availability of lakes and running waters in the EAC region entails a huge potential of small and large hydro power. Large-scale hydro power is used to a greater extend in the region. Burundi has a 99 % hydro power share in electricity. The average was 65 % in 2007 as compared to 73 % in 2001. The potential for small hydro power plants are estimated as follows:

TABLE 5

PV Market Data in the EAC Region (as of 2008)

PROGRAM	BURUNDI	RWANDA	KENYA	TANZANIA	UGANDA
Installed capacity	72 kWp	n.a.	4,000 kWp	1,800 kWp	n.a.
Market size per year	n.a.	n.a.	n.a.	200 kWp	200 kWp
No of solar companies	3	<5	20	18	17
Remark, special local condition	n.a.	250 kWp Kigali Solaire ACP-EU Energy Facility	No financial support scheme available	Well-established trainings and awareness	ERT II program as main driver

Source: table compiled by the author (PSE AG)

4.2 SOLAR ENERGY

The solar energy sector is the most developed sector in the EAC region due to a decade of international support programs in capacity building, training and subsidy programs. Thus a few hundred of well-trained solar technicians exist in the region. As the number of PV system integrators and wholesalers is limited to about 50 companies in the entire EAC region, it is obvious that the private sector is underdeveloped. The companies are mainly situated in the capitals or commercial cities and have poor distribution channels into the targeted rural areas.

The miracle self-running PV market in Kenya is a niche market dominated by cash and carry sales as it can also be found in the other EA countries. Although a lot of attempts within the international programs were made to increase the awareness towards higher quality and after-sales services, PV market lacks of technical and commercial professionalism. The table below summarizes the current RE market.

TABLE 6

Estimation of Geothermal Potential in the EAC Region

	BURUNDI	RWANDA	KENYA	TANZANIA	UGANDA
Geothermal potential	n.a.	170–300 MW	2,000 MW	600 MW	450 MW

Source: table compiled by the author (PSE AG)

TABLE 7

Small Hydro power Potential in the EAC Region

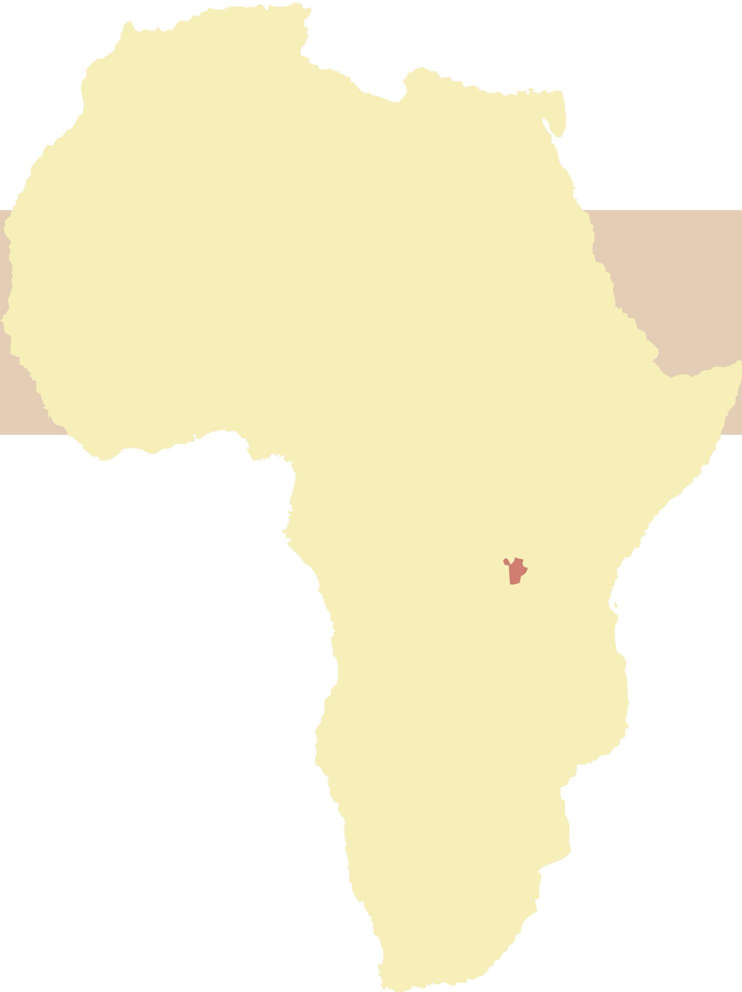
	BURUNDI	RWANDA	KENYA	TANZANIA	UGANDA
Small hydro power potential	300 MW	10 MW	3,000 MW	315 MW	210 MW

Source: table compiled by the author (PSE AG)

5 BIBLIOGRAPHY[6]

- East African Community – EAC (2009): various documents with information on the institution, function and program activities of the EAC, (www.eac.int/about-eac.htm)
- EAC (2008): Fact and Figures 2008 (www.eac.int/downloads/cat_view/73-facts-and-figures.html)
- UNCTAD (2005): An Investment Guide to the EAC (www.unctad.org/Templates/WebFlyer.asp?intItemID=3450&lang=1)

6 NOTE: OTHER MAIN REFERENCES AND INDICATIONS OF SOURCES ARE PROVIDED IN THE RESPECTIVE COUNTRY CHAPTERS AND NOT IN THIS SUMMARY OF THE COUNTRY CHAPTERS.



COUNTRY CHAPTER: BURUNDI

Author of Country Chapter
Godefroy Hakizimana (MSc. Eng.)

Coordination and Review of the Country Chapter
Dipl. Phys. **Rafael Wiese**
PSE AG
Freiburg, Germany
www.pse.de

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS BURUNDI

ACRONYMS AND ABBREVIATIONS

BURUNDI

AfDB	African Development Bank
AIDS	Acquired Immune Deficiency Syndrome
BIF	Burundi Franc (1 BIF = 0.00056 €, as of November 2009)
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)
CD	Contractual Demand
CEBEA	Centre d'Études Burundais en Énergies Alternatives (Burundian Center of Renewable Energies)
CRE	Crédit Régénération Économique (Economic Recovery Credits)
CSLP	Cadre Stratégique de Croissance et de Lutte Contre la Pauvreté (Strategic Master Plan of Growth and Fight against Poverty)
DGEE	Directorat Général d'Eau et d'Énergie (Directorate General of Water and Energy)
DGHER	Directorat Général de Hydrauliques et d'Énergie Renouvelable (Directorate General of Hydraulics and Renewable Energies)
DR Congo	Democratic Republic of the Congo
EAC	East African Community
EIRP	Electricity Infrastructures Rehabilitation Project
FCBN	Forum de la Société Civile du Bassin du Nil (Nile Basin Burundian Civil Society)
F.O.B.	Free On Board
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation Agency)
HIPC	Heavy Indebted Poor Countries
HIV	Human Immunodeficiency Virus
ICRC	International Committee of the Red Cross
IDA	International Development Agency
IMF	International Monetary Fund
ISN	Interim Strategy Note
KfW	Kreditanstalt für Wiederaufbau (German Banking Group – including KfW Entwicklungsbank as German Development Bank)
MDG	Millennium Development Goals
MEFCD	Ministère de l'Economie, des Finances et de la Coopération au Développement (Ministry of Economy, Finance and Development Cooperation)
MELM & PW	Ministry of Environment, Land Management and Public Works
MIA	Ministry of Internal Affairs
MWEM	Ministry of Water, Energy and Mines
N.a.	Not applicable
NBI	Nile Basin Initiative
O & M	Operation and Maintenance
ONATOUR	Office National de la Tourbe (Peat National Utility)
PAP	Priority Action Program
PREBU	Programme pour la Réhabilitation du Burundi (Program for Rehabilitation of Burundi)
PRSP	Poverty Reduction Strategy Papers
PTPCE	Projet des Travaux Publics et de Création d'Emplois (Public Works and Employment Creation Project of IDA – International Development Association)
RDC	République Démocratique du Congo (Democratic Republic of Congo)
REGIDESO	Régie de Production et de Distribution d'Eau et d'Électricité (Urban Burundian Electricity Utility)
RE	Renewable Energy
PSE	Programme Spécial de l'Énergie (Special Energy Program)
SHS	Solar Home Systems
SINELAC	Société Internationale des Pays des Grands Lacs (International Society of Electricity of the Great Lakes Countries)
SNEL	Société Nationale d'Électricité (Congolese National Electricity Utility)
SOSUMO	Société Sucrière du Moso (Sugar Cane Industry of MOSO)
UNICEF	United Nations Children's Fund
USD	United States Dollar

MEASUREMENTS

AC	alternative current
bbl	barrel
°C	degree Celsius
DC	direct current
€	Euro
ha	hectare
HV	high voltage
kV	kilovolt
kWh	kilowatt hour
LV	low voltage
m	meter (1 m = 1,000 mm)
m^2	square meter
MV	medium voltage
MW	megawatt (1 MW = 1,000 kW)
Wp	Watt-peak (1kWp = 1,000 Watt-peak)
toe	tons of oil equivalent (1 toe = 1,000 kgoe (kilogram of oil equivalent))

SUMMARY

ECONOMICAL STATUS AND DEVELOPMENT OF BURUNDI

Burundi was one of the poorest countries in the world even before the severe civil crisis and the ethnic conflict of the 1990s. An internationally brokered power-sharing agreement between the Tutsi-dominated Government and the Hutu rebels in 2003 paved the way for a transition process. A new Constitution was established in 2005 and ethnic quota was formed for determining positions in Burundi's Government. To this day, conflicts between the Hutu and the Tutsi continue[1].

Poverty in rural areas, where 91 % of the population live, rose from 35 % to 58 % in the decade between 1992 and 2002, standing now at 60 %. For the period of 1986 to 1992, Burundi knew a relatively constant real growth with an average rate of 3,7 % without the structure of the productive apparatus changing. With the crisis of 1993, the Gross Domestic Product (GDP) dropped cumulatively by 20 %, the income per head, which was 210 USD in 1990, dropped to 110 USD in 2004 and 88 USD in 2007, placing Burundi in the third rank of the poorest countries[2].

STRUCTURE OF ENERGY SUPPLY IN BURUNDI

Nearly all of Burundi's gross energy demand is met by wood, charcoal or peat. Thus 95 % of the total primary energy supply in Burundi is met by biomass[3].

Electricity

Only 1 % of the population has access to electricity, which is mainly supplied to the capital city of Bujumbura and some other cities. Hydro power is the only source of electricity supply with an operative capacity of 38 MW (as of 2008). The total electricity consumption of 188 GWh (as of 2007) was covered by national hydro power stations (58 %) and derives from imports. Transmission losses are high and average at around 24 %[4].

Oil

As Burundi has no oil reserves of its own, it is importing oil through the land corridor mainly from Mombasa. Since 2006, the prices for oil products have been jumping from 1.10 USD per liter of gasoline in 2006 to 2.00 USD in 2008[5].

The national thermal power stations with a total capacity of 5.5 MW are not in operation due to low maintenance and high oil prices (that cannot be covered by the local plants' operators).

STATUS OF RENEWABLE ENERGIES IN BURUNDI

Renewable Energy (RE) utilization is negligible in Burundi. Although there are huge potentials, the private and public RE sector is underdeveloped. Solar energy radiation is constant at 4–5 kWh/m² throughout the year[6], but only three private companies[7] are actively selling small Solar Home Systems (SHS) and facilitating a current PV program targeting schools and clinics.

In total, only 24 small and medium size hydro power stations[8] are currently in operation, rehabilitation or in planning status. Hydro power is the only source of electricity in the country so far. Other sources have not yet been exploited.

1 INTEGRATED BUREAU OF THE UNITED NATIONS IN BURUNDI, AS OF 2007
2 IMF, AS OF 2007
3 REPUBLIC OF BURUNDI, AS OF 2006
4 REPUBLIC OF BURUNDI, AS OF 2007
5 MINISTRY OF INFRASTRUCTURE OF RWANDA, AS OF 2007
6 SEE ANNEX 7 – AFRICA SOLAR MAP
7 SEE CHAPTER 6.1 OF THIS REPORT – RENEWABLE ENERGY (RE) COMPANIES
8 SEE ANNEX 7.12 – LIST OF ACTUAL AND PLANNED HYDRO POWER SOURCES

1 COUNTRY INTRODUCTION

1.1 BURUNDI OVERVIEW

Burundi is a landlocked country that straddles Central and East Africa, with a total area of 27,834 km² and approximately 8.2 million inhabitants[9]. Burundi has one of the highest population densities in Africa with about 280 inhabitants per km², about 10.6 % of them living in urban areas. Burundi's frontiers are formed by natural borders, namely Lake Tanganika, the Rusizi River in the West and the Kagera and Kanyaru Rivers in the North (see Map of Burundi in annex 8.1).

Burundi is bordered by Rwanda in the North, Tanzania in the South and East and the DR Congo on the West. Although the country is landlocked, much of its western border is adjacent to Lake Tanganyika. The country's modern name is derived from its language Kirundi. Burundi is a mountainous country. Its climate is favorable to agriculture with precipitations ranging from 1,000 to 2,000 mm/year and temperatures from 12° to 25 °C[10].

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

The country is divided into 17 provinces, with Bujumbura Mayor hosting the capital city of Bujumbura. The other provinces are Bubanza, Bujumbura Rural, Bururi, Cankuzo, Cibitoke, Gitega, Karuzi, Kayanza, Kirundo, Makamba, Muramvya, Muyinga, MWaro, Rutana and Ruyigi. The provinces are sub-structured into 117 communes and 2,638 collines (hills)[11].

Of the 8.2 million people, about 700,000 (9.75 %) live in Bujumbura and 250,000 (0.3 %) in other urban and peri-urban centers (Gitega, Ngozi, Rumonge, Kayanza, Muyinga, Kirundo, Muramvya, Bururi, Rutana).

An ethnic-based war that lasted for over a decade between Tutsi and Hutu resulted in more than 200,000 deaths, forced more than 48,000 refugees into Tanzania and displaced 140,000 others internally. Today, the Constitution lays down a shared political power between Tutsi and Hutu (40 % for Tutsi and 60 % for Hutu). In the army and the police, the share is 50 % for each group[12].

LAND AREA:	27,834 square kilometers
POPULATION:	8.2 million, growth rate 3,4 %
DENSITY:	280 inhabitants/km²
SHARE URBAN/RURAL POPULATION:	10 %/90 %
BIGGEST CITIES AND POPULATION:	700.000 (9.3 %) in Bujumbura
LANGUAGE:	Kirundi (official), French (official)
CLIMATE:	12–26 °C; two rainy seasons (February–Mai, September–November)
ALTITUDE:	772 to 2,670 m
MAIN WATER BODIES	Ruzizi and Kagera rivers, Tanganyika and Rweru lakes
VEGETATION	Much of natural vegetation has been cut for cultivation (high deforestation)
GDP PER CAPITA (AT PURCHASING POWER PARITY)	346 USD (as of 2007)
INFLATION RATE:	8,4 % (as of 2007)
AGRICULTURAL PRODUCTS:	Coffee, cotton, tea, corn, sorghum, sweet potatoes, bananas, manioc, beef, milk, hides
ELECTRICITY – PRODUCTION:	94 million kWh (as of 2006)
ELECTRICITY – CONSUMPTION:	188 million kWh (as of 2007)
NATIONAL ELECTRICITY CAPACITY IN OPERATION:	37,63 MW (as of 2008)
ELECTRIFICATION RATE:	1 %
OIL – PRODUCTION:	0 bbl/day (as of 2007)
OIL – CONSUMPTION:	2,900 bbl/day (as of 2005)
OIL – PROVEN RESERVES:	None
NATURAL GAS – PRODUCTION:	None
NATURAL GAS – PROVEN RESERVES:	None
EXPORTS:	44 million USD F.O.B. (2007)
EXPORTS – COMMODITIES:	Coffee, tea, sugar
EXPORTS – PARTNERS:	Germany (25.3 %), Switzerland (20.5 %), Pakistan (5.5 %), Belgium (4.6 %) (as of 2006)
IMPORTS:	272 million USD F.O.B. (as of 2007)
IMPORTS – COMMODITIES:	Capital goods, petroleum products, food
IMPORTS – PARTNERS:	Saudi Arabia (15.4 %), Kenya (10.4 %), Belgium (7.8 %), France (5.5 %), Uganda (4.9 %), Germany (4.9 %), India (4.3 %), Russia (4.2 %) (as of 2006)
EXCHANGE RATE:	1 Burundi-Franc (BIF) = 0.00056 € (as of November 2009)

Source: data compiled by the author from different sources, e.g. CIA, as of 2009

9 REPORT ON STATISTICS OF THE POPULATION OF BURUNDI, AS OF 2008
10 GEOGRAPHICAL INSTITUTE OF BURUNDI, AS OF 2007
11 SEE ANNEX 7 – MAP OF BURUNDI
12 ARUSHA PEACE AGREEMENT BETWEEN THE G10 (TUTSI POLITICAL PARTIES) AND G7 (HUTU POLITICAL PARTIES) GROUPS OF POLITICAL PARTIES OF BURUNDI

The Burundian economy depends on coffee and tea exports, which account for 90 % of foreign exchange earnings. The socio-political crisis during the last ten years resulted in a considerable decrease of the interior production and a serious imbalance of the state account.

2 ENERGY MARKET IN BURUNDI

2.1 OVERVIEW OF THE ENERGY SITUATION

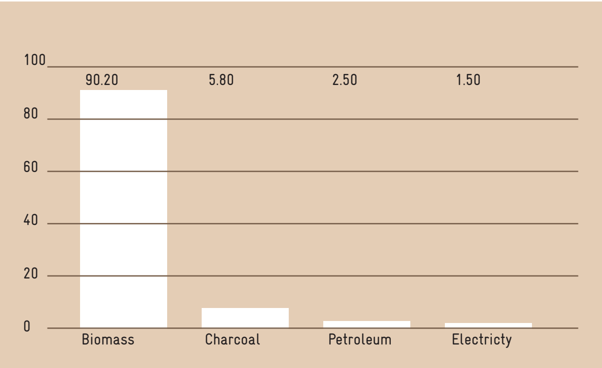
Overall, 96 % of Burundi's energy requirements are met by traditional biomass. The biomass energy is composed of 70.80 % of fuel wood, 18.36 % of agricultural residues, 5.80 % of charcoal, 1.00 % of bagasse and 0.04 % of peat 0.04 %[13].

Only 1 % of the population has access to electricity, which only accounts for about 1.5 % of energy requirements. Burundi's energy sector and its problems have to be understood in light of the special conditions of this small, landlocked country. Energy consumption in Burundi is very low. The demand and use of energy is based on the location as well as the types of economic activities and local habitat.

The shares of energy supply are shown in the following figure 1.

FIGURE 1

Shares of Total Primary Energy Consumption



Source: Graph by PSE AG, based on data from Ministry of Water, Energy and Mines, as of 2008, and from AfDB, Rehabilitation Project of Electrical Infrastructures in Burundi, as of 2007;

2.2 ENERGY CAPACITIES, PRODUCTION AND CONSUMPTION

Burundi faces severe constraints in electricity supply, either national or imported. Most of the electricity supply is generated by 24 hydroelectric plants with a combined installed capacity of 37.63 MW (as of 2008). These plants generated about 91 GWh in 2006 or nearly 100 % of the total national electricity production.

The utility REGIDESO (Régie de Production et de Distribution d'Eau et d'Électricité) exploits nine power stations with a working installed capacity of 30.9 MW (around 90 GWh every year). The power stations of Rwegura with 18 MW and Mugere with 8 MW account for 82 % of the total capacity installed. The Directorate General of Hydraulics and Renewable Energies (DGHER) exploits five micro power stations with a total of 0.5 MW. In addition, private producers have ten micro power stations with 0.65 MW capacity[14]. An overview of all 24 hydro power stations is given in the annex (List of Actual and Planned Hydro Power Sources).

During the years of civil conflict, the electricity access rate in connected areas halved as the urban population doubled, while the number of REGIDESO's customers barely increased to 41,074 by the end of 2007[15]. The average electricity consumption per citizen in Burundi is among the lowest in Africa and averages at around 20 kWh/year.

Burundi also benefits from imports from the regional hydro plants of Rusizi I and II operated by Société Internationale des Pays des Grands Lacs (SINELAC) and Société Nationale d'Électricité (SNEL) respectively. The supply deficit currently varies between 12.9 MW during the wet season and 23.5 MW during the dry season when the country's main hydro power plants are running at reduced capacity. Assuming that the economic growth continues at the current pace, the supply deficit may reach 22 MW and 34 MW (during the wet and dry seasons, respectively) by 2014. At this point, substantial generation capacity could be added through the commissioning of the Mpanda and Kabu 16 (Burundi), Rusumo Falls and Rusizi III (Regional) hydro power plants.

The impact of power cuts was identified in the Interim Strategy Note (ISN, 2006–2007) as one of the major hurdles to economic growth. Demand for electricity is expected to continue to rise steadily as the economy improves, returning refugees re-establish themselves and standards of living increase. Peak demand occurs during the evening hours and emanates mainly from household lighting needs. Due to the lack of maintenance and the supply deficit described above, the quality of service and operations is currently insufficient, with an estimated 48 GWh in combined technical and non-technical losses for 2007, representing nearly 25 % of total supply.

Technical losses are deemed to make up a large portion of these losses given the poor condition of the network, of the high voltage and medium voltage stations and of the low voltage distribution posts. The numbers of power interruptions are high both on LV and on the HV/MV backbone network. The quality of the electricity delivered suffers from poor frequency and significant voltage deviations estimated to be in excess of the normal 10 % below and above 220 V.

2.3 ELECTRICITY PRICES

Despite the 2007 tariff revision, the tariff structure remains inadequate to address issues of efficiency, financial viability and social equity among service users. A revised tariff regime is needed to adjust the tariff structure and its levels. The household electricity tariffs currently in place include subsidized pricing for up to 750 kWh per two-month billing cycle with an average of 5.2 Eurocent /kWh. In order to return to financial and operational viability, REGIDESO will need to:

13 SEE ANNEX 7.9 – STRUCTURE OF GROSS ENERGY SUPPLY IN BURUNDI 2002–2007
14 SEE ANNEX 7.12 – LIST OF ACTUAL AND PLANNED HYDRO POWER SOURCES IN BURUNDI
15 REGIDESO, 2002–2007

- Execute the financial restructuring before 31 December 2008 as agreed by the Government prior to negotiations
- Have the tariff structure revised so that it is efficient, covers at least operation and maintenance costs and is fair and equitable
- Improve its technical and commercial performance through the execution of a performance contract between REGIDESO and the State

REGIDESO, with the Government's support, has already taken a number of steps in these directions. As indicated above, tariffs were recently increased and the Government has authorized REGIDESO to apply for a 4 % surcharge to electricity tariffs when the thermal generation plant is in use. In April 2007, the Ministry of Finance and REGIDESO also signed an agreement for the settlement of approximately 50 % of the State's debt to the utility by means of bonds.

The power tariff[16] is going to be revised with the proposed Financial Restructuring Plan of REGIDESO financed through the World Bank's Multisectoral Water and Electricity Infrastructure Project.

Small thermal diesel generating sets are operated by REGIDESO with subsidies from the Government. A calculation made by REGIDESO shows that a thermal kWh is worth 350 BIF while the kWh is sold only at 41 BIF for customers with a social status that is based on consumption of up to 150 kWh.

This is the reason why thermal diesel generating sets are used only for towns located far from the national grid. Stand-alone diesel generator sets and inverters are also in use, but are mainly limited to hotels and lodges or public institutions like military camps, hospitals and schools.

Oil Products

In a normal period, the oil products are mainly imported from the refineries of Mombasa, the oil terminal of Nairobi or directly from the Middle East. These products arrive in Burundi by two corridors: the northern corridor (Kenya-Uganda-Rwanda-Burundi) and the central corridor (through Tanzania). Importation and distribution of the oil products are carried out by national companies. Since the period of 1996–1999, the price has not ceased to increase, rising from 0.35 USD in 1999 to 1.10 USD per liter of gasoline in 2006 and 2.00 USD in 2008[17]. Oil research in the Lac Tanganyika and the plain of Rusizi, which had been started with the Amoco American Company in the Eighties, was stopped, but has been taken up again by Streamoil at block D[18] in the South of the country.

2.4 MARKET ACTORS FOR PLANNING, REGULATION AND DISTRIBUTION

The public services DGEE, CEBEA, REGIDESO, DGHER, SINELAC, ONATOUR are under the authority of the Ministry of Water, Energy and Mines (MWEM).

MWEM, DGEE, MEFCD, MELM & PW

The Ministry of Water, Energy and Mines (MWEM), through the Directorate General of Water and Energy (DGEE), is responsible for the planning and regulations of the energy sector. The Ministry of Economy, Finances and Development Cooperation (MEFCD), through the Deputy Ministry of Planning, is responsible for the programming of the energy projects within the National Plan of Priority Actions. The Ministry of Environment, Land Management and Public Works (MELM & PW) is responsible for the environmental aspects.

CEBEA

During the Eighties, CEBEA (Centre d'Études Burundais en Énergies Alternatives – Burundian Center of Renewable Energies) as a testing institute installed a number of PV systems and had a production schedule for solar cookers, solar heaters and solar dryers. Unfortunately, the national crisis blocked the project.

REDIGESCO

The urban electricity utility (Régie de Production et de Distribution d'Eau et d'Électricité – REGIDESO) is the national power authority that owns all of the country's power plants, excluding those below 150 kW. REDIGESCO is responsible for power distribution in urban areas.

Moreover, REGIDESO operates Burundi's thermal power stations, most of which are located in Bujumbura and the surrounding areas, and a small amount of hydro capacity in the form of small units in rural areas. REGIDESO also operates the transmission system and the distribution network in Burundi.

REGIDESO in the capital Bujumbura purchases electricity from the SINELAC site at RUSIZI via a 110 kV transmission line operated by RD Congo.

DGHER

The rural electricity utility of DGHER (Directorate General of Hydraulics and Renewable Energies) independently develops rural electrification projects.

SINELAC

The regional electricity utility of SINELAC (Société Internationale des Pays des Grands Lacs – International Society of Electricity of Great Lakes Countries) was established by Burundi, Rwanda and Zaire to develop international electricity projects of 40 MW. SINELAC pursues several other hydro projects presently in the study stage. RUSIZI III-145 MW and RUSIZI IV-205 MW are located between RD Congo and Rwanda. These projects include the 28 MW RUSIZI I hydro power plant, operated by RD Congo (SNEL).

16 SEE ANNEX 7.11 – POWER TARIFFS FOR PRIVATE AND INDUSTRIAL USES, P.37. LATEST INFORMATION ON POWER TARIFFS CAN BE CHECKED ON THE WEBSITE OF REGIDESO (WWW.REGIDESORDC.COM/)

17 SAIC, AS OF 2008

18 THERE ARE 4 BLOCKS OF RESEARCH OF PETROLEUM IN BURUNDI (BLOCK A, B, C AND D).

ONATOUR
The national peat utility of ONATOUR (Office National de la Tourbe) is responsible for the exploitation of the peat in highlands of Burundi (Gisozi, Matana, Gitnga, Buyongwe).

SOSUMO
The sugar cane utility of SOSUMO (Société Sucrière du Moso) is operating a cogeneration power station for bagasse (5 MW).

Biomass Sector
The biomass sector of Burundi is mainly administrated by the Ministry of Environment that focuses on the sustainable production of firewood and charcoal. The Ministry of Trade regulates the transport of these commodities as well as related tax issues. The Ministry of Energy plans and regulates the firewood and charcoal demand in urban areas of Burundi.

3 RENEWABLE ENERGY POLICY FRAMEWORK CONDITIONS

It must be noted that Burundi's energy sector is dominated by the traditional sources of energy such as wood and charcoal accounting for nearly 96 % of the energy balance. Consumption far exceeds sustainable annual production if the forestry cover is to be reconstituted. As to the other energy forms, petroleum products (2.50 %) predominate consumption, followed by electricity accounting for only 1.50 % of the energy balance and peat accounting for 0.04 %[19].

3.1 POLICY AND RENEWABLE ENERGY PROMOTION PROGRAMS
In the short and medium term, the Government of Burundi is planning to carry out the following actions for extending energy supply by RE:

- Doubling the capacities of the hydro power stations of Nyemanga and Buhiga
- Feasibility and implementation studies for the hydro power stations of Kabu 23, Ruzizi III and Mule 34
- Development of rural electrification by the construction of mini hydro, solar and wind-power as well as of the use of biogas
- Renovation of the hydroelectric power stations and electricity transmission and distribution networks
- Construction of the power generation plant of Mpanda
- Extension of urban and rural electric networks and maintenance of existing power stations and networks
- Organizational audit and financial turnaround of REGIDESO

The Government has given high priority to rehabilitating and extending electricity services. The MWEM recognizes that the provision of these services constitute a crucial factor for economic development of the country. Developing sustainable services, however, requires considerable investments and an improved financial and operational management. Regarding the production of electricity, the MWEM favors hydroelectricity, while acknowledging that thermal power production needs to be utilized in the short run to bridge the gap between demand and supply. In addition, the MWEM would like to:

- Restructure the energy sector by merging the electricity activities of REGIDESO and DGHER
- Encourage private sector participation in electricity production
- Fully enact the regulatory framework

The MWEM considers the direct subsidy of operation and maintenance (O & M) costs as inadequate and inefficient and adheres to a tariff policy of fully covering at least O & M costs.

3.2 DONOR AID ACTIVITIES
Although limited investments took place during the period of conflict, REGIDESO and DGHER have indirectly benefited from donor-funded multisectoral activities to support the reconstruction. Those activities included:

- The Program for Rehabilitation of Burundi (PREBU) financed by the European Union and the IDA-financed Economic Recovery Credits (CRE)
- The Social Funds and the IDA Public Works and Employment Creation Project (PTPCE)
- The Emergency Activities conducted by the ICRC (International Committee of the Red Cross) and United Nations Children's Fund (UNICEF)
- The Chinese cooperation financing the rehabilitation of the hydroelectric power plants of Mugere (8 MW) in 2003 and the rehabilitation of the micro hydro power plants Ruvyironza (1.28 MW) and Gikonge (0.85 MW) in 2005 for which work was completed in 2008.

For the period of 2007–2010, some donors have already agreed to finance the projects mentioned above. Those donors are:

- World Bank
- AfDB
- Chinese Exim Bank
- Government of Denmark

The rationale for donors' involvement is registered, for example, in line with the World Bank's Interim Strategy Note (ISN) dated 11 April 2005 and the Poverty Reduction Strategy Paper (PRSP) of September 2006 and carries strategic importance in light of the Bank's focus on poverty reduction and post-conflict assistance in IDA countries.

The proposed World Bank Multisectoral Project, the AfDB Electricity Infrastructures Rehabilitation Project (EIRP), the support of Chinese Government to manage the power generation of Mpanda and the Government's solar

19 HAKIZIMANA, AS OF 2008

rural electrification activities will contribute to both aspects by improving access to electricity, which has been identified in the ISN as requirements to achieve higher and sustained growth performance. These goals also coincide with those of the PRSP, which aims to promote sustainable economic growth and to develop human capacities. The scope of the projects is mainly focusing on rural water supply contributing to achieve the Millennium Development Goals (MDGs) on water supply. In the case of electricity, the projects also seek to improve Burundi's capacity to participate in a regional integrated network as well as to explore alternative sources of energy that would be less costly and more environmentally sustainable. There is an urgent need for investments in the electricity sector because electricity will play a crucial role in accelerating industrial and commercial activities and hence contribute to the country's economic growth.

3.3 MARKET RISKS

The conditions to lead businesses in Burundi are currently favorable. As a matter of fact, all rebel movements signed the agreement of cease-the-fire, and the latest to date will enter in the political and administrative institutions. That made it possible for the donors of Burundi to organize a Round Table in May 2007 to financially support the country in order to leave poverty and to rehabilitate the economic infrastructures of production. Thus, legal certainty is also given for foreign investors to employ local experts and trained technical personnel for the techniques of RE.

Intellectual property rights are acknowledged and protected by Burundi's legislation. This legal basis makes it possible for investors to sell their equipment at lower risks. In addition companies investing in Burundi have now the right to transfer their margins, in accordance with the Code of Investments (which in particular gives a guarantee of non payment of taxes for a certain period). The research institutes in the sector of energy (e. g. the University of Burundi / Faculty of Applied Sciences) are prepared to actively support research for rural development. The barriers hindering to promotion of the RE as identified recently were:

- Missing capacities
- Low awareness of the purchasers of the equipment and of the population in general
- Lack of policy attention and institutional framework
- Lack of quality and consistency in the RE technology made available, extending from the equipment itself right through to installation, operation and maintenance
- Lack of incentives to promote technology transfer

3.4 CUSTOMS DUTIES AND TAXES RELATED TO RENEWABLE ENERGY PRODUCTS

In addition to the law liberalizing the electricity sector, the field of RE was declared as a priority for both the social and rural development. It is the reason why the Government of Burundi decided to reduce tax for all imported RE components. Within this framework, the companies WATEL, ECOGEER and ENESCO, which are facilitating the electrification of health centers and the secondary schools pay neither customs duties nor other taxes for imported solar equipment.

SHORT BUSINESS INFO

Zero custom duty and zero tax on imported RE equipment.

4 STATUS AND FUTURE OUTLOOK FOR RENEWABLE ENERGIES

4.1 BIOMASS / BIOGAS

Traditional biomass-based fuels for cooking and heating are currently the most important source of primary energy in Burundi with wood and charcoal consumption accounting for 96 % of the total consumption (rural 76 %, urban 24 %;)[20]. The total sustainable firewood biomass supply from all sources was estimated at 6,400,000 m³ in 2007.

Firewood comes from three main areas: the rangelands, Government forests and small farmlands. Before the civil war, the rangelands covered about 131,636 hectares and the Government forests 74,024 hectares, but now they are together about 188,000 hectares, which means that Burundi lost about 17,660 hectares.

According to a survey carried out by DGEE (as of 2004), 320 biogas plants for cooking and lighting purposes were in operation in Burundi by end of 1993. Most of these systems are between 4–16 m³ with a maximum gas capacity of 3 m³, which is considered sufficient to meet the cooking and lighting needs of a family of five persons[21].

Peat offers an alternative to increasingly scarce firewood and charcoal as a domestic energy source. The Government is promoting peat production.

Cogeneration from bagasse, a waste product of the sugar cane industry, is used in two 2.5 MW power plants operated by SOSUMO. As the unit runs 300 hours per month and over a period of six months, the energy production in 2007 was 9 MWh. The electricity and heat is not fed into the national grid, but is used to power the SOSUMO sugar production facilities.

SHORT BUSINESS INFO

Biomass commercial energy is used in cogeneration in the sugar industry (5 MW, 9 MWh).

4.2 SOLAR ENERGY

Burundi has an estimated insolation of about 4–5 Wh/m²/day[22]. Solar radiation has been used traditionally for drying of crops, animal products and clothes. There is a large potential for PV electricity generation in rural parts of Burundi as most regions are not grid-connected. But application of PV in these areas is not very common. Actually, the MWEN is installing solar PV equipment in 60 health centers and colleges in rural areas. This

20 DGEE, AS OF 2006
21 GTZ/DGEE, AS OF 2004
22 SEE ANNEX 7 – AFRICA SOLAR/PV MAP
23 DIRECTORATE GENERAL OF WATER AND ENERGY, AS OF 2008

program will be implemented in the next two years to electrify 90 clinics and 90 schools[23].

Health services are equipped with waiting rooms, consultation units, laboratories, administration and registration areas, family planning and maternity facilities, store rooms, sanitary facilities and housing for staff. Now the health centers have lighting and sterilization facilities. Personnel working at the health centers have access to TV and lighting in their residences. At the community colleges, examination results have improved since students have had electric lighting for longer study hours.

The electrical installations in the health centers are in alternative current (AC) to allow not only lighting but also electricity supply for refrigerators, electron microscopes, computers and distillers. 2 kWp systems cost 21.000 USD per installation. The school systems are for lighting with an installed direct current (DC) capacity between 600–700 Wp per school. Each PV installation costs between 10,000 and 11,000 USD[24].

In Burundi, there is a lack of PV equipment in local markets. An intensive awareness-raising campaign is being implemented to gain support for the project from stakeholders who were initially reluctant to participate because they were unfamiliar with PV systems. The Government has released all taxes on the imported materials and equipment needed for the PV systems. Currently, mainly small (12–30 Wp) SHS are sold on a small commercial market. Until 1993, 1,678 PV kits with 72 kWp were installed for telecommunication systems[25] (56 %), water pumping (30 %), lighting[26] (13 %) and refrigeration of medicine and vaccines[27] (1 %), but 60 % were destroyed during the civil war. According to the ENESCO Report, 17 % were functional in 2002[28].

SHORT BUSINESS INFO

- Current solar electrification program for 90 schools (0,7 kW DC) and 90 clinics (2 kW AC)
- 72 kW installed countrywide, 56 % telecom systems, 30 % water pumping, 13 % lighting, 1 % refrigeration

RE Business Opportunity

4.3 WIND POWER

The wind energy potential has not been explored so far in Burundi. No reliable data is available to estimate wind velocities and to locate potential sites for electricity production. No small-scale wind turbines have been installed in the country[29].

4.4 GEOTHERMAL POWER

Geothermal resources have been identified in the West Rift Valley region in neighboring eastern DR Congo. Several geothermal indicators exist in Burundi, but very little useful data is available to assess their commercial viability. There is, however, a strong need to carry out detailed exploration to quantify the available resource capacity.

4.5 HYDRO POWER

In Burundi, 24 large and small hydro plants are currently in operation with a total national capacity of 37.63 MW (as of 2008). In 2006, the recorded electricity production was 152 GWh[30].

Hydro power provides about 99 % of the country's electricity power supply. The resource, however, is not fully exploited yet. There is considerable potential for further development, including micro, mini and small hydro power.

REGIDESCO exploits nine power stations with an installed capacity of 30.9 MW producing around 90 GWh every year. The power stations of Rwegura with 18 MW and Mugere with 8 MW account for 82 % of the installed capacity. DGHER exploits five micro power stations for a total of 0,5 MW, and private producers have ten micro power stations for a power of 0,65 MW.

The Lahmeyer International Studies of the Development of the Hydroelectric Resources of Burundi (as of 1983) showed that there is 1,700 MW of theoretical capacity of which 300 MW (from sites with capacities above 1 MW) could be economically installed[31].

RE Business Opportunity

SHORT BUSINESS INFO

- Currently, there are 24 small and large scale hydro power units with total of 38 MW produce 152 GWh per year.
- The economically viable potential is about 300 MW of medium and large hydro stations.

24 NUMBERS OBTAINED FROM THE DGEE FOR IMPLEMENTATION OF SOLAR ENERGY IN RURAL AREAS IN BURUNDI
25 THESE TELECOMMUNICATION SYSTEMS WERE PROVIDED BY THE COMPANIES/ORGANIZATIONS ONATEL, NATIONAL RTV-RTNB, CONTROL OF THE AERONAUTICAL SERVICES-RSA, ENERGY OF GREAT LAKES-EGL AND CARITAS.
26 REPORTS OF DGEE AND DGHER
27 REPORTS OF THE MINISTRY OF PUBLIC HEALTH
28 ENESCO, AS OF 2002
29 AS COUNTRY SPECIFIC WIND MAPS FOR BURUNDI ARE STILL MISSING PLASE SEE GENI, 2010 FOR A GENERAL OVERVIEW ON WND ENERGY POTENTIAL IN AFRICA› HTTP://WWW.GENI.ORG›LIBRARY› RENEWABLE ENERGY RESOURCE MAPS›AFRICA›WIND)
30 SEE ANNEX 7.12 – LIST OF ACTUAL AND PLANNED HYDRO POWER SOURCES
31 SEE ANNEX 7.13 – LIST OF POTENTIAL LARGE SCALE HYDRO POWER PROJECTS

5 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

The following information is mainly supplied by Dismas Nditabiriye, Ir. Godefroy Hakizimana and Marie-Ange Kigeme in 'Comparative Study on the Ecological and Economic Advantages of the Various Sources of Energy exploited in Burundi, NBI-FCBN', as of 2008.

5.1 RENEWABLE ENERGY COMPANIES & BUSINESS RELATED ORGANIZATIONS

NAME	ADDRESS	PROFILE	ESTIMATED RELIABILITY
CHARCOAL			
Associations of Women and Artisans	c/o ACVE Hotel Novotel Bujumbura – Burundi Phone: +257 2222 2600	Sale and manufacture of improved stoves	Associations of women are promoting and selling improved stoves in rural areas in cooperation artisans
AGRICULTURAL AND URBAN WASTE			
BRICOOP	Q. Industriel Bujumbura – Burundi (around SODECO) Phone: +257 22 22 5909	Densified agricultural waste	BRICOOP produces 40 tons per day of densified briquettes from coffee parch, sawdust, rice straw, cotton scrap, fibers of palm and dung as binder for the Army Force barracks
ADLP	Q. Nyakabiga Bujumbura – Burundi (around SOS School) Phone: +257 22 22 9555	Densified urban household waste	ADLP manufactures 500 kg per day of densified briquettes produced from household wastes (including household refuse in the peripheral districts of Bujumbura) for the National Police Force
SOLAR ENERGY PARTNERS			
WATEL	Q. Industriel Bujumbura - Burundi, Avenue de l'Imprimerie CHANIC House Phone: +257 22 22 6579	Import and sale of PV solar equipment	Contract for the electrification of health centers and communal colleges in the rural off-grid environment, awarded in October 2006 at WATEL by the Government
ECOGEER	Bujumbura – Burundi Phone: +257 79 916110	Import and sale of PV solar equipment	Contract for the electrification of health centers and communal colleges in the rural off-grid environment, was awarded in October 2006 at ECOGEER by the Government
ENESCO	Rue des Eucalyptus, Bujumbura – Burundi, Phone: +257 79 934 212	Import and sale of PV solar equipments	Engineering and design office also working in PV solar electrification
ENVIRONMENTAL LEADERS			
ACVE	Hotel Novotel Bujumbura –Burundi Phone: +257 2222 2600	Association for green reforestation	Association dealing with programs of reforestation and protection of the environment via micro projects (in particular protection of banks in cities and promotion of improved stove cookers)
FCBN	Avenue de l'Amitié Building Radio Isanganiro – Burundi Phone: +257 22 21 7991	Burundian forum of the Civil Society for the Nile Basin	Grouping of associations dealing with the protection of the environment by promoting projects of micro appropriations related to reforestation and popularization of improved stove cookers within the framework of the Basin of the Nile

5.2 LOCAL INSTITUTIONS RELATED TO RENEWABLE ENERGY BUSINESS

NAME	ADDRESS	PROFILE	ESTIMATED RELIABILITY
MINISTERIAL INSTITUTIONS			
Ministry of Water, Energy and Mines (MWEM)	B.P. 745 Bujumbura – Burundi Phone: + 257 22 22 5909 Fax: + 257 22 22 3337	Governmental	Promotion of RE
Ministry of Environment, Land Management and Public Works (MELM & PW)	B.P. Bujumbura – Burundi Fax: +257 22 22 8902 dp_enviro@cbinf.com	Governmental	Protection of environment
Ministry of Internal Affairs (MIA)	B.P. Bujumbura Phone: + 257 22 22 4573 Fax: +257 22 22 4678	Governmental	Mobilization
PUBLIC UTILITIES			
Urban National Power Utility (REGIDESO)	B.P. 660 Bujumbura – Burundi Phone: +257 22 3412	Para-stately	Production, distribution and sale of electricity in urban centers
Rural National Power Utility (DGHER)	B.P. 1192 Bujumbura – Burundi Phone: +257 22 22 5909 E-Mail : dgherbdi@yahoo.fr	Personalized administration	Sales, production and distribution of electricity in rural areas
Alternatives Energies Burundian Centre (CEBEA)	–	Governmental project	Research in thermal solar energy
OTHERS			
University of Burundi	B.P. 906 Bujumbura – Burundi Phone: + 257 22 6220, Mobile: + 257 79 925701, 77 750200, Fax: + 257 22 3288	Personalized administration	Research and training in local material for utilization of thermal solar energy

5.3 GOVERNMENTAL AND MULTILATERAL DONORS PROJECTS

GOVERNMENTAL PROJECTS AND PROGRAMS	TYPE OF PROJECT	DONORS			FINANCING AMOUNT (USD)	DURATION OF THE PROJECT
		NATIONAL ANNUAL BUDGET	BILATERAL	MULTILATERAL		
Multisectoral Water and Electricity Infrastructure Project (HV switchyard and electric lines)	National	–	–	World Bank	31 million	2008–2012
Electric Infrastructures Project (MV Switchyard and electric lines)	National	–	–	African Development Bank	11 million	2008–2012
Construction of Mpanda Hydroelectric Power Station (10.6 MW	National	–	Chinese Exim Bank	–	42 million	2009–2011
Construction of Kabu 16 Hydroelectric Power Station (20 MW)	National	–	–	Burundi/South African Public-Private Partnership	Under evaluation	–
Construction of Mule 34 Hydroelectric Power Station (15 MW)	National	–	–	Burundi/South African Public-Private Partnership	Under evaluation	–
Annual projects of electrification of health centers and communal colleges by PV solar energy	National	Extraordinary budget of investment	–	–	1 Million	Every year
Construction of Rusumo Hydroelectric Power Station	Regional	–	–	World Bank/AfDB Public-Private Partnership	Under evaluation	2012–2017
Construction of Rusizi III Hydroelectric Power Station	Regional	–	–	European Union	Under evaluation	–
Construction of Eldoret-Kampala-Kigali-Bujumbura Pipeline	Regional	–	–	Public-Private Partnership	Under evaluation	–
Search for hydrocarbons along Lake Tanganika	Bi-Lateral with DRC	–	–	Public-Private Partnership	Under evaluation	–
EAC Energy Master Plan	Regional	–	–	AfDB	Under evaluation	–
EAC Refineries Master Plan	Regional	–	–	AfDB	Under evaluation	–

6 BIBLIOGRAPHY

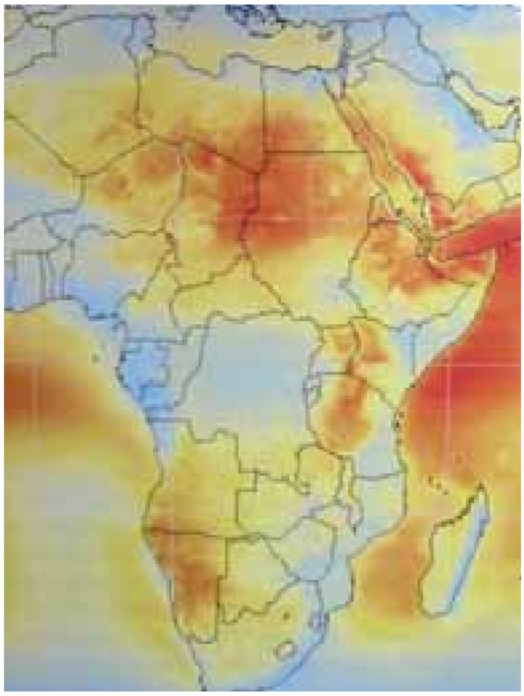
- African Development Bank – AfDB (2006): Overview of Potential Projects, Financing Electricity for Growth in Africa
- African Development Bank – AfDB (2007): Electric Infrastructures Rehabilitation Project in Burundi
- Cadre Stratégique de Croissance et de Lutte contre la Pauvreté – CSLP (2006): Priority Action Program (PAP) for the Implementation of the PRSP in Burundi 2007–2010
- Centre d'Études Burundais en Énergies Alternatives – CEBEA (1997): Rural Solar Electrification in Burundi.
- Chinese CGGC International (2006): Hydroelectric Power Station of Mpanda
- Central Intelligence Agency – CIA (2009): The World Fact Book – Burundi (www.cia.gov/library/publications/the-world-factbook/geos/by.html)
- DGEE and DGHER (without year): Several reports
- Directorate General of Water and Energy – DGEE (2006): Report of 2006
- Directorate General of Water and Energy – DGEE (2008): Project of Rural Electrification with Solar Energy, Report of 2008
- Economist (1999): The Economist Intelligence Unit, Country Profile Rwanda and Burundi 1998–1999, pp. 16-18. London
- EIA (2003): Energy Information Administration, Country Energy Balance Burundi
- ENESCO (2002): Report Rwanda
- Fitchner (1997): Hydroplan Burundi
- Geographical Institute of Burundi (2007): Report
- Global Energy Network Institue - GENI (2009): Wind Energy Potential in Africa (http://www.geni.org/globalenergy/library/renewable-energy-resources/world/africa/wind-africa/index.shtml)
- GTZ/DGEE (2004): Programme Spécial de l'Énergie / Special Energy Program (PSE), Report 2004
- Hakizimana, Ir. Godefroy (2008): EAC Strategy to Scale-Up Access to Modern Energy Services, Burundi Country Report GTZ/UNDP
- Integrated Bureau of the United Nations Burundi (2007): Strategic Framework for Peace Building in Burundi
- International Monetary Fund – IMF (2007): Burundi – Note on the Poverty Reduction Strategy Paper and Joint International Development Association (IDA)
- Lahmeyer International (1983): Brief Report on Metallurgy and Energy Supply – Burundi Nickel Project, Düsseldorf
- Ministry of Infrastructure Rwanda (2007): Feasibility Study for the Rwanda-Burundi Oil Products Pipeline – Capacity Market Analysis Phase 1, draft report
- Ministry of Public Health (without year): Several reports
- Ministry of Water, Energy and Mines – MWEM (2007): Sectoral Policy of the Ministry of Water, Energy and the Mines, 2007–2010
- Ministry of, Water, Energy and Mines (2007): Sectoral Policy of the Ministry of Water, Energy and Mines, Republic of Burundi
- Multinational Nile Basin Initiative (2006): Rusumo Falls Hydro power Station (RFHS), Proposal for the Award of an AfDB Fund
- N. N. (2006): Balance of Energy of the Republic of Burundi
- N. N. (2008): Report on Statistics of the Population of Burundi
- Nditabiriye, Dismas, Hakizimana, Ir. Godefroy, Kigeme, Marie-Ange (2008): Comparative Study on the Ecological and Economic Advantages of the Various Sources of Energy Exploited in Burundi, NBI-FCBN
- PVGIS/European Communities (2001-2007) & Tele Atlas/Europe Technologies (2010): Photovoltaic Geographical Information System – Interactive Maps - Africa (http://re.jrc.ec.europa.eu/pvgis/apps3/pvest.php?map=africa; viewed in December 2009).
- REGIDESO (2007): Reports of National Electricity Utility REGIDESO 2002–2007 (www.regidesordc.com/)
- Régie de Production et de Distribution d'Eau et d'Électricité – REGIDESO (2002) : Burundian-Chinese SHP Training Workshop, Presentation
- Republic of Burundi, (2007): Sectoral Policy of the Ministry of Energy and Mines
- Round Table on External Aid (2007): Report on the Project Profiles Prepared for the Round Table on External Aid Held at Bujumbura on May 2007
- SAIC (2008): Several reports
- UNEP (2006): Environmental Future of Africa – Our Environment, Our Treasure
- World Bank, SNC-LAVALIN International, Hydro Quebec International (2004): Strategic/Sectoral, Social and Environmental Assessment of Power Development Options in Burundi, Rwanda and Western Tanzania, Status Report (Draft Report No. 2)
- World Bank (2008): Multisectoral Water and Electricity Infrastructures in Burundi
- World Energy Council – WEC (2007): The Benefits and Deficiencies of Energy Sector Liberalisation

7 ANNEX

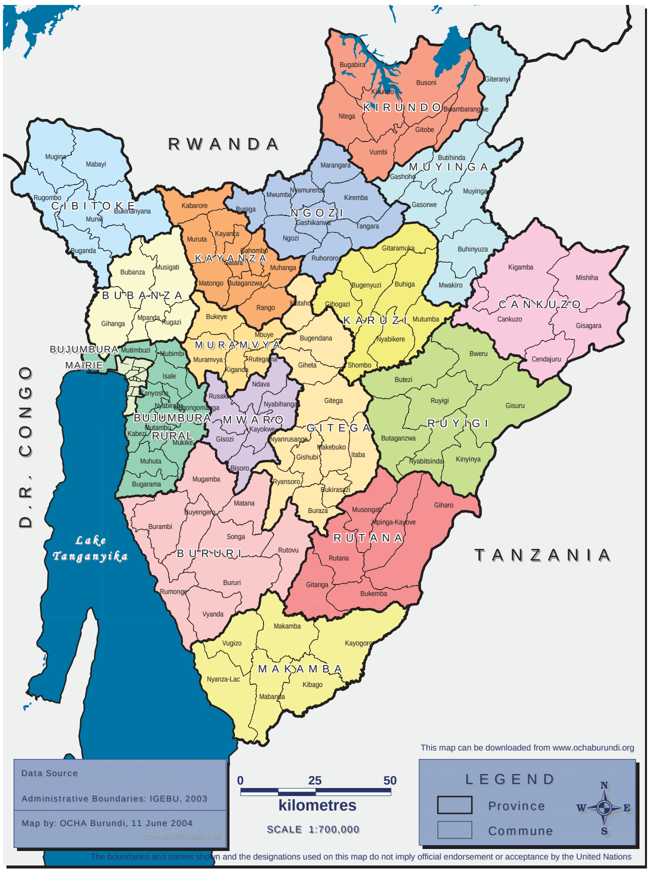
Burundi Electrical National Grid Map

Note: The map also contains net connections to Rwanda, DRC and Tanzania.
Source: REGIDESO, as of 2007

Africa Solar/PV Map



Note: Burundi is negotiating with KFW to realize a National Solar Map.
Source: extracts from PVGIS/European Communities,
2001-2007; Tele Atlas/Europe Technologies 2010



7.6 GOVERNMENTAL AND MULTILATERAL DONORS PROJECTS

TYPE OF ENERGY	2002	2003	2004	2005	2006	2007	TOE (2007)	% (2007)
Biomass								
Firewood (m³)	5,881,060	5,749,775	5,922,539	6,105,303	6,278,067	6,400,000	1,216,000	70.80
Agricultural residues (tons)	n.a.	n.a.	n.a.	n.a.	n.a.	900,000	315,000	18.35
Charcoal (tons)	327,674	336,521	346,617	355, 500	364,650	375,55	100,000	5.82
Bagasse (tons)	n.a.	42,757	47,579	48,283	46,526	48,000	16,800	0.98
Waste wood (tons)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.04
Petroleum products (tons)	37,500	39,230	41,880	41,150	38,750	40,500	42,000	2.50
Hydroelectriciy (GWh)	167	161	163	171	152	188	45	1.50
Peat (tons)	6,816	6,977	4,581	4,642	4,840	8,000	2,276	0.04
Solar and biogas	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.01
Total								100

Source: Report on the Project Profiles prepared for the Round Table on External Aid, as of 2007

7.7 DEVELOPMENT OF POWER GENERATION IN BURUNDI

	POWER (MW)	2002	2003	2004	2005	2006	2007	SHARE (%)
		GWH						
Interconnected hydro power stations								
National power stations (Rwegura, Mugere, Ruvyironza, Gikonge)	27.27	118	94	85	89	85		
Regional power stations (Rusizi I, Rusizi II)	22.00 (share Burundi)	40	57	72	71	58		
Total production of interconnected hydro power stations		158	153	157	165	145		
Isolated hydro power stations								
(Nyemanga, Gikonge, Kayenzi, Marangara, Buhiga)		8	7	6	6	6		
Total hydro power energy		167	161	163	171	152	188	99.99999
National thermal power stations								
Bujumbura, Kirundo and Muyinga	5.50	0	0	0	0	0	0.015	0.00001
Total Energy Supply		167	161	163	171	152	188	

Source: Reports of National Electricity Utility (REGIDESO), 2002–2007

7.8 SALES AND PRODUCTION FORECAST FOR POWER GENERATION

GWH	2008	2009	2010	2011	2012	2013	2014
Electricity sales	143	152	183	188	205	207	207
Losses %	24.4	24	23	21	19	18	18
Total production	189	200	238	238	253	253	253
Hydro	189	200	238	238	253	253	253
Existing Regideso hydro plants	189	200	238	238	253	253	253
Small hydro plants					26	26	26
Thermal	0	11.44	11.44	11.44	0	0	0
– Diesel	0	11.44	11.44	11.44	0	0	0
– HFO	0	0	0	0	0	0	0

Current production: 189 GWh (100 %). Rehabilitation and additional production from Mpanda and small run-of-the-river hydro power plants are expected to increase capacity by 4.31 MW, 10.6 MW and 3 MW respectively.

Source: Reports of National Electricity Utility (REGIDESO), 2002–2007

7.9 SHARE OF NATIONALLY GENERATED AND IMPORTED ELECTRICITY IN BURUNDI

OPERATING PERFORMANCE	2002	2003	2004	2005	2006	2007	SHARE (%)
Total electricity available (GWh)		161	164	171	152	188	100
of which electricity produced nationally (GWh)		131	90	100	94	110	58.5
% growth (annual)	n.a.	n.a.	1.7%	4.5%	–11.3%	24.2%	n.a.
Electricity purchased from SINELAC (GWh)	n.a.	30	42	51	41	52	n.a.
Electricity purchased from SNEL (GWh)	n.a.	n.a.	31	20	17	26	n.a.
Total electricity purchased/imported (GWh)	167	161	163	171	152	188	

Source: Reports of National Electricity Utility (REGIDESO), 2002–2007

7.10 EVOLUTION OF NATIONAL ELECTRICITY CONSUMERS BY REGION

	2002	2003	2004	2005	2006	2007	RATE OF INCREASE (%)
Bujumbura	19,466	20,754	21,025	20,576	21,510	24,774	4.5
South Region	2,061	2,208	2,366	2,494	2,754		10.4
North Region	3,351	3,707	3,932	4,039	4,409		9.1
West Region	2,183	2,304	2,422	2,492	2,905		16.5
East Region	2,618	2,906	3,124	3,257	3,558		9.2
Large-scale consumers				64	64		0
Total	29,674	31,915	32,889	32,986	35,200	41,074	6.7
LV			34,800	35,335	37,946	37,660	
MV			468	445	452	412	

Source: Reports of National Electricity Utility (REGIDESO), 2002–2007

7.11 POWER TARIFFS FOR PRIVATE AND INDUSTRIAL USERS

CATEGORIES OF CUSTO-MERS	SLICE 1		SLICE 2		SLICE 3		SLICE 4		SLICE 5	
	INVOICED QUANTITIES (KWH)	PRICE/KWH	INVOICED QUANTITIES (KWH)	PRICE/KWH	INVOICED QUANTITIES (KWH)	PRICE /KWH	INVOICED QUANTITIES	PRICE/KWH	INVOICED QUANTITIES	PRICE/KWH
Households	0–150	41 BIF	151–300	46 BIF	301–750	85 BIF	751 kWh and more	127 BIF	–	–
Trade	0–300	116 BIF	301–1,000	127 BIF	1,001	137 BIF	–	–	–	–
Administra-tion	All consumption	127 BIF	–	–	–	–	–	–	–	–
Medium Voltage	*CD (kW/month) *extra premium (kW/month)	3,231 BIF 6,462 BIF	CD + the peak (0–150 h/month)	122 BIF	CD + the peak (151–450 h/month)	77 BIF	451 h and more	52 BIF	Without peak and CD	138 BIF
DGHER (Rural Electricity Utility)	All consumption	53 BIF	–	–	–	–	–	–	–	–
Public lighting	All consumption	127 BIF	–	–	–	–	–	–	–	–

Source: Reports of National Electricity Utility (REGIDESO), 2002–2007

Note: The source from National Electricity Utility (REGIDESO) really reflects the daily market prices/tariffs. REGIDESO is one important of the two electricity utilities (REGIDESO, DGHER). Regarding the quantities of electricity (kWh) a household, trade or administration etc., consumes pay the price in accordance of the indicated slices (1–3) they are corresponding to.
Source: National Electricity Utility (REGIDESO), as of 2009

7.12 LIST OF ACTUAL AND PLANNED HYDRO POWER SOURCES

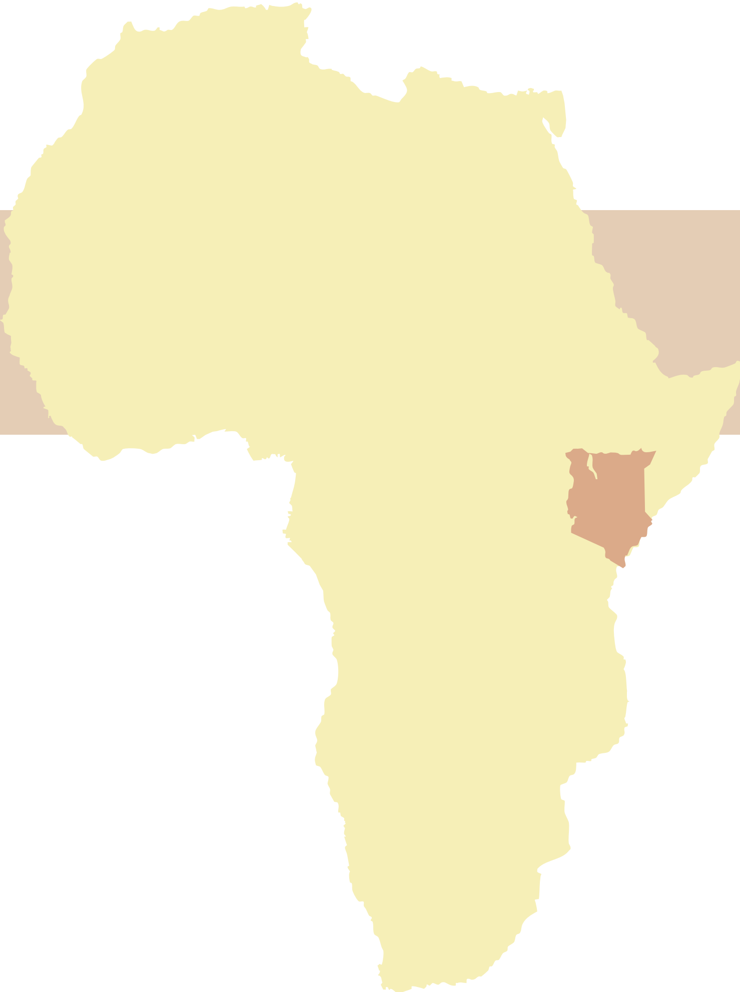
	DENOMINATION OF THE POWER STATION	OWNER	YEAR OF START	INSTALLED POWER (MW)	POWER SUPPLY (MW)				
					2008	2010	2012	2015	2020
Regideso Thermo-power Plant	Bujumbura	REGIDESO		5.50	5.50	5.50	5.50	5.50	
	Reinforcement Bujumbura	REGIDESO							
	Subtotal I			5.50					
Regideso Hydro Power Plant	Rwegura	REGIDESO	1986	18.00	18.00	18.00	18.00	18.00	18.00
	Mugere	REGIDESO	1982	8.00	8.00	8.00	8.00	8.00	8.00
	Nyemanga	REGIDESO	1988	1.44	1.44	2.88	2.88	2.88	2.88
	Ruvyironza	REGIDESO	1980/1984	1.50	1.50	1.50	1.50	1.50	1.50
	Gikonge	REGIDESO	1982	1.00	1.00	1.00	1.00	1.00	1.00
	Kayenzi	REGIDESO	1984	0.85	0.85	0.85	0.85	0.85	0.85
	Marangara	REGIDESO	1986	0.24	0.24	0.24	0.24	0.24	0.24
	Buhiga	REGIDESO	1984	0.24	0.00	0.80	0.80	0.80	0.80
	Sanzu	REGIDESO	1983	0.07	0.00	0.07	0.07	0.07	0.07
	Mpanda	REGIDESO		10.60	0.00	10.60	10.60	10.60	10.60
	Kabu 16	REGIDESO	2012	20.00	0.00	20.00	20.00	20.00	20.00
	Mule 34	REGIDESO	2012	20.00	0.00	20.00	20.00	20.00	20.00
	Subtotal II			81.94	31.03	83.48	83.48	83.48	83.48
DGHER Hydro Power Plant	Kigwena	DGHER	1986	0.05	0.05	0.05	0.05	0.05	0.05
	Butezi	DGHER	1990	0.24	0.24	0.24	0.24	0.24	0.24
	Ryarusera	DGHER	1984	0.02	0.02	0.02	0.02	0.02	0.02
	Nyabikere	DGHER	1990	0.14	0.14	0.14	0.14	0.14	0.14
	Murore	DGHER	1987	0.02	0.02	0.02	0.02	0.02	0.02
	Subtotal III			0.45	0.45	0.45	0.45	0.45	0.45
Private Hydro Power Plant	Mugera	Church	1962	0.03	0.03	0.03	0.03	0.03	0.03
	Kiremba	Church	1981	0.06	0.06	0.06	0.06	0.06	0.06
	Masango	Church	1979	0.03	0.03	0.03	0.03	0.03	0.03
	Musongati	Church	1981	0.01	0.01	0.01	0.01	0.01	0.01
	Mutumba	Church	1982	0.05	0.05	0.05	0.05	0.05	0.05
	Mpinga	Church	1983	0.02	0.02	0.02	0.02	0.02	0.02
	Kiganda	Church	1984	0.04	0.04	0.04	0.04	0.04	0.04
	Gisozi	Church	1983	0.02	0.02	0.02	0.02	0.02	0.02
	Burasira	Seminary	1961	0.03	0.03	0.03	0.03	0.03	0.03
	Teza	Tea Leaf Factory	1971	0.36	0.36	0.36	0.36	0.36	0.36
	Subtotal IV			0.65	0.65	0.65	0.65	0.65	0.65
National power supply					37.63	90.08	90.08	90.08	90.08
Import to Burundi	Rusizi I	SNEL		27.8	9				
	Rusizi II	SINELAC		40	7		12	12	12
	Rusumo Falls	NELSAP		60	0		20	20	20
	Rusizi III	CEPGL		250	0				
Total import supply					16	83.48	32		

Source: Lahmeyer International Report, as of 1983

7.13 LIST OF POTENTIAL LARGE SCALE HYDRO POWER PROJECTS

PROJECTS	PINST (MW)	PGAR (MW)	EPRIM (GWH)	COSTS (1 BN USD)	SPECIFIS COSTS	
					(USD/KWH)	(USD/MWH)
STORAGE PROJECTS (8 H)						
KITE 011 (Rushiha)	15.3	15.2	46.4	44.3	2,906	106
KITE 020 (Masango)	9.3	9.3	27.1	28.9	3,112	118
KAGU 006 (Kagunuzi B)	6.7	6.7	21.4	20.8	3,115	106
MPAN 049 (Mpanda A)	14.6	13.9	40.9	44.1	3,186	119
KAGU 010 (Kagunuzi A)	10.7	10.2	29.8	33.8	3,316	126
KAGU 016 (Kabulantwa V)	36.1	31.3	111.7	108.3	3,455	107
MUYO 029 (Muyovozi III)	6.0	5.7	18.0	21.4	3,746	131
KABU 023 (Kabulantwa IV)	21.5	16.8	61.6	69.6	4,136	125
CHAINS OF STORAGE PROJECTS (12 H)						
KABULANTWA (023-016-009)	67.0	62.2	201.3	156.1	2,510	86
KITENGE-KAGUNUZI (020-011-010-006)	42.0	41.3	124.7	127.8	3,094	113
RUZIBAZI (028-021-014-012)	40.6	39.8	119.9	130.6	3,279	121
NYAMUHENDE/KIRASA (013-009-006-003)	38.3	36.7	111.0	126.0	3,437	126
KANYOSHA/KANIKI (016-010)	8.4	8.1	24.9	34.0	4,172	150
MUYOVOZI	8.2	7.7	24.0	37.8	4,920	174
PONDAGE PROJECTS (12 H)						
LUA 035 (Lua)	10.8	10.8	47.4	40.5	3,745	95
KIKU 002 (Kikuka)	3.0	2.9	13.1	11.5	3,911	97
KABU 016 (Kabulantwa V)	15.4	14.3	67.3	58.3	4,085	96
RUZB 014 (Ruzibazi C)	3.6	3.6	15.7	16.3	4,571	116
RUVU 216 (Murongwe/Kunyanga)	6.2	4.7	25.9	21.7	4,632	93
RUZB 012 (Ruzibazi D)	3.2	3.2	13.8	15.6	4,935	125
CHAINS OF PONDAGE PROJECTS (12 H)						
KABULANTWA (016-009)	16.9	15.8	74.0	65.7	4,159	99
RUZIBAZI (014-007)	11.8	11.8	57.2	39.5	3,347	79
RUN-OF-RIVER -PROJECTS (24 H)						
JIJI 003 (Jiji)	7.5	7.5	65.8	18.3	2,430	31
SIKU 008 (Nyemanga)	2.5	2.5	21.9	6.4	2,539	32
MULE 034 (Mulembwe)	5.3	5.3	46.3	18.7	3,544	45
RUZB 007 (Ruzibazi E)	4.7	4.7	41.4	18.0	3,801	48
KABU 016 (Kabulantwa V)	7.3	7.3	64.0	28.7	3,919	50
KABU 023 (Kabulantwa IV)	2.7	2.7	23.5	12.5	4,658	59
NDAH 013 (Ndahangwa)	1.3	1.3	11.1	7.3	5,799	73
SIKU 011 (Sikuvyaye)	2.4	2.4	20.6	13.9	5,934	75
LUVI 012 (Ruvironza)	1.3	1.3	11.8	8.3	6,202	78
NYHE 006 (Nyamuhende/Kirasa C)	1.2	1.2	10.8	7.7	6,234	79

Source: Lahmeyer International Report, as of 1983



COUNTRY CHAPTER: KENYA

Author of Country Chapter
Bernard Mutiso Osawa
(MSc. RE, Phy.)

Coordination and Review of the Country Chapter
Dipl. Phys. **Rafael Wiese**
PSE AG
Freiburg, Germany
www.pse.de

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS KENYA

ACRONYMS AND ABBREVIATIONS

BURUNDI

AC	Alternating Current
ACP	African, Caribbean and Pacific States
AfDB	African Development Bank
AFD	Agence Française du Développement (French Development Agency)
AFREPREN/FWD	African Energy Policy Research Network Limited
ATIA	African Trade Insurance Agency
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Development and Cooperation)
CDC	Capital For Development (UK government-owned fund)
CDM	Clean Development Mechanism
CI	Commercial/Industrial
COMESA	Common Markets of East and Southern Africa
DFID	Department for International Development of the UK
DGCD	Direction Générale de la Coopération au Développement (Directorate-General for Development Cooperation)
DGCS	Direzione Generale per la Cooperazione allo Sviluppo (Directorate-General Development Cooperation in Italy)
DGEF	Division of Global Environment Facility Coordination
DGIS	Dutch Ministry of Foreign Affairs
DC	Domestic Consumers
EAC	East African Community
EDF	Électricité de France (Electricity of France)
EE	Energy Efficiency
EIB	European Investment Bank
ELCI	Environment Liaison Center International
EPA	Energy Policy Act
ERC	Energy Regulatory Commission
FIPA	Foreign Investment Protection Act
GDC	Geothermal Development Company
GDP	Gross Domestic Product
GEF	Global Environment Facility
GoK	Government of Kenya
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation Agency)
IBRD	International Bank for Reconstruction and Development
ICO	Instituto de Crédito Oficial (state-owned corporate entity of the Spanish Ministry of Economy and Finance)
ICSID	International Centre for Settlement of Investment Disputes
IDA	International Development Association
IEET	Institute for Energy and Environmental Technology
IFC	International Finance Corporation
IPC	Investment Promotion Centre
IRSEAD	Institute of Research in Sustainable Energy and Development
IPP	Independent Power Producers
IT	Interruptible off-peak supplies
JBIC	Japan Bank for International Cooperation
JKUCAT	Jomo Kenyatta University of Agriculture and Technology
KEBS	Kenya Bureau of Standards
KNBS	Kenya National Bureau of Statistics
KES	Kenyan Shilling
KenGen	Kenya Electricity Generating Company
KfW	Kreditanstalt für Wiederaufbau (German Banking Group including KfW Entwicklungsbank as German Development Bank)
KPC	Kenya Pipeline Company
KPLC	Kenya Power and Lighting Company
LCPDP	Least Cost Power Development Planning
LPG	Liquefied Petroleum Gas
MSTQ	Metrology, Standards, Testing and Quality Management

MFA	Ministry of Foreign Affairs
MHI	Mitsubishi Heavy Industries
MIGA	Multilateral Investment Guarantee Agency
NEMA	National Environmental Management Authority
NGO	Non-Governmental Organization
NOCK	National Oil Corporation of Kenya
NORAD	Norwegian Agency for Development Cooperation
NZG	New Zealand Government
PPA	Power Purchase Agreements
PPP	Private-Public Partnership
PV	Photovoltaic
R&D	Research and Development
RE	Renewable Energy
REA	Rural Electrification Authority
REECON	Renewable Energy Engineering Contractors
REP	Rural Electrification Program
SC	Small Commercial
SHS	Solar Home Systems
SIDA	Swedish International Development Cooperation Agency
SME	Small and Micro Enterprise
SL	Street Lighting
SWERA	Solar and Wind Energy Resource Analysis
TBT	Technical Barriers to Trade
TDA	Tea Development Authority
UN	United Nations
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
USD	United States Dollar
WTO	World Trade Organization

MEASUREMENTS

°C	degree Celsius
GWh	gigawatt hours
km	kilometer
km^2	square kilometer
kV	kilovolt
kW	kilowatt
kVA	kilovolt ampere
kWh	kilowatt hour
m	meter
MW	megawatt
MWp	megawatt peak
s	second
V	volt
Wp	Watt-peak

SUMMARY

ECONOMICAL STATUS AND DEVELOPMENT OF KENYA

Kenya is a major powerhouse in East and Central Africa. The capital of Nairobi is an important commercial and communication hub for the East African Community (EAC) region and hosts a United Nation (UN) office and different UN programs, e. g. the United Nations Environment Program (UNEP) and the United Nations Human Settlements Program (HABITAT) as well as 22 other multinational bodies. Although the Gross Domestic Product (GDP) per capita is high (1,700 USD) with a stable growth rate of 6 %, the rate of poverty stands at 48 %. Tea and coffee are the main export commodities.

Kenya has developed its Vision 2030 Program, which aims to transform Kenya into a newly industrialized, "middle-income country providing a high quality life to all its citizens by the year 2030". The program is an all-inclusive and participatory stakeholder consultative process and includes various business opportunities for private investment, which have been highlighted in the following paragraphs[1].

STRUCTURE OF ENERGY SUPPLY IN KENYA

Over two thirds of the population still rely on biomass like wood, animal waste and agricultural residues as primary energy source (68 %), which is mainly used for cooking. Commercial energy resources are petroleum (22 %), electricity (9 %) and other sources (1 %). The electricity demand of 5,000 GWh is fully met by national hydro power stations, thermal oil-fired stations and geothermal sources. The total installed capacity is 1,200 MW.

Around 80 % of the population live in rural areas, where the electrification rate is 4 %, while in the urban areas around 51 % are connected to the national grid[2].

STATUS OF RENEWABLE ENERGIES IN KENYA

Hydro

Kenya has a technical potential for large-scale hydro power stations of 1,300 MW. Half of it (currently 677 MW) is already used. The small-scale hydro power potential is estimated at 3,000 MW, only a fraction of it is already developed. Currently, micro and pico hydro power stations are implemented in the off-grid area around Mt. Kenya, 140 km North East of Nairobi.

Solar

Around 4 MWp of small PV systems are installed in Kenya. The commercial sale and distribution network is well established with wholesalers in the commercial centers and small shops and retailers with access to off-grid areas. Thus the market is mainly driven by small residential systems for lighting and communication. Currently there is no solar support program in place.

Wind

The highest wind potential is in the district of Marsabit, which cannot be developed due to the lack of electricity grid. Currently, two wind farms (a 40 MW wind farm at Ngong Hills and a 30 MW wind farm at Kinangop) are under construction. Additionally, around 100 small wind turbines (400 MW) are in operation. Reliable wind measurements are not available, but the Solar and Wind Energy Resource Analysis (SWERA) database for Kenya is providing basic information for further investigations[3].

Geothermal

Kenya is the only EAC country using geothermal power. A 128 MW station is providing electricity to the national grid. The potential in Kenya's Rift Valley is estimated at over 2,000 MW. The Government of Kenya has established entities for test drillings and further development of geothermal resources. Funds of about 5 million € were made available for this development.

Biomass

Biomass is mainly sold and used in the informal sector to supply wood and charcoal to rural and urban households. The German Technical Cooperation Agency (GTZ) on behalf of the German Government has implemented agro-industrial biogas pilot projects for electricity generation with 160 kW and 20 kW capacities. The most important contribution of biomass for commercial energy supply is seen in cogeneration of bagasse. It has a potential of 340 MW provided by four state-owned sugar factories that are going to be privatized in the next two years.

1 FOR FURTHER INFORMATION SEE WEBSITE OF KENYA'S VISION 2030 (NATIONAL ECONOMIC & SOCIAL COUNCIL OF KENYA, AS OF 2008)
2 GVE/UNDP, AS OF 2005
3 UNDP, AS OF 2008

1 COUNTRY INTRODUCTION

1.1 KENYA OVERVIEW[4]

Kenya is a major powerhouse in East and Central Africa. Nairobi, the administrative and commercial capital, is an important business and communication hub for the region and head quarter of several multinational companies and international bodies including the United Nations. The city hosts a large number of diplomatic offices in Africa.

The country extends from 5º North to 4º76' South and from 34º East to 41º6' East over the equator. It covers an area of approximately 583,000 km² with a 470 km long coastline on the Indian Ocean. It borders Somalia, Ethiopia, Sudan, Tanzania and Uganda. The Indian Ocean lies to the East.

Kenya's landscape varies from low coastal plains to plateaus with altitudes of over 3,000 m in inland regions. The highlands, which are characteristically wet and densely populated, cover only 25 % of the landmass. The country shares a small portion of the Lake Victoria with Uganda and Tanzania.

Kenya became a republic in 1964 after attaining independence from Britain. Kenya is a major player in the East African Community (EAC). The Government is a parliamentary democracy modeled along the Westminster System of Government. The official languages are English and Swahili, the latter being spoken widely in Eastern Africa.

Poverty in Kenya is widespread with some 48 % of the population living below the poverty line.

1.2 KENYA STATISTICS: GEOGRAPHY AND ECONOMICS[5]

Kenya's Vision 2030 is the country's new development blueprint covering the period 2008–2030[6]. It aims to transform Kenya into a newly industrialized, middle-income country providing a high quality life to all its citizens by the year 2030'. The Vision has been developed through an all-inclusive and participatory stakeholder consultative process and has three main pillars:

- The economic pillar aims to put in place mechanism for a sustained economic growth targeting 10 % per annum over the next 25 years.

LAND AREA:	582,600 km²
POPULATION:	36.5 million (as of 2007), growth rate 2.8 %
DENSITY:	64.7 inhabitants/km²
SHARE URBAN/RURAL POPULATION:	19 % urban and 81 % rural
BIGGEST CITIES AND POPULATION:	Nairobi (2.8 million), Mombasa, (0.695 million) and Kisumu (0.3 million)
CLIMATE:	Two rainy seasons (March–April, October–November); average temperatures in Nairobi 28°C, the North 34°C and at the coast 32°C, February and September are the hottest months
ALTITUDE:	The coastal plains and the Nike plateau lie low (generally < 300 m above sea level); the highlands East and West of the Rift Valley constitute the highest altitudes ranging from 1,400 m to 3,000 m above sea level; Mt. Kenya is Kenya's highest and Africa's second hightest mountain reaching 5,200 m above sea level; Nairobi is at 1,700 m, Mombasa is at sea level on the Indian ocean; Kisumu on Lake Victoria is 1,131 m above sea level.
MAIN WATER BODIES	Lake Victoria, Lake Turkana, Lake Naivasha, Lake Baringo and Lake Nakuru
VEGETATION	The mountains and high rainfall areas have tropical forests which comprise wet mountain forests found in parts of Mt. Kenya, the Abardare ranges, the Mau forest, Mt. Elgon and the Cherangani hills; the lee wind sides of these mountains enjoy dry mountain vegetation; along the coast are remnants of the once widespread tropical lowland forest around Malindi; other parts of the country are arid and semi arid with the vegetation being largely the Nyika ecosystems dominated by camphor and acacia woodlands
GDP PER CAPITA (AT PURCHASING POWER PARITY)	USD 1.700 (as of 2007)
GDP GROWTH RATE:	6.8 % (as of 2007)
INFLATION RATE:	12.2 % (as of 2007), 2008 expected to peak at 18 %
AGRICULTURE:	Tea, coffee and horticulture
INDUSTRIES:	Cement, agro processing, refining and construction
ELECTRICITY – PRODUCTION:	6,868.8 GWh (as of 2007)
ELECTRICITY – CONSUMPTION:	5,067 GWh (as of 2007)
OIL – CONSUMPTION:	3,508 metric tons of oil equivalent per annum (as of 2006)
OIL – PROVEN RESERVES:	None
EXPORTS:	4.08 billion USD (as of 2007)
EXPORTS – COMMODITIES:	Tea, coffee and horticultural products including cut flowers, processed products including refined petroleum
EXPORTS – PARTNERS:	East African Community, COMESA countries, Pakistan, Egypt, Europe and East Asia
IMPORTS – COMMODITIES:	6.77 billion USD
IMPORTS – PARTNERS:	Gulf countries, China, Western Europe and COMESA countries
EXCHANGE RATE:	1 KES = 0,00912 € (as of 2009)

Source: data compiled by the author from different sources, e.g. CIA, as of 2009

4 CIA, AS OF 2009

5 SEE ALSO CIA, AS OF 2009

6 SEE ALSO OFFICIAL WEBSITE OF KENYA'S VISION 2030: NATIONAL ECONOMIC & SOCIAL COUNCIL OF KENYA, AS OF 2008

- The social pillar addresses an agenda for a just and cohesive society enjoying equitable social development in a clean and secure environment
- The political pillar provides that the country's development is people-centered, result-oriented, and based on an accountable democratic political system.

These three pillars are anchored on the thematic subjects of macro-economic stability, continuity in governance reforms, enhanced equity and wealth creation opportunities for the poor, infrastructure, energy, science, technology and innovation, land reform, human resources development, security and public sector reforms.
This long-term development plan will directly depend on the availability of energy and the provision of energy services and therefore offers enormous opportunities for investment in the energy sector.

RE Business Opportunity

2 ENERGY MARKET IN KENYA

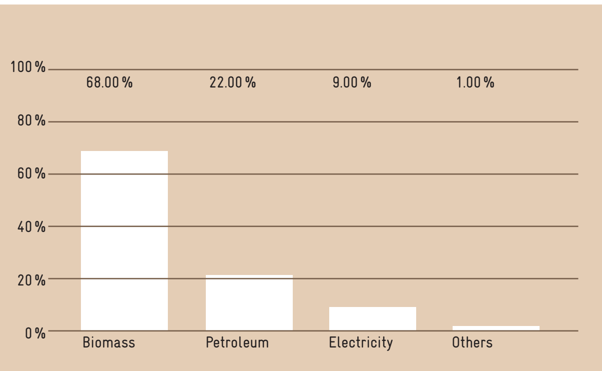
2.1 ENERGY SITUATION OVERVIEW

The Kenyan Government recognizes that without adequate and affordable energy services, the above-mentioned „Vision 2030" cannot be achieved. Kenya targets a GDP growth rate of over 10 % per annum over the next 25 years with increased energy demand and high investments in the energy sector.

Today, wood fuel and other biomass account for 68 % of the total primary energy consumption, followed by petroleum with 22 %, electricity with 9 % and others with about 1 %[7].

FIGURE 1

Shares of Total Primary Energy Consumption in Kenya



Source: data from GVEP/UNDP, as of 2005; graph compiled by PSE AG

Petroleum and electricity dominate the country's modern energy sector and supply primarily the commercial energy needs. Wood fuel supplies the energy needs of the largely non-commercial and informal sectors as well as of the rural and poor urban households. Other sources of energy include solar electricity, solar thermal and wind power, of which much is still untapped.

The anticipated growth of demand requires specific efforts to generate more energy at a lower cost and increased efficiency in energy consumption, which are expected to be met through continued institutional reforms in the energy sector (encouraging more private sector participation in power generation) and through separating transmission from distribution.

2.2 ENERGY CAPACITIES, PRODUCTION AND CONSUMPTION

The energy market can be divided in the **four major sub-sectors** of biomass, petroleum and electricity and others.

Biomass

Biomass[8] energy consumption constitutes 68 % of primary energy consumption. This sub-sector is the largest within the energy sector and remains largely unregulated and underdeveloped. Fuels include firewood, charcoal, wood waste and farm residues. The sector is dominated by households and small business.

For a majority of the population wood fuel remains the predominant fuel for cooking with 68.3 % households using firewood and charcoal. Of that 80 % of the rural households use firewood compared with 10 % for urban residents. Charcoal, derived from fuel wood, is the second most popular cooking fuel used by 13.3 % of the households in the country, mostly in urban centers. Firewood is increasingly supplied by large private tree plantations, which offer a wide scope for commercial biomass businesses.

Petroleum

Petroleum[9] is Kenya's major source of commercial energy accounting for about 80 % of the country's requirements. Petroleum, being the number one driver of the economy, reflects a consumption pattern corresponding to the economic activities.

Kerosene is the third of the predominant cooking fuels and the most common in urban areas. Other fuels used in Kenya include Liquefied Petroleum Gas (LPG) employed by 3.5 % of the population, mainly urban dwellers. Kerosene is the most popular lighting fuel across the country used by over 75 % of the population. It is employed for lighting in off-grid rural locations and for lighting and cooking in urban settings without access to grid electricity.

Kenya has no known reserves of petroleum. Crude oil is imported and refined in Mombasa. Domestic consumption of petroleum products has progressively increased from 2.2 million tons in 2003 to 2.7 million tons in 2007, accounting for 25.7 % of the country's total import bill.

Electricity

The national electrification rate averages at 15.4 %, but 51 % of urban households are connected to the national grid as compared to only 4 % of the rural households. Electricity[10] is mainly used for lighting. Only 1.6 % of mainly off-grid households in Kenya use solar photovoltaic (PV) for lighting.

7 GVEP/UNDP, AS OF 2005

8 GVEP/UNDP, AS OF 2005

9 DATA COMPILED BY THE AUTHOR FROM DIFFERENT SOURCES

10 DATA COMPILED BY THE AUTHOR FROM DIFFERENT SOURCES; SEE ALSO KPLC 2004–2007

Electricity consumption in rural areas is on average 544 kWh per household or 115 kWh per capita per year. In urban areas, the consumption is higher, amounting to 217 kWh per capita per year.

Electricity as sub-sector is second to petroleum in terms of commercial value and comprises power generation, transmission and distribution. The Electricity Act of 1999 set the prerequisites for separating the electricity sector in the two categories (i) generation and (ii) transmission and distribution.

Plans are underway to separate transmission and distribution in single entities. The electricity demand is covered mainly by hydro power, thermal and geothermal power stations (see also the following table).

TABLE 1

Installed Capacity and Generation of Electricity 2002–2007

SOURCE	2004		2005		2006		2007	
	Installed MW	Net Gen. GWh	Installed MW	Net Gen. GWh	Installed MW	Net Gen. GWh	Installed MW	Net Gen. GWh
Hydro Power (local)	677.3	3,169.0	677.3	3,039	677.3	3,025.0	677.3	3,592.0
Hydro Power (imports)	–	162.0	–	28	–	10.8	–	22.6
Thermal (oil)	392.0	1,038.0	351.0	1,506	370.0	1,487.0	389.0	1,738.0
Solar PV							4.0	4.0
Wind	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2
Geothermal	128.0	987.0	128.0	1,002	128.0	1,046.0	128.0	989.0
Thermal (emergency)	–	–	–	–	–	–	105.0	523.0
Total power generated	1,198.0	5,564.0	1,156.0	5,57.4	1,177.0	5,568.2	1,303.7	6,868.8

Source: Kenya Power and Lighting Company, 2004–2007

Hydro power remains the largest single source. The total installed capacity as of June 2007 was 1,197 MW with an effective capacity of 1,153 MW. Peak demand reached 1,053 MW confirming a growth rate of 8.3 % up from 6.5 % in 2002, which was caused by grid extension to rural areas.

With 58 % of grid connected electricity being generated by hydro, power cuts are common during the dry seasons when the river regimes are at their lowest. In recent times, as the reserve margins have decreased with increased demand and more erratic rains, the seasonal breakdowns have become more frequent. Furthermore, the recipients at the end of the lines often suffer voltage drops that trigger power outages. This has caused the need for standby generators in the country, which in 2007 were estimated at approximately 100 MW in capacity.

Most of the line losses are attributed to the distances between generators and transformer stations and the low rate of maintenance. Transmission losses are estimated at 15 %, while theft of electricity is estimated at 2 %.

Grid extension is part of the Government's strategy to increase access to electricity and is carried out in connection with the rural electrification projects. During 2007, the expansion and upgrading of the distribution system led to about 22 % of network growth. About 500 km of distribution were projected to be constructed in 2008. The construction and upgrading of transmission lines and associated substations for other rural towns include a 122 km 132 kV transmission line between Kamburu and Meru and a 61 km 132 kV transmission line between Chemosit and Kisii.

TABLE 2

Total Power Generation and Interconnected Power Purchase by Utility

SOURCE	INSTALLED CAPACITY (MW)	ENERGY SUPPLIED TO GRID (GWH)	SHARE OF TOTAL ENERGY (%)
Hydro (including imports)	697.2	3,290.0	54.2
Geothermal	128.0	1,013.0	16.7
Thermal (including IPPs)	390.2	1,763.0	29.0
Wind	0.4	4.0	0.1
Total	1,215.8	6,070.0	100.0

Source: KPLC, as of 2007

2.3 ELECTRICITY PRICES

Grid electricity prices are set through a tariff process administered by the Kenyan Energy Regulatory Commission. The tariffs are set to reflect the long-run marginal cost of energy services that allow the generation and distribution utilities to remain solvent. The table below summarizes the current electricity tariffs and rates. For an average consumption of 150 kWh per year, the private consumer price is 11.6 KES/kWh (12 € Cent/kWh) due to the high fixed monthly charges[11].

RE Business Opportunity

TABLE 3

Schedule of Retail Electricity Tariffs and Rates

TARIFF	TYPE OF CUSTOMER	SUPPLY VOLTAGE (V)	CONSUMPTION (kWh/MONTH)	FIXED CHARGE (KES/MONTH)	ENERGY CHARGE (KES/kWh)	DEMAND CHARGE (KES/kVA/MONTH)
DC	Domestic consumers	240 OR 415	0–50	120.00	2.00	–
			51–1,500		8.10	
			› 1,500		18.57	
SC	Small commercial	240 OR 415	≤ 15,000	120.00	8.96	–
CI1	Commercial/ industrial	415 3 PHASE	› 15,000	800.00	5.75	600.00
CI2		11,000	NO LIMIT	2,500.00	4.73	400.00
CI3		33,000/40,000		2,900.00	4.49	200.00
CI4		66,000		4,200.00	4.25	170.00
CI5		132,000		11,000.00	4.10	170.00
IT	Interruptible off-peak supplies	240 OR 415	≤ 15,000	240.00 (WHEN USED WITH DC OR SC)	4.85	–
SL	Street lighting	240	–	120.00	7.50	–

Source: Kenya Gazette Notice, as of 2008

In March 2008, the Ministry of Energy published a feed-in tariff policy for electricity generation from wind, small hydro and biomass. The tariff allows IPPs to sell and oblige distributors to buy on a priority basis all RE sources generated electricity at a fixed tariff for a given period of time. No project has been established in 2008, but the Agakhan Foundation is planning to scale down a planned 70 MW wind farm in Ngong Hills near Nairobi to 50 MW so that they can benefit from the tariff.

The tariffs are consistent with Section 103 of the Energy Act No. 12 of 2006[12] and shall apply for 15 years. Its objectives are to:

- Facilitate resource mobilization by providing investment security and market stability for investors in RE electricity generation
- Reduce transaction and administrative costs by eliminating the conventional bidding processes
- Encourage private investors to operate the power plant prudently and efficiently so as to maximize its returns

TABLE 4

Schedule of Retail Electricity Tariffs and Rates

TECHNOLOGY TYPE	PLANT CAPACITY (MW)	MAXIMUM FIRM POWER TARIFF (USD/kWh) AT THE INTERCONNECTION POINT	MAXIMUM NON-FIRM POWER TARIFF (USD/kWh) AT THE INTER-CONNECTION POINT
Wind power (single wind farm)	0–50	0.090	0.090
Any individual capacity	≥ 50	TARIFF TO BE NEGOTIATED ON COMMERCIAL BASIS	TARIFF TO BE NEGOTIATED ON OMMERCIAL BASIS
Biomass derived electricity	0–40	0.070	0.045
Any individual capacity	≥ 40	TARIFF TO BE NEGOTIATED ON COMMERCIAL BASIS	TARIFF TO BE NEGOTIATED ON COMMERCIAL BASIS
Small hydro power	0.50–0.99	0.120	0.100
	1–5	0.100	0.080
	5.1–10	0.080	0.060
Any individual capacity	≥ 10	TARIFF TO BE NEGOTIATED ON COMMERCIAL BASIS	TARIFF TO BE NEGOTIATED ON COMMERCIAL BASIS

Source: Kenya Gazette Notice March, as of 2008

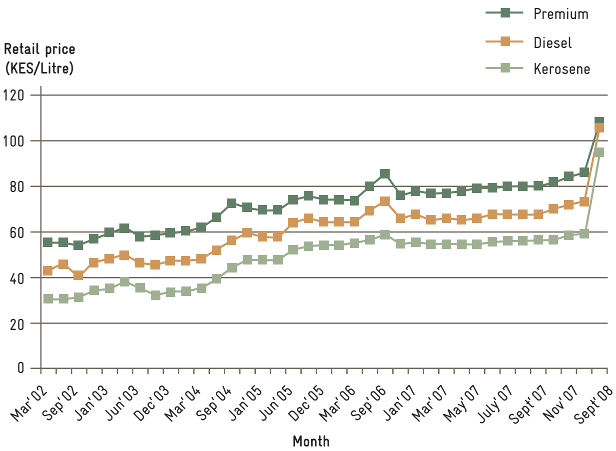
11 ELECTRICITY REGULATORY BOARD, AS OF 2005

12 PARLIAMENT OF KENYA, AS OF 2006

The development of retail prices for petroleum products between 2002 and 2008 shows a substantial price increase for diesel from 40 KES/l to over 100 KES/l within the last six years. The fuels are subject to excise duty, petroleum development levy and road levy for diesel and petrol.

FIGURE 2

Evolution of Retail Prices for Petroleum Fuels 2002–2008



Source: graph compiled by the author with data from KNBS, Leading Economic Indicators 2002–2008 and Economics Survey, as of 2009

2.4 MARKET ACTORS FOR PLANNING, REGULATION AND DISTRIBUTION

The Ministry of Energy is responsible for the overall energy sector planning and investment. The primary objective is to ensure the cost effective and affordable supply of energy in adequate quality to meet the national demand for development. Planning for grid-based electricity is done in partnership with Kenya Power and Lighting Company (KPLC).

KPLC

The Kenya Power and Lighting Company (KPLC) is 48 % state-owned. It is the sole electricity utility in Kenya responsible for transmission and distribution.

KenGen

Kenya Electricity Generating Company (KenGen) is 70 % state-owned. It is the largest generator of electricity in Kenya operating an array of hydro, geothermal and thermal generators. The company generates more than 65 % of all electricity fed into the national grid.

ERC

The Energy Regulatory Commission (ERC) is responsible for regulatory and tariff processes of the energy sector including negotiations with IPP.

NEMA

ERC is mandated by the National Environmental Management Authority (NEMA) to be the leading institution on environmental matters related to energy including environmental impact assessments and mitigation measures as well as the supervision of Clean Development Mechanism (CDM).

IPP

Kenya's private sector IPPs include Iberafrica Power, Tsavo Power, Simba Power and Agrekko Power (thermal) and Or Power (geothermal).

REA

The Rural Electrification Authority (REA) manages the Rural Electrification Program and privatization or concessions for isolated systems.

3 RENEWABLE ENERGY POLICY FRAMEWORK CONDITIONS

Kenya has put greater emphasis on Renewable Energy (RE) resources through the Sessional Paper No. 4 of 2004 (see annex 7, Bibliography). It recognizes the importance of RE as well as the importance of energy efficiency (EE) and lays the policy framework for the development and provision of cost-effective, affordable and adequate quality energy services on a sustainable basis in the short to long term.

3.1 POLICY AND RENEWABLE ENERGY PROMOTION PROGRAMS

Kenya's key policy aspects, amongst others, comprise the following[13]:

Legal and Regulatory Framework

- Establishment of an independent energy regulator, the ERC, to facilitate prudent regulation, enhance stakeholder interests and boost investor confidence. The policy was consolidated in the Energy Policy Act (EPA) 97 and the Petroleum Act Cap. 116.

Institutional Arrangements

- Creation of the REA to accelerate rural electrification
- Promotion of privately or community-owned energy service entities operating RE power plants
- Establishment of a state-owned Geothermal Development Company (GDC) to conduct geothermal resource assessment and sale of steam

Energy Trading Arrangements

- Creation of a domestic power pool with provision for a wholesale and retail market to create competition and hence reduce cost of electricity
- Streamlining of biomass energy trading arrangements
- Increasing of lifeline tariff to recover the cost of electricity generation

Energy Security

- Encouragement of wider adoption and use of RE technologies to enhance their role in the energy supply matrix
- Formulation of plans for biomass energy development
- Development of a national energy research agenda
- The strategies proposed under the Energy Act 2006 to promote the development and use of RE technologies include the following:
- Formulation of a national strategy for coordinating research in RE
- Provision of an enabling framework for the efficient and sustainable production, distribution and marketing of biomass, solar, wind, small hydro, municipal waste, geothermal energy and charcoal
- Promotion of fast-growing trees for energy production including biofuels and the establishment of commercial woodlots including peri-urban plantations
- Promotion of the production and use of gasohol and biodiesel
- Promotion of energy production with municipal waste (not specified in detail)
- Promotion of cogeneration of electric power by sugar millers for sale to the national grid and directly to the consumers
- Development of appropriate local capacity for the manufacture, installation, maintenance and operation of basic RE such as bio-digesters, solar systems and hydro turbines
- Promotion of international cooperation on programs focusing on RE sources
- Harnessing of opportunities offered under the CDM and other mechanisms including carbon trading

Financial incentives[14] supporting the RE policy include income tax holidays for RE projects as well as exemption from duties and taxes during the implementation of generation and transmission projects.

Exclusive RE products are exempt from customs and import duties. Depending on the expected benefits to the economy, however, specific projects may attract preferential treatment from the Treasury. Documentation and permits for tax holidays and other exemptions for energy projects can be obtained from the permanent Secretary of the Ministry of Energy. A comprehensive customs classification for goods can be obtained from the Commissioner of Customs at the Kenya Revenue Authority.

SHORT BUSINESS INFO

- Income tax holidays and exemption from tax and duty during implementation of RE projects
- Zero custom duty, zero tax on imported RE equipment

13 PARLIAMENT OF KENYA, AS OF 2004

14 KRA, AS OF 2009

3.2 DONOR AID ACTIVITIES

The following table shows the contribution of donor aid activities in the energy sector. It lists donor funded energy projects, including their lifeline total budget and the donors funding the project. As shown below, donor activity in the RE market in Kenya is limited.

TABLE 5

Donor Funded Energy Projects in Kenya

PROJECT TITLE	DONOR	LIFELINE	TOTAL BUDGET	OBJECTIVES
The Energy Sector Recovery Project	World Bank through IBRD/IDA	2004–2010	80.00 million USD	Enhancing of the policy as well as the institutional and regulatory environment for private sector participation and sector development for efficient reliability and quality of services
Market Transformation for Efficient Biomass Stoves for Institutions and Small- and Medium-Scale Enterprises	GEF through UNDP	2006–2010	1.00 million USD	Removing of market barriers for the adoption of sustainable biomass energy practices and technologies by institutions
The Rural Electrification Master Plan Stud	Finnish Government though MFA	2005–2010	9.94 million USD	Upgrading of the rural electrification master plan prepared in 1997 with emphasis on the pro-poor rural electrification master plan
Renforcement Distribution Elec	French Government through AFD	2005–2010	31.00 million USD	The AFD Energy Program includes the French Rural Electrification Project Phase II (rehabilitation of KPLC sub-stations etc.). AFD is present and highly active in the development of all energy sectors in Kenya. Through the AFD, France is a lead donor in Kenya's energy sector and chairs the energy donor coordination group.
Olkaria II Extension (Electrical Distribution and Transmission)	European Commission through EIB	2005–010	40.00 million USD	The loan contributes to the financing of a grid development project including the upgrading and construction of transformer sub-stations, the rehabilitation and extension of distribution lines and will allow to connect 320 000 new consumers. The project also includes the replacement of outdated network control and radio communication facilities.
KPLC Grid Development	European Commission through EIB	2005–2010	53.00 million USD	Enhancement of electrical distribution and transmission
Sondu/Miriu Hydro Power Project II	Japan Government through JBIC	2005–2010	13.00 million USD	Construction of hydro power station
No title	Japan Government through JBIC	2005–2010	2.82 million USD	Hydroelectric power plants
Tea Development Authority Integrated Energy Management	United States through TDA	2005	342,000 USD	Feasibility sector study
No title	United States through TDA	2005	396,000 USD	Hydroelectric power plants
No title	United States through USAID	2005	123,000 USD	Assistance in energy policy and administrative management
No title	United States through USAID	2005	2.64 million USD	Electrical transmission and distribution
No title	United States through AID	2005	397,000 USD	Electrical transmission and distribution
No title	United States through USAID	2005	398,000 USD	Coal-fired power plants
No title	United States through USAID	2005	388,000 USD	Energy policy and administrative management
No title	United States through USAID	2005	315,000 USD	Energy policy and administrative management
No title	Sweden through SIDA	2005	38,000 USD	Power generation/non-renewable sources
No title	Sweden through SIDA	2005	24,000 USD	Power generation/non-renewable sources
No title	United States through USAID	2005	4.70 million USD	Energy policy and administrative management
No title	Germany through KFW	2005	247,000 USD	Power generation/renewable sources
Bonification d'Intérêts Électricité, AF	Belgium through DGCD	2005	249,000 USD	Electrical transmission and distribution
Promotion of Private Sector Development in Agriculture	Germany through GTZ	2005–2012	6.9 million USD	The project aim is to support small and medium-size agricultural entrepreneurs in making use of their market opportunities by implementing economically viable and environmentally sound practices. Particular consideration is given to the poorer segments of the population

PROJECT TITLE	DONOR	LIFELINE	TOTAL BUDGET	OBJECTIVES
Windenergienutzung Afrika	Germany through BMZ	2005	97,000 USD	Wind power
Jpo Fugelsnes	Norway through MFA	2005	103,000 USD	Energy policy and administrative management
SMYRNA Community Development Program – SMYRNA Clinic	Norway through NORAD	2005	6,000 USD	Funding for the costs related to access to the electricity net
Jpo Fugelsnes	Norway through MFA	2004	214,000 USD	Energy policy and administrative management
Awareness Raising on Sustainable Energy Issues	United Kingdom through DFID	2004	5,000 USD	To influence the GoK, the Parliament, the civil society and the private sector to develop a sustainable policy for energy use in Kenya
Natural Resources	Sweden through SIDA	2004	66,000 USD	Power generation/non-renewable sources
Training Support	Norway through NORAD	2004	32,000 USD	Power generation/renewable sources
No title	Norway through NORAD	2004	214,000 USD	Energy policy and administrative management
Not title	Italy though DGCS	2004	16,000 USD	Technical cooperation for power generation/re-newable sources
Olkaria Geothermal Power Plant	Germany through KFW	2004	1.24 million USD	Geothermal energy
Olkaria Geothermal Power Plant	Germany through KFW	2004	9.47 million USD	Geothermal energy
Olkaria II Geothermal Power Plant	Germany through KFW	2004	858,000 USD	Equipment for geothermal power plant
Windenergienutzung Afrika – Dezent-rale Energieversorgung und Windparks am Netz'	Germany through BMZ	2004	29,000 USD	Wind power generation
Bonification d'Intérêts Électricité, AF	Belgium through DGCD	2004	292,000 USD	Electrical transmission and distribution
Olkaria Geothermal Power	European Commission though EDF	2004	1.64 million USD	Geothermal energy
No title	Japan through JBIC	2004	1.99 million USD	Hydroelectric power plants
No title	Italy through DGCS	2004	263,000 USD	Pilot plant for using solar energy to favor fishery in Kerio Valley
Tsavo Power Co Ltd.	United Kingdom through CDC	2004	1.69 million USD	Power generation/non-renewable sources
Extension of the Rural Electrification Network	Spain through ICO	2003	779,000 USD	Electrical distribution net for several rural districts
No title	Japan through JBIC	2003	1.596 million USD	Hydr-electric power plants
No title	New Zealand through NZG	2003	11,000 USD	Geothermal energy
No title	Japan through JBIC	2002	7.023 million USD	Hydroelectric power plants

Source: EUEI, as of 2009
(http://ec.europa.eu/development/policies/9interventionareas/waterenergy/energy/initiative/bkcp/related_project.htm › Projects Database › Choose a beneficiary country › Kenya › Find project)

3.3 MARKET RISKS

Establishing a Business

In order to conduct business in Kenya, a company must be registered with the Registrar of Companies as branch office of an overseas company or a locally incorporated company. Where the investment may have adverse impact on security, health or environment, clearance from the competent authorities (such as National Environment Management Authority (NEMA), Public Health authorities etc.) will be required before approval is granted. Clearance is required from parent ministries for investments in restricted areas before approval can be granted. Investments in energy and petroleum products require clearance from the Ministry of Energy. Apart from that, no specific restrictions apply to energy businesses in Kenya.

Corruption

Kenya ranks number 142 out of 163 in the corruption index of Transparency International. Kenya Bribery Index is pointing out that corruption causes damage to the economy worth 1 billion USD[15].

The GoK is undertaking the following measures to mitigate corruption:

- Zero-tolerance to corruption
- Establishing an anti-corruption police unit
- Emphasizing on the rule of law
- Enhancing transparency in the licensing process through enactment of an Investment Act
- Streamlining Government procurement procedures (Procurement act enacted)
- Enhancing accountability in the judicial system

Protection of Investments

Kenya is a liberalized market in both trade and currency and does not limit the repatriation of business profits. Other aspects of the investment climate include the Foreign Investment Protection Act (FIPA) (Cap. 518). Under FIPA regulations, investors can repatriate the after tax profits including retained profits which have not been capitalized. Investors can also repatriate proceeds of investment after payment of the relevant taxes.

Kenya has concluded agreements with the EU and Germany, Belgium, Switzerland and India among other countries. Other earlier agreements are being revised and/or negotiated. The original agreements were concluded between the African, Caribbean and Pacific States (ACP) under the Lome convention I to IV[16].

The constitution of Kenya provides guarantees against expropriation of private property, which may only be executed for reasons of security or public interest. In this case, a fair and prompt compensation is guaranteed. Kenya is a member of the World Bank or more precisely of the affiliated Multilateral Investment Guarantee Agency (MIGA). MIGA issues guarantees for non-commercial risks to enterprises that invest in member countries. Kenya is also a member of the International Center for Settlement of Investment Disputes (ICSID) and of the African Insurance Agency (ATIA).

Investment risks in Kenya are low given the stability of the economy. This was demonstrated by the speed with which the economy recovered from the post-election stalemate. With vision 2030 driving the economic development, the stability of the Kenyan economy has never been better.

The Kenya Intellectual Property Organization polices and regulates intellectual property.

Awareness and Security

Kenya is a cosmopolitan society where diverse cultures and nationalities do business together across the country. In fact, Kenya as an entrepreneur society has a high awareness for international business and investment opportunities and is sometimes said to be too welcoming to foreigners.

The security situation in Kenya is satisfactory and not worse than in many parts of the world. Adequate health facilities of international standards are available, particularly in urban areas. High-quality education for investors relocating to Kenya is available for their families with overseas curriculars available in most of the international schools. Adequate transport and communication channels by air, road, sea, post and telecommunications are available to any destination in the world.

Staff

Investors must acquire class H work permits for directors and class A work permits for expatriate employees. Entry into Kenya will require visitors to obtain either business visa or visitors' visas. Expatriate professionals, engineers or technicians who are required to install machineries or train local employees for a short period of time are issued with special passes. Local RE experts are available, but limited, while trained engineers and technicians are readily available. More than four technical universities are established in the country offering sufficient scope for cooperation and research.

Minimum wages defined by the Government depend on skills. Workers are allowed to join trade unions related to their sectors of work and receive wages negotiated through tripartite agreements (between trade unions, Government and employers.) Labor disputes are settled through the industrial court.

Kenya has a well-developed professional services sector with a number of multinational professional companies operating regional offices in Nairobi. Most major insurance companies, banks and other private sector-related institutions have a presence in Kenya.

15 TI, KENYA, AS OF 2009
16 FOR FURTHER INFORMATION SEE EU AID: ACP – LOME CONVENTION, AS OF 2009. THE REVISIONS AND NEGOTIATIONS CAN BE FOUND AT ACP, AS OF 2000.

4 STATUS AND FUTURE OUTLOOK FOR RENEWABLE ENERGIES

With the exception of biomass, which is largely consumed in its raw form, the utilization of RE in Kenya in contrast to its potential is extremely low. Commercial RE is dominated by large hydro and geothermal power, which also constitutes the largest percentage of grid-connected power at 58 % and 13 % respectively. The geothermal potential in Kenya is the biggest in the EAC.

Solar PV is, however, the most widely used off-grid source of RE and provides electricity especially to rural households. About 2.2 % or 200,000 mainly off-grid households in Kenya use solar PV for lighting. A total capacity of 4 MW is installed with an average system size of 25 Wp. While more than 500,000 small PV systems have been sold, a large number of these are replacements for faulty a-Si PV modules and batteries. Small and Micro Enterprise (SME) private sector businesses dominate the RE sector.

4.1 BIOMASS/BIOGAS

Despite heavy reliance on biomass, especially on firewood and charcoal, minimal planning and regulatory measures have been put in place by the Government. For example, even though the production of charcoal so far remains illegal while the consumption is legal, the ‘illegal’ trade is estimated to have a turnover of 320 million € annually[17].

Traditional biomass energy supplies come from four distinct sources: natural vegetation (closed forests, woodlands and bush-lands), trees on farms, plantations and residues from crops and industrial wood. Firewood and residues are consumed largely for household cooking at or near source. The total sustainable biomass supply from all sources is estimated at 15 million tons with approximately 21 % from natural vegetation, 60 % from farms, 5 % from plantations and 14 % from crop and wood residues.

Industries requiring thermal energy have on their own initiative as demonstrated by the use of raw biomass for energy provision in their operations. Examples include tea, clay works, cement, edible oils and some small-scale furnace operators. Industrial solid biomass provides the largest opportunity for investment in the biomass sector.

At the Kilifi Plantations, a pilot installation for biogas production was installed by the German company agriKomp in cooperation with GTZ as part of a cooperation project under the Private-Public Partnership (PPP) program of German Development Cooperation[18]. Two cogeneration plants with total 160 kW are fed with animal dung and sisal. The electricity and heat is supplied to a nearby milk farm. GTZ also worked on PPP base with a slaughterhouse in Kiserian Nairobi to install a 20 kW biogas digester.

17 DATA COMPILED BY THE AUTHOR FROM DIFFERENT SOURCES AND OWN RESEARCH

18 FOR MORE INFORMATION ON THE GERMAN DEVELOPMENT COOPERATION PPP PROGRAM (DEVELOPPP) AND GTZ SERVICES IN THIS FIELD SEE WWW.GTZ.DE/EN/LEISTUNGSANGEBOTE/2362.HTM.

Cogeneration

An estimated 43 MW of electricity cogeneration is currently installed in the five sugar factories operating across Kenya. Development of a 35 MW sugar bagasse cogeneration project by Mumias Sugar is ongoing as a CDM project.

A further potential of 340 MW of sugar bagasse cogeneration is estimated at the state corporations of Chemelil, Sony Sugar, Nzoia and Muhoroni. These companies are expected to be privatized by the Government within the next two years. This proves an opportunity for private investment by local and international players in the cogeneration business.

RE Business Opportunity

SHORT BUSINESS INFO

- Most of biomass products are sold in the informal sector
- Cogeneration of bagasse has a potential of 340 MW in four state-owned sugar factories which are going to be privatized

Various jatropha plantation initiatives are ongoing with an estimated cultivation area of over 4,000 hectares. The biggest groups involved are Better Globe Forestry, an international commercial forestry developer, and Green Africa, a local Non-Governmental Organization (NGO). The Kenyan component of the Africa Biogas Initiative financed by the Dutch Ministry of Foreign Affairs (DGIS) targets at 10,000 domestic biogas digesters (4–16 m^3) over the next 10 years. The Africa-wide project targets 2 million digesters in Africa. The Ministry of Energy invites bids from local companies and joint ventures to provide the development and installation services.

Biofuels

The development of biofuels in Kenya is currently hampered by lack of policy framework. Measurements have, however, been taken to develop a comprehensive biodiesel strategy and a draft has been developed, which is awaiting cabinet approval. The initiative is coordinated by the Ministry of Energy through a National Biofuels Committee that incorporates stakeholders from all relevant Government ministries as well as civil society and private sector players. In addition, GTZ has completed and released a study on biofuels potentials and risks in Kenya in cooperation with the Kenyan Ministry of Agriculture in 2008[19]. Much research, however, still needs to be done on the sub-sector as information is still inadequate.

4.2 SOLAR ENERGY

Kenya has relatively high insolation rates with an average of 5 peak sunshine hours in the most of the country. However, areas in the highlands are affected by cloud cover with significant variations in radiation[20]. The most widely used applications for solar energy in Kenya are small domestic PV systems.

The installed PV capacity is estimated at more than 4 MW, mainly delivered by small PV systems of 14–120 Wp. An estimated 120,000 rural households use small Solar Home Systems (SHS). Larger PV systems for telecommunications and health institutions of typically 2–5 kW are also to be

19 GTZ/GOVERNMENT OF KENYA, AS OF 2008

20 UNEP, AS OF 2008

found in remote locations across the country.
Around 50 PV installations for schools and health institutions with an average power of 400 Wp were installed in 2007 in arid and semi-arid areas through grants from the GoK as part of the Arid Lands Development Program.

The Kenyan solar energy market is a fairly well developed and mature commercial market. The existing companies sell systems to homeowners and institutions. In some cases, institutional systems were financed by donor programs. Financing is either in cash or through microfinance or savings and credit groups.

SHORT BUSINESS INFO

- 4 MWp installed capacity with an average system size of 25 Wp
- No financial support scheme available
- Retailer network for cash sale of PV is well established in a well developed commercial market
- Around 20 solar companies, mainly based in Nairobi

4.3 WIND POWER

Use of wind turbines and wind pumps in Kenya is marginal. The current installed capacity of wind turbines is 750 kW, 150 kW of which are small isolated wind turbines and 600 kW of medium size grid connected wind turbines. Two of them are located at the Ngong Hills and one is in Marsabit operated by the Kenya Power and Lighting Company on behalf of the Ministry of Energy. These turbines were installed in 1982 by the Ministry with funding from the Belgian Government under a pilot scheme to study the wind resource potential for the two possible areas. With the company that produced these turbines going under in the mid 2000s, lack of spare parts and technical support has led to only one turbine at NGong being still operational.

The Marsabit district located in the North of Kenya offers the best wind regime with more than 10.0 m/s. The project development in this district is constrained due to inaccessibility to the national grid. This, however, will change once the planned grid interconnection with Ethiopia is in operation.

The GVEP / UNDP Energy Atlas[21] points out about 10–13 good sites with wind speeds of above 7 m/s with a total potential of 100 MW. A wind resource assessment and mapping was completed in 2008 under the SWERA project of UNEP[22]. Current developments include the following:

- A feasibility study being undertaken for the Turkana Wind project in West Marsabit by a Dutch Consortium
- The development of a 40 MW wind farm at the Ngong Hills by the Kenyan Investment Promotion Centre (IPC) and a 30 MW wind farm at Kinangop by KenGen
- A planned feasibility for the development of wind farms in Lamu and Mpeketoni[23]

An estimated 100 small wind turbines (with an average capacity of 400 W) have been installed to date, often as part of a PV/wind hybrid system with battery storage. Wind pumps are more common than wind turbines. Two local companies manufacture and install wind pumps. To date, wind pumps installations range about 300–350.

SHORT BUSINESS INFO

- No reliable data for wind potential mapping available
- Marsabit district with the highest potential, but no grid available
- 40 MW Wind farm at Ngong Hills and 30 MW wind farm at Kinangop under construction
- Around 100 small wind turbines (400 W) in operation
- Accessibility to the national grid in Northern Kenya will be improved when planned grid interconnection with Ethiopia is in operation

4.4 GEOTHERMAL POWER

RE Business Opportunity

Given the high cost of geothermal exploration, the Government has set up a Geothermal Development Company (GDC) to quickly track the prospecting and drilling of geothermal wells for development by private sector investors. Investment in the country‘s geothermal resources as major source for electricity generation should inject a much-needed element of stability and diversification into the generation mix.

Currently, only 128 MW of an estimated geothermal potential of over 2,000 MW has been developed, accounting for about 10 % of the total installed grid connected capacity. KenGen owns 115 MW of this capacity while the company Or Power owns 13 MW. These plants are located in the Olkaria geothermal field (in the South of the country) and produce on average 989 GWh annually[24].

KenGen is building a third unit at its Olkaria II geothermal power station. The plant is located about 100 km North West of Nairobi[25]. It taps the geothermal field in Kenya‘s Rift Valley. The 35 MW turnkey expansion is being built by Mitsubishi Heavy Industries (MHI) and should go on-stream by the end of 2009. It will cost around 100 million USD.

The GoK plans to spend about 5 million € to drill geothermal power wells in the Menengai crater. The geothermal energy potential of this area is estimated at about 740 MW. The area covers about 29 by 30 km² and extends from Nakuru town in the South to Kisanana in the North. The main objective is to prove availability of geothermal steam for construction of a 140 MW Menengai geothermal power plant. It is planned to be commissioned in 2013 and will provide 15 % of the country’s total installed electrical capacity.

4.5 HYDRO POWER

The economical viable potential for large-scale hydro power is estimated at 1,500 MW of which, according to a technical feasibility study, 1,310 MW is for projects with a 30 MW capacity or bigger. Of these, only 677 MW have so far been developed[26] comprising the following stations:

21 SEE GVEP/UNDP, 2005, P 29 F.
22 SEE ALSO UNEP, 2008
23 UNEP, AS OF 2008
24 EMERGING AFRICA, AS OF 2009
25 SEE ALSO AFREPREN/GTZ, AS OF 2007
26 GVEP/UNDP, AS OF 2005

- Seven Forks Hydro Stations have an installed capacity of 543 MW. They are situated along the lower part of the Tana River and comprise Masinga Power Station, Kamburu Power Station, Gitaru Power Station, Kindaruma Power Station and Kiambere Power Station.
- Masinga Power Station has an installed capacity of 40 MW.
- Kamburu Power Station has an installed capacity of 94.2 MW.
- Gitaru Power Station has an installed capacity of 225 MW.

The hydro power project of Sondu Miriu (60 MW) has been completed, but has not been commissioned yet due to low water levels. The development of the 20 MW Sangoro power project (also on the Sondu Miriu River) is ongoing. Both projects are threatened by the destruction of the Mau Forest, which is the main catchment zone of the Sondu Miriu River. Three other hydro power projects have been identified as feasible for development within the next 15 years. These are Ewaso Ngiro South (220 MW), Mutonga (60 MW) and Low Grand Falls (70 MW).

Micro Hydro Power

The potential for small hydro is estimated at 3,000 MW countrywide. The actual capacity available is, however, declining due to depletion of forests in key water catchment areas and the changing climate. While small hydro schemes are economically feasible for off-grid electrification, only a few have been developed mainly by private individuals and community groups. Small hydro remains largely underdeveloped with less than 15 MW connected to the grid[27].

Over the past 3–4 years, 60 pico and micro hydro systems have been installed in the region of Mt. Kenya. This is driven mainly by availability of technical know-how and equipment following a pilot project in the area implemented by the NGO of Practical Action through a community micro hydro scheme. Other sector players are involved in implementing small hydro projects in central Kenya including Clean Air Kenya and Greenpower Ltd.

The systems vary between 1–100 kW, the specific costs are around 4,000–6,000 USD/kW for pico systems and 3,500 USD/kW for micro systems. Systems are owned by local communities, which form associations or companies that own and operate them. The communities through their associations fully finance the systems and work with private sector developers to realize the projects. Two of the largest developers and suppliers are Q-Energy Ltd. and Numerical Machines (K) Ltd. Households pay a standard monthly charge of 60–100 KES to cover maintenance and additionally contribute to the installation costs.

RE Business Opportunity

There is a remarkable scope for small, micro and pico hydro in all the drainage basins across Kenya. Independent SME and the NGO Practical Action (formerly Intermediate Technology Development Group – ITDG) as well as other international NGOs have completed over 35 projects (2 MW in total).

Major barriers to development include limited local capacity to develop schemes as well as capacity for local production of turbines. This offers business opportunities for foreign producers.

SHORT BUSINESS INFO

- Large-scale hydro potential: only 677 MW out of 1,300 MW exploited
- Small-scale hydro potential estimated at 3,000 MW
- Micro and pico hydro market around Mt. Kenya

The table below summarizes the financing opportunities and investment potential for RE in Kenya.

TABLE 6
Economic Potential for RE Investments in Kenya

RENEWABLE RESOURCE	ECONOMIC POTENTIAL	BUSINESS OPPORTUNITY	INVOLVED AND INTERESTED PROJECT FINANCIERS
Large hydro	1,400 MWe	Not attractive as most of the remaining sites are outside the economic merit	Very few
Small hydro	1,000 MWe	Attractive for off-grid power generation, especially targeting the tea industry and households, mechanical application also possible	Local and international RE development financing (IFC, KfW, AfDB, TRIODOS, GROFIN, K-REP, Equity, EADB etc.)
Geothermal	› 2,000 MWe	Investment open to IPPs and other thermal applications once prospecting is complete and wells drilled	International financing (IFC, AfDB, EDB)
Wind	› 500 MWe	Mapping shows high potential for grid-connected wind, mechanical use in water pumping demonstrated	International financing (IFC, AfDB, EDB)
Cogeneration	360 MWe	Availability of bagasse, demand for steam and connectivity of plants to grid network	International financing (IFC, AfDB, EDB)
PV and solar thermal	Not quantified	Large off-grid market, mainly liberalized with high customer awareness	Local bank finance (Equity, GROFIN, K-REP etc.)
Biomass	Not quantified	Demand for cleaner and cost-effective thermal energy for industrial fuel switch	International and local finance, potential for CDM

Source: table compiled by the author, as of 2009

27 MURIITHI/MOE, AS OF 2006

5 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

The overview names only potential partners for international business contacts. Besides these, there are numerous other smaller companies involved in retail and installation of small RE systems across Kenya.

5.1 RENEWABLE ENERGY COMPANIES & BUSINESS RELATED ORGANIZATIONS

COMPANY	CONTACT ADDRESS	PRODUCTS AND SERVICES
Chloride Solar	Dunga Rd., Industrial Area P.O. Box: 20553 00200 Nairobi – Kenya Phone:+ 254 20 553322 Fax: +254 20 547865 Website: www.chlorideexide.com	Design, supply, installation, repair and maintenance of automotive batteries, solar systems, wind generators, power backup systems and solar water heating
Kenital Solar Ltd.	Off Ngong Rd. P.O. Box 19764 00202 Nairobi – Kenya Phone: +254 20 2715960 Fax: +254 20 27145514 Website: www.kenital.com	Design, supply, installation, repair and maintenance of hybrid solutions, power backup, solar hot water systems, solar lighting kits, solar street lighting, water pumping, wind energy solutions
Davis and Shirtliff Ltd.	Dundori Rd. P.O. Box 41762 00100 Nairobi – Kenya Phone: +254 20 6968 000, 558 335 d&s@dayliff.com Website: www.dayliff.com	Design, supply, installation, repair and maintenance of pumps, swimming pools, water treatment, water supply equipment, solar equipment
Sollatek Electronics Kenya Ltd.	Bamburi Off Malindi Rd. P.O. Box 34246 80118 Mombasa – Kenya Phone: +254 41 5486250/1/2/3 Fax: +254 41 5486259 sales@sollatek.co.ke Website: www.sollatek.co.ke	Supply, installation, repair and maintenance of power control, wind and solar equipment
PHONEESALES Solar	Bruce House, Kaunda Str. P.O. Box 45525, Nairobi – Kenya Phone: +254 22 13143/336027 Fax: +254 2 745 655 Phoneesales@insightkenya.com	Retail sales, wholesale supplier of PV systems and components, solar water pumping systems, wind energy systems (small), emergency power back-up systems, rural communications and energy systems, energy efficient cookers, refrigerators and freezers, consulting, installation and project development services, site survey and assessment services, maintenance and repair services
Chardust	Langata Hardy P.O. Box 24371 Karen, 00502 Nairobi – Kenya Phone: +254 020 270 0316, 353 89957, 350 5576 Website: www.chardust.com	Consultancy services on the salvage, recovery and conversion of charcoal waste to fuel briquettes including installation of machinery and training of operators
Bob Harries Engineering Limited – Kijito Wind Pump	Karamaini Estate P.O. Box 40 01000 Thika – Kenya Phone: + 254 733723401 Contact: Mike Harries revcop@africaonline.co.ke	Manufacture, installation, repair and maintenance of Kijito wind pumps
Winafrique Technologies	3rd Floor Soin Arcade, Westlands P.O. Box 73193 00200 Nairobi – Kenya Phone: +254 2 4453898/949 Fax: +254 2 4453988 info@winafrique.com Website: www.winafrique.com	Design, supply, installation, repair and maintenance of hybrid remote alternative power systems, wind power solutions, solar power solutions, water pumping solutions, power enhancing solutions and energy storage systems
ASP Ltd.	Old Airport Road Nairobi P.O. Box 556038 Nairobi – Kenya Phone: +254 20 823901, 823411/6 Fax: +254 29 823905/10 asp@Net2000ke.com	Manufacture, distribution and installation of pipes, penstocks, solar water heaters and PV equipment
CAT Center for Alternative Technologies	Jos Hansen & Soehne Building Baba Dogo Road P.O. Box 64921 Nairobi – Kenya Phone: +254 20 8562034/-8561253 Fax: +254 20 8562310 info@cat.co.ke	Wholesale distributors and system integrators of RE specializing in the sale of power backup solutions, wind electric turbines and equipment, DC energy efficient appliances, solar & wind powered water pumping solutions, solar water heating, solar pool water heating and filtration
Solar World EA Ltd.	P.O. Box 78516-00507, Ring Road Parklands and General Mathenge Rd. Junction, Westlands Nairobi – Kenya Phone: +254 20 3599699 Fax: +254 20 3751998 Website: www.solarworldea.com	Retail sales, wholesale supplier of solar electric power systems, backup power systems and batteries lead acid deep-cycle, solar water heating components, PV module components, LED lighting, solar torches, solar lanterns, solar caps, radios, solar mobile chargers, wind turbines, consulting, design, installation, engineering, contractor services, maintenance and repair services

COMPANY	CONTACT ADDRESS	PRODUCTS AND SERVICES
Adept Pacesetters Ltd.	Cargen Hse, Harambee Ave. P.O. Box 55672 00200 Nairobi – Kenya Phone: +254 20 315117/-315116	Wholesale supplier, exporter, importer of solar electric power systems, wind energy system components (small), wind energy systems (large), air cooling systems, solar water heating systems, air heating systems
Dial A Battery	P.O. Box 27517– 00506 Nairobi – Kenya Phone: +254 20 550715/ -20 6750692/+254 725 775555 Fax: +254 20 530413	Retail sales of automotive starting batteries, emergency backup batteries, deep cycle batteries, battery chargers, DC to AC power inverters and solar lighting systems
Digi Communication Systems Ltd.	P.O. Box 56366 -00200 Nairobi – Kenya Phone: +254 20 609240 Mobile: +254 73 3604668 Fax: +254 20 604216	Retail sales, wholesale supplier, importer of solar water heating systems, solar water heating components, water heating systems, PV systems, VHF & HF Radio Networks, consulting, design, installation, engineering, maintenance and repair services
Renewable Energy Engineering Contractors (REECON)	Ngara Rd. 00600 P.O. Box 31620 Nairobi – Kenya Phone: +254 20 3752136 Fax: +254 20 3751201 Mobile: +254 722 306276 rencon@clubinternetk.com	Wood burning stoves and furnaces, biomass energy systems, composting systems, energy efficient homes and buildings, hydro energy system components (small), solar cooking systems, biogas plant, waste water, incineration, energy efficiency
CAMCO (formerly Energy for Sustainable Development Africa)	Muringa off Elgeyo Marakwet Rd. P.O. Box 76406 - 00508 Nairobi – Kenya Phone: +254 20 37851 Website: www.esd.co.uk	RE Consulting, project development, management and evaluation, carbon asset development

5.2 LOCAL INSTITUTIONS RELATED RENEWABLE ENERGY BUSINESS

INSTITUTION	CONTACT ADDRESS	ROLE	SERVICES
Petroleum Institute of East Africa	Bruce House 4th Floor Standard Street P.O. Box 8936 – 00200 Nairobi – Kenya Phone: +254 20 249081 Fax: +254 20 313048 Website: www.petroleum.co.ke/	Provides a forum for expertise and excellence in the oil industry in the East African region with the aim of promoting professionalism and free enterprise in petroleum business supported by the highest business and operating standards, adherence to environment, health and safety ideals	Development of petroleum standards, capacity building and policy, creation of public and consumer awareness on basic environment, health and safety issues touching on handling and use of petroleum products
Ministry of Energy	22-24 Floor Nyayo House, off Uhuru Highway P.O. Box 30334 – 00100 Nairobi – Kenya Phone: +254 20 310112 Fax: +254 334567 Website: www.energy.go.ke	Planning and management of national energy demand and supply to ensure adequate, qualitative, cost effective and affordable supply of energy to meet development needs, while protecting and conserving the environment	Energy policy and energy sector development
Kenya Industrial Research and Development Institute	Dunga/Lusaka Road P.O. Box 30650 Nairobi – Kenya Phone: +254 20 535966/84/90 Fax : +254 20 555738 Website: www.kirdi.go.ke	Enhances the national industrial technology innovation process as a strategy towards rapid socio-economic development, facilitates access by local enterprises to business development services, including cleaner production and industrial information	R&D and consultancy
Kenya Bureau of Standards (KEBS)	Kapiti Road, Off Mombasa Road P.O. Box 00200 – 54974 Nairobi – Kenya Phone: +254 20 605506 Fax: +254 20 604031 Website: www.kebs.org	Ensures that no technical barriers to trade are created while providing services in standardization and conformity assessment	Trade facilitation services in metrology, standards, testing and quality management (MSTQ) including the WTO/TBT National Enquiry Point, certification and accreditation
National Environmental Management Authority (NEMA)	Kapiti Road off Mombasa Road P.O. Box 67839 – 00200 Nairobi – Kenya Phone: +254 20 605522 Fax: +254 20 608997 Website: www.nema.go.ke	Exercising general supervision and coordination over all matters relating to the environment and to be the principal instrument of Government in implementing all policies related to the environment	Coordination, research, facilitation and enforcement
Energy Regulatory Commission	Integrity Centre 1st floor, Valley RD P.O. Box 42681 – 00100 Nairobi – Kenya Phone: +254 20 2717627 Fax: +254 20 2717603 Website: www.erb.go.ke/	Economic and technical regulation of power, RE and downstream petroleum sub-sectors	Setting, review and adjustment of tariffs, licensing, approval of power purchase and network service contracts, enforcement of environmental and safety regulations in the power sub-sector, complaint investigation and dispute settlement
Practical Action (ITDG)	Practical Action East Africa AAYMCA Building P.O. Box 39493 Nairobi – Kenya Phone: +254 20 2719313 Fax: +254 20 2710083 Website: www.practicalaction.org	Support of poor communities to help them choose and use technology to improve their lives for today and generations to come	Campaigning, technical information service, education, consultancy and publishing
Jomo Kenyatta University of Agriculture and Technology (JKUCAT) – Institute for Energy and Environmental Technology (I.E.E.T)	Juja-Main Campus P.O. Box 62000-00200 Nairobi – Kenya Phone: + 254 06752711 Fax: + 254 0672164 Website: www.jkuat.ac.ke/	Research and training on energy and environmental technologies with emphasis on transfer of technology for efficient energy use	Consultancy services, waste treatment, environmental impact assessment and environmental and energy audit as well as biogas technology, research activities on development of biofuels/biodiesel, biomass biogas, small hydro power
Nairobi University	Off Harry Thuku Road P.O. Box 30197 - 00100 Nairobi – Kenya Phone: + 254 (020) 318262 Ext. 28483 Fax: + 254 (020) 245566 inst@uonbi.ac.ke Website: www.uonbi.ac.ke	Development of knowledge in nuclear sciences and technology and their application for enhancement of life in our society	RE research and training as well as consultancy services
Kenyatta University –Department of Environmental Services	P.O. Box 43844-00100 Nairobi – Kenya Phone: +254 20 810901-19 Fax: +254 20 811575 info@ku.ac.ke Website: www.ku.ac.ke/	Study of the environment, incorporating its structure and functioning in order to better evaluate the impacts of human activities on surrounding ecosystems	Training and research related to energy and environmental topics
United Nations Environmental Program (UNEP) – Division of Global Environment Facility Coordination (DGEF)	UNEP/Division of GEF Coordination P.O. Box 30552 Nairobi 00100, Kenya Phone: +254 20 7623424 Fax: +254 20 7624041 Website: www.dgef.unep.org/	Catalyzing of the development of scientific and technical analysis and advancing environmental management in GEF-financed activities	Guidance on relating the GEF-financed activities to global, regional and national environmental assessments, policy frameworks and plans, and to international environmental agreements
AFREPREN/FWD	House, Elgeyo Marakwet Close P.O. Box 30979 GPO 00100 Nairobi – Kenya Phone: +254 20 3866032 Fax: +254 20 3861464 Website: www.afrepren.org		Registered NGO with vast expertise on energy in East and Southern Africa and some experience in West and North Africa, brings together over 300 African energy researchers and policy makers from Africa with long-term interest in energy research and the respective policy-making process

INSTITUTION	CONTACT ADDRESS	ROLE	SERVICES
Institute of Research in Sustainable Energy and Development (IRSEAD)	David Yuko, Executive Director Kabarnet Road P.O. Box 3576-00100 Nairobi – Kenya Phone: +254 722 846260 Fax: +254 20 3870938 irsead@yahoo.com, David.yuko@reeep.org		
Climate Network Africa	Wood Avenue, Kilimani, P.O. Box 76479 00508 Nairobi – Kenya Phone: +254 20 3864040 Fax: +254 20 3873737 cnaf@cnaf.or.ke, gakumu@yahoo.com Website: www.cnaf.or.ke		Tackle climate change, desertification, biodiversity loss, ozone depletion, energy, poverty and other environmental and development issues affecting the communities in which it operates
Environment Liaison Centre International (ELCI)	Environment Liaison Center International Kasarani Road P.O. Box 72461-00200 Nairobi – Kenya Phone: +254 20 8566172/3/4 Fax: +254 20 8566175 info@elci.org Website: www.elci.org		Global coalition of more than 800 NGOs working on issues of environment and sustainable development in more than 80 countries
International Finance Corporation (IFC)	IFC Kenya, Hill Park Building Upper Hill Road Phone: +254 20 322-6340/400 Fax: +254 20 322-6383 Website: www.ifc.org/	Promote open and competitive markets in developing countries, support companies and other private sector partners, generate productive jobs and deliver basic services, create opportunity for people to escape poverty and improve their lives	Project finance: financial products and services that enable companies to manage risk and broaden their access to foreign and domestic capital markets; Advisory services: advisory services in support of private sector development in developing countries
United nations Industrial Development Organization (UNIDO)	UNIDO Office Kenya P.O. Box 41609, United Nations Avenue, Gigiri, Block Q, Room 118 Nairobi – Kenya Phone: +254 20 7624369 Fax: +254 20 7624368 office.kenya@unido.org Website: www.unido.org/	Mobilizes knowledge, skills, information and technology to promote productive employment, a competitive economy and a sound environment	De-linking intensity of energy use from economic growth, reducing the environmental damage that occurs with energy use
The K-Rep Group	K-Rep Bank Limited Naivasha Road P.O. Box 25363-00603 Lavington, Nairobi – Kenya Phone: +254 20 3873229 Fax: +254 20 3873178 Website: www.k-rep.org	Development of appropriate microfinance products and services to create economic opportunities for low income people and contribute to eliminating poverty	Developing, testing and promoting the adoption of appropriate microfinance models for improving the accessibility of financial services to people with low incomes
GROFIN	CIC Plaza Mara Rd, Upper Hill P.O. Box 19447 KNH 00202 Nairobi – Kenya Phone +254 20 273 0280 Fax: +254 20 273 0279 info.kenya@grofin.com Website: grofin.com/	Business development and finance company focused on providing business support and risk capital to small- and medium-sized enterprises in emerging markets underserved by traditional sources of capital	Advisory, financing and project development
Commissioner of Customs (at the Kenya Revenue Authority)	Times Tower, P.O. Box 40160 00100 Nairobi – Kenya Phone: + 254 20 310900, 2810000 Fax: + 254 20 316872 Email: cic@kra.go.ke Website: www.kra.go.ke		

6 BIBLIOGRAPHY

- AFREPREN / GTZ (2007): Successful Energy Policy Interventions in Africa (www.gtz.de/de/dokumente/en-successful-policy-interventions-2007.pdf)
- Central Bureau of Statistics – CBS (2003): A Geographic Dimension of Well Being in Kenya (www.scribd.com/doc/2224390/geographic-Dimensions-of-WellBeing-in-Kenya)
- Central Intelligence Agency – CIA (2009): The World Fact Book – Kenya (www.cia.gov/library/publications/the-world-factbook/geos/ke.html)
- Data Exchange Platform for the Horn of Africa – Depha (2009): Provincial Map of Kenya (www.depha.org)
- Electricity Regulatory Board (2005): Retail Electricity Tariffs Review Policy (www.erc.go.ke/retail-tariff.pdf)
- Emerging Africa (2009): Emerging Africa Infrastructure Fund Finances Two Vital Environmental and Construction Projects in Kenya and Algeria (http://www.emergingafricafund.com/Files/MediaFiles/DRAFT%20PRESS%20RELEASE%20FMFM%20Olkaria%20and%20SMT%20Feb%2009%20Final%20(2).doc)
- EU Aid, ACP – LOME Convention (2009): (http://homepages.uel.ac.uk/ben2417s/EUAid3.htm and www.acpsec.org/en/conventions/cotonou/accord1.htm)
- European Union Energy Initiative – EUEI (2009): Projects Database (http://ec.europa.eu/development/policies/9interventionareas/waterenergy/energy/initiative/bkcp/related_project.htm > Projects Database > Choose a beneficiary country > Kenya > Find projects)
- Gesellschaft für Technische Zusammenarbeit – GTZ (2009): Public-Private Partnership (www.gtz.de/en/leistungsangebote/2362.htm)
- Global Village Energy Partner – GVEP / United Nations Development Program – UNDP (2005): Kenya Energy Atlas 2005 (www.ke.undp.org/KenyaEnrgyAtlas Final-UN.pdf), Nairobi
- GTZ / Government of Kenya (2008): A Roadmap for Biofuels in Kenya Opportunities and Obstacles (www.bioenergywiki.net/.../Executive_Summary_Kenya_Biofuel_Roadmap.pdf)
- Kenya Electricity Generating Company (2007): Annual Report 2007 (www.kengen.co.ke/AnnualReport.aspx?Status=1)
- Kenya National Bureau of Statistics – KNBS (2007): Leading Economic Indicators (www.knbs.or.ke / > Leading Economic Indicators 2006–2007)
- Kenya National Bureau of Statistics – KNBS (2009): Economic Survey 2009 Highlights, (www.knbs.or.ke / > Economic Survey)
- Kenya Power and Lighting Company – KPLC (2007): Annual Report 2007 (www.kplc.co.ke/displayPageInside.asp?level_three_title_id=35&top_level_id=4&level_two_title_id=15)
- Kenya Revenue Authority (2009): Domestic Taxes and Customer Service (www.kra.go.ke/customs/customsdownloads.php)
- Meseret Teklemariam (2006): Overview of Geothermal Resource Utilization and Potential in East African Rift System. Presentation at the First International Conference on geothermal in the East African Rift Region, November 24-26, 2006, www.bgr.de/GEOTHERM/ArGeoC1/pdf/13%20%20M.%20Teklemariam%20Overview%20of%20geothermal%20resource%20utilization.pdf), Addis Abbeba
- Ministry of Energy ¬– MoE (2002): Study on Kenya's Energy Demand, Supply and Policy Strategy for Households, Small Scale Industries and Service Establishments
- Ministry of Energy – MoE (2004): National Energy Policy of Kenya (www.energy.go.ke/)
- Ministry of Energy – MoE (2004): Sessional Paper No. 4 on Energy
- Ministry of Energy – MoE (2006): Geothermal Potential in Kenya
- Ministry of Energy – MoE (2007): Annual Report 2007 (www.energy.go.ke/)
- Ministry of Energy – MoE (2007): Kenya's Least Cost Power Development Plan 2008–2080
- Ministry of Energy (MoE) 2008. Geo-exploration department – Geothermal Potential in Kenya (www.energy.go.ke/geothermalnew.php)
- Muriithi / Ministry of Energy – MoE (2006): Developing Small Hydro Power Infrastructure in Kenya (www.inshp.org/conclusion/apr2006/Developing%20Small%20Hydro power%20Infrastructure%20in%20Kenya.pdf)
- National Economic & Social Council of Kenya (2008): Kenya's Vision 2030 (www.nesc.go.ke/News&Events/KenyaVision2030Intro.htm)
- Parliament of Kenya (2006): Energy Act 2006, (www.erc.go.ke/energy.pdf)
- Practical Action East Africa: Microhydro in Kenya (http://practicalaction.org/?id=micro_hydrowww.practicalaction.org)
- Secretariat of the African, Caribbean and Pacific Group of States – ACP (2000): The Cotonou Agreement (www.acpsec.org/en/conventions/cotonou/accord1.htm)
- Solarnet (2009): Various publications (www.solarnet-ea.org/docs/publications.htm)
- United Nations Environment Program – UNEP (2008): SWERA Report (http://swera.unep.net)

Websites

- Green Africa Foundation (www.greenafricafoundation.org)
- Better Globe Group (www.betterglobegroup.com)
- Kenya Revenue Authority (www.kra.go.ke)
- Transparency International – TR, Kenya
- (www.tikenya.org/)

7 ANNEX

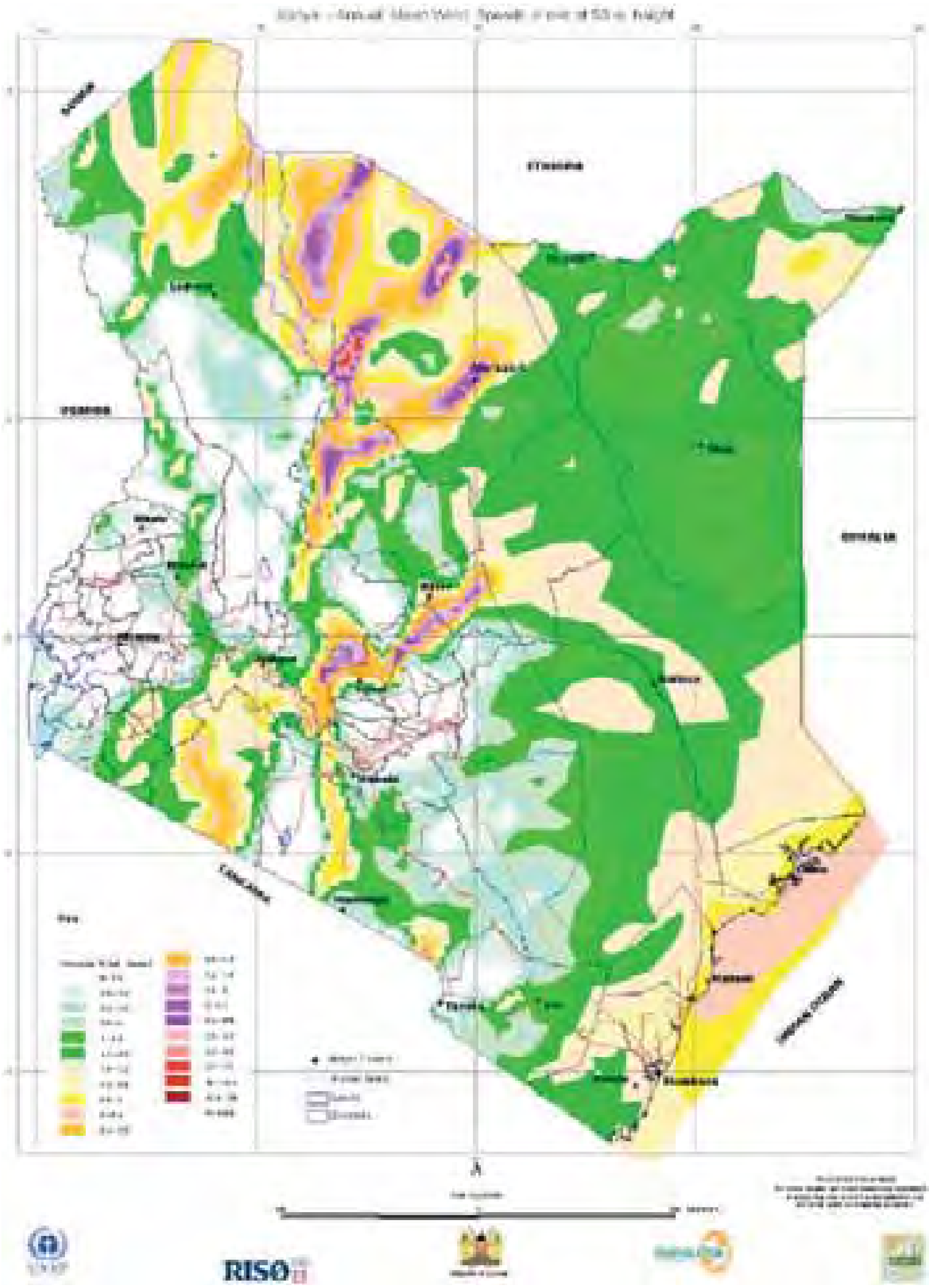
7.1 COUNTRY MAP

Source: Depha, as of 2009

7.2 MAP OF THE NATIONAL GRID SYSTEM

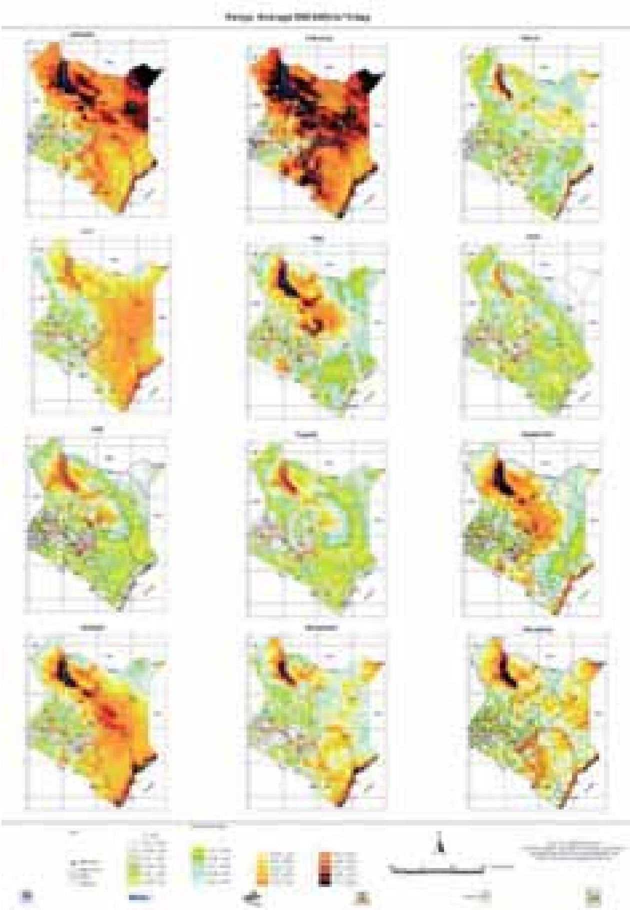
Source: unknown

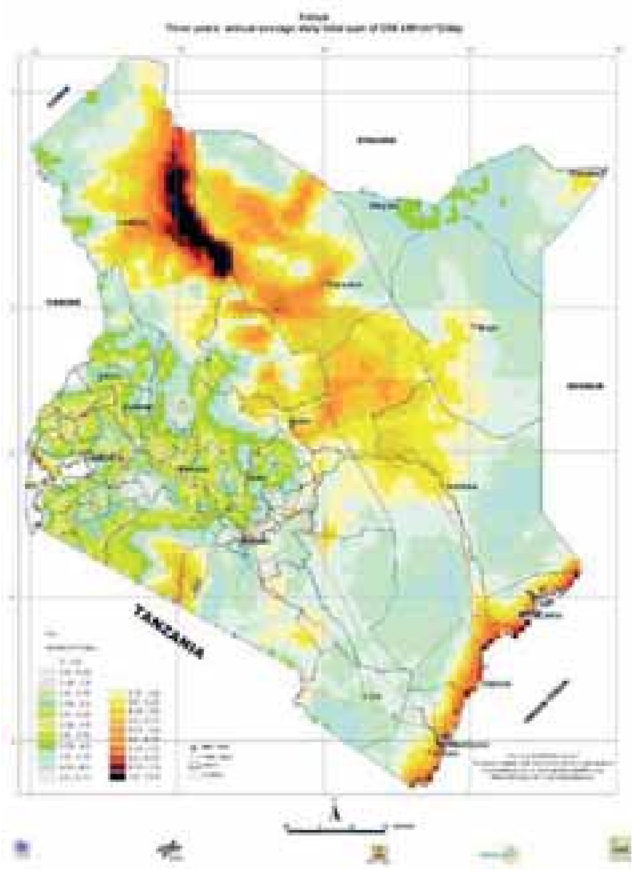
7.3 MAP OF WIND ENERGY SOURCES IN KENYA



Source: UNEP, as of 2008

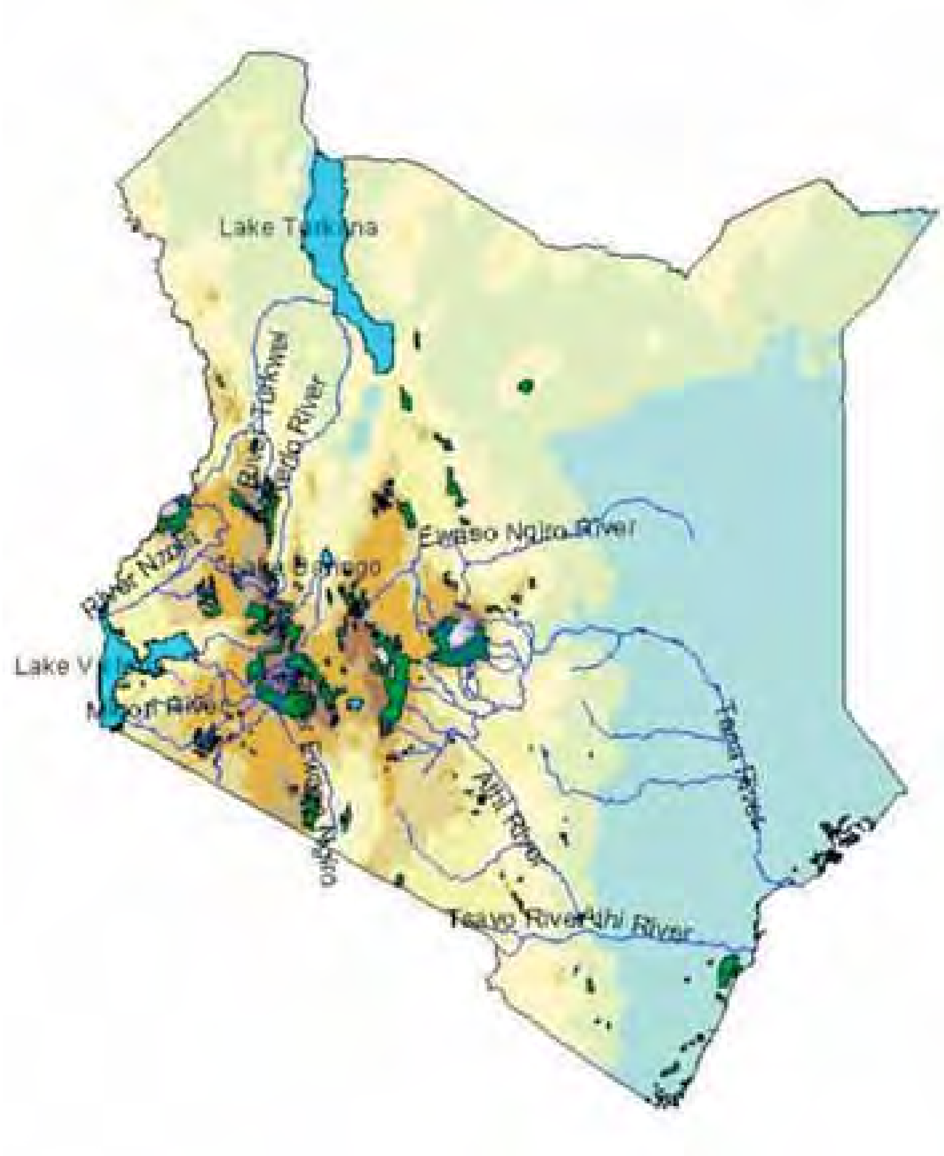
7.4 SOLAR RADIATION OF KENYA





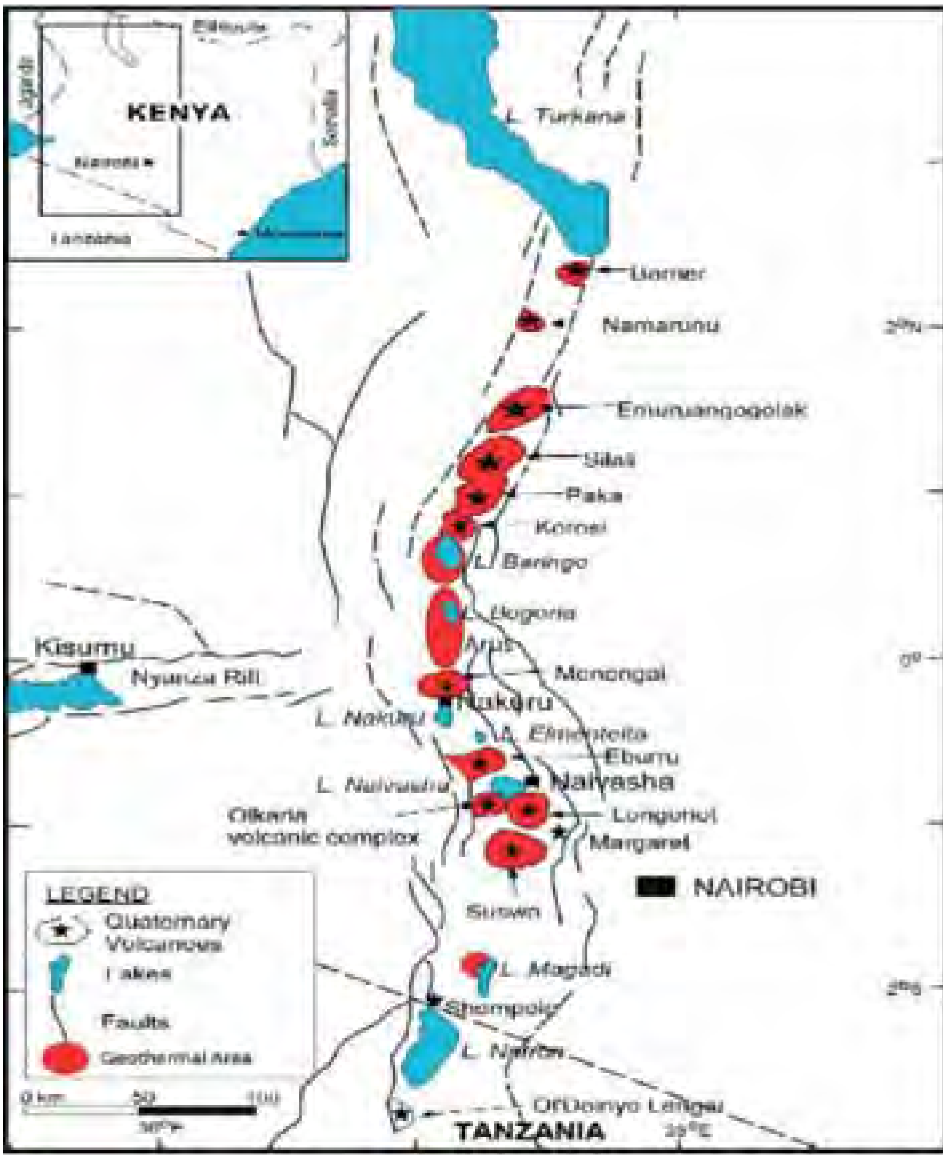
Source: UNEP, as of 2008

7.5 MAPS OF HYDRO POWER SOURCES (MAJOR RIVERS) IN KENYA



Source: Depha, as of 2009

7.6 MAP OF GEOTHERMAL SOURCES IN KENYA



Source: Meseret Teklemariam, as of 2006

7.7 ONGOING POWER SECTOR DEVELOPMENT PROJECTS

PROJECT AND TIME FRAME	DESCRIPTION	FINANCIER	CONTACT
Rural Electrification Program (various) Grid Extension ongoing	Extension of the national grid primarily to trading centers for water supplies to schools and health facilities	Governments of Kenya, France and Spain	REA
Rural Electrification Master Plan 2004–2008	Upgrading the national rural electrification master plan	Government of Finland	Ministry of Energy
Geothermal Resource Appraisal 2004–2008	Assessment of the readily available steam resources for power generation up to 2028	Governments of Kenya and China	Ministry of Energy and KenGen
KenGen Geothermal Olkaria Power Plant 2006–2009	Installation and commissioning of a 35 MW grid-connected geothermal plant	World Bank	KenGen
Or Power Geothermal Olkaria Power Plant 2006–2009	Installation and commissioning of a 35 MW grid-connected geothermal plant		Or Power Inc
KenGen Wind Kinangop 2006–2009	Development of a grid-connected 20 MW wind farm	World Bank	Ministry of Energy
Coal Resource Appraisal Drilling 2007–2009	Prospecting for coal deposits in MWingi district for economic exploitation	Government of Kenya	Ministry of Energy
Energy Sector Recovery Program 2004–2008	Grid system upgrade, rehabilitation and reinforcement	World Bank	Ministry of Energy
Mumias Sugar Bagasse Cogeneration 2006–2009	Development and installation of grid connected 35 MW bagasse cogeneration plant	Mumias Sugar, Japan Carbon Finance	Mumias Sugar

Source: data compiled by the author

7.8 SHARE OF ENERGY SOURCE IN TOTAL POWER GENERATION

SOURCE	CAPACITY IN MW	% OF TOTAL CAPACITY
Hydro (including imports)	697.2	57.340
Geothermal	128.0	10.530
Oil thermal generation	133.5	10.980
IPPs (thermal)	174.0	14.310
Gas turbine	73.5	6.050
Wind	0.4	0.033
Isolated diesel plants	9.2	0.760
Total	**1,215.8**	**100**

Source: KNBS, as of 2007

7.9 POWER CONSUMPTION BY INDUSTRY SECTORS

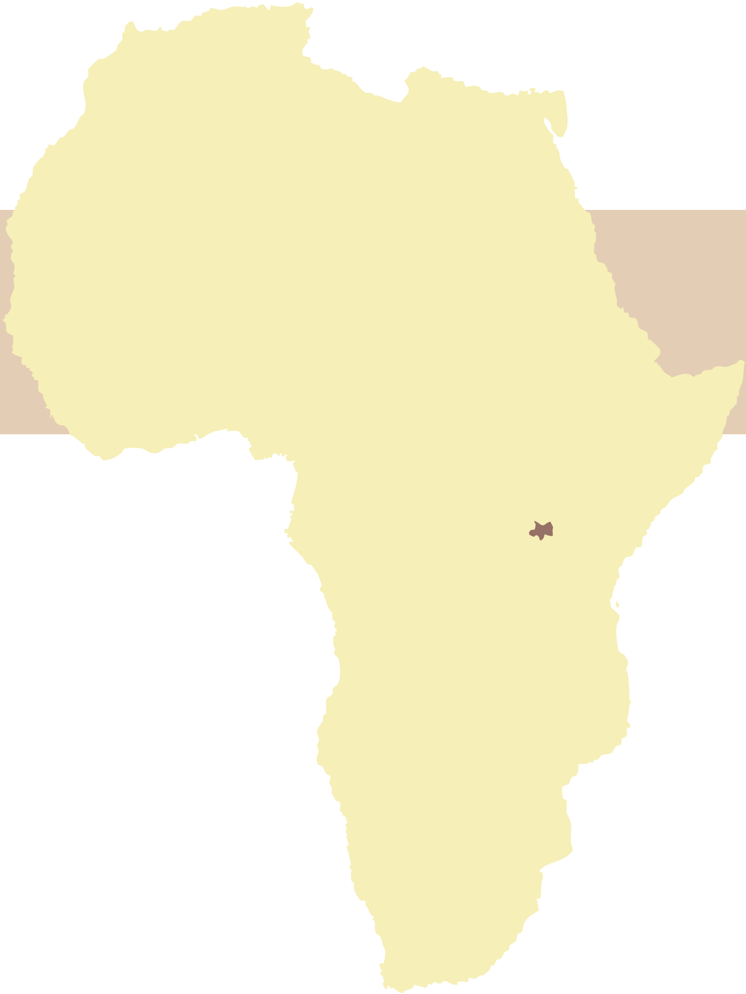
	2002	2003	2004	2005	2006	2007
Demand	GWh	GWh	GWh	GWh	GWh	GWh
Domestic and small commercial	1,262.9	1,325.5	1,416.6	1,507.7	1,572.4	1,741.8
Large commercial and industrial	2,277.9	2,368.8	2,587.00	2,753.5	2,919.8	3,140.6
Off-peak	60.5	55.6	66.8	52.9	44.8	49.2
Street lighting	6.4	7.0	7.2	8.5	10	12.2
Rural electrification	134.3	153.2	156.5	175.8	205.6	212.8
Total	**3,742**	**3,807.2**	**4,234.1**	**4,498.4**	**4,752.4**	**5,156.6**
Transmission losses and unallocated demand	943.6	855.1	960.3	1,024.2	1,095.8	1,109.7
Total demand = total supply	**4,685.6**	**4,662.3**	**5,194.5**	**5,547**	**5,894.9**	**6,324.6**
Imports of that from Uganda	238.4	189.4	161.9	27.9	10.8	22.6
Net generation	**4,447.2**	**4,472.9**	**5,032.6**	**5,519.1**	**5,884.1**	**6,302**

Source: Data compiled by the author from different sources; see also GVEP/UNDP, as of 2005

7.10 POWER TARIFFS FOR PRIVATE AND INDUSTRIAL USERS

TARIFF	TYPE OF CUSTOMER	SUPPLY VOLTAGE (V)	CONSUMPTION (kWh/MONTH)	FIXED CHARGE (KES/MONTH)	ENERGY CHARGE (KES/kWh)	DEMAND CHARGE (KES/kVA/MONTH)
DC	Domestic consumers	240 or 415	0–50	120.00	2.00	–
			51–1,500		8.10	
			> 1,500		18.57	
SC	Small commercial	240 or 415	≤ 15,000	120.00	8.96	–
CI1		415–3 phase	> 15,000	800.00	5.75	600.00
CI2	Commercial/industrial	11,000	No limit	2,500.00	4.73	400.00
CI3		33,000/40,000		2,900.00	4.49	200.00
CI4		66,000		4,200.00	4.25	170.00
CI5		132,000		11,000.00	4.10	170.00
IT	Interruptible off-peak supplies	240 or 415	≤ 15,000	240.00 when used with DC or SC	4.85	–
SL	Street lighting	240	–	120.00	7.50	–

Note: Schedule of Retail Electricity Tariffs and Rates (effective as of 1July 2008)
Source: Electricity Regulatory Board, as of 2005



COUNTRY CHAPTER: RWANDA

Author of Country Chapter
Emmanuel Kanigwa (MSc. Eng.)

Coordination and Review of the Country Chapter
Dipl. Phys. **Rafael Wiese**
PSE AG
Freiburg, Germany
www.pse.de

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS RWANDA

ACRONYMS AND ABBREVIATIONS

RWANDA

AfDB	African Development Bank
ACP	African, Caribbean and Pacific Group of States
AKFED	Agakhan Fund for Economic Development
ARED	Association Rwandaise pour Énergie Durable (Rwandan Association for Sustainable Energy)
ARD	Associates in Rural Development
ARIPO	African Regional Intellectual Property Organization
ATI	African Trade Insurance Agency
BADEA	Banque Arabe de Développement Économique en Afrique (Arab Bank for Economic Development in Africa)
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe (Federal Institute for Geosciences and Natural Resources)
BRGM	Bureau de Recherche Géologique et Minière (Bureau of Geological and Mining Research)
BTC	Belgian Technical Cooperation
CDM	Clean Development Mechanism
CEPGL	Communauté Économique des Pays des Grands Lacs (Economic Community of the Countries of the Great Lakes)
CIF	Cost Insurance and Freight
CITT	Center for Innovation and Technology Transfer
COMESA	Common Market for Eastern and Southern Africa
DED	Deutscher Entwicklungsdienst (German Development Service)
DGIS	Directoraat Generaal Internationale Samenwerking (Dutch Directorate General for International Cooperation)
DNA	Designated National Authority
EAC	East African Community
EDPRS	Economic Development and Poverty Reduction Strategy
EU	European Union
€	Euro
EXIM	Export and Import Bank in India
F.O.B.	Free On Board
GEF	Global Environmental Facility
GDP	Gross Domestic Product
GoR	Government of Rwanda
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation Agency)
HFO	Heavy Fuel Oil
IDA	International Development Agency
IFC	International Finance Cooperation
IPA	Industrial Promotion Agency
IPP	Independent Power Producer
IRST	Institut de Recherche Scientifique et Technologique (Institute of Scientific and Technological Research)
KenGen	Kenya Generating Company
KIST	Kigali Institute of Science and Technology
KP1	Kibuye Project 1
MIGA	Multilateral Investment Guarantee
MINAGRI	Ministry of Agriculture
MINALOC	Ministère d'Affaires Locales (Ministry of Local Governments)
MINECOFIN	Ministère d'Économie et de Finances (Ministry of Finance and Economic Planning)
MINICOM	Ministry of Commerce
MININFRA	Ministry of Infrastructure
MINITER	Ministère des Terres, de l'Environnement, des Forêts, de l'Eau et des Mines (Ministry of Lands, Environment, Forests, Water and Mines)
MoU	Memorandum of Understanding
NDBP	National Domestic Biogas Program
NEDA	National Energy Development Agency
NEPAD	New Partnership for Africa's Development
NTB	National Tender Board
NUR	National University of Rwanda
OGMR	Office of Geology and Mines in Rwanda
OPEC	Oil Producing and Exporting Countries

PPP	Private-Public Partnership
PV	Photovoltaic
RE	Renewable Energy
RIEPA	Rwanda Investment and Export Promotion Agency
RURA	Rwanda Utilities Regulatory Agency
RIG	Rwanda Investment Group
RRA	Rwanda Revenue Authority
RWF	Ruanda Franc
SINELAC	Société Internationale d'Électricité de Pays du Grand Lacs (International Electric Society of the Countries ofthe Great Lakes)
UPEGAZ	Unité de Promotion et d'Exploitation du Gaz Méthane (Association for the Promotion and Exploitation of Methane Gas)
UNIDO	United Nations Industrial Development Organization
USTDA	US Trade and Development Agency
SLF	Solar Electric Light Fund
SNEL	Société Nationale d'Électricité (National Electricity Company)
SNV	Stichting Nederlandse Vrijwilligers (Netherlands Development Organization)
UNDP	United Nations Development Program
USAID	United States Agency for International Development
USD	United States Dollar
VAT	Value Added Tax
WB	World Bank
WTO	World Trade Organization

MEASUREMENTS

bbl	barrel
cbm	cubic meters
GWh	gigawatt hour
km^2	square kilometer
KW	kilowatt
kWp	kilowatt-peak
l	liter
m	meter

SUMMARY

ECONOMIC STATUS AND DEVELOPMENT OF RWANDA

Rwanda has made substantial progress in stabilizing its economy after it has managed to overcome the genocide in 1994. Over 40 % of the population, however, live below poverty line. The GDP per capita is 250 USD, the economic growth has been stable since the year 2000 with an average rate of 5 % per year (with higher rates claimed over the last years) mainly driven by construction and agriculture. Coffee and tea are the central products in Rwanda's economy, accounting for nearly two-thirds of the export value. Tourism is another important source of foreign income. The Government of Rwanda (GoR) remains committed to a strong and enduring economic climate for the creation of a favorable investment conditions as proclaimed in its Vision 2020 with the issue of 'Development of Entrepreneurship and the Private Sector' as one of its central objectives.[1]

STRUCTURE OF ENERGY SUPPLY IN RWANDA

The population still relies on biomass like wood, animal waste and crop residues as its primary energy source (85 %) used mainly for cooking. Commercial energy resources include hydro power, oil-fired thermal power stations and methane gas from lake Kivu.

Oil

Rwanda's oil consumption averaged about 5,300 barrels per day (bbl/day) in 2007, which is almost all imported through the port of Mombasa, Kenya. Kerosene is used extensively in rural areas for lighting and, to some extent in urban areas, for cooking and lighting.

Electricity

A national average of 6 % of the population is connected to the national grid, mainly in Kigali and other cities, only 1 % of the rural population uses electricity. Power stations in Rwanda produced 54 MW in 2007, of which 30 MW came from thermal oil-fired power stations and 24 MW from hydro electricity. Rwanda's electricity consumption was 210 GWh, only 138 GWh were produced within the country (hydro and diesel power). 69 GWh was imported from Rusizi I power plant (Congo) as well as from Rusizi II (Uganda).

Rwanda's Government is committed to diversify the country's sources of energy, and a number of large investments are underway (e. g. the Nyaborongo Hydro Power Dam of 27,5 MW, other small micro hydro power and lake Kivu methane plants with an estimated 250 MW to be installed over the coming years. The country's electricity supply has been erratic in the early years of the decade because of the national grid's heavy reliance on hydroelectric power, which in turn depends on rainfall. In the past years, poor rainfall caused several electricity shortages. Ongoing high transmission losses of around 25 % deteriorate the country's electricity supply.[2] Currently, however, the electricity supply is stable due to the installation of diesel-powered generators.

Natural Gas

Rwanda has proven natural gas reserves identified as methane in the Lake Kivu waters. Currently, 4,5 MW of electricity are generated in a pilot plant in the vicinity of Gisenyi. Other projects are underway for the expanded exploitation and use of this resource, one of them being operated by the Rwanda Investment Group (RIG) with a concession of 3.5 MW for a pilot project. The US-based Contour Global Group has a concession of 100 MW and construction has started to put the first 25 MW in operation by late 2010. The reserves of methane gas deposits in Lake Kivu are estimated be sufficient for 350 MW of electricity power and other uses for a period of up to 50 years. Similar reserves are available for the DR Congo with whom Rwanda is sharing the lake Kivu.[3]

STATUS OF RENEWABLE ENERGIES IN RWANDA

Biogas

The National Domestic Biogas Program (NDBP) aims to install at least 15,000 biogas digesters in rural households to provide sufficient energy for cooking and lighting. So far, over 300 biogas digesters have been installed in rural households. Biogas has also been used in prisons and schools where it is produced with waste from the latrines. Rwanda has even gained international recognition for its achievement, which has reduced the cost of cooking in prisons by 40 %. The Government is now considering the expansion of this technology to more schools and hospitals.

Solar

Africa's so far largest grid-connected solar plant of Kigali Solaire is in operation at Mount Jali on the outskirts of Kigali. It has been constructed by the Ministry of Infrastructure with the support of the German utility of Stadtwerke Mainz and the German company of Juwi. The first phase of the project was started in June 2007. Through the solar plant, the Stadtwerke Mainz as an Independent Power Producer (IPP) currently feeds 250 kWp into the grid (from June 2007 to April 2009 production of 626,010 kWh) and is planning to expand to a capacity of 1 MWp.

PV systems have been implemented in recent decades by local and international organizations for the electrification of churches, schools and households in rural areas. Starting in 2009, the EU will contribute 10 million € for the support of solar and hydro power rural electrification projects through funds from the ACP-EU Energy Facility.[4]

1 SEE MINECOFIN, AS OF 2000
2 SEE POVERTY ENVIRONMENT INITIATIVE RWANDA, AS OF 2006
3 SEE REPUBLIC OF RWANDA, AS OF 2009
4 FOR MORE INFORMATION ON THE ACP-EU ENERGY FACILITY SEE WEBSITE (HTTP://EC.EUROPA.EU/EUROPEAID/WHERE/ACP/REGIONAL-COOPERATION/ENERGY/INDEX_EN.HTM)

Hydro

Several large hydro power projects are underway through international cooperation. 21 micro hydro power stations in various places are under construction and are expected to generate 10 MW in 2009. An additional 300 sites have been identified for the construction of micro hydro power stations. The construction of the 27,5 MW Nyaborongo dam has started early 2009 and the project is expected to be in operation by the end of 2012. Pre-feasibility studies are underway for a number of large projects with a total capacity of around 400 MW at the Ruzizi and Akagera rivers, which are shared with neighboring countries.

Wind

Wind energy has not yet been given priority in Rwanda because of the lack of detailed and reliable information on wind regimes and potential exploitation sites. A wind atlas has to be developed which requires detailed meteorological measurements[5]. A wind survey will be carried out in 2009/10 in selected locations.

Geothermal

The exploitation of the geothermal potential is in its preliminary stage. Studies and prospects have estimated a potential of 170–300 MW[6]. Since June 2007, the German Federal Institute for Geosciences and Natural Resources (BGR) has been assessing the geothermal potential.

Methane

55 billion cubic meters of methane are trapped at the bottom of Lake Kivu, roughly equivalent to 275 million barrels of oil. A pilot project of extraction started in 2008 to pump methane gas from a rig to a small on-shore power plant. Next steps will include projects with private investors for up to 250 MW of electric power. The Government is also looking at the opportunities to convert gas into liquid for transport and is cooperating with a South African investment group for this purpose.

CDM

Rwanda is a signatory to Clean Development Mechanism (CDM) and has therefore created a Designated National Authority (DNA). A permanent secretariat has identified a number of projects, e. g. energy saving lamps, hydro power, biogas, methane gas, solar for water purification, voluntary credits for reforestation etc.

5 ALSO SEE REPUBLIC OF RWANDA, 2009
6 SEE MININFRA, 2009

1 COUNTRY INTRODUCTION

1.1 RWANDA OVERVIEW

Rwanda is a landlocked nation of rich culture and great natural beauty. The country is situated in central Africa bordered by Uganda, Tanzania, Burundi and the Democratic Republic of Congo. The Republic of Rwanda comprises Kigali City and four provinces (North, East, South and West). The country is mainly rural with about 90 % of the population engaged in mainly subsistence agriculture. It is the most densely populated country in Africa with few natural resources, minimal industry and coffee and tea as the primary foreign exchange earners. Over 40 % of the population live in poverty with less than 1 USD per day.

The 1994 genocide decimated Rwanda's fragile economic base. However, Rwanda has made substantial progress in stabilizing and rehabilitating its economy to pre-1994 levels. Gross Domestic Product (GDP) has rebounded and inflation has been curbed. The Government has embraced an expansionary fiscal policy to reduce poverty by improving education, infrastructure, foreign and domestic investment and pursuing market-oriented reforms, although energy shortages, instability in neighboring states and lack of adequate transportation linkages to other countries continue to handicap growth.

1.2 RWANDA STATISTICS: GEOGRAPHY AND ECONOMICS

LAND AREA:	26,340 square kilometers
POPULATION:	9.7 million (as of 2007), growth rate 2.35 %
DENSITY:	369 inhabitants/km² (as of 2007)
CLIMATE:	Two rainy seasons (February–April, November–January), mild in mountains with frost and snow
AVERAGE TEMPERATURE:	24.6–27.6° C (hottest months: August–September)
ALTITUDE	From 1,000–4,500 m above sea level, highest point is Karisimbi volcano (4,507 m)
MAIN WATER BODIES:	Lake Kivu, Lake Muhazi, Lake Ihema, Lake Bulera, Lake Ruhondo, Lake Mugesera
VEGETATION	Ranges from dense equatorial forest in the North West of the country to tropical savannah in the East
GDP PER CAPITA (AT PURCHASING POWER PARITY)	813 USD (as of 2007)
INFLATION RATE:	8 % (as of 2007)
AGRICULTURE:	Coffee, tea, pyrethrum (insecticide made from chrysanthemums), bananas, beans, sorghum, potatoes, livestock
INDUSTRIES:	Cement, agricultural products, small-scale beverages, soap, furniture, shoes, plastic goods, textiles, cigarettes
ELECTRICITY – PRODUCTION:	138.79 million kWh (as of 2007)
ELECTRICITY – CONSUMPTION:	210.13 million kWh (as of 2007)
ELECTRIFICATION RATE:	6 % (urban 35 %, rural 1 %; as of 2007/2008)
OIL – PRODUCTION:	0 bbl/day (as of 2007)
OIL – CONSUMPTION:	5,300 bbl/day (as of 2005)
OIL – PROVEN RESERVES:	0 bbl/day (as of 2007)
NATURAL GAS – PRODUCTION:	0 bbl/day (as of 2006)
NATURAL GAS – PROVEN RESERVES:	54.32 billion cubic meters (as of 2006)
EXPORTS:	170.8 million USD F.O.B. (as of 2007)
EXPORTS – COMMODITIES:	Coffee, tea, hides, tin ore
EXPORTS – PARTNERS:	China (10.3 %), Germany (9.7 %), USA (4.3 %) (as of 2006)
IMPORTS:	472.5 million USD F. O. B. (as of 2007)
IMPORTS – COMMODITIES:	Food, machinery and equipment, steel, petroleum products, cement and construction material
IMPORTS – PARTNERS:	Kenya (19.6 %), Germany (7.9 %), Uganda (6.8 %), Belgium (5.1 %) (as of 2006)
EXCHANGE RATE:	1 RWF = 0,00126 € (as of 2009)

Source: data compiled by the author from different sources, e.g. CIA, as of 2009

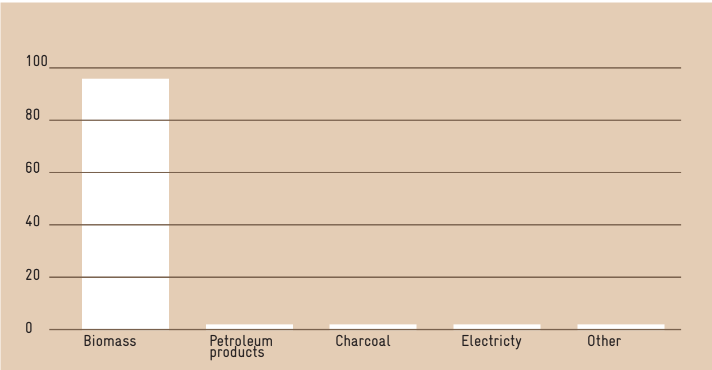
2 ENERGY MARKET IN RWANDA

2.1 ENERGY SITUATION OVERVIEW

Rwanda's demand for energy has grown rapidly by 25 % per year due to population growth and the increase in economic activities. Biomass accounts for 95 % of the total energy consumed and only 70.000 households (about 5 %) are connected to grid power. The electricity consumed in Rwanda has changed from almost entirely hydro-generated to largely thermal-generated at present. This has been a result of a high demand for electricity and unexpectedly low reservoir levels. The shares of the total primary energy consumption are shown below. It is obvious that the commercial energy sources contribute only 5 % to the total primary energy supply, for example electricity 0.6 %.

FIGURE 1

Shares of Total Primary Energy Consumption



Source: UNIDO, 2002, graph PSE AG

2.2 ENERGY CAPACITIES, PRODUCTION AND CONSUMPTION

The UNDP Human Development Report stated Rwanda's electricity consumption per capita and year as 31 kWh.[7] This figure was crosschecked by dividing the electricity production of 138 million kWh through 8.6 million inhabitants. On average, the per capita electricity consumption in Rwanda is 19,5 kWh (for 2005; for comparison: Germany has 7,442 kWh per capita per year).

Table 2 shows the electricity production by hydro power and thermal oil power stations.

In 2007, local hydro power stations produced 27.32 GWh and thermal oil-fired power stations 111.47 GWh. This results in 138.79 GWh in total. Another 69.34 GWh were imported. A more detailed table showing all power stations of Rwanda can be found in annex 8.4 (Share of Local and Imported Energy Sources).

TABLE 2

Electricity Sources, Capacities and Net Generation

TYPE OF ENERGY SOURCE	2002		2003		2004		2005		2006		2007	
	Cap. (MW)	Net Gener. (GWh)	Cap. (MW)	Net Gener. (GWh)	Cap. (MW)	Net Gener. (GWh)	Cap. (MW)	Net Gener. (GWh)	Cap. (MW)	Net Gener. (GWh)	Cap. (MW)	Net Gener. (GWh)
Hydro Power – of that												
Local	24.44	233.90	24.44	117.64	24.44	84.32	24.44	65.73	24.44	41.17	24.44	27.32
Imports		135.69		120.92		115.81		89.05		90.02		69.34
Hydro Power total	24.44	233.90	24.44	238.56	24.44	200.13	24.44	154.78	24.22	121.19	24.44	96.66
Thermal power (oil)	2.00	0.00	2.00	0.00	14.57	6.25	24.57	50.14	29.57	127.40	29.57	111.47
Solar PV		0.00		0.00		0.00		0.00		0.00		2.00
Total capacity	26.44		26.44		39.01		49.01		54.01		54.01	
Total power generated		233.90		238.56		238.21		204.92		248.59		210.13

Source: ELECTROGAZ, Electricity Department, as of 2007

7 SEE UNDP, 2008

2.3 ENERGY PRICES

Electricity prices in Rwanda are one the highest amongst all East African countries with around 14 Eurocent/kWh, as shown table 3.

With the exception of kerosene, prices of all other petroleum products have been fluctuating since January 2007 and are heavily taxed although the Government sometimes reduces taxation to stabilize prices. Table 4 shows the trend of price from January 2007 to February 2008.

TABLE 3

Energy Prices in Rwanda

ELECTRICITY (RWF/KWH)		PREMIUM (RWF/L)		GASOIL (RWF/L)		KEROSENE (RWF/L)	
Private	Industrial	Private	Industrial	Private	Industrial	Private	Industrial
123	105	726	726	726	726	623	623

Source: MINICOM, as of 2007

TABLE 4

Increasing Fuel Prices in Rwanda 2007–2008

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB
Petrol	Price RFW	607	607	607	607	607	617	617	617	617	617	637	684	726	726
	Subsidies (reduced taxes)	61	47	58	72	86	90	90	89	88	85	83	81	90	80
Diesel	Price RFW	595	595	595	595	595	605	605	605	605	605	620	677	726	726
	Subsidies (reduced taxes)	72	62	70	74	89	87	89	93	94	96	99	99	91	90

Source: MINICOM, as of 2008

2.4 MARKET ACTORS FOR ENERGY PLANNING, REGULATIONS AND DISTRIBUTION

MININFRA

The overall governance of the energy sector is in the responsibility of the Ministry of Infrastructure (MININFRA). The Department of Energy supervises the implementation of the energy policy, which is the main guidance for change, backed by legislation and regulation.

ELECTROGAZ

While the ministry is responsible for policy, the public utility company of ELECTROGAZ (entirely owned by the Government of Rwanda) offers electricity services. The Government has assigned the monopoly to produce and distribute electricity to ELECTROGAZ. It is currently in the process of restructuring ELECTROGAZ to increase private sector involvement in an attempt to improve managerial and operational performance.

RURA

Rwanda Utilities Regulatory Authority (RURA) was established in 2001 for the regulation of certain public utilities including those providing for energy. The regulatory authority promulgates rules to establish licenses and tariffs and dispatches preferences for indigenous and foreign Renewable Energy (RE) producers of electricity in their production, transmission, distribution, system operation and international trade activities.

RIEPA

The Rwanda Investment and Export Promotion Agency (RIEPA)[8] has a mandate to promote investment opportunities with local and foreign investors, to facilitate the establishment and smooth operation of investor projects and the business development and export production. It also advises the Government on additional policies and initiatives needed to encourage and support investment in the country.

8 SEE WEBSITE OF RWANDA INVESTMENT AND EXPORT PROMOTION AGENCY – RIEPA (WWW.RWANDAINVEST.COM)

3 RENEWABLE ENERGY POLICY FRAMEWORK CONDITIONS

According to the East African Community (EAC) Development Strategy (2006–2010)[9], only a small percentage of the EAC region specifically provides support for medium-term investments in the energy sector. Each country is compiling a detailed inventory of all RE technologies to be submitted to the EAC Secretariat for the integration in a regional inventory. Based on that the EAC region plans to develop standards and codes of practice on RE technologies.

3.1 POLICY AND RENEWABLE ENERGY PROMOTION PROGRAMS

The following regulations in Rwanda are in place:

Law on Investment:
A new Law on Investment and Export Promotion and Facilitation (No. 26/2005)[10], which came into force in March 2006, is intended to assist investors in obtaining the necessary license and other activities. The principal features of the law include the following:

- The law distinguishes between foreign and local investors and specifies that foreign investors qualify for an investment certificate with an investment of 250,000 USD and local investors with an investment of 100,000 USD.
- The law provides for free economic zones of three kinds: export-processing zones, single-export processing zones and free trade zones.
- The provisions for fiscal incentives have been shifted to the new Law of Customs and the new Law of Income Tax, but were maintained as annexes to the Investment Law for ease of reference.
- The law provides special non-fiscal incentives for investors who invest 500,000 USD in one step. These include permanent residence, citizenship and access to land.
- RIEPA is required to make and communicate its decision regarding an investment certificate within 10 working days after receiving a complete application. Should RIEPA fail to act within 10 days, the investor may complain to the Minister of Commerce (MINICOM) who is in turn required to investigate the matter and communicate the result within five working days.
- The law states that the holder of an investment certificate, amongst other benefits, is entitled to free residence and work permits for three members of the certificate holder's management or technical staff, valid for one year and reusable to the same or different persons.
- Value Added Tax (VAT) on imported capital goods and raw material is subject to zero-rated tariffs. In contrast, a flat tax of 5 % on imported capital goods and raw materials - in lieu of all other duties (tariffs, excise and VAT) is not subject to zero-rated tariffs. Further conditions are that upon application for each transaction, an accelerated rate of depreciation of 40 % in the first year is available, if the asset is held for the minimum of four years, increasing to 50 % for investments located outside Kigali or in one of the 10 priority sector. These regulations are specified by the 2005 Law on Investment and Export Promotion and Facilitation.

There are no special import conditions for RE products. Law No. 54 (as of 2006) – modifying and the complementing law No. 21 (as of 2006)[11] which establishes the customs system – stipulates that capital goods, equipment, raw materials and imported goods by an investor in a free trade zone shall be relieved from customs duties when imported by an investor registered under the investment agency (RIEPA).

There are no clear legal guidelines for electricity production and feed-in tariffs into the power grid for RE or other sources. There is no separate incentive package for investors in RE or any special support program for RE investment.

At the end of 2008, the EU contributed 10 million € supporting solar and hydro power rural electrification projects through funds from the ACP-EU Energy Facility. The GoR has developed a five-year development plan to improve energy access and rural development. The European Union is supporting Rwanda in achieving these objectives by financing half of this energy program. The program targets areas of the country beyond the reach of the national electricity network and will provide electricity primarily via solar PV systems to some 25 % of the currently non-electrified institutions such as health centers, schools and public offices, covering 350 institutions in 150 of Rwanda's 419 sectors. In addition, micro hydro electricity plants will be installed at various sites serving up to 70 villages (Umudugu) giving access to electricity to some 15,000 households. The program will support decentralization of education, health, water supply, telecommunication and general administration functions. It is designed as a Private-Public Partnership (PPP), as the micro hydroelectric plants will be financed, constructed, managed and maintained by private firms, thus leading to the promotion of the private sector and the creation of many new off-farm jobs in rural areas.[12]

SHORT BUSINESS INFO

- Zero VAT on imported capital goods and raw material
- No feed-in tariff for RE electricity
- 19 different projects planned in hydro, biogas, solar, geothermal
- 10 Mio € for ACP-EU project on hydro and solar energy in rural areas

RE Business Opportunity

There are several reconstruction and development projects in the energy sector planned and/or under implementation, which are shown in the following table:

9 SEE EAC, 2006
10 SEE REPUBLIC OF RWANDA, AS OF 2005
11 SEE REPUBLIC OF RWANDA, AS OF 2006
12 FOR RECENT DEVELOPMENTS ON THE PROGRAM SEE WEBSITE OF MININFRA (WWW.MININFRA.GOV.RW)

TABLE 5

Planned and Implemented Energy Projects in Rwanda

PROGRAM	RE TECHNOLOGY	FINANCING PARTNERS	COST IN RWF	STATUS
Construction of the 3 micro hydro power stations Keya,Nkora and Cyimbili (1.6 MW)	Micro hydro	Belgian Technical Cooperation (BTC)	1,185,740,158	Under construction
Study and construction of micro electric stations in Kibuye and Cyangugu Region	Micro hydro	Belgian Technical Cooperation (BTC)	789,419,400	Planned (there is no tender body because the project is still under planning)
Construction of 8 micro hydro power stations (total capacity: 6.7 MW)	Micro hydro	GoR	1,500,000,000	Under construction by the Sri-Lankan company of Hydro Power Internatio-nal Ltd.
Construction of hydroelectric power station at Rukarara (9.5 MW)	Hydro	GoR	1,000,000,000	Under construction by Eco Power Global Ltd.
Construction of hydroelectric power station at Nyabarongo (27.5 MW)	Hydro	GoR (through a grant)	4,725,776,000	Started
Construction of 6 hydro power stations (1.5 MW)	Hydro	Private Sector Participation (Rwandan Companies) with GTZ (financed by BMZ/ DGIS)	531,000,000	Under construction
Rehabilitation of 3 micro hydro power stations (Gihira, Mukungwa, Gisenyi)	Micro hydro	Loan from BADEA/ OPEC and GoR	1,092,470,012	Feasibility has been advertised
Urgent electricity rehabilitation project for transmis-sion and distribution (20 MW)	/	GoR, IDA, Norwegian Fund	7,016,883,340	Under construction
Geothermal resource assessment	Geothermal	GoR and BGR	300,000,000	Ongoing
Rural energy facility	/	GoR and Grants	220,000,000	Planned (contact: MININFRA)
Electrification by solar	Solar	BTC	161,106,000	Planned (contact: MININFRA)
Network line for micro hydro power stations of 20 KW (Cyimbiri, Funda, Nkora)	Hydro	BTC	513,391,120	
Rehabilitation of Gikondo and urgent electrical material	/	GoR	270,000,000	Planned
Umutara rural electrification by solar energy	Solar	GoR	500,000,000	Planned (there is no tender body as the project is still under planning; contact: MININFRA)
Elaboration and study of electricity tariffs	/	GoR	55,000,000	Planned (contact: MININFRA)
Setting up of control system for stability of Lake Kivu	/	Grants	300,083,000	Planned (contact: MININFRA)
Project to substitute wood and wood/coal use in families by biogas	Biogas	GoR, SNV, GTZ, SNV, DGIS	397,000,000	Being implemented
Project to substitute wood and wood/coal based stoves by improved stoves	Improved stoves	GoR	332,000,000	Being implemented

Source: compiled by the author from various data sources

4 STATUS AND FUTURE OUTLOOK FOR RENEWABLE ENERGIES

RE energy sources in Rwanda are less or even non-exploited. The Rwanda Government has given strong emphasis on the development of hydro power. Due to rising oil prices and the currently high electricity prices, the development of RE power supply can be financially viable within the near future.[13]

4.1 BIOMASS/BIOGAS

Firewood is clearly the main source of energy for cooking in Rwanda and is being used by more than 80 % of the households. The other sources of energy used for cooking include charcoal (over 5 %) and other vegetal materials. Even in Kigali City, some 65 % of the households are using charcoal and around 25 % wood for cooking. This underlines the dominant role of biomass as a major energy source in Rwanda.

Households with two or more cows have the potential for a small biogas plant. A significant national domestic biogas program has been launched, staff has been recruited and funds have been made available by GoR. The program is especially viable because the national zero grazing policy makes the cow dung available close to the household.

On top of that, the one-cow-per-family program will enable more people to actually benefit from the biogas program. So far, 350 biogas digesters have already been installed in households . These digesters are built by local craftsmen with the support of the Center for Innovation and Technology Transfer (CITT) of the Kigali Institute of Science and Technology and Management (KIST). Most of the digesters are made from stones and cement. There is also a pilot test phase for digesters made of fiberglass with help of Chinese engineers in Kirehe district. By December 2011, the project is aiming to install 15,000 biogas systems for cooking and lighting.
Biogas plants using human feces are in operation in six prisons

13 FOR A GENERAL CURRENT OVERVIEW SEE WEBSITE OF MININFRA, 2009

with 30,000 inmates. KIST is expected to install three more plants every year.

Other players in the sector include SAM Muhiima, a community-based organization, which collects, sorts and processes garbage for high-quality biomass fuel briquettes for household (for cooking) and industrial use (to run engines and produce electricity). This project is financed by USAID through Associates in Rural Development Inc (ARD).

SHORT BUSINESS INFO

- 95 % of primary energy source is „non-commercial" biomass.
- NEDA facilitates a national domestic biogas plant program targeting implementation in 15,000 households by 2011.
- Biogas plants are used in prisons.

4.2 SOLAR ENERGY

Rwanda has favorable irradiation conditions of 5.15 kWh/m^2 per day[14], but the use of solar energy is still very limited. In Rwanda, solar energy has been exploited in recent decades by local and international organizations for the electrification of churches, schools and households in rural areas. However, the low income situation and the resulting high costs of solar systems have been a barrier to widespread dissemination until now . The Government has been able to attract efficient partners including the European Union (EU), the Belgian Technical Cooperation (BTC), the Global Environmental Facility (GEF) and the United States Agency for International Development (USAID).

The GoR through the Ministry of Infrastructure (MININFRA) and with the support of Stadtwerke Mainz[15] was able to inaugurate the first phase of a solar power generation project in June 2007. The Kigali Solaire Plant is located on Mount Jali at the outskirts of the city and is currently feeding 250 kWp into the grid, operated by Stadtwerke Mainz as IPP and constructed by German Juwi GmbH. It is so far the largest solar power plant known in Africa. Stadtwerke Mainz in cooperation with MININFRA is looking into expanding the plant to a capacity of 1 MWp. Technicians from ELECTROGAZ have already been trained to take care of the maintenance of this system. With mixed financing of BTC, GEF, EU, USAID and German Technical Cooperation Agency (GTZ) on behalf of the German Government, 268 health centers, 500 schools and 200 administrative offices will be electrified with solar systems by 2010.

Stadtwerke Mainz is investing in 50 small-scale solar plants of 1 kW each for remote off-grid villages. The solar systems will supply refrigeration for medicine in health centers and will provide light for schools. The Public-Private Partnership (PPP) project of Stadtwerke Mainz and GTZ on behalf of the German Development Cooperation guarantees the smooth operation of the solar systems. GTZ trains electricians from the various rural districts and the capital as solar technicians. The cooperation project also includes the establishment of a micro-financing system for solar start-up companies[16].

14 SEE ALSO ANNEX 7.3

15 POWER UTILITY IN THE FEDERAL STATE OF RHINELAND-PALATINATE, GERMANY

16 SEE GTZ, 2007, AND RENEWABLES MADE IN GERMANY, AS OF 2007

The private sector, which has been more or less inactive so far, is eventually emerging and starting to participate. A number of players in both thermal and PV are setting themselves up and some have already started to offer these services in isolated cases. The MININFRA is keen to assist such private initiatives in staff capacity building and other promotional logistics.

Solar Electric Light Fund (SELF) has installed solar diesel hybrid systems for the communities of Mulindi, Rusumo, Rukira, Nyarabuye and Kirehe. SELF was approached by Columbia University's Mailman School of Public Health to carry out the solar electrification of clinics run by the School's International Center for AIDS Care and Treatment programs. Through this collaboration, there are now 15 additional health centers enjoying the benefits of a solar-diesel hybrid power station in the country's North and West (4 kWp each), with a total capacity of 60 kWp.

Through the ACP-EU Energy Facility, solar PV systems shall electrify 25 % of the currently non-electrified institutions such as health centers, schools and public offices, covering 350 institutions in 150 of Rwanda's 419 sectors.

SHORT BUSINESS INFO

- The 250 kWp grid-connected PV Kigali Solaire Plant was put in operation by Stadtwerke Mainz.
- Training for solar technicians is carried out as PPP with Stadtwerke Mainz and GTZ (on behalf of German Development Cooperation).
- 15 PV diesel hybrid systems for clinics (4 kWp each) were installed by SELF.
- ACP-EU Energy Facility is operational from 2009 with grants for PV systems in schools and clinics.

4.3 WIND POWER

In collaboration with the Belgian Government, a wind regime study is projected to develop a wind atlas in the country. A contract has been awarded to an international company to install wind metering equipment at a limited number of points with the highest potential in the country. It is expected that the first results of these measurements will be available by mid-2010.

4.4 GEOTHERMAL POWER

The investigation of geothermal energy is still in its preliminary stage. Currently, the northern region (Virunga geothermal prospect) is under investigation carried out jointly by GoR and the German Government organization of BGR. Further investigation is to follow for the southern section (Bugarama). The French bureau BRGM (Bureau de Recherche Géologique et Minière) has estimated the geothermal energy potential between 170 and 300 MW, based on the preliminary work carried out at geothermal springs in the northwestern part of the country.

In 2006, the US company of Chevron confirmed the results of BRGM. In June 2007, MININFRA submitted a proposal to BGR. Project activities started in November 2007.
So far, the Virunga geothermal prospect has been assessed by structural analysis via aerial photographs and satellite images.

In addition, a detailed geothermal sampling campaign and geophysical surveys are being conducted by BGR and Ken Gen from Kenya. Expected activities for 2009 are additional gas measurements and further geophysical studies. The first phase of the geo-scientific assessment will be completed in June 2009.

The ministry furthermore has plans to begin geothermal exploratory drilling of appraisal wells once the best locations have been selected, and is set to identify prospective investors.

SHORT BUSINESS INFO

- A potential of 170 to 300 MW has been identified is estimated by BRGM (as of 1984) and Chevron (as of 2006).
- A detailed assessment by BGR is currently ongoing.
- GoR is seeking for investors.

RE Business Opportunity

4.5 HYDRO POWER

Small Hydro Power

A study conducted in 2007 with the support of the Belgian Government identified 333 potential sites for smaller hydro power stations, 125 located in the Western Province, 115 in the Southern Province, 92 in the Northern Province and 13 in the Eastern Province. As only very few of these sites are being exploited so far, this condition provides good investment opportunities. The country has 23 lakes and numerous rivers, and the technical potential for small hydro power stations is estimated at 10 MW, which would provide more than 40,000 households with electricity. The tributaries within the upper Kagera river catchment area offer particularly good prospects for hydro development, especially the Mukungwa, Nyabarongo, Rukarara and Akanyaru rivers in the West. Further projects could be built on the Ruzizi river, where a water head of approximately 664 m is available over a relatively short distance along the East Africa Rift. International agreements would be necessary to start such initiatives.

The Government is constructing a hydroelectric dam at Rukarara with a capacity of 9.5 MW and operational in 2009. Moreover, through cooperation with GTZ on behalf of the German Government, BTC, UNIDO, World Bank, AfDB and Private Partnership Program, 21 micro hydro power stations in various places financed under different schemes are under construction and are expected to generate 10 MW in 2009. Eight micro hydro plants financed by the Government are currently being constructed by the Sri-Lankan company of Hydro Power International Ltd. The sites are: Rugezi, Mukungwa II, Janja, Gashashi, Nyabahanga, Nyirabuhombohombo, Nshili I and Ruhwa. Construction works on these sites will be completed by the second half of 2009.

To ensure the sustainability of micro hydro power businesses through private sector participation, the GoR with financial support from the Dutch Directorate-General for International Cooperation (DGIS) and through GTZ initiated a project (as part of the international Energizing Development Program) consisting of the construction of the 6 micro hydro power plants. The program finances 50 % of the total cost, and the private developers cover the remaining 50 % through their own equity and loan from financing institutions. They are getting technical assistance from GTZ who are advising the project developers in financial as well as engineering aspects. These 6 projects are expected to deliver a total of 1.5 MW by 2010.

Through an UNIDO/GoR partnership, 4 micro hydro power plants are being constructed while the construction of three micro hydro stations (Keya, Nkora and Cyimbiri) is ongoing in partnership with CTB. These projects are expected to yield 1.8 MW by the year 2009.

Rural electrification through micro hydro power production is being developed by the ACP-EU Energy Facility with a budget of 10 million €. 50 % of the construction costs for a total production capacity of 3 MW have been secured for 5–10 different sites. As financing has already been approved, project development is currently under way with the necessary feasibility studies to be conducted for tendering the construction contracts. It is expected that the power plants will be operational also by 2010.[17]

Large Hydro Power

The construction of the 27,5 MW Rukarara hydro dam, financed through domestic resources and with credit from the Indian Government banks, is ongoing and almost on track. Power output is expected by the end of 2009. The negotiations with an Indian company for the building of the Nyabarongo hydro power plant are being finalized. The EXIM Bank (Export and Import Bank in India) will provide a portion of the financing through a grant. The Government will also invest own sources through direct funding of the project by taking a commercial loan. The total cost will be 126 million USD.

Some larger regional projects are being designed on the borders of Rwanda (Rusumo, Rusizi III and IV) and can only be developed from 2012 onwards.

SHORT BUSINESS INFO

- 333 potential sites identified in the country
- 3 MW for rural electrification under ACP-EU Energy Facility as PPP with 50 % investment funds
- Supply of 7,000 households and 350 small businesses in rural areas under DGIS/GTZ
- 21 micro hydro stations (with total 10 MW as PPP)

4.6 METHANE GAS

There is a high level of exploitable methane gas in Lake Kivu that can serve the country for a whole century. Lake Kivu is estimated to have over 55 billion m^3 of methane gas of which 29 billion are economically exploitable. Such reserves are located at a depth of approximately 300 m. This resource is renewable at the rate of 100 to 150 billion m^3 per year as far as the large-scale exploitation of this resource is concerned. GoR is in negotiations with a number of parties to produce methane from the lake at an initial development of 35 MW.

It is expected that the cost of generation from the Lake Kivu IPP will be about 0.04–0.05 € Cent/kWh (as compared to current diesel generation cost of 0.17 € Cent/kWh), thereby dramatically lowering the overall costs of power generation.

17 SEE EUROPEAN COMMISSION – EC, AS OF 2009

Switching to the proposed Lake Kivu IPP will also improve the reliability and stability of power.

The pilot plant of Kibuye Stage 1 (KP1) has a capacity of 4.5 MW. The project experienced considerable delays due to technical setbacks and the dispute with Dane Associates Ltd., an Israeli-Norwegian group. Since the end of November 2008, the plant has been producing 1.5 MW of methane gas. Furthermore, Rwanda Investment Group (RIG) has been granted a gas concession of 50 MW. So far, it has two pilot projects under development (totaling around 7.5 MW) expected to be commissioned in March 2009. RIG, GoR and the Industrial Promotion Service (IPS), part of the Agakhan Fund for Economic Development (AKFED), decided to join forces and form a consortium for a 100 MW project. Negotiations with an American investor (Contour Global) for the gas concession and the Power Purchase Agreement (PPA) have been completed early 2009. The investor Contour Global wishes to develop a 100 MW methane gas to power plant, starting with a first phase of 25 MW with equity funding. The Government has embarked on a monitoring program in partnership with the Democratic Republic of Congo. A Memorandum of Understanding (MoU) was signed between the two governments for the monitoring of the stability of Lake Kivu.

SHORT BUSINESS INFO

- 29 billion m^3 are economically exploitable in 300 m depth.
- Rwanda Investment Group (RIG) holds a 50 MW gas concession.
- KP1 pilot project of 4.5 MW is in operation since May 2008.

4.7 PEAT

There are several sites with peat reserves in Rwanda. The total amount of exploitable dry peat reserves is currently estimated at 155 million tons . Due to technical and economic difficulties and possible environmental impacts, however, there has been very little exploitation of peat yet. The Office of Geology and Mines in Rwanda (OGMR) mines peat in Rwabusoro on behalf of the MININFRA, while a concession has been given to ENEDOM, a local company, to mine peat in Rulindo. The Government is considering the use of peat for electricity generation and has invited potential investors to come forward for power plants of 25–50 MW capacity.

5 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

5.1 RENEWABLE ENERGY COMPANIES & BUSINESS RELATED ORGANIZATIONS

The following list shows RE companies and other business related organizations in Rwanda. None of the companies is manufacturing RE related products. There are also a number of companies involved in consultancy and research on the development of RE technology.

COMPANY	SUB-SECTOR	ADDRESS	EXPERIENCE IN RE	PHONE	E-MAIL/WEBSITE
(ABC-R) Africa Business Consulting Rwanda	Wind, solar, hydro, bioenergy	/	/	Phone: +250 (0)8803665/ 08302323	jbmirira@yahoo.fr
Coopérative pour l'Environnement et le Développement au Rwanda (COOPED)	Bioenergy	/	Established in 1999 as a waste collection company; has now expanded to produce bioenergy	Phone: +250 (0)8508290-55101070	bupaulin@yahoo.fr
Rwanda Import Export (RIEX)	Micro Hydro Power, solar	P.O. Box 6165 Kigali – Rwanda	In final stage of implementing a micro hydro power plant project	Phone: +250 (0)8302845	gtayi@hotmail.com
Africa Business (AFRIBUS)	Established as an ICT company; has now expanded to include micro hydro and solar	P.O. Box 1253 Kigali – Rwanda	In the final stage of implementing a project to build a micro hydro power plant on river Masige in Kibuye	Phone: +250 (0)8305299-55101691	gilkal@yahoo.fr
Société de Transformation Industrielle de Ruhengeri (SOTIRU)	Micro hydro	/	Constructing a micro hydro power plant on Mpenge river to cater for the factory's power needs; has already experience in mini power plant management	Phone: +250 (0)8307455	sotiru1@yahoo.com
SOGEMER s.a.r.l.	Micro hydro	/	Currently constructing a 425 KW power plant on Musarara River in Gakenke District under the PSP Program	Phone: +250 (0)842 1191	hakundajmv@yahoo.fr
Groupe de Travail Ruraue (GTR)	Construction, distribution, commercialization of electricity to local population	P.O. Box 6445 Kigali – Rwanda	In the final phase of starting the construction of a 120 KW mini hydro power plant on River Mpenge Musanze	Phone: +250 (0)861 1946	mutag1@yahoo.com

COMPANY	SUB-SECTOR	ADDRESS	EXPERIENCE IN RE	PHONE	E-MAIL/WEBSITE
Association pour le Développement de Nyabimata (ADENYA a.s.b.l) Nyaruguru Southern Province	Micro hydro for rural electrification	P. O Box 226 Butare – Rwanda	Constructing a 250 KW micro power plant at Mazimeru river in Nyaruguru District under the PSP program through its affiliate company Energie Nyaruguru	Phone: +250 (0)842 1911	firmin_mutabazi@yahoo.fr
Rural Energy Solutions (RES)	Micro hydro power	/	Constructing a 110 KW micro hydro power plant on River Kavumu MWange river in Gicumbi District under PSP Program	Phone: +250 (0)877 1385	edkato2000@yahoo.co.uk
Énergie Domestique (ENEDOM)	Bioenergy	P.O. Box 339 Nyarugenge – Muhima	Established in 2000 for purposes of manufacturing briquettes from waste materials using funds secured from UNDP and Swiss embassy. Full-scale operation of the briquetting process started in 2001.	Phone: +250 8501309	enedom@yahoo.fr
Biomass Renewable Energy Rwanda (BRER)	Promotion of biomass technology	/	Building a 600 KW bioenergy plant at the BRALIRWA plant in Rubavu	Phone: +250 (0)8304031-05106636	atkanyo@yahoo.com
Construction and Renewable Energy Technologies (CRET s.a.r.l.)	Promotion of biofuel and biogas from organic waste	P.O. Box 1437 Kigali - Rwanda	Started operations in the field of construction and biogas technology. Design and construction of 60 m³ biogas plant at St. Gabriel Monastery, Nyarugenge. Don Bosco Secondary School in Gatsibo and 21 others are under construction	Phone: +250 (0)8561340-05102712	cret06_sarl@yahoo.fr
AFRISET/HYGEBAD	Bioenergy and solar	/	Exploitation of the existing potentials in RE to provide alternative energy solutions	Phone: +250 8300327	afriset1@yahoo.fr
Rwanda Energy Company (REC)	Exploitation of methane gas	/	It has contracted the French Datat Environment Company and the German/Belgian group of Global Power Systems to carry out a 7.5 MW power project with Methane from Lake Kivu; project is expected to be commissioned in March 2009	Phone: +250 8303959	ivan.twagirashema@gmail.com,itwagirishema@rig.co.rw
Kibuye Power Ltd.	Methane gas	/	KP1 pilot project of 4.5 MW commissioned in May 2008	Phone: +250 (0)8304499,58062/63	akabuto@yahoo.fr
Rwanda investment Group (RIG s.a.r.l.)	Association of Rwanda's business acumens	/	Currently in consortium with GoR and IPS to exploit methane gas from Lake Kivu	Phone: +250 8301452	fbirasa@yahoo.fr,fbirasa@rig.co.rw
CRE	Production of bioenergy	/	/	Phone: +250 8305836	mikemunya@hotmail.com
AHIG	Promotion of bioenergy	/	/	Phone: +250 8304001	Ahig_rw@yahoo.com
Modern Technologies Services (MTS) s.a.r.l.	Hydro, solar	/	/	Phone: +250 8352222	muluart@gmail.com
GIC	/	/	Production of biogas, pollution reduction and environmental protection by lowering firewood consumption	Phone: +250 8450078	nyiragnes@yahoo.fr
SEFIK	Solar, micro hydro and wind	/	Sale and installation of solar equipment	Phone: +250 8303426	b_assum@yahoo.fr
Bureau des Formations Medicales Agrées du Rwanda (BUFMAR).	Installation and maintenance of electricity by solar energy in rural areas	P.O. B 716 Kigali –Rwanda	Installation of solar equipment since 1975	Phone: +250 8300306	Erwagasana@hotmail.com
SOS Energy	Sale and installation of solar equipment	/	Not operating	Phone: +250 8301780	sosenergierw@yahoo.fr
Rural Energy Production (REPRO)	Electricity power production, especially for rural areas	P.O. Box 5155 Kigali – Rwanda	Currently constructing a micro hydro plant on R. Rwishwa in Murunda, Kamonyi District	Phone: +250 8646404	ngobro@hotmail.com
SNV	/	P.O. Box 1049 Kigali –Rwanda	Dutch organization with 25 years of experience in Rwanda; carries out advisory services to develop a viable biogas sector	Phone: +250-504121	www.snvworld.org/en/Pages/default.aspx
Industrial Promotion Service (IPS)	Part of Agakhan Fund for Economic Development (AKFED)	/	Has formed consortium with Rwandan Government and RIG to exploit methane gas form lake KIVU	Phone: +41 22 909 7200 Fax: +4122 9097292	/
(ABC-R) Africa Business Consulting Rwanda	Wind, solar, hydro, bioenergy	/	/	Phone: +250 (0)8803665/08302323	jbmirira@yahoo.fr
Coopérative pour l'Environnement et le Dévelop-pement au Rwanda (COOPED)	Bioenergy	/	Established in 1999 as a waste collection company; has now expanded to produce bioenergy	Phone: +250 (0)8508290-55101070	bupaulin@yahoo.fr
Rwanda Import Export (RIEX)	Micro hydro power, solar	P.O. Box 6165 Kigali - Rwanda	In final stage of implementing a micro hydro power plant project	Phone: +250 (0)8302845	gtayi@hotmail.com
Africa Business (AFRIBUS)	Established as an ICT company; has now expanded to include micro hydro and solar	P.O. Box 1253 Kigali –Rwanda	In the final stage of implementing a project to build a micro hydro power plant on river Masige in Kibuye	Phone: +250 (0)8305299-55101691	gilkal@yahoo.fr

COMPANY	SUB-SECTOR	ADDRESS	EXPERIENCE IN RE	PHONE	E-MAIL / WEBSITE
Société de Transformation Industrielle de Ruhengeri (SOTIRU)	Micro hydro	/	Constructing a micro hydro power plant on Mpenge river to cater for the factory's power needs; has already experience in mini power plant management	Phone: +250 (0)8307455	sotiru1@yahoo.com
SOGEMER s.a.r.l.	Micro hydro	/	Currently constructing a 425 KW power plant on Musarara River in Gakenke District under the PSP Program	Phone: +250 (0)842 1191	hakundajmv@yahoo.fr
Groupe de Travail Ruraue (GTR)	Construction, distribution, commercialization of electricity to local population	P.O. Box 6445 Kigali –Rwanda	In the final phase of starting the construction of a 120 KW mini hydro power plant on River Mpenge Musanze	Phone: +250 (0)861 1946	mutag1@yahoo.com
Association pour le Développement de Nyabimata (ADENYA a.s.b.l) Nyaruguru Southern Province	Micro hydro for rural electrification	P. O Box 226 Butare – Rwanda	Constructing a 250 KW micro power plant at Mazimeru river in Nyaruguru District under the PSP program through its affiliate company Energie Nyaruguru	Phone: +250 (0)842 1911	firmin_mutabazi@yahoo.fr
Rural Energy Solutions (RES)	Micro hydro power	/	Constructing a 110 KW micro hydro power plant on River Kavumu MWange river in Gicumbi District under PSP Program	Phone: +250 (0)877 1385	edkato2000@yahoo.co.uk
Énergie Domestique (ENEDOM)	Bioenergy	P.O. Box 339 Nyarugenge – Muhima	Established in 2000 for purposes of manufacturing briquettes from waste materials using funds secured from UNDP and Swiss embassy. Full-scale operation of the briquetting process started in 2001.	Phone: +250 8501309	enedom@yahoo.fr
Biomass Renewable Energy Rwanda (BRER)	Promotion of biomass technology	/	Building a 600 KW bioenergy plant at the BRALIRWA plant in Rubavu	Phone: +250 (0)8304031-05106636	atkanyo@yahoo.com
Construction and Renewable Energy Technologies (CRET s.a.r.l.)	Promotion of biofuel and biogas from organic waste	P.O. Box 1437 Kigali – Rwanda	Started operations in the field of construction and biogas technology. Design and construction of 60 m^3 biogas plant at St. Gabriel Monastery, Nyarugenge. Don Bosco Secondary School in Gatsibo and 21 others are under construction	Phone: +250 (0)8561340-05102712	cret06_sarl@yahoo.fr
AFRISET/HYGEBAD	Bioenergy and solar	/	Exploitation of the existing potentials in RE to provide alternative energy solutions	Phone: +250 8300327	afriset1@yahoo.fr
Rwanda Energy Company (REC)	Exploitation of methane gas	/	It has contracted the French Datat Environment Company and the German/Belgian group of Global Power Systems to carry out a 7.5 MW power project with Methane from Lake Kivu; project is expected to be commissioned in March 2009	Phone: +250 8303959	ivan.twagirashema@gmail.com,itwagirishema@rig.co.rw
Kibuye Power Ltd.	Methane gas	/	KP1 pilot project of 4.5 MW commissioned in May 2008	Phone: +250 (0)8304499,58062/63	akabuto@yahoo.fr
Rwanda investment Group (RIG s.a.r.l.)	Association of Rwanda's business acumens	/	Currently in consortium with GoR and IPS to exploit methane gas from Lake Kivu	Phone: +250 8301452	fbirasa@yahoo.fr,fbirasa@rig.co.rw
CRE	Production of bioenergy	/	/	Phone: +250 8305836	mikemunya@hotmail.com
AHIG	Promotion of bioenergy	/	/	Phone: +250 8304001	Ahig_rw@yahoo.com
Modern Technologies Services (MTS) s.a.r.l.	Hydro, solar	/	/	Phone: +250 8352222	muluart@gmail.com
GIC	/	/	Production of biogas, pollution reduction and environmental protection by lowering firewood consumption	Phone: +250 8450078	nyiragnes@yahoo.fr
SEFIK	Solar, micro hydro and wind	/	Sale and installation of solar equipment	Phone: +250 8303426	b_assum@yahoo.fr
Bureau des Formations Medicales Agrées du Rwanda (BUFMAR).	Installation and maintenance of electricity by solar energy in rural areas	P.O. B 716 Kigali –Rwanda	Installation of solar equipment since 1975	Phone: +250 8300306	Erwagasana@hotmail.com
SOS Energy	Sale and installation of solar equipment	/	Not operating	Phone: +250 8301780	sosenergierw@yahoo.fr
Rural Energy Production (REPRO)	Electricity power production, especially for rural areas	P.O. Box 5155 Kigali – Rwanda	Currently constructing a micro hydro plant on R. Rwishwa in Murunda, Kamonyi District	Phone: +250 8646404	ngobro@hotmail.com
SNV	/	P.O. Box 1049 Kigali –Rwanda	Dutch organization with 25 years of experience in Rwanda; carries out advisory services to develop a viable biogas sector	Phone: +250-504121	www.snvworld.org/en/Pages/default.aspx
Industrial Promotion Service (IPS)	Part of Agakhan Fund for Economic Development (AKFED)	/	Has formed consortium with Rwandan Government and RIG to exploit methane gas form lake KIVU	Phone: +41 22 909 7200 Fax: +4122 9097292	/

5.2 LOCAL BUSINESS-RELATED INSTITUTIONS

NAME	ADDRESS	PROFILE	ROLE
Kigali Institute of Science and Technology (KIST)	P.O. Box 3900 Kigali – Rwanda	KIST was established through the combined efforts of Rwanda's Ministry of Education, UNDP Rwanda and the German Technical Cooperation Agency (GTZ) as the implementing agency.	The institute equips students with advanced skills and hands-on training and promotes research on energy, environment and other disciplines. It has established a center for innovation and technology transfer between various disciplines including RE.
The Institute of Scientific and Technological Research (IRST)	P.O. Box 227 Butare – Rwanda Phone: +250 530395	The institute was established within the framework of research restructuring in Rwanda. Its innovative technologies help the Rwandan population to solve their socio-economical problems.	The institute specializes in research activities in energy (peat, solar, hydro electric micro central).
National University of Rwanda	P.O. Box:117 Butare – Rwanda Phone: +(250) 30122	The university was established in 1963 by the Government in cooperation with Quebec and focuses on science, technology and humanity science.	The university generates and disseminates high-quality multidisciplinary knowledge and promotes effective research, skills training and community service for sustainable socio-economic development .

6 BIBLIOGRAPHY

- BBC (2006): Rwanda Fired up by Methane Plans, (http://news.bbc.co.uk/1/hi/world/africa/4698278.stm)
- Butare A. (2008): Concentrated Effort to Spur Economic Growth and Integrated Development – the Perspective form the Energy Sector, (http://web.univ-pau.fr/~scholle/ecosystemes/2-dev/24-rwa/24-pg-en.htm)
- Central Intelligence Agency- CIA (2009): World Fact Book - Rwanda (www.cia.gov/library/publications/the-world-factbook/geos/rw.html, viewed December 2009)
- Dekeler, G. et al. (2005): Report on the Feasibility Study for a Biogas Program in the Republic of Rwanda
- EAC (2006): EAC Development Strategy 2006–2010 – Deepening and Accelerating Integration (www.eac.int/about-eac/quick-links/unido-norad-programme/doc_download/159-eac-development-strategy-2006-2010.html)
- European Commission – EC (2009): ACP-EU Energy Facility – First Energy Facility (http://ec.europa.eu/europe-aid/where/acp/regional-cooperation/energy/energy-facility-former-calls/former_calls_en.htm; viewed in December 2009)
- Gatare, F. K. / Representative of H.E the President to NEPAD (2005): NEPAD Implementation in Rwanda. A Concept Paper: Rwanda at the Forefront of NEPAD Implementation – four years after adoption, December 2005 (www.nepad.gov.rw/docs/NEPAD_in_Rwanda_DPM_2005.pdf)
- GTZ (2007): Ruanda – Sonnenstrahlen für die Wirtschaft (www.gtz.de/de/aktuell/20217.htm)
- International Chamber of Commerce – ICC (without year): Investment Guide Kenya, Uganda, Tanzania, Rwanda (www.iccwbo.org/policy/trade/id9089/index.html)
- MINCOFIN (without year): Economic Development and Poverty Reduction Strategy Paper 2008–2012
- MINECOFIN (2000): Rwanda Vision 2020 (www.nur.ac.rw/IMG/pdf/Vision_2020.pdf)
- MINICOFIN (2007): National Budget for fiscal Year 2008/2009
- MININFRA (2009): Current Electricity Generation Capacity (http://mininfra.gov.rw/index.php?option=com_content&task=view&id=114&Itemid=142)
- MINNFRA (2007): Information Package on Investment Opportunities in the Energy Sector
- Poverty Environment Initiative Rwanda (2006): Mainstreaming Environment in Energy – Strategies to Address Poverty in Rwanda, Concept Note by Sustainable Energy Africa, (www.unpei.org/PDF/Rwanda-Mainstreaming-env-energy-stras.pdf)
- Renewables Made in Germany (2007): Das größte Solarkraftwerk Afrikas ist in Kigali, der Hauptstadt von Ruanda, ans Netz gegangen (www.german-renewable-energy.com/Renewables/Navigation/Englisch/Solarenergie/case-studies,did=222930.html)
- Republic of Rwanda (2005): Law No. 26/2005 of 17 December 2005 Relating To Investment and Export Promotion and Facilitation, Official Gazette of the Republic of Rwanda (www.rwandainvest.com/pdfs/investment_code.pdf)
- Republic of Rwanda (2006): Law Determining the State Finances for the 2007 Fiscal Year with Other Fiscal Laws, Official Gazette of the Republic of Rwanda (www.primature.gov.rw/index2.php?option=com_docman&task=doc_view&gid=349&Itemid=95)
- Republic of Rwanda (2009): Government Sets Eyes on Alternative Energy (www.gov.rw/sub.php?page=print&id_article=22)
- Republic of Rwanda, National Census Commission (2004): 3rd Census of Population and Housing of Rwanda, Census 2002 in Brief
- Republic of Rwanda/ MINECOFIN (2002): Privatization Secretariat. Energy & Water (www.privatisation.gov.rw/documents/energy_water_e.pdf)
- Republic of Rwanda/ MININFRA (2004): Energy policy for Rwanda – Final. October 2004 (http://www.upegaz.gov.rw/Rwanda___Energy_Policy_for_Rwanda__final____10_2004__W0695884_.DOC)
- Rural Poverty Portal (2009): Rural poverty in Rwanda (www.ruralpovertyportal.org/english/regions/africa/rwa/agriculture_in_rwanda/CDRom/reports/donors/investmentO.doc)

- Rwanda Investment and Export Promotion Agency – RIEPA (2008): RIG Investments Grow to 25.1 Million USD (www.rwandainvest.com/spip.php?article559)
- Rwanda Investment and Export Promotion Agency – RIEPA (2009): Various reports (www.rwandainvest.com)
- Stadtwerke Mainz (2007): PV Microfinancing Rwanda 2007 – Market Analysis Study as Part of a PPP Cooperation Project between Stadtwerke Mainz and GTZ (available on request at Stadtwerke Mainz and GTZ)
- Theodora.com (2009): Rwanda Economy 2009 (www.theodora.com/wfbcurrent/rwanda/rwanda_economy.html)
- UNDP (2008): 2007/2008 Human Development Report, Rwanda, HDI Rank 161 (http://hdrstats.undp.org/countries/data_sheets/cty_ds_RWA.html)
- UNDP, Rwanda (2009): Energy and Environment (www.undp.org.rw/Energy_and_Environment.html)
- UNFCCC (2009): Rwanda Electrogaz Compact Fluorescent Lamp (CFL) Distribution Project (http://cdm.unfccc.int/Projects/Validation/DB/26PMKJ754ZO5ISWE8AWM5HC6HSY49K/view.html)
- World Bank/ Watkins, A./ Verma, A. (2008): Building Science, Technology and Innovation Capacity in Rwanda. Developing Practical Solutions to Practical Problems (http://siteresources.worldbank.org/EDUCATION/Resources/278200-1099079877269/547664-1099079975330/Building_STIcapacity_Rwanda.pdf)

Websites

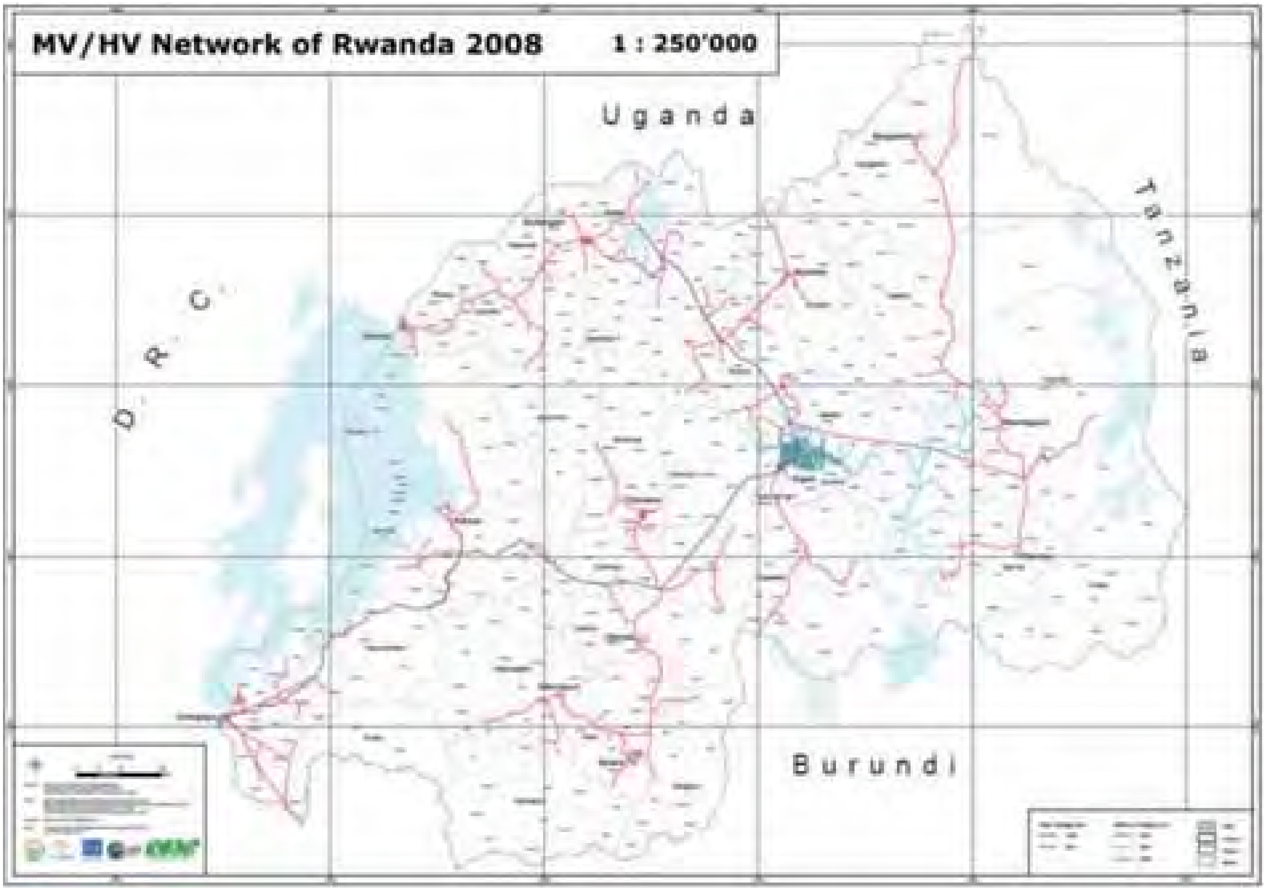
- www.minaffet.gov.rw/magazine/investment-conference.pdf
- www.unctad.org/Templates/StartPage.asp?intItemID=2068
- Rwanda Development Gateway (www.rwandagateway.org/article.24)
- UNIDO (2002): (www.unido.org/file-storage/download/?file_id=8285)
- Worldbank / Rwanda http://siteresources.worldbank.org/INTPSIA/Resources/4900231120841262639/ch7_rwanda.pdf
- MINITERE (www.minitere.gov.rw)
- www.globalregulatorynetwork.org/files/PDFs/RwandaTariffReport.pdf, viewed in November 2009
- Manna Energy Foundation. Powering Social Enterprise (www.mannaenergy.org)
- UPEGAZ (www.upegaz.gov.rw)
- De Lorenzo, M./ American Enterprise Institute for Public Policy Research (2008): The Rwandan Paradox (www.aei.org/article/27476)

7 ANNEX

7.1 COUNTRY MAP OF RWANDA

Source: Institute National de la Statistique du Rwanda, Décembre 2005

7.2 MAP OF THE NATIONAL ELECTRICITY GRID

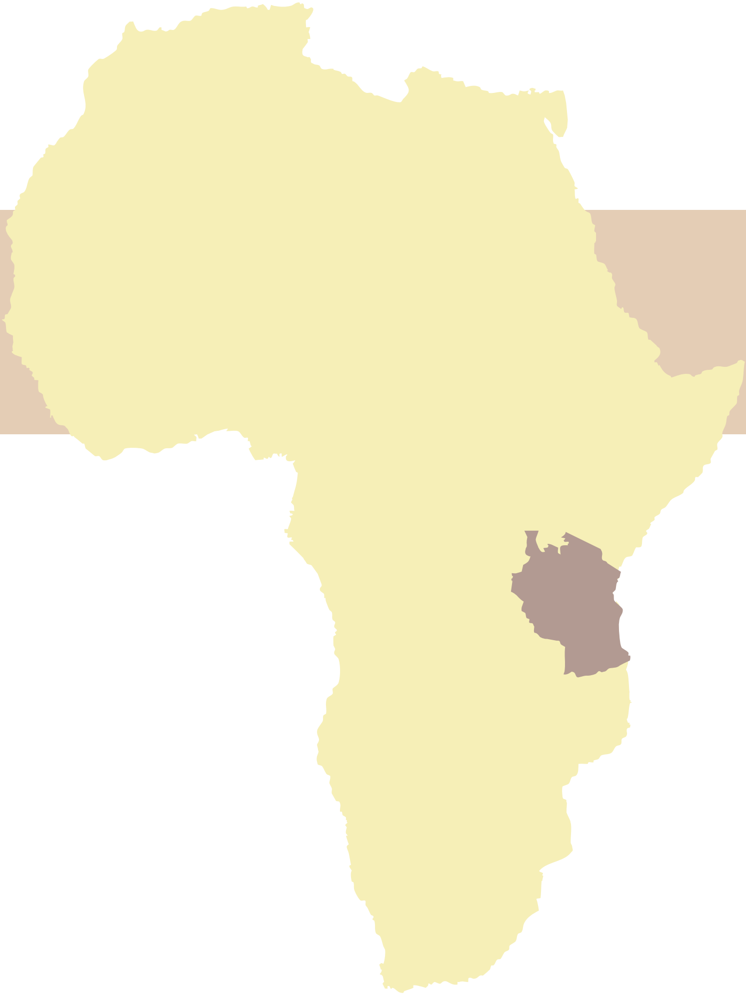


Source: BTC-CTB/CGIS-NUR, as of 2008

7.3 SHARE OF LOCAL AND IMPORTED ENERGY SOURCES

LOCAL ENERGY SOURCES		2002	2003	2004	2005	2006	2007
Type of power	Power plant	Net gen. (GWh)	Net gen. (GWh)	Net gen. (GWh)	Net gen. (GWh)	Net gen (GWh)	Net gen. (GWh)
Hydro	GIHIRA	6.91	6.57	5.55	5.91	5.91	5.95
Hydro	GISENYI	5.70	4.78	4.54	4.38	3.81	4.53
Hydro	MUKUNGWA	56.69	71.11	53.03	40.09	25.70	16.04
Hydro	NTARUKA	28.91	35.17	21.20	15.35	5.75	0.80
Hydro	**Total**	**98.21**	**117.64**	**84.32**	**65.73**	**41.17**	**27.32**
Diesel/light fuel oil	Jabana	0.00	0.00	3.59	25.40	19.24	9.47
Diesel/light fuel oil	Gatsata (old plant)	0.00	0.00	0.00	0.00	0.00	0.00
Diesel/light fuel oil	Gatsata (new)	0.00	0.00	2.66	14.08	1.18	1.93
Diesel/light fuel oil	Gikondo	0.00	0.00	0.00	10.66	82.26	66.22
Diesel/light fuel oil	Mukugwa	0.00	0.00	0.00	0.00	24.72	33.85
Diesel/light fuel oil	**Total**	**0.00**	**0.00**	**6.26**	**50.14**	**127.40**	**111.47**
Biomass		12,240.00	12,290.00	12,341.00	12,391.00	12,442.00	12,492.00
Solar	JARI	0.00	0.00	0.00	0.00	0.00	2.00
Total energy produced locally		12,338.21	12,407.64	12,410.38	12,506.84	12,610.87	12,632.79
Imported energy sources							
Hydro Power							
Import of power	RUSIZI 1/SINELAC	7.44	2.52	20.09	20.89	36.45	15.06
Import of power	GOMA SNEL/DRC	0.00	0.00	0.10	0.00	0.00	0.00
Import of power	RUSIZI II/SINELAC	126.74	116.06	91.42	64.56	40.78	53.62
Import of power	KABALE/UGANDA	1.52	2.33	4.19	3.59	2.79	0.66
Import of power	Total	135.69	120.92	115.81	89.05	80.02	69.34
Oil		2,498.00	2,498.00	2,498.00	2,498.00	2,498.00	2,498.00
Total imported energy		2,633.69	2,618.92	2,613.81	2,587.05	2,578.02	2,567.34
Total energy (local and imported)		14,971.90	15,026.56	15,024.19	15,093.89	15,188.89	15,200.13
Energy imported to the total (%)		17.60	17.40	17.40	17.40	17.00	16.90

Source: unknown



COUNTRY CHAPTER: TANZANIA

Author of Country Chapter
Finias Magessa (Eng.)

Coordination and Review of the Country Chapter
Dipl. Phys. **Rafael Wiese**
PSE AG
Freiburg, Germany
www.pse.de

Editor
Deutsche Gesellschaft für Technische
Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic
Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS TANZANIA

ACRONYMS AND ABBREVIATIONS

TANZANIA

AfDB	African Development Bank
AREED	African Rural Energy Enterprises Development
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe (Federal Institute for Geosciences and Natural Resources)
BDS	Business Development Services
BEB	Bio-Energy Berlin GmbH
BP	British Petroleum
BRELA	Business Registration and Licensing Authority
CAMARTEC	Center for Agriculture Mechanization and Rural Technology
CDM	Clean Development Mechanism
CEO	Chief Executive Officer
CHP	Combined Heat and Power
CNG	Compressed Natural Gas
CoET	College of Engineering and Technology
COSTECH	Commission for Science and Technology
DIT	Dar es Salaam Institute of Technology
DNA	Designated National Authority
DRC	Democratic Republic of Congo
E&CO	Energy & Company (Enterprise for clean energy investments in developing countries)
DTP	Deutsch-Tansanische Partnerschaft
E+Co	Energy through Enterprise (international financing institution)
EE	Energy efficiency
ESAMI	Eastern and Southern Africa Management Institute
EU	European Union
EWURA	Energy and Water Utilities Regulatory Authority
FELISA	Farming for Energy for Better Livelihoods in Southern Africa
GDP	Gross Domestic Product
GEF	Global Environment Facility
GENI	Global Energy Network Institute
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation Agency)
HFO	Heavy Fuel Oil
IEA	International Energy Agency
ICSID	International Center for Settlement of Investment Disputes
ICT	Information Communication Technology
IIRT	International Investor's Round Table
IPPs	Independent Power Producers
IPTL	Independent Power Tanzania Ltd.
KAKUTE	Kampuni ya Kusambaza Teknolojia
KARADEA	Karagwe Development Association
LIRT	Local Investors' Round Table
LPG	Liquefied Petroleum Gas
MCC	Millennium Challenge Corporation
MEM	Ministry of Energy and Minerals
MFI	Microfinance Institutions
MIGA	Multilateral Investment Guarantee Agency
MIGESADO	Miradi ya Gesi ya Samadi Dodoma
MLVTC	Mafinga Lutheran Vocational Training Center
MRHP	Mwanza Rural Housing Project
NAPA	National Adaptation Program of Action
NEMC	National Environment Management Council
NEP	National Energy Policy
NG	Natural Gas
NGO	Non-governmental Organization
NORAD	Norwegian Development Agency
PDD	Project Design Document

PIN	Project Idea Note
PPA	Power Purchase Agreement
ProBEC	Program for Biomass Energy Conservation
PSMP	Power Sector Master Plan
PSOM	Programma Samenwerking Opkomende Markten (Program for Cooperation with Emerging Markets)
R&D	Research and Development
RE	Renewable Energy
REA	Rural Energy Agency
REB	Rural Energy Board
REDCOT	Renewable Energy Development Company Tanzania
REF	Rural Energy Fund
RES	Rural Energy Systems
SACCOS	Savings and Credit Cooperative Society
SEECO	Sustainable Energy and Environment Company
SGP	Small Grant Program
SIDA	Swedish International Development Agency
SIDO	Small Industries Development Organization
SSMP	Sustainable Solar Market Packages
SSPPA	Standardized Small Power Purchase Agreement
SUDERETA	Sustainable Development through Renewable Energy Tanzania
SUMATRA	Surface and Marine Transport Regulatory Authority
TANESCO	Tanzania Electric Supply Company
TANWAT	Tanzania Wattle Company
TASEA	Tanzania Solar Energy Association
TaTEDO	Tanzania Traditional Energy Development and Environment Organization
TAZARA	Tanzania Zambia Railway
TBS	Tanzania Bureau of Standards
TCCIA	Tanzania Chamber of Commerce, Industries and Trade
TCRA	Tanzania Communication Regulatory Authority
TDTC	Technology Development and Transfer Center
TEDAP	Tanzania Energy Development Access Program
TFC	Total Final Energy Consumption
TIC	Tanzania Investment Center
TIRDO	Tanzania Industries Research Development Organization
TPC	Tanzania Planting Corporation
TPDC	Tanzania Petroleum Development Corporation
TPES	Total Primary Energy Supply
TPSF	Tanzania Private Sector Foundation
TRA	Tanzania Revenue Authority
TZS	Tanzanian Shilling
UDSM	University of Dar es Salaam
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Program
UNIDO	United Nations Industries Development Organization
USD	United States Dollar
VAT	Value Added Tax
VETA	Vocational Education and Training Authority
WB	World Bank
ZASEA	Zanzibar Solar Energy Association

MEASUREMENTS

°C	degree Celsius
m^2	cubic meter
GWh	gigawatt hour
kg	kilogram
kgoe	kilogram of oil equivalent
km	kilometer
km^2	square kilometer
kWh	kilowatt hour
l	liter
m	meter
MW	megawatt
MWe	megawatt electrical
s	second
toe	tons of oil equivalent
Wp	Watt-peak (kWp = kilowatt peak)

SUMMARY

ECONOMICAL STATUS AND DEVELOPMENT OF TANZANIA

Tanzania is located at the Indian Ocean with Dar es Salaam as the country's commercial capital.

Agriculture is the dominant sector in Tanzania, providing livelihood, income and employment to over 80 % of the population. It accounted for 56 % of the Gross Domestic Product (GDP) and 60 % of export earnings in the past three years. It is also an important sector in terms of food production, employment generation, production of raw materials for industries and generation of foreign exchange. Poverty is one of the main problems affecting about 50 % of the households throughout the country and even more in rural areas[1]. The recently completed National Adaptation Program of Action (NAPA) is supposed to enable the country to further integrate adaptation issues in the development process. The program is focusing on high and shared growth, quality livelihood, peace, stability, unity, good governance, high-quality education and international competitiveness[2].

Gold, coffee and cashew nuts are the main export goods. The economy is growing steadily at a rate of about 6 % (as of 2006).

82 % of the population live in rural areas and are mainly engaged in subsistence agriculture. The GDP per capita is 1,400 USD. About 50 % of the population live below the poverty line, spending around one third of their income on energy products. Tanzania Development Vision 2025 aims at poverty alleviation by the year 2025.

STRUCTURE OF ENERGY SUPPLY IN TANZANIA

Tanzania's primary energy supply and consumption is dominated by biomass (90 %) followed by petroleum (7 %), gas (2 %) and hydro power (1 %)[3]. The majority of the population relies on biomass as fuel for cooking.

Electricity

Electricity is generated from six hydro power stations (591 MW) and thermal gas or oil fired power stations (658 MW). Tanzania also imports electricity from Uganda (8 MW) and Zambia (5 MW). The total capacity of 1,249 MW produced 4,156 GWh in 2008. In the last years, the share of Independent Power Producers (IPP) increased from 14 % (as of 2002) to 42 % (as of 2008) due to the increase in private electricity generation by thermal sources increased from 190 GWh to 1,58 GWh[4].

The electrification rate is at 10 % countywide with about 30 % of the urban population having access to the national grid, while in rural areas access stands at 2 %. The average per capita consumption is 82 kWh per year.

Oil

Oil exploration is being pursued by more than eleven companies, but so far no oil has been found. The nation imports all of its liquid fuel for an annual demand of about 1.8 million metric tons. Petroleum consumption by sector was at the following levels in 2006: transport 76 %, industry 10 % and residential use 13 %. Presently, Tanzania spends more than 190 billion USD per year on the importation of petroleum products equaling about 26 % of the country's total foreign currency earnings[5].

It is important to note that a number of exploration agreements for petroleum have been signed between the Government and oil exploring companies, namely Dodsal Hydrocarbon and Power of India (exploration of Ruvu area), Funguo Petroleum of Australia (exploration of western Songosongo area) and Hydrotanz of Mauritius (exploration of northern Mnazi Bay area).

STATUS OF RENEWABLE ENERGIES IN TANZANIA

Biomass

90 % of Tanzania's primary energy supply is covered by biomass as dominant source of energy with a per capita consumption of 1.13 m^2 per year. To reduce deforestation, improved efficiency stoves were introduced many years ago. Today, around 15,000 improved stoves are produced and sold per month in Tanzania. In addition, around 6,000 small residential biogas plants for cooking purpose are currently in operation[6].

The conversion of biomass into biofuels is currently under development with eight international companies having registered pilot projects. Moreover, a pilot biogas demonstration plant for electricity production is in operation.

Solar

The photovoltaic (PV) market in Tanzania has been developed via international programs in the recent years. The total installed PV capacity is around 1,8 MW, while the annual installation rate is at around 200 kWp per annum with rising tendency. Around 20 registered solar companies are currently benefiting from two PV promotion projects, the Swedish Development Agency (SIDA)/Ministry of Energy and Minerals (MEM) project and the United Nations Development Program (UNDP)/Global Energy Facility (GEF)/MEM project. In addition, residential PV systems of up to 100 Wp are subsidized at 2 USD per Wp by the Rural Energy Agency (REA) respectively the Rural Energy Fund (REF).

There are more than 300 technicians already trained for installation and after-sales service, but the distribution channels of the solar companies into the rural areas remain weak.

1 SEE ALSO UNITED REPUBLIC OF TANZANIA/VICE PRESIDENT'S OFFICE, AS OF 2007
2 SSN TANZANIA ADAPTATION TEAM, AS OF 2006
3 IEA, AS OF 2007
4 MINISTRY OF ENERGY AND MINERALS MEM, AS OF 2008
5 IEA, AS OF 2007
6 PROBEC, AS OF 2009

Hydro

Over the years, the power sector of Tanzania has been dominated by hydro power at 50–75 % of the electricity supply. To date, the development of new hydro power capacities still offers the main business opportunity in the power sector.

Of the available 315 MW of small hydro potential in Tanzania, only less than 8 MW have been exploited. Feasibility studies in seven regions were facilitated by MEM in 2006 and 2007 for further development.

Wind

The potential for wind energy was quantified by the East Africa Meteorological Department in 1975 for the entire region. Since the data were measured at an insufficient height of about 2 m, they are not reliable. No wind map exists for Tanzania so far.

Geothermal

A geological survey of Tanzania is being conducted since June 2006 by MEM and the Federal Institute for Geosciences and Natural Resources (BGR) of Germany. The estimated geothermal potential is about 600 MWe. Detailed surveys, however, are still required to quantify the available potential.

1 COUNTRY INTRODUCTION

1.1 TANZANIA OVERVIEW

The United Republic of Tanzania became a union of two sovereign states namely Tanganyika and Zanzibar on 26 April 1964. Tanzania borders Kenya and Uganda in the North and Rwanda, Burundi and Democratic Republic of Congo in the West. In the South, it borders Zambia, Malawi and Mozambique and in the East it the Indian Ocean.[7]

1.2 TANZANIA STATISTICS: GEOGRAPHY AND ECONOMICS

LAND AREA:	945,000 km^2 (Tanzania mainland 881,000 km^2, Zanzibar 2,000 km^2)
LOCATION:	Between longitudes 290 and 410 East and latitudes 10 and 120 South
POPULATION:	38.7 million (mainland 37.6, Zanzibar 1.1), growth rate 2.9 % (as of 2007)
ADMINISTRATIVE REGIONS:	26 administrative regions (21 are in the mainland and 5 in Zanzibar)
LANGUAGE	Swahili (common language) and English
CAPITAL CITY:	Dodoma region is the political capital city, located 309 km West of Dar es Salaam as commercial capital
POLITICAL:	Free of ideological confrontations, ethnic problems and labor disputes; center of economic and political stability in Sub-Saharan Africa; multiparty democracy was adopted in 1992 and has not disturbed the peaceful political climate; country is home of a number of refugee camps for neighboring countries in the region (e.g. Burundi, Rwanda, Democratic Republic of Congo)
ROLE IN EAST AFRICA:	Easy networking; it boarders the Indian Ocean, has three international airports and extensive road networks; is strategically positioned as a hub for most surrounding landlocked countries including Malawi, Zambia, Burundi, Rwanda and Uganda as well as Eastern DRC; other sea ports include Zanzibar, Tanga, and Mtwara; Dar es Salaam Port and the international airport present themselves as gateways into East and Central Africa thus rendering Tanzania a logical investment destination for investors; furthermore, Tanzania is home of the East African Community Secretariat in Arusha
POPULATION DENSITY:	41 inhabitants / km^2 (as of 2007)
SHARE URBAN/RURAL POPULATION:	Urban 18 % and rural 82 %
BIG CITIES AND POPULATION:	Dar es Salaam (2.5 million), MWanza (2.9 million), Mbeya (2.1 million), Arusha (1.3 million), Dodoma (1.7 million) and Tanga (1.6 million) (as of 2002)
CLIMATE:	Tropical climate; in highlands temperatures between 10° and 20°C for both cold and hot seasons; rest of the country has an average temperature of above 20°C; hottest period between November and February (25°–31°C); coldest period between May and August (15°C–20°C); two rainfall regimes over Tanzania: unimodal (December–April, experienced in southern, southwestern, central and western parts of the country) and bimodal (October–December; March–May, found towards the northern coast)
PHYSIOGRAPHIC REGIONS:	Islands and coastal plains to the East; inland saucer-shaped plateau; the highlands; Tanzania is also marked by the Great Rift Valley running from the North East of Africa through central Tanzania
ALTITUDE:	Main mountains include Mount Kilimanjaro (5,895 m), Mount Meru (4,566 m) and Mount Rungwe (2,960 m); others are the Uluguru Mountains (2,648 m), Rubeho Mountains (2,576 m), Livingstone Mountains (2,521 m), Mbizi Mountain (2,418 m), Mahari Mountain (2,373 m) and Usambara Mountains (2,300 m)
MAIN WATER BODIES:	Water surfaces cover 62,000 km^2 and include Lake Victoria, Nyasa, Tanganyika, Rukwa, Kitangiri, Eyasi and Manyara; Tanzania also borders the Indian Ocean with significant part of the coastline, islands and waters within its boundaries
FOREST AND WOODLANDS:	3.350 km^2
MINERALS:	Gold, diamonds, tanzanite and various other gemstones, natural gas, iron ore, coal, spring water, phosphates, soda ash and salt
WILDLIFE:	12 National Parks, the Ngorongoro Conservation Area, 13 game reserves, 38 game controlled areas and about 120 national cultural heritage sites
FORESTRY:	Non-reserved forest land (1,903.8 km^2), forest/woodlands with national parks etc. (200 km^2) and forest reserves (1,251.7 km^2)
FISHERY:	Practiced on the three large lakes, i.e. Victoria, Tanganyika and Nyasa, on Indian Ocean coastline, rivers and wetlands; potential yield of fish from natural waters is 730,000 metric tons annually; present catch is 350,000 metric tons
GDP – PER CAPITA (AT PURCHASING POWER PARITY):	TZS 399,873 (as of 2006); 1,296 USD (as of 2007)
GDP SECTORS:	Agriculture 45 %, industry 17 %, services 38 %
INFLATION RATE (CONSUMER PRICES):	7 % (as of 2007)
EXCHANGE RATE:	1 TZS = 0, 00053 € (as of 2009)
GDP GROWTH (2007):	6.2 %
POVERTY:	About 35 % of the population live below poverty line (as of 2007), out of which 35.7 % are unable to access all basic needs (including energy services; the poor spend 35 % of household income on energy; the better off spend only 14,45 %)
CORRUPTION PERCEPTIONS INDEX 2007 (TRANSPARENCY INTERNATIONAL):	Rank 94 out of 179
AGRICULTURE:	Tea, coffee, cotton, sisal, cashew nuts and horticulture
INDUSTRIES:	Cement, agro processing, mining, textile, refining and construction industry

7 A COUNTRY MAP FOR VISUALIZATION IS ATTACHED AS ANNEX 7.1.

TOTAL ENERGY CONSUMPTION:	22 million toe or 0.7 toe per capita (energy consumption in rural areas accounts for about 85 % of total national energy consumption)
ELECTRICITY – PRODUCTION:	4,156 GWh (as of 2007)
ELECTRICITY – CONSUMPTION:	3,288 GWh (as of 2007)
ELECTRIFICATION RATE:	urban 30 %, rural 2 %
PETROLEUM – CONSUMPTION:	1.45 million metric tonnes per annum (2005 est.)
OIL – PROVEN RESERVES:	45 million cubic metres (at Songo Songo and Mnazi Bay)
EXPORTS:	2.49 billion USD (as of 2008)
EXPORTS – COMMODITIES:	gold, diamond, gemstones, nickel, tea coffee, cotton, cashew nuts and horticultural products including cut flowers
EXPORTS – PARTNERS:	East African Community, SADC Countries, Europe, South Africa and East Asia
IMPORT – COMMODITIES:	5.901 billion USD (as of 2008)
IMPORT – PARTNERS:	EU (22 %), South Africa (14 %), China (8 %), Japan (7 %), UAE (7 %), Kenya (5 %)
TOURISM (2006):	622,000 arrivals; 950 million USD revenue

Source: data compiled by the author from different sources, e.g. CIA, as of 2009

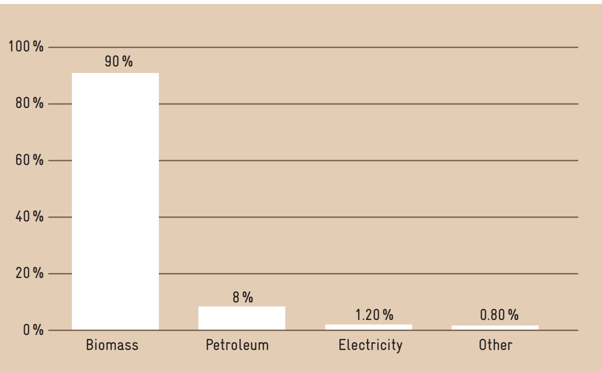
2 ENERGY MARKET IN TANZANIA

2.1 ENERGY SITUATION OVERVIEW

Similar to other East African countries, the majority of the population lives on biomass (90 %). The share of other energy sources is significantly lower with petroleum at 8 %, electricity at 1.2 % and others as solar, wind etc. at 0.8 %. Biomass is mainly used for cooking (primarily firewood and charcoal). Tanzania's energy demand and supply balance reflects the country's low level of industrialization and development. Tanzania has no known petroleum or crude oil resources. There are substantial gas deposits and some coal is found, but the majority of used resources still comes from renewable biomass and waste. Concerning its petroleum products, Tanzania is fully dependent on imports. Electricity is generated mainly from hydro power and thermal (gas) plants[8]. Further detailed information about supply, resources and consumption is given in annex 7.

FIGURE 1

Shares of Total Primary Energy Consumption in Uganda



Source: graph compiled by PSE AG with data from MEM (as of 2008) and from ProBEC, as of 2009

8 SEE IEA, AS OF 2007 AND 2007

9 NOTE: THIS NUMBER ONLY CONSIDERS THE DECOMMISSIONED DOWAN'S POWER PLANT AND THE AMOUNT OF POWER GENERATED UP TO JUNE 2008.

10 MAGESSA, 2008, P. 9.

11 THE MAJORITY OF HOUSEHOLDS USES WOOD OR CHARCOAL FOR COOKING; SEE ALSO PROBEC, VIEWED IN 2009

2.2 ENERGY CAPACITIES, PRODUCTION AND CONSUMPTION

The table below (Table 1) shows the overall performance of the electric power sector:

A significant portion of electric energy is produced by hydro power followed by gas as the second important electricity source. The total installed capacity (hydro and thermal) was about 1,186 MW in 2008[9]. Still, current hydro power resource exploitation is estimated at less than 13 % of the available potential[10]. The additional electricity demand is covered by small imports from Zambia and Uganda of around 2 % in 2006 and about 1 % in 2008.

The total electrification rate reached 10.8 % (as of 2008), of which urban electrification rate is around 30 % and the rural electrification rate only reaches 2 %. At the same time, 94 % of the rural population use biomass (such as wood or dung) as prior (non-electric) energy source. On household level, 12 % have access to the national grid, but only 1 % is able to use electricity for cooking[11]. This means that the vast majority of people have no access to electricity and the rural population is nearly completely excluded from this source of modern energy. Basically, the high costs of grid extension and connections as well as for the transport of petroleum products adversely impact on the pace of exploitation and extension of grid services especially to communities in rural areas. It costs more than 10,000 USD per kilometer to extend a high transmission line of 132 kW. The total number of customers connected to the grid is about 701,000. New connections are still limited to 3,255 connections per month. Regardless of connection bureaucracy at TANESCO, there are more than 100,000 applications for new connection per annum, which suggest an existence of a strong demand for the service[12].

Regarding the sectoral energy consumption in Tanzania, the industry sector accounts for 11 % of the final energy consumption. The highest consumption is covered by other sectors such as residential, commercial and public services, agriculture etc. (83 %)[13].

12 MAGESSA, 2008, P. 9–10 AND TANESCO, 2008

13 FOR DETAILS SEE ANNEX 8.5 – FINAL ENERGY CONSUMPTION BY ENERGY SOURCE AND SECTOR, P. 42–43, AND IEA, AS OF 2007

TABLE 1

Power and Electricity Performance in Tanzania

YEAR	2002	2003	2004	2005	2006	2007	JUNE 2008
Peak Demand (MW) Load Factor	474.9 69.5	506 73.1	509 76.1	551 78.1	603 67.9	653 72.6	760 74.7
Total Installed Capacity (MW)	882	871	911	953	958	1226	1186
Public %	717 86	755 87	635 70	633 66	615 64	715 58	715 60
Private (IPPs) %	115 14	116 13	276 30	320 34	343 36	511 42	471 40
Generation (GWh) by	2,892	3,239	3,394	3,771	3,588	4,156	2,154
Hydro	2,668	2,551	2,011	1,881	1,439	2,576	1,422
Thermal (mainly gas)	190	647	1,337	1,840	2,089	1,580	700
Imports from Zambia and Uganda	33.5	41.0	46.0	50.4	60.5	60.5	32.1
Electricity sales (GWh)	2,187	2,326	2,465	2,628	2,769	3,288	3,288
Total electricity customer	515,000	581,000	608,000	665,000	635,000	662,000	701,000

Source: TANESCO, as of 2008

2.3 ENERGY PRICES

The average prices of energy sources in 2008 are provided in the table below. The prices fluctuate very much with crude oil prices and exchange rates.

TABLE 2

Average Energy Prices in Tanzania

ENERGY FORM	PRICE		REMARK
Diesel	1,430.00 TZS/l	0.780 €/l	Price at filling station
Petroleum	1,340.00 TZS/l	0.730 €/l	Price at filling station
Electricity	129.03 TZS/kWh	0.070 €/kWh	For households
Electricity	70.00 TZS/kWh	0.039 €/kWh	For industry
Kerosene	1,000.00 TZS/l	0.540 €/l	Pump price
LPG	2,133.00 TZS/kg	1.160 €/kg	Retail price at dealers
Charcoal	500.00 TZS/kg	0.270 €/kg	Not sold per kg, but a bag of 60 kg is sold at 30,000 in TZS Dar es Salaam (differs in other townships)

Sources: data compiled by the author (as of 2008) with information on tariffs from EWURA website (www.ewura.go.tz/fuelprices and www.tanesco.com)

2.4 MARKET ACTORS FOR PLANNING, REGULATION AND DISTRIBUTION

The Ministry of Energy and Minerals is responsible for policy planning, implementation and the facilitation of a conductive atmosphere for the development and use of energy in the country. RE is a section in the Department of Energy of the MEM. Other energy sections include energy development and planning for electricity, petroleum and gas and are headed by Assistant Commissioners who report to the Commissioner for Energy and Petroleum Affairs.

Other actors who also take part in energy planning, regulation and distribution include EWURA, REA, TANESCO and established IPPs. While REA is responsible for rural energy investment promotion, EWURA regulates energy and water utilities. TANESCO is still the key generator, grid operator and distributor of grid power in the country.

3 RENEWABLE ENERGY POLICY FRAMEWORK CONDITIONS

The Government of Tanzania is committed to facilitate the increased use of RE as an important source in the energy mix and a major means to support the national development goals. Therefore, a number of legal framework measures, policies and strategies have been formulated and enacted to provide a constructive atmosphere for industrial growth. In the following section, some of the existing policies and strategies adopted for the promotion and facilitation of an increased use of RE within the country are presented.

There are no Value Added Tax (VAT) and custom duties on solar and wind technology products. Other products and appliances are subject to a VAT of 20 %, while custom duties range from 20 to 30 %.

SHORT BUSINESS INFO

Zero import duty on wind and solar technology products.

3.1 POLICY AND RENEWABLE ENERGY PROMOTION PROGRAMS

The current National Energy Policy (NEP) was issued in the year 2003. This is the second energy policy after launching the first NEP in 1992. Some legal framework measures and strategies have been formulated by the Government in order to enhance and guide the implementation of the energy policy. These include the Rural Energy Act of 2005 established by the REA/REF, the Energy and Water Utilities Regulatory Authority (EWURA) Act of 2001 and the Electricity Act of 2008.

National Energy Policy

Objectives of the NEP[14] are to ensure availability of reliable and affordable energy supply and use in a rational and sustainable manner in order to support national development goals. Therefore the existing energy policy aims to establish energy production, procurement, transportation, distribution and end use systems in an efficient, environmentally sound, sustainable and gender-sensitized manner. The NEP comprises local and international political, economic, social, environmental and other structural changes. Key objectives of the NEP regarding RE technologies and services include:

- Encourage efficient use of alternative energy sources
- Ensure priority on power generation capacity based on indigenous resources
- Facilitate R&D and application of RE for electricity generation
- Facilitate increased availability of energy services including grid and off-grid electrification of rural areas
- Establish norms, codes of practice, standards and guidelines for cost-effective rural energy supplies and for facilitating the creation of an enabling environment for the sustainable development of RE sources
- Introduce and support appropriate fiscal, legal and financial incentives for RE
- Ensure the inclusion of environmental considerations in energy planning and implementation
- Enhance co-operation with other relevant stakeholders
- Support R&D in RE technologies
- Promote entrepreneurship and private initiatives for the production and marketing of products and services for rural and renewable energy

Energy and Water Utilities Regulatory Authority

EWURA, established by Act No. 11 of 2001 (amended as chapter 414)[15], is responsible for water and energy regulation affairs. Being a legal corporate entity, EWURA promotes effective competition and economic efficiency, protects the interests of consumers and the financial viability of efficient suppliers and promotes the availability of regulated services to all consumers including low-income, rural and disadvantaged consumers. It also enhances public knowledge, awareness and understanding of the regulated sectors including:

- Rights and obligations of consumers and regulated suppliers
- Ways in which complaints and disputes may be initiated and resolved
- Duties, functions and activities of EWURA

The key functions of EWURA include the issuing, renewing and canceling of licenses, the establishment of standards, terms and conditions for the supply of goods and services and the regulation of rates and charges. Other functions comprise performance monitoring of the regulated sectors with regard to investment, availability, quantity and standard of services, cost of services, efficiency of production and distribution of services. As to petroleum and natural gas, EWURA regulates transmission and distribution, facilitates the resolution of complaints and disputes, disseminates relevant information, consults with other regulatory authorities and administers the Act.

Rural Energy Act[16]

The Rural Energy Agency (REA) and the Rural Energy Fund (REF) are autonomous bodies established under the Rural Energy Act No. 8 of 2005. The Ministry of Energy and Minerals (MEM) oversees the activities of REA/REF.
As rural energy issues are diverse and characterized by various actors with different interests, an institutional framework was established in order to mobilize, coordinate and facilitate private and public initiatives for the development of a rural energy industry. In order to reach this goal, the REA/REF were established to:

- Promote, stimulate, facilitate and improve modern energy access for social and commercial use in rural areas
- Promote the rational and efficient production and use of energy
- Utilize the REF to finance suitable rural energy projects
- Facilitate activities of key stakeholders with interest in rural energy
- Provide capital subsidies to rural energy projects through a trust fund
- Allocate resources to projects in a transparent manner and with well-defined criteria

The Act provides REF with funds from the following sources:
- Governmental budgetary allocations on an annual basis
- Contributions from international financial organizations, multilateral and bilateral agencies and other development partners
- Levies of up to 5% on the commercial generations of electricity from the national grid
- Levies of up to 5% on the generation of electricity in specified isolated systems
- Fees for programs, publications, seminars, consultancy activities and other services provided by the agency
- Interests or return on investment

REA/REF have already supported various off-grid projects with developers including 13 Small Hydro Power Projects, two Biomass Cogeneration Projects (TPCL & Sao Hill) and

14 SEE ALSO PARLIAMENT OF TANZANIA (WWW.PARLIAMENT.GO.TZ) › DOCUMENTS ›ACTS
15 EWURA, AS OF 2001
16 SEE ALSO PARLIAMENT OF TANZANIA (WWW.PARLIAMENT.GO.TZ) › DOCUMENTS ›ACTS

two Biomass Gasification Projects (Mafia & Mkonge Energy). These projects are currently at various stages of implementation. The total expected capacity is 46.2 MW, 8,400 new connections are expected. The total expected costs for all projects are 118.9 million USD of which REA will contribute 4.2 million USD.

REA/REF support fiscal incentives for rural energy projects and programs and count amongst the national aid initiatives attracting international fiscal initiatives. The autonomous agency provides capital subsidies and grants for successful rural energy projects developers. On top of the Government subsidy to the REF, the agency is allowed to take up to 5 % surcharge on each unit of energy generated by commercial electricity producers. The REA/REF will grant a subsidy of 500 USD per rural connection that will be made.

REA/REF subsidies also support solar PV systems, but whereby all small rural PV systems need to be installed by a developer. The subsidy is Ltd. to 100 Wp for residential systems and 300 Wp for Institutions. System subsidy is 2 USD per Wp. Bigger projects must be negotiated bilaterally with REA.

Electricity Act of 2008[17]

The Act replaced the Electricity Ordinance Cap. 131 of 1931, which was amended eleven times and was stipulating monopoly in the electricity sector. The act implements the NEP of 2003. It is opening up the sectors of electricity generation, transmission, distribution and sales to private sector participation. The Act provides instruments for the regulator (EWURA), stipulates the roles of REA/REF and sets the general conditions for cost reflective tariffs and least-cost electrification options.

The Act recognizes other strategic Acts and legal entities for the electricity sector such as the EWURA Act, Fair Competition Commission, Rural Energy Act, Standardized Small Power Purchase Agreement for 100 kW to 10 MW, Standardized Power Purchase Tariff and Fair Competition Tribunal. The act allows for electricity to be generated from any primary source (including RE). Moreover, the Act lays down that the Power Sector Master Plan (PSMP) be updated annually, which is an opportunity for new confirmed resources to be accommodated as potential options for power supply and use in the country. It also calls for the preparation of a Rural Electrification Strategy & Plan to promote access to electricity in rural Tanzania.

In general, the Electricity Act 2008 has opened up windows for increased RE promotion especially in rural areas. As to the aspects of least cost and cost effectiveness in electricity supply, more research and development in RE would increase competitiveness of the same.

Finance Sector

In Tanzania there are 25 commercial banks, three financial institutions, more than 150 Bureau de Changes and a number of local Microfinance Institutions (MFIs) and savings and credit organizations. The participation of local financial entities in the promotion and support of RE businesses, however, has been Ltd..

A study on removing barriers for solar PV markets in Tanzania revealed the fact that a financing scheme for solar PV systems could raise the market segment of potential customers (those who can buy right away from shelves) from 10 % to 40 %. A number of international finance organizations like the World Bank, Triodos Bank of the Netherlands and E+Co are already lending money to energy projects and private companies involved in RE for the following projects:

- The World Bank is supporting a solar PV scheme named Sustainable Solar Market Packages (SSMP) piloted in the Rukwa region. The region has been divided into three zones. Each of them will be served by one contractor. Education, health and community centers will be supplied with solar systems. In addition, commercial enterprises are being encouraged to develop their own supply chains and technical bases in the area. Currently tenders are being evaluated.
- The Triodos Bank supported the private company Umeme Jua Ltd.. with a loan from the Dutch Program for Cooperation with Emerging Markets (PSOM)[18].
- E+Co has been investing a total of 1.6 million USD in 13 Tanzanian enterprises since 2001. The companies include FREDKA, TaTEDO, ENSOL, ZARA SOLAR, RESCO, BETL, UMEME JUA, FADECO, FELISA, MENA WOOD, REX, OMK and AFROZONE. Zara Solar, for example, has been receiving 350,000 USD since 2002. Zara was established in 1998 by the local entrepreneur Mohammed Parpia and is selling SHS in MWanza. To date, Zara has sold over 10,000 SHS (due to legal requirements other financial information for the companies cannot be quoted). The average interest rate is 8 % (in USD).
- The Tanzania Investment Bank is the Trust Bank that handles and transacts REA/REF funds to rural energy developers.

3.2 DONOR AID ACTIVITIES

SIDA/MEM Solar PV Project

The MEM, with support from the Swedish International Development and Cooperation Agency (SIDA), is engaged in a five-year national project to facilitate solar PV market development in rural Tanzania. The Swedish support makes up about 3 million USD in total. The project started in May 2005 and consists of four components:

- Business development services (BDS) for existing and start-up companies
- Marketing and public awareness
- Development of a solar network
- Policy reforms and institutional development

With BDS, capacity building is provided for regional dealers, suppliers, importers and local microfinance agents addressing specifically business planning, marketing, bookkeeping, accounting and product knowledge. Technicians are trained in

17 SEE PARLIAMENT OF TANZANIA (WWW.PARLIAMENT.GO.TZ) › DOCUMENTS ›ACTS

18 FOR MORE INFORMATION ON THE PSOM SEE WEBSITE OF NL EVD INTERNATIONAAL – PSOM (WWW.EVD.NL/HOME/FINANCIERING_PROJECTEN/INVESTEREN/PROGRAMMA.ASP?LAND=PSM)

PV system design, installation and maintenance. Both suppliers and dealers can apply for specific training and support. Support is granted to them on demand and on a case-by-case basis. The training of dealers and technicians is sub-contracted.

Regarding marketing, the component focuses on end users and involves awareness creation for solar technology, its availability and workability through physical demonstration. Other marketing strategies include promotional campaigns at national and regional level using TV, radio broadcasting, posters, brochures and other means. Suppliers and local dealers are made to actively participate in the campaign, and a special solar campaign targeted to Savings and Credit Cooperative Society (SACCOS) is carried out.

The networking component aims at the development of a networking association of all solar PV stakeholders in the country. TASEA was chosen to support institutional capacity building, to support the SunENERGY magazine and to host solar energy days.

The policy and institutional development component aims at developing a system to enforce solar PV quality standards through the Tanzanian Bureau of Standards. It also focuses on taxation issues and on the dissemination and sharing of project findings among policy makers in various ministries and awareness creation in higher levels of the Government.

RE Business Opportunity

The SIDA/MEM solar PV project awarded small grants to six rural based solar market development projects activities. It granted 67 % of the project costs with the remaining sum to be met by the project owners. The maximum grant from SIDA/MEM for solar PV projects is 20,000 USD. Njombe Electronics Center and Ensol Tanzania Ltd., for example, are among the six companies that received the grant. The Njombe Electronics Center project involved solar PV market development campaigns in the Ludewa district and the training of rural electricians and sellers of solar PV systems. This training covered specification, installation, troubleshooting and maintenance and aimed at building capacity at the local level. The Ensol Tanzania Ltd. project involved the development of a dealer network, technical training and market development campaigns in the Karatu, Ngorongoro, Hanang and Mbulu districts (further information can be found in chapter 7 Bibliography among the indicated internet sources).

UNDP/GEF/MEM Solar PV Project

The project is similar to the SIDA/MEM solar PV project and was piloted in MWanza region between 2002 and 2007. It eventually will be replicated in the lake zone. The project has four components covering policy support and institutional strengthening, awareness raising, private sector strengthening, financial engineering and learning as well as replication. Under policy support, PV standards were developed. Under the awareness component, information about companies and institutions active in solar energy in the MWanza region was given. Regarding private sector strengthening, technical and business skills were imparted to target groups. Under the financial engineering, dealers received loans through a local bank and end users got consumer financing through two selected pilot SACCOS in the region. Moreover, actors willing to enter solar income generating activities were supported through a subsidy to a maximum of 40 % of the system costs. After three years of project activities, learning and replication started in other lake zone regions.

The project supports part of the investment costs for pilot solar PV income generating activities in rural areas of MWanza, where more than 12 firms benefited. Such income generating activities included the provision of solar PV systems (80 Wp) for Phone charging in Sengerema district. The system owner at Kijiweni currently charges more than 60 cell phones at a rate of 300 TZS. The grant contributed was 30–40 %. Maximum contribution of the project was 3,000,000 TZS (about 2,500 USD) per project. The project cost is estimated at 2.5 million USD[19].

NGO Initiatives: TASEA, TaTEDO and Clinton Foundation

A number of NGOs are involved in promotion of RE. The Tanzania Solar Energy Association (TASEA) is a national association that brings together RE actors and stakeholders targeting improved sector dynamics. These include, among others, lobbying and advocacy for a sound sector environment, quality peer pressure creation, information dissemination, capacity building (training, magazines, workshops, solar days etc.) and networking.

The Tanzania Traditional Energy Development and Environment Organization (TaTEDO) is involved in capacity building for sustainable energy services. It implements RE projects in rural areas with support from development partners including the EU, Norway, the Netherlands and the UN.

The Clinton Foundation is supporting solar PV installations for rural health facilities in Mtwara and Lindi regions to support HIV reduction initiatives by powering vaccination fridges, wards, laboratories, computers and staff houses to motivate them to remain in rural areas.

3.3 MARKET RISKS

Business environment in Tanzania is currently very stable with legal support through policies and framework measures as well as political will. The translation of political will is, however, not necessarily executed through budgets allocated for energy. That may result in delays and unimplemented commitments when it comes to decision-making on investments. Corruption in the energy sector needs a strong political will and commitment. If the current fight against corruption in the energy sector is not backed-up by high level political and Government leaders, it could negatively impact on investment planning and decision-making. So far, there is no restriction on transfer of margins in relation to investors' interests.

19 FURTHER INFORMATION CAN BE FOUND AT THE CORRESPONDING PROJECT WEBSITE SOLAR MWANZA (WWW.SOLARMWANZA.ORG)

4 STATUS AND FUTURE OUTLOOK FOR RENEWABLE ENERGIES

RE are still in an infancy stage with a Ltd. number of project developers, promoters, finance providers, service companies and planners. RE is a section in the Department of Energy of the MEM. Other sections include energy development, planning, electricity, petroleum and gas, which are all headed by Assistant Commissioners who report to the Commissioner for Energy and Petroleum Affairs.

RE sources contribute less than 1 % of the national energy balance. Biomass energy within the RE section accounts for more than 90 % of the cooking resources in Tanzania, but the budget allocated by the Government for RE (including biomass energy services) is Ltd. to less than 1 % of the annual energy development budget of the MEM. The budget for year 2007/2008 was 354 million USD, of which local contribution is 197 million USD. Out of this budget only about 300,000 USD were allocated for RE and energy efficiency (EE).

Nevertheless, RE applications in Tanzania have a good potential for powering development goals considering their local availability, the Ltd. energy per capita consumption, the sparsely populated communities and the ever-hiking prices of imported fossil fuels.

Presently, there is no manufacturer of RE products in Tanzania. REDCOT, a private company, and the College of Engineering and Technology (CoET) of the University of Dar es Salaam have recently started building up education facilities to stimulate entrepreneurship in the production sector. While the Tanzania Bureau of Standards (TBS) is strictly advocating quality products, it has no testing facility for most of RE products.

The following RE education facilities can be found in Tanzania:

- CoET: The college offers courses for the manufacturing and fabricating of RE technologies. Technologies such as windmills, solar water heaters and micro hydro turbines are being researched. In addition, a masters course on RE has recently been introduced.
- University of Dar es Salaam: The university's Physics Department is offering solar PV activities to physics students.
- VETA: The Vocational Education and Training Authority has piloted a curriculum on solar PV systems.
- MLVTC: The Mafinga Lutheran Vocational Training Center has been offering courses for empowering skills on RE for more than five years.
- TASEA: The Tanzania Solar Energy Association has been offering short courses on the basics of solar PV systems including system components, system planning, sizing, installation, troubleshooting and maintenance.
- KARADEA: The Karagwe Development Association has RE training facilities.
- TaTEDO: The Tanzania Traditional Energy Development and Environment Organization also has training facilities for RE.

In total, approximately 300 technicians for basic solar PV systems were trained in Tanzania over the last years. It is, however, important to note that a number of Tanzanian experts on RE undertook studies in the Netherlands, Germany, UK, USA, Japan, India and China.

4.1 BIOMASS/BIOGAS

More than 90 % of primary energy consumption in Tanzania come from biomass. The administration of the forests in Tanzania covers 38.83 million hectares, and the fuel consumption in Tanzania in 2005 was 46.2 million cubic meters of solid round wood. However, biomass used in rural Tanzania is collected by the people themselves, but vendors from urban areas employ the rural poor to collect biomass for urban use. The majority of the urban population uses firewood and charcoal for cooking. A few people from the middle and upper class use electricity and LPG for cooking in urban areas. Fuel wood and charcoal business is largely practiced as an informal business.

In Tanzania around 6,000 small residential biogas plants for cooking purpose are in operation (Guardian newspaper of 26.7.07; and Citizen newspaper of 24.7.07).

Tanzania has the power capacity for cogeneration of more than 200 MW from sugarcane residues (bagasse) in the four sugar factories of Mtibwa, Kilombero, Kagera and Tanzania Planting Corporation (TPC). Mtibwa currently generates 7 MW although it has the capacity to generate 15 MW. TPC has invested in the power plant generating 15 MW of which 7 MW will be fed into the national grid.

RE Business Opportunity

A total of eight developers have been registered by the Tanzania Investment Center (TIC) to develop biofuel activities in Tanzania including Sun Biofuels Tanzania Ltd., CAMS Agri-Energy Tanzania, and Sweden's Sekab Company. A Germany company, PROKON, has mobilized 1,800 farmers in Rukwa region to plant jatropha with an agreement to buy seeds from them for biofuel production. These activities are part of a PPP project with German Development Cooperation. The company FELISA is involved in palm oil production for energy.

UNIDO is managing the implementation of a pilot project on Cleaner Integral Utilization of Sisal Waste for Biogas and Bio-fertilizers initiated in 2001. It became a reality in May 2006 when Bio-Energy Berlin (BEB) of Germany was awarded the contract to supply equipment, material and parts for the construction, installation and commissioning of a pilot biogas demonstration plant at Hale Estate in Tanga Region. BEB opted for steel tanks instead of concrete tanks and subcontracted the erection of the tanks to Sichuan Guojiao Energy and Environmental Protection Engineering Co. Ltd. from Chengdu in Sichuan Province of China. Jinan Diesel Engine Co. Ltd. from Jinan City was subcontracted to supply a 180 kW biogas engine and generator (CHP unit). The pilot plant was operational by July 2007, six months after the construction started. This pilot biogas demonstration plant utilizes sisal biomass from the stationary decorticator and the hammer mills installed at Hale Estate. It utilizes only 30 % of the sisal biomass generated which is normally 100–130 tons. The plant has a 180 kW engine and generator. With one more storage tank added, the plant capacity can be increased to utilize 45 % of the leaf waste to produce up to 300 kW of electricity.

Other biomass initiatives include:

- KAKUTE of Arusha is promoting jatropha by buying jatropha seeds and processing biofuels for different uses.
- Mgololo Paper Industry in Iringa Region generates about 40 MW from wood residues. The energy is used for running paper making machineries.
- Tanzania Wattle industry in Njombe generates about 2.5 MW from wattle tree residues, which are fed into the national grid. The industry is planning to generate 15 MW and sell to TANESCO. Research has established that 2.4 kg of wattle residues can generate 1 kWh of electricity.
- The City of Dar es Salaam is in the process of generating 2.5 MW from waste from a closed dumpsite at Mtoni. Methane from the dumpsite is already being collected and burnt to protect the environment. It is expected that in a near future the gas could be used to generate electricity. This is the only Clean Development Mechanism (CDM) project in Tanzania.
- The SADC Biomass Energy Conservation Project (ProBEC) under the MEM has developed, constructed and tested 60 prototype barns for curing tobacco in Tabora, where preliminary results show savings of up to 50 % of wood as compared to traditional curing barns.
- TaTEDO has been involved in development, promotion and dissemination of improved firewood and charcoal stoves in Tanzania for more than 15 years. About 15,000 improved wood and charcoal stoves are produced and sold in the country per month.
- Presently, the following private companies are generating electricity from biomass either for their own use or for selling to TANESCO: sugar companies (generating 38 MW), TANWAT (wood/forestry, generating 2.5 MW), Sao Hill (wood/paper, generating 1.0 MW), Mufindi Paper Mills (generating 15 MW) and Hale Sisal Estate (sisal waste biogas, generating 300 kW).

SHORT BUSINESS INFO

- Biomass consumption per capita is 1.13 m^3/year
- Cogeneration capacity (200 MW) in four sugar plants are nearly untapped
- 8 developers have been registered to develop biofuels
- 15,000 improved stoves are produced and sold per month
- 6,000 small residential biogas plants are in operation
- BEB supplied equipment of a pilot biogas demonstration plant

4.2 SOLAR ENERGY

Tanzania is endowed with a global solar radiation of 4 to 7 kWh/m^2/day. Tanzanian solar industry has been growing fast over the last five years. This is caused by various factors including frequent modern energy crises in the country, increased level of awareness in some communities where promotional projects are in progress, globalization that has brought rural Tanzanians in touch with Information Communication Technology (ICT) and the growth of the number of organizations and commercial institutions operating in areas without electricity.

RE Business Opportunity

The current total installed electricity generation from solar energy is estimated at around 1.8 MW. The annual capacity was 100 kWp in 2005 and 200 kWp in 2006. The situation indicates a positive growth in the sector, which can also be seen from the increase in the number of solar companies. While the number of solar companies was less than 10 in 2000, there were already 20 in 2007. These companies rarely do have branches or established networks in rural areas. Promotional projects to stimulate market development and to remove market barriers are ongoing, e. g. the SIDA/MEM project and the UNDP/GEF/MEM project in the MWanza region (see also chapter 4.2 Donor Aid Activities).

The REA/REF subsidy goes to solar PV systems in general; in addition all small rural PV systems of up to 100 Wp that are installed by a developer will be subsidized with 2 USD per Wp (see chapter 4.1 Policy and Renewable Energy Promotion Programs).

The two associations active in solar energy market development, training and information dissemination are TASEA and TaTEDO. For more detailed description see chapter 4.2 Donor Aid Activities.

SHORT BUSINESS INFO

- Installed PV capacity is around 1,8 MW.
- The annual installation rate is increasing to over 200 kWp.
- Two PV promotion projects with subsidy schemes are ongoing (the SIDA/MEM project and the UNDP/GEF/MEM project).
- 20 solar companies are registered.
- PV systems up to 100 Wp will be subsidized with 2 USD/Wp by REA/REF.

4.3 WIND POWER

The potential for wind energy has not been quantified yet. According to Climatologic Statistics of East Africa (Part III), Tanzania, edited by the East Africa Meteorological Department in September 1975, the annual average wind speeds vary from 2.1 m/s in the Morogoro region to 6.3 m/s in Tanga region. The data were measured in 17 regions, but in an insufficient height of about 2 m.

Ongoing wind studies in the country considering surface roughness and heights over 30 m have already revealed some more potential sites for wind farms in Tanzania. The Singida region and Makambako in the Iringa region have for example revealed wind speeds of more than 8 m/s, which is good and promising for electricity generation at reasonable costs. Other areas with wind speeds of more than 4.5 m/s are Mkumbara, Karatu and Mgagao. Wind farms for commercial plants appear promising at Makambako and Kititimo in Singida as well as at Mkumbara, Karatu and Mgagao. Wind resource measurements in other areas are planned and include the Rift valley in Rukwa, the Livingstone Mountains, the Mafia island, Singida and Shinyanga, just to mention a few.

Good wind speeds are also expected along the eastern coastline. Areas along rift valleys, the southern highlands and along Lake Victoria are reported to have some possibilities of potential wind sites as well.

Unfortunately, no reliable wind maps exist for Tanzania so far. The lack of wind energy feed-in tariffs has negatively affected the development of wind energy. However, the national grid in such areas of high wind speeds is available.

Over the years, wind energy resources in Tanzania have been used for windmills to pump water. Less has been done in electricity generation. These wind mills (installed numbers of windmills indicated in brackets) are found in the Singida (36), Dodoma (25), Iringa (16), Shinyanga (6), Tabora (4), Arusha (4), Klimanjaro (1) and Mara (8) regions. 44 % of them are still operational, the remaining ones are defunct.

4.4 GEOTHERMAL POWER

There is some potential of geothermal resources in Tanzania. Currently, the existing potential is being assessed by the Government of Tanzania through the MEM. A geological survey of Tanzania has been conducted since June 2006 in collaboration between MEM and the Federal Institute for Geosciences and Natural Resources (BGR) of Germany. The project partners have been assessing the geothermal potential at Songwe. Songwe is located about 20 km west of Mbeya, which is the third largest city in Tanzania. The estimated geothermal potential there is about 600 MWe.

Detailed surveys, however, are still required to come up with realistic figures on the available potential.

4.5 HYDRO POWER

Small Hydro

Out of the available 315 MW small hydro potential in Tanzania, less than 8 MW have been exploited by installing two power plants. The MEM has been effective in funding studies for small hydro power plants. Studies for seven regions including Ruvuma, Rukwa, Iringa, Kagera, Morogoro, Mbeya and Kigoma were facilitated by MEM in 2006 and 2007.

Large Hydro

Over the years, the power sector of Tanzania has been dominated by hydro power. Poor rainfalls in the past few years, however, have resulted in a shortage of water for the turbines. This has been further aggravated by agricultural activities that are going on upstream. The table below provides data on hydro electricity installations as of June 2007. All stations are operated by the national utility TANESCO.

Feasibility studies[20] reveal the potential of hydro power as follows: Ruhudji (360 MW), Rumakali (222 MW), Nakatuta (15 MW) and Mandera (21 MW). Other potentials studied to a pre-feasibility level include Mpanga (144 MW), Masigira (118 MW), Malagarasi (11 MW) and Stiglers Gorge (2100 MW). All these are possible business opportunities that could be exploited.

TABLE 3

Hydro Electricity Installations in Tanzania

STATION	UNITS	SIZE (MW)	INSTALLED CAPACITY (MW)	GENERATED ELECTRICITY IN 2007 (GWH)	SYSTEM
Kidatu	4	51.0	204	964	Great Ruaha River
Kihansi	3	60.0	180	662	Kihansi River
Mtera	2	40.0	80	363	Great Ruaha River
New Pangani falls	2	34.0	68	323	River Pangani
Hale	2	10.5	21	88	River Pangani
Nyumba ya Mungu	2	4.0	8	35	River Pangani
Total hydro	/	198.5	561	2435	/

Source: TANESCO, as of 2007

20 TANESCO, AS OF 2007

5 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

The private and Government-related actors in Tanzania's RE sector are manifold. In the following, a list of companies and organizations indicates this variety.

5.1 RENEWABLE ENERGY COMPANIES & BUSINESS-RELATED ORGANIZATIONS

NAME	ADDRESS	EMAIL	WEB PAGE	TECHNOLOGY	SHORT DESCRIPTION
A. A. Power and Tools Ltd.	Along Zanaki Street P.O. Box 1205 Dar es Salaam – Tanzania Phone: +255 22 2123284	/	/	Solar energy systems	Supplies of solar systems, equipment and balance of system
AGLEX Company Ltd.	Plot 302, Regent Estate, Victoria Area, Ali Hassan MWinyi Road, P.O. Box 9818 Dar esSsalaam – Tanzania Phone: +255 22 2700069	radiocalls@ aglexcompany.com	www.aglexcompany.com	Solar energy systems	Solar equipment and 2-way radios supply and installations
Artumas Group	Artumas Group Inc. 900, 606 – 4th Street SW, Calgary, Alberta, Canada Phone: +(1) 403 294-1530 Dar es Salaam Office Artumas Energy (T) Ltd. P.O. Box 203, Plot 8/1, Tumbawe Road, Oyster Bay Dar es Salaam – Tanzania Phone: +255 22 266 6622 Mtwara Office, P.O. Box 432 Mtwara – Tanzania Phone: +255 23 233333	info@artumas.com info.tz@artumas.com	www.artumas.com	Oil and gas	Independent oil and gas exploration and production company with significant asset position and competitive advantage in the emerging resource basins of East Africa
BP (Tanzania) Ltd.	Kurasini, Bandari Road, P.O. Box 9043, Dar es Salaam – Tanzania Phone: +255 22211126972	SPhonela.kasamballa@ tz.bp.com	www.bp.com	Solar PV	Supply of solar PV systems and equipment
Chloride Exide Tanzania Ltd.	Millenium Business Park, along Morogoro Road P.O. Box 12746 Dar es Salaam – Tanzania Phone: +255 22 2450	cexidetz@africaonline. co.tz		Solar energy technologies	Sale of solar energy systems and components
D. Light Design East Africa	Coral Lane Plot 580, Msasani Peninsula, P.O. Box 110297 Dar es Salaam – Tanzania Phone: +255 22 2601559	infoea@dlightdesign.com	www.dlightdesign.com	Solar lanterns	International lighting and power company with design, manufacturing and distribution capabilities
Davis & Shirtliff (T) Ltd.	Nyerere Road, opposite Shoprite Supermarket, P.O. Box 10725, Dar es Salaam – Tanzania Phone: +255 22 2112515	office@tzdayliff.com	www.tzdayliff.com	Solar water pumps	Sale and installation of solar PV systems and water pumps
Energy for Sustainable Development (T) Ltd.	P.O. Box 8694 Dar es Salaam – Tanzania Phone: +255 22 2667758	esd@esdt.co.tz	www.esdt.co.tz	Technology-free	Consulting firm in sustainable energy development
ENSOL (T) Ltd.	P.O. Box 42227 3rd Floor NSSF Ubungo Office Block, Dar es Salaam Phone: +255 22 2450468	Solartz@yahoo.com	www.ensol.co.tz	Solar energy technologies (PV and thermal)	Solar energy contractors for sales, services, solar water pumps, backup systems
Farming for Energy for Better Livelihoods in Southern Africa (FELISA)	P.O. Box 1349 Kigoma – Tanzania Phone: +255 28 2804909 Fax: +255 28 2804904	farmingforenergy@ yahoo.com	/	Biofuels	Palm oil growing for biodiesel production, processing and electricity generation
GS Power Installations Ltd.	Gerezani Area, P.O. Box 45924 Dar es Salaam Phone: +255 22 2183278	gspower2@yahoo.com	www.gspower.piczo.com	Solar energy equipment and control systems	Supply of solar equipment, balance of systems and security systems
Kagera Sugar Company	P.O. Box 16541 Dar es Salaam – Tanzania Phone: +255 22 2862661 Fax: +255 22 2862667	info@gmitz.com nkandala@gmi-tz.com	/	Cogeneration	Combined heat and electricity generation from bagasse
KAKUTE Ltd. (Kampuni ya Kusambaza Teknolojia)	Nane Nane Grounds, P.O. Box 13954, Arusha – Tanzania Phone: +255 27 2544549	kakute@tz2000.com	/	Biofuels	Promotion of jatropha growing and products
Katani Ltd.	Katani House, 1 Tasma Road, Bombo Area, P.O. Box 123 Tanga – Tanzania Phone: +255 272644401	info@katani.co.tz	www.katanitz.com	Biogas	Private firm generating biogas from sisal residues for electricity generation

NAME	ADDRESS	EMAIL	WEB PAGE	TECHNOLOGY	SHORT DESCRIPTION
Kilombero Sugar Company	P.O. Box 50, Kidatu Morogoro Phone: +255 23 2626027/2119525	dcoates@illovo.co.za rwarren@africaonline.co.tz	/	Cogeneration	Combined heat and electricity generation from bagasse
Locking Center Chromagen Solar water heaters	102 Kinondoni Road, P.O. Box Dar es Salaam – Tanzania Phone: +255 22 2666547	/	/	Solar	Solar water heater supply and services
Mtibwa Sugar Factory	P.O. Box 16541 Dar es Salaam – Tanzania Phone: +255 22 2862661 Fax: +255 22 2862667	info@gmitz.com nkandala@gmi-tz.com		Cogeneration	Combined heat and electricity generation from bagasse
NORPLAN Tanzania Ltd.	Plot 127 Mafinga Street, P.O. Box 2820 Dar es Salaam – Tanzania Phone: +255 22 2668090/2667020 Fax: +255 22 2668340	admin@norplantz.org	www.norplan.com	Energy technologies and services	Consulting firm in energy

5.2 LOCAL INSTITUTIONS RELATED RENEWABLE ENERGY BUSINESS

PROJECTS AND DEVELOPMENT PARTNERS

NAME	ADDRESS	EMAIL	WEB PAGE	TECHNOLOGY	SHORT DESCRIPTION
African Rural Energy Enterprise Development (AREED)	c/o TaTEDO, off Shekilango Road near National Socio Welfare Institute P.O. Box 32794, Dar es Salaam – Tanzania Phone: +255 22 2700438 Fax: +255 22 2700438	energy@tatedo.org	www.tatedo.org	Solar, wind, biomass, MFPs	NGO specializing in dissemination of sustainable energy services and biofuels
Biomass Energy Tanzania Ltd.	c/o P.O. Box 1828 Tanga	biobrik@satconet.net	/	Biomass	Production of briquettes
Danish Embassy,	Embassy of Denmark Ghana Avenue P.O. Box 9171 Dar es Salaam – Tanzania Phone: +255 (22) 211 3887 Fax: +255 (22) 211 6433	daramb@um.dk	www.ambdaressalaam.um.dk	Wind technologies and services	Development partner in the wind industry
Deutsch-Tansanische Partnerschaft e.V. (DTP)	Deutsch-Tansanische Partnerschaft e.V. (DTP Furtredder 18, 22395 Hamburg, Germany	andreakarsten@gmx.de	www.d-t-p-ev.de	Wind, solar, biomass	Volunteer project in renewable energy and environment
Eastern and Southern African Management Institute (ESAMI)	ESAMI, P.O. Box 3030 Arusha – Tanzania Phone: +255 27 2508384-7	admin@esami-africa.org	www.esami-africa.org	Solar, wind and biomass	Training institute offering periodical renewable energy courses
German Technical Cooperation (GTZ)	GTZ Office Dar es Salaam, P.O. Box 1519, Dar es Salaam – Tanzania Phone: +255 222 115901 Fax: +255 222 116504	gtz-tanzania@tz.gtz.de	www.gtz.de	Biomass energy and conservation	Preparation, implementation and evaluation of technical cooperation projects
Germany Embassy	Umoja House Garden Avenue und Mirambo Street, P.O. Box: 9541, Dar es Salaam – Tanzania Phone: +255 – 22 – 211 7409 –15 Fax: +255 – 22 – 211 2944	german.embassy@bol.co.tz	www.daressalam.diplo.de/	Sustainable energy technologies	Development partner and key supporter of energy activities and initiatives
Japanese Embassy	P.O. Box 2577, Plot No. 1018, Ali Hassan MWinyi Rd, Dar es Salaam – Tanzania Phone: +255-22 2115827/9 Fax: +255-22 2115830	EmbassyofJapan_TZ@raha.com	www.tz.emb-japan.go.jp/	Technology-free	Development partner in environmental issues and climate change initiatives
Netherlands Embassy	PO Box 9534, Umoja House, 4th Floor, Corner Mirambo Street/Garden Avenue Dar es Salaam – Tanzania Phone: +255 22 2110000 Fax: +255 22 2110044	dar@minbuza.nl	tanzania.nlembassy.org/	Solar and biomass	Development partner
Norwegian Embassy (NORAD)	P.O. Box 2646, Dar es Salaam, Phone: +255 22 2113366/2139955 Fax: +255 22 2116564	emb.daressalaam@mfa.no	www.norway.go.tz/	Biomass, solar, wind	Development partner, among others, key supporter of energy activities and initiatives
Project for Biomass Energy Conservation (ProBEC)	Coordinator P.O. Box 1519 Dar es Salaam – Tanzania Phone: +255 713 420380	probec.gtz-tanzania@gtz.de		Biomass	SADC biomass conservation project administered by GTZ
SIDA/MEM Solar PV Project	SIDA/MEM Solar PV Project P.O. Box 71605 Dar es Salaam Phone: 255 22 2667758	esd@esdt.co.tz	www.esdt.co.tz	Solar PV technology	Solar PV market development project
Swedish Embassy	Mirambo Street/Garden Avenue, P.O. Box 9274, Dar es Salaam Phone: +255-22-219 6500/219 6503	ambassaden.dar-es-salaam@foreign.ministry.se	www.swedenabroad.com/	Sustainable energy technologies	Development partner and key supporter of energy activities and initiatives

NAME	ADDRESS	EMAIL	WEB PAGE	TECHNOLOGY	SHORT DESCRIPTION
The European Commission's Delegation in Tanzania	The European Commission's Delegation in Tanzania Umoja House, P.O. Box 9514 Dar es Salaam, Tanzania Phone: +255 22 2117473/6 Fax: +255 22 2113277	delegation-tanzania-info@ ec.europa.eu	www.deltza.ec.europa. eu/en/contact.htm	Solar, wind, biomass and climate change mitigation	Development partner supporting energy and climate research
UNDP/MEM PV Project MWanza	UNDP/MEM Solar PV Project, P.O. Box, Dar es Salaam Phone: 255 22 2500857 Fax: 255 22 2500858	solar@solarmwanza.org	www.solarmwanza.org	Solar PV technology	Solar PV market development project
United Nations Development Programme (GEF, SGP)	UNDP, Msimbasi Creek Housing Estate Ltd. Kings Way/Mafinga Street Plot 134-140 Kinondoni P.O. Box 9182 Dar es Salaam – Tanzania Phone: (255-22) 2199255	registry.tz@undp.org	www.tz.undp.org/	Solar, wind, biomass, MFPs	Development partner in various sectors including energy and environment
United Nations Industrial Development Organisation (UNIDO)	UNIDO Msimbasi Creek Housing Estate Ltd. Kings way/Mafinga Street Plot 134-140 P.O. Box 9182, Dar es Salaam – Tanzania Phone: 255-22 2199264 Fax: +255-22 2668749	ofice.tanzania@unido.org	www.unido.org	Biomass, micro hydro, solar	Development partner
World Bank – SSMP	World Bank, 50 Mirambo Street, P.O. Box 2054, Dar es Salaam – Tanzania Phone: +255-22 2163200 Fax: +255-22 2163295/2113039	jmcintire@worldbank.org	go.worldbank.org/ PFHCJT2VM1 OR web.worldbank.org/	Solar, biomass, wind, micro-hydro	Development partners supporting sustainable energy initiatives in Tanzania

NON-GOVERNMENTAL ORGANIZATIONS

NAME	ADDRESS	EMAIL	WEB PAGE	SHORT DESCRIPTION
Karagwe Development Association (KARADEA)	Karadea Solar Training Facility, P.O. Box 299, Karagwe – Tanzania Phone: +255 28 2222971	/	/	Training and awareness creation on solar energy systems
Mafinga Lutheran Vocational Training Center	P.O. Box 15, Mafinga, Iringa – Tanzania Phone: 255 767 255780	maselekaofm@ yahoo.com	/	Vocational training on renewable energy technologies
Miradi ya Gesi ya Samadi Dodoma (MIGESADO)	P.O. Box 9, Dodoma – Tanzania	migesado@maf.or.tz	/	Promotion and dissemination of biogas and improved wood and charcoal stoves
Mwanza Rural Housing Programme (MRHP)	P.O. Box 2745, MWanza Phone: +255 754 654883	/	/	Promotion, dissemination and installation of improved biomass stoves and solar PV systems credits
Sustainable Development through Renewable Energies in Tanzania (SUDERETA)	P.O. Box 3033, Arusha Phone: +255 27 2508855	sudereta@yahoo. coclshila@yahoo. com	/	NGO promoting and disseminating RETs in Tanzania
Tanzania Solar Energy Association (TASEA)	P.O. Box 32643, Dar es Salaam – Tanzania Phone: +255 22 2457416 Fax: +255 22 2457416	info@tasea.org	www.tasea.org	Information dissemination, lobbying, advo-cacy, networking and advisory services
Tanzania Traditional Energy Development and Environment Organisation (TaTEDO)	P.O. Box 32794, Dar es Salaam – Tanzania Phone: +255-22-2700771/2700438 Fax: +255-22-2774400	energy@tatedo.org	www. tatedo.org	NGO specialized in dissemination of sustainable energy services
Zanzibar Solar Energy Association (ZASEA)	P.O. Box 3754 Zanzibar – Tanzania Phone: +255 24 5502232	zasea2003@yahoo. com		Information dissemination, lobbying, advocacy, networking services

6 BIBLIOGRAPHY

- Central Intelligence Agency – CIA (2009): World Fact Book – Tanzania (www.cia.gov/library/publications/the-world-factbook/geos/tz.html)
- EWURA (2001): EWURA Act Chapter (www.ewura.go.tz/pdf/EWUREA-ACT-CHAPTER-414.pdf)
- GTZ (2005): Liquid Biofuels for Transportation in Tanzania: Potential and Implications for Sustainable Agriculture and Energy in the 21st Century, Eschborn, Germany
- IEA (2007a): Statistics 2007, Electricity/Heat for Tanzania (www.iea.org/Textbase/stats/electricitydata.asp?COUNTRY_CODE=TZ)
- IEA (2007b): 2007 Energy Balances for Tanzania (www.iea.org/Textbase/stats/balancetable.asp?COUNTRY_CODE=TZ; viewed in September 2009).
- Kaale, Bariki (2007): Introduction on Bitale MFP: Energy Mainstreaming into Regional and District Programs in Kigoma Region, UNDP/GVEP, Dar es Salaam, Tanzania
- Kaale, Bariki (2007): Monitoring and Evaluation of Rural Energy Development in Kigoma Region, UNDP/GVEP, Dar es Salaam, Tanzania
- Kiwele, Paul (2007): Status of Energy in Tanzania and its Implication to Poverty Reduction. A Paper presented at a Workshop on Mainstreaming Energy in Regional and District Programs in Kigoma July 2007, Ministry of Energy and Minerals, Dar es Salaam, Tanzania
- Magessa, F. (2008): EAC Strategy to Scale-up Access to Modern Energy Services, Tanzania Country Report and Implementation Work Plan, Dar es Salaam, Tanzania
- MEM/ TANESCO (1998): Study report on the potential wind sites for power generation in Tanzania, Dar es Salaam, Tanzania
- Ministry of Energy and Minerals – MEM (2003): National Energy Policy of Tanzania, Dar es Salaam, Tanzania
- Ministry of Energy and Minerals – MEM (2006): Register of Key Actors and Stakeholders of Rural Energy by Technology, Dar es Salaam, Tanzania
- Ministry of Energy and Minerals – MEM (2008): Report on Joint Energy Sector Review for 2008, Dar es Salaam, Tanzania
- Ministry of Energy and Minerals – MEM (2008): Solar Photovoltaic Market Prospects in Tanzania – Enhancing Energy Access: National Energy Goals and Strategies, Dar es Salaam, Tanzania
- ProBEC (2009): Basic Energy & Conservation Interventions (www.probec.org/displaysection.php?czacc=&zSelectedSectionID=sec1194880064)
- ProBEC (2009): Tanzania Country Profile (www.probec.org/displaysection.php?czacc=&zSelectedSectionID=sec1194880009)
- Shilogile (2007): A Paper on Status of Energy Mainstreaming in the Ministry of Natural Resources and Tourism. Presented at Energy Mainstreaming in Regional and District Programs and Projects Workshop in Kigoma July 2007, UNDP/GEF, Dar es Salaam, Tanzania
- Solar MWanza PV Project (2009): Indicators of PV Market Potential in MWwanza Region (www.solarmwanza.org)
- SSN Tanzania Adaptation Team (2006): Poverty and Climate Change: A South North Collaboration Summary of Tanzania Vulnerability and Adaptation to Climate Change, Variability and Extreme Events, Dar es Salaam, Tanzania
- Tanzania Commission for Science and Technology (2006): Energy Resources in Tanzania: Volume 1, Dar es Salaam, Tanzania
- TANESCO (2007): Tanzania Power Systems Master Plan
- TASEA (2007): SunENERGY: TASEA Renewable Energy Magazine – Issues I & 2, Dar es Salaam, Tanzania
- N. N. (2009): Transformation of the Rural PV Market, MWanza Solar MWanza PV Project (www.solarmwanza.org)
- UNDP Tanzania (2009): Energy and Environment Issues (www.tz.undp.org/ee_proj_intro.html)
- United Republic of Tanzania/ Vice President's Office (2007): National Adaptation Program of Action (NAPA), (http://unfccc.int/resource/docs/napa/tza01.pdf)

Websites

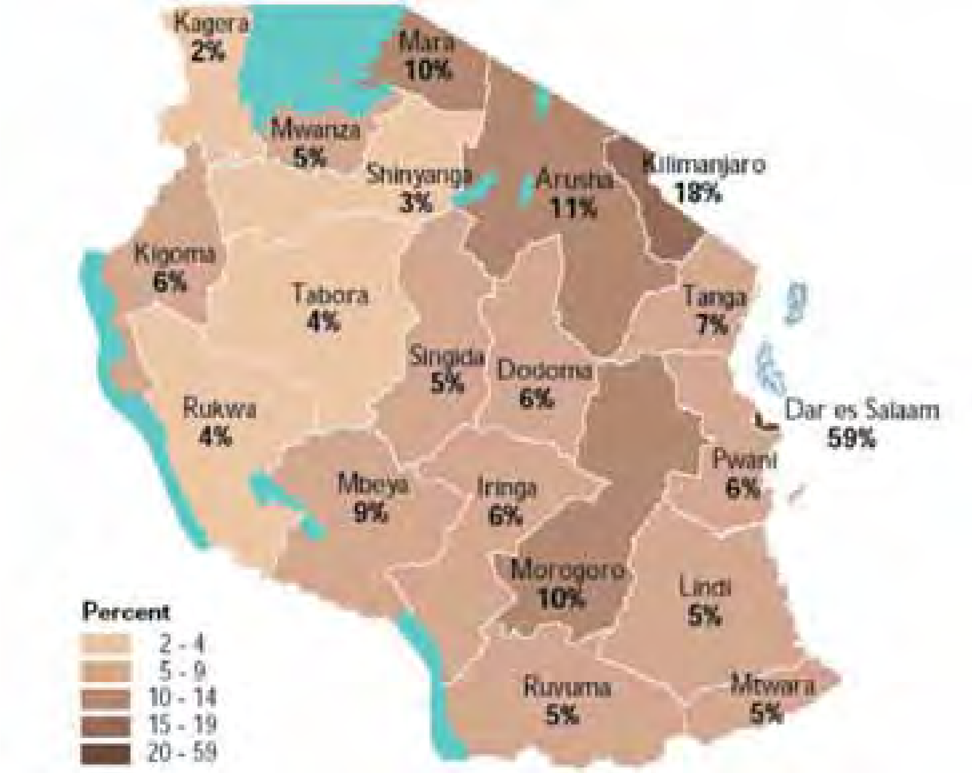
- EWURA: (www.ewura.go.tz/fuelprices)
- Geothermal Potentials: (www.bgr.de)
- Global Energy Network Institute – GENI: (www.geni.org)
- Government of Tanzania: (www.tanzania.go.tz/vision.htm.)
- Ministry of Energy and Minerals: (www.mem.go.tz)
- Parliament of Tanzania: (www.parliament.go.tz)
- Related Institutions for PV Projects, Publications and Trainings: (www.tasea.org or www.tatedo.org/publications.html)
- TANESCO Tariffs: (www.tanesco.com)
- NL EVD Internationaal – PSOM: (www.evd.nl/home/financiering_projecten/investeren/programma.asp?land=psm)

7 ANNEX

7.1 COUNTRY MAP OF TANZANIA

Source: United Nations, as of 2005

7.2 MAP OF ELECTRIFICATION RATE IN TANZANIA



Source: MEM, as of 2008

7.3 MAP OF NATIONAL ELECTRICITY GRID

Source: Global Energy Network Institute – GENI (www.geni.org, without year)

7.4 PRIMARY ENERGY SUPPLY

SUPPLY AND CONSUMPTION *	COAL AND PEAT	CRUDE OIL	PETROLEUM PRODUCTS	GAS	NUCLEAR	HYDRO	GEOTHERMAL, SOLAR ETC.	COMBUSTIBLE, RENEWABLES AND WASTE	TOTAL **
TPES	49	0	1,367	314	0	123	0	18,941	20,805
TPES %	0 %	0 %	7 %	2 %	0 %	1 %	0 %	91 %	100 %

Source: IEA, as of 2006
* In thousand tons of oil equivalent (ktoe) on a net calorific value basis
** Totals may not add up due to rounding

7.5 FINAL ENERGY CONSUMPTION BY ENERGY SECTOR AND SOURCE

ENERGY CONSUMPTION BY SECTOR

ENERGY FORM	PRICE		REMARK
Diesel	1,430.00 TZS/l	0.780 €/l	Price at filling station
Petroleum	1,340.00 TZS/l	0.730 €/l	Price at filling station
Electricity	129.03 TZS/kWh	0.070 €/kWh	For households
Electricity	70.00 TZS/kWh	0.039 €/kWh	For industry
Kerosene	1,000.00 TZS/l	0.540 €/l	Pump price
LPG	2,133.00 TZS/kg	1.160 €/kg	Retail price at dealers
Charcoal	500.00 TZS/kg	0.270 €/kg	Not sold per kg, but a bag of 60 kg is sold at 30,000 in TZS Dar es Salaam (differs in other townships)

Source: IEA, as of 2006
* In thousand tons of oil equivalent (ktoe) on a net calorific value basis
** Totals may not add up due to rounding

ENERGY CONSUMPTION BY SOURCE

SUPPLY AND CONSUMPTION *	COAL AND PEAT	CRUDE OIL	PETROLEUM	GAS	NUCLEAR	HYDRO	GEOTHERMAL, SOLAR ETC.	COMBUSTIBLE, RENEWABLES AND WASTE	ELECTRICITY	HEAT	TOTAL**
TFC	19	0	1,359	0	0	0	0	14,787	190	0	16,355
TFC in %	0,05 %	0 %	7,95 %	0 %	0 %	0 %	0 %	90.00 %	1.00 %	0 %	100 %

Source: IEA, as of 2006
* In thousand tons of oil equivalent (ktoe) on a net calorific value basis
** Totals may not add up due to rounding

7.6 DOMESTIC ENERGY RESOURCES, IMPORTS AND EXPORTS

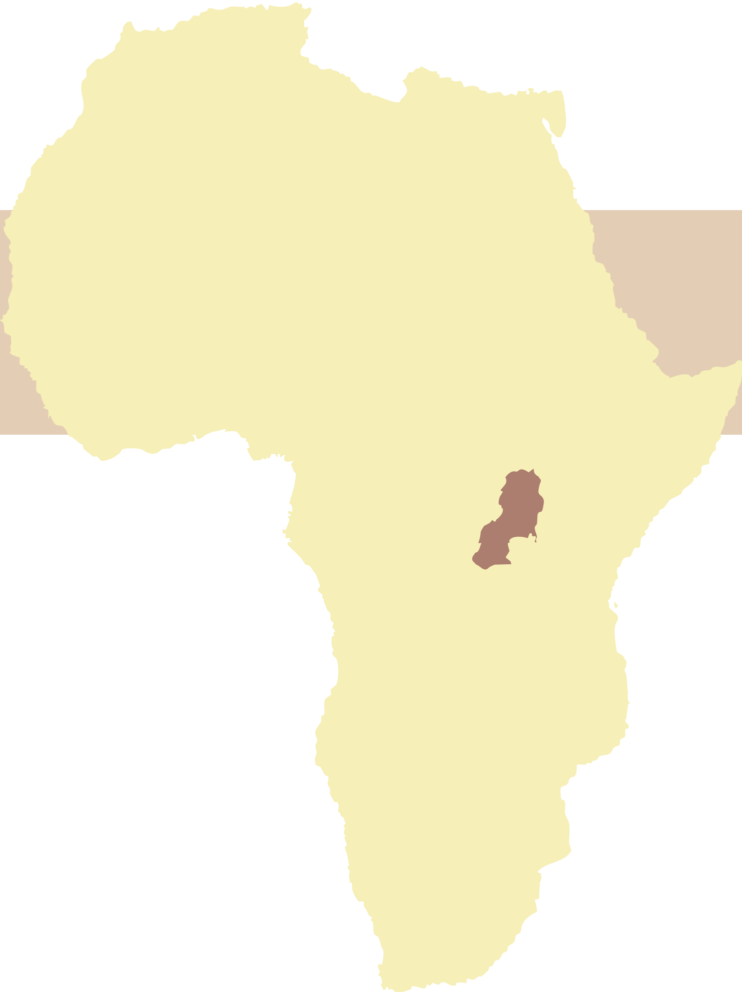
SUPPLY AND CONSUMPTION *	COAL AND PEAT	CRUDE OIL	PETROLEUM PRODUCTS	GAS	NUCLEAR	HYDRO	GEOTHERMAL, SOLAR ETC.	COMBUSTIBLE RENEWABLES AND WASTE	ELECTRICITY	HEAT	TOTAL*
Production	49	0	0	314	0	123	0	18,941	0	0	19,427
Imports	0	0	1,389	0	0	0	0		11	0	1,400
Exports	0	0	0	0	0	0	0	0	0	0	0

Source: IEA, as of 2006
* In thousand tons of oil equivalent (ktoe) on a net calorific value basis
** Totals may not add up due to rounding

7.7 ENERGY SOURCES FOR ELECTRICITY AND HEAT PRODUCTION IN TANZANIA

YEAR 2006	ELECTRICITY (GWH)	HEAT (TJ) (NO INDICATIONS)
Production from		
Coal	106	0
Oil	17	0
Gas	1,217	0
Biomass	0	0
Waste	0	0
Nuclear	0	0
Hydro*	1,436	0
Geothermal	0	0
Solar PV	0	0
Solar thermal	0	0
Wind	0	0
Tide	0	0
Other sources	0	0
Total production	2,776	0
Imports	123	0
Exports	0	0
Domestic supply	2,899	0
Statistical differences	0	0
Total transformation**	0	0
Electricity plants	0	0
Heat plants	0	0
Energy sector***	106	0
Distribution losses	580	0
Total final consumption	2,213	0
Industry	1,138	0
Transport	0	0
Residential	871	0
Commercial and public services	0	0
Agriculture/forestry	0	0
Fishing	0	0
Other non-specified	204	0

Source: IEA, as of 2006
* Includes production from pumped storage plants
** Transformation sector includes electricity used by heat pumps and electricity used by electric boilers
*** Energy Sector also includes own use by plant and electricity used for pumped storage



COUNTRY CHAPTER:
UGANDA

Author of Country Chapter
Dr. Eng. **Mackay A.E. Okure**

Coordination and Review of the Country Chapter
Dipl. Phys. **Rafael Wiese**
PSE AG
Freiburg, Germany
www.pse.de

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS UGANDA

ACRONYMS AND ABBREVIATIONS

UGANDA

ACP	African, Caribbean and Pacific Group of States
AfDB	African Development Bank
ARGeo	African Rift Geothermal Development Facility
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe (Federal Institute for Geosciences and Natural Resources)
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)
BUDS-ERT	Business Uganda Development Services – Energy for Rural Transformation
BOU	Bank of Uganda
CDM	Clean Development Mechanism
CERA	Carbon Emission Reduction Association (in Uganda)
COMESA	Common Market for Eastern and Southern Africa
GSMD	Geological Survey and Minerals Department
DNA	Designated National Authority
DWD	Directorate of Water Development
EAC	East African Community
EAP	Energy Advisory Project
ERA	Electricity Regulatory Authority
ERT	Energy for Rural Transformation
EU	European Union
F.O.B.	Free On Board
GDP	Gross Domestic Product
GEF	Global Environment Facility
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation Agency)
IPP	Independent Power Producer
IPS	Industrial Promotion Services Ltd.
JICA	Japanese International Cooperation Agency
KfW	Kreditanstalt für Wiederaufbau (German Banking Group including KfW Entwicklungsbank as German Development Bank)
LPG	Liquefied Petroleum Gas
MEMD	Ministry of Energy and Mineral Development
MIGA	Multilateral Investment Guarantee Agency
MOFPED	Ministry of Finance, Planning and Economic Development
N.a.	Not Applicable
NEMA	National Environment Management Authority
NFA	National Forestry Authority
NGO	Non Governmental Organization
PPA	Power Purchase Agreement
PPP	Public Private Partnership
PSFU	Private Sector Foundation
PREEEP	Promotion of Renewable Energy and Energy Efficiency Program
PREPS	Priority Rural Electrification Projects
PV	Photovoltaic
RAP	Resettlement Action Plan
RE	Renewable Energy
REA	Rural Electrification Agency
REB	Rural Electrification Board
REF	Rural Electrification Fund
SCOUL	Sugar Corporation of Uganda Ltd.
SHS	Solar Home Systems
SIDA	Swedish International Development Agency
UAE	United Arab Emirates
UBOS	Uganda Bureau of Statistics
UEB	Uganda Electricity Board

UEDCL	Uganda Electricity Distribution Company Ltd.
UEGCL	Uganda Electricity Generation Company Ltd.
UERD	Uganda Energy for Rural Development
UETCL	Uganda Electricity Transmission Company Ltd.
UIA	Uganda Investment Authority
UNBS	Uganda National Bureau of Standards
UNDP	United Nations Development Program
UNEP	United Nations Environmental Program
UNIDO	United Nations Industrial Development Organization
URA	Uganda Revenue Authority
USD	United States Dollar (US Cent = United States Cent)
USEC	Uganda Sustainable Energy Company Limited
UG Shs	Uganda-Shilling (100 UG Shs = 0.036 €, as of December 2009)
VAT	Value Added Tax
WENRECO	West Nile Rural Electrification Company

MEASUREMENTS

bbl	Barrel
°C	degree Celsius
GWh	gigawatt hour (1 GWh = 1,000,000 kWh)
kg	kilogram
kgoe	kilograms of oil equivalent
kV	kilovolt
km^2	square kilometer
l	liter
LPD	liters per day
m	meter
m^3	cubic meter
MW	megawatt (1 MW = 1,000 kW)
Wp	Watt-peak (1kWp = 1,000 Watt-peak)

SUMMARY

ECONOMIC STATUS AND DEVELOPMENT OF UGANDA

Uganda is a landlocked country but blessed with a huge variety of fresh water. It is the source of the Great River Nile and home to Lake Victoria. 85 % of the population live in rural areas and are mainly engaged in subsistence agriculture[1]. More than one third of the population lives below the poverty line. Coffee and fish are the main export goods. The economy is steadily growing with a last year rate of 9 %[2].

STRUCTURE OF ENERGY SUPPLY IN UGANDA

Uganda's primary energy supply and consumption are dominated by biomass with 92 % followed by petroleum (6 %) and electricity (2 %)[3].

Electricity

Electricity is generated from two hydro- (380 MW) and three thermal power plants (50 MW each). The countrywide electrification rate is 9 %. In urban areas, mainly in Jinja-Entebbe-Kampala, about 42 % of the population have access to the national grid, while in rural areas the rate is 3 %[4]. The average per capita consumption is 57 kWh per year.

Oil

Uganda's oil consumption[5] of 11.570 barrels a day (as of 2006) is met by imports from Kenya. Currently oil has been discovered in western Uganda after years of exploration. The production was expected to begin in 2009. The country plans to build an oil refinery, producing between 6,000 to 10,000 barrels a day.

STATUS OF RENEWABLE ENERGIES IN UGANDA

Biomass

The main source of the nation's energy consumption is biomass, accounting for 92 % of the total primary energy supply. It is mainly used for cooking and water heating. A Dutch-German funded project has distributed around 600,000 improved stoves to decrease wood consumption. The sugar companies in the country are using bagasse for cogeneration. Out of the installed 22 MW capacity, around 12 MW are supplied to the national grid. So far, biogas technology is used on a small scale.

Solar

The annual PV market potential is estimated at 200 kWp, mainly driven by the Energy for Rural Transformation (ERT) program[6]. Main applications in rural areas are small solar home systems (SHS) and institutional systems for schools and clinics.

Solar water heaters are typically installed in hotels and lodges, but have lately also become popular with high-income urban customers. The average time for return on investment is about two years.

Hydro

Two large hydro power stations with a capacity of 380 MW are the backbone of the Ugandan electricity supply. A new dam with a capacity of 250 MW is currently under construction.

More than 60 mini hydro power sites with a total potential of about 210 MW have been identified through different studies in Uganda and some are under construction.

1 RURAL POVERTY PORTAL, AS OF 2009
2 MOFPED, AS OF 2008
3 MEMD, AS OF 2007, AND UBOS, AS OF 2009
4 MEMD, P. 27, AS OF 2007
5 CIA, AS OF 2009
6 SEE MEMD, ERT FACT SHEET, AS OF 2009

1 COUNTRY INTRODUCTION

1.1 UGANDA OVERVIEW

Uganda is a landlocked country, about 2,000 km inland from the Indian Ocean. It lies between latitudes and longitudes 4°20' North, 1°50' South, 280° East, and 350° West. Its neighboring countries are Kenya to the East, Tanzania and Rwanda to the South and South West, the Sudan to the North and the Democratic Republic of Congo to the West.

Uganda is the source of the Great River Nile and home to Africa's largest fresh water lake, Lake Victoria. 85 % of the population live in rural areas and mainly engaged in subsistence agriculture.

Uganda's political state is governed by the Constitution of 1995 adopted after emerging from the political and economic chaos of the 1970s and 1980s. The Constitution provides for presidential, parliamentary and local elections in a five-year term. Previous elections have been held in 1996, 2001 and 2006. All of the elections were won by President Yoweri Museveni. The last election of 23 February 2006 was held under a multi-party system. Considerable progress has been made in restoring peace across Uganda and in rebuilding infrastructure shattered by civil war. The lingering insecurity in northern Uganda was also being brought to an end within the framework of a peaceful settlement with the rebel movement.

1.2 UGANDA STATISTICS: GEOGRAPHY AND ECONOMICS[7]

LAND AREA:	241,020 km²
POPULATION:	31.4 million (as of 2007), growth rate 3,2 %
DENSITY:	130 inhabitants/km²
SHARE URBAN / RURAL POPULATION:	15 % / 85 %
BIGGEST CITIES AND POPULATION:	Kampala (1.5 million inhabitants)
CLIMATE:	Two rainy seasons (March–May, October–November)
AVERAGE TEMPERATURE:	15–30 °C
ALTITUDE	1,000–1,300 m above sea level
MAIN WATER BODIES:	Lake Victoria, Lake EdwaRd., River Nile
VEGETATION	Fertile to mountainous
GDP PER CAPITA (AT PURCHASING POWER PARITY)	963 USD (as of 2007)
GDP GROWTH RATE:	9 % (as of 2007)
INFLATION RATE:	6 % (as of 2007)
AGRICULTURE:	Coffee, tea, cotton
INDUSTRIES:	Sugar, cotton
ELECTRICITY – PRODUCTION:	1,560 GWh (as of 2006)
ELECTRICITY – CONSUMPTION:	1,609 GWh (as of 2006)
OIL – PRODUCTION:	None
OIL – CONSUMPTION:	11,000 bbl/day (as of 2005)
OIL – PROVEN RESERVES:	Under assessment
NATURAL GAS – PRODUCTION:	None
NATURAL GAS – PROVEN RESERVES:	None (as of 2006)
EXPORTS:	1,686 billion USD f.o.b. (as of 2007)
EXPORTS – COMMODITIES:	Coffee, fish and fish products, tea
EXPORTS – PARTNERS:	Netherlands, Belgium, Germany
IMPORTS:	2,983 billion USD
IMPORTS – COMMODITIES:	Vehicles, petroleum
IMPORTS – PARTNERS:	Kenya, China, UAE
EXCHANGE RATE:	100 UG Shs = 0.036 € (as of December 2009)

Source: CIA, as of 2009

7 CIA, AS OF 2009

2 ENERGY MARKET IN UGANDA

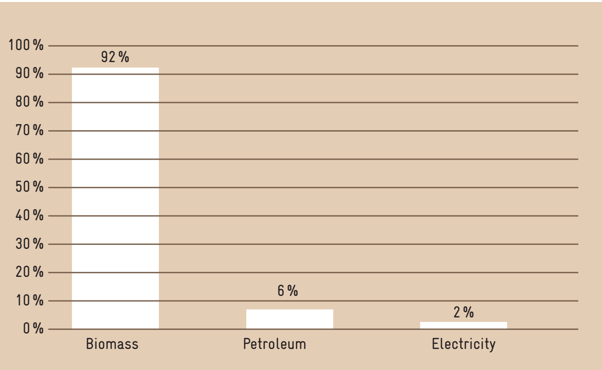
2.1 ENERGY SITUATION OVERVIEW

Uganda's energy supply and consumption is dominated by biomass, which accounts for more than 92 % of the primary energy supply. Other primary energy sources used in the country are petroleum and hydro. Since 2002, the shares of the different primary energy sources in the total supply have remained unchanged. Biomass is consumed in its traditional form as firewood and crop residues. Petroleum products are imported. Electricity is generated mainly from hydro power and thermal plants[8].

The following table provides commercial energy consumption figures for the last three years.

FIGURE 1

Shares of Total Primary Energy Consumption



Source: MEMD, 2007c, Graph: PSE AG

TABLE 1

Shares of Total Energy Consumption

ENERGY TYPE	2005	2006	2007
Electricity (GWh)	1857, 000	1609,000	1797,000
Petrol (m^3)	174,054	198,125	191,713
Diesel (m^3)	319,574	417,449	464,121
LPG (m^3)	2,822	3,474	4,300
Kerosene	39,836	42,897	34,309

Source: MEMD, as of 2007, and UBOS, as of 2008

2.2 ENERGY CAPACITIES, PRODUCTION AND CONSUMPTION

Up to 2005, electricity generation was dominated by two large hydro power stations. The stations of Nalubale and Kiira are located at the Owen Dam Falls and have a total generation capacity of 380 MW. During 2005 and 2006, the country experienced a drought enforcing the reduction of hydro power capacity to 145 MW.

Since 2006, three thermal oil-fired plants with a total capacity of 150 MW have been built, a fourth plant of 50 MW is under construction. The higher generation costs meant higher tariffs which the Government subsidized to make electricity affordable to industry and other consumers. A subsidy of about 35 % is offered through the national budget. In order to increase the generation capacity of the cheaper hydro power, the Government has introduced an energy fund of about 100 million USD per year. The funds are used to invest in large hydro power plants[9]. The table below shows the electricity generation capacity and supply to the grid.

Due to shortage of capacity on the national grid, power rationing currently takes place. At the worst, power cut-offs happen from 6:00 p. m. to 8:00 a. m. or alternately from 8:00 a.m. to 2:00 p.m. Usually, nighttime cut-offs take place once a week. For towns supplied with generators, power is available for only 4 hours from 7:00 p.m. to 11:00 p.m.[10]

The national system operator reports technical losses amounting to 4 %[11]. Commercial losses at about 35 % due to poor lines and transformers, power thefts and lack of billing are reported by the distributor[12]. There have been attempts to cut this rate but with limited success.

The national electrification rate is 9 %. It is 42 % in the urban area of Jinja-Entebbe-Kampala and 3 % in the rural areas[13]. The average electricity consumption per capita is 57 kWh.

TABLE 2

Electricity Production

	2005		2006	
SOURCE OF ELECTRICITY PRODUCTION	PRODUCED CAPACITY	PRODUCED ELECTRICITY	PRODUCED CAPACITY	PRODUCED ELECTRICITY
Large hydro power (Nalubale and Kiira)	380.0 MW	1,698,535	145.0 MW	1,160,456
Thermal power (oil fired)	50.0 MW	140,304	100.0 MW	369,499
Small-scale hydro power	15.9 MW	21,262	15.9 MW	30,021
Biomass (sugar) cogeneration (Kakira, Kinyara, SCOUL)	n. a.	n. a.	22.0 MW	n. a.
Imports (Kenya, Rwanda)	n. a.	24,177	n. a.	49,027
TOTAL	445.9	1,884,278	495.9	1,609,003

Source: table compiled by the author with data from MEMD Annual Reports as of 2005, 2006, 2007

8 UBOS, P. 48, AS OF 2009
9 MOFPED, AS OF 2008
10 SEE UMEM, WWW.UMEME.CO.UG, AS OF 2009
11 UETCL, AS OF 2007
12 UMEM, WWW.UMEME.CO.UG, AS OF 2009
13 MEMD, P. 27, AS OF 2007

2.3 ENERGY PRICES

Energy prices in Uganda vary widely depending on the location and the supply situation. Electricity tariffs are, however, uniform on the grid and deviate slightly on mini grids. Current energy prices can be found in the table below.

Currently, feed-in tariffs for Independent Power Producers (IPP) are negotiated on a case-by-case basis[14]. Within the Renewable Energy (RE) policy, feed-in tariffs have been specified for the existing hydro power and cogeneration plants. Details can be found in annex 8.7.

Two sugar plantations have build cogeneration plants and are currently negotiating the tariff with the grid operator on avoided cost basis.

TABLE 3

Energy Prices November 2007/ Grid Electricity for Domestic Consumers

ENERGY TYPE	PRICE
Fuel wood (Kampala)	0.7 USD/kg
Fuel wood (outside Kampala)	0.4 USD/kg
Charcoal (Kampala)	0.21 USD/kg
Charcoal (outside Kampala)	0.10 USD/kg
Kerosene	1.17 USD/l
LPG	2.44 USD/l
Diesel	1.37 USD/l
Petrol	1.49 USD/l
Grid Electricity (without VAT)	0.25 USD/kWh

Source: ERA, www.era.or.ug, viewed In June 2009; data on petroleum products and other fuels compiled from open markets in and around Kampala.

2.4 MARKET ACTORS FOR PLANNING, REGULATION AND DISTRIBUTION

MEMD

The Ministry of Energy and Mineral Development (MEMD) is the lead Government body responsible for energy policy development, planning and programming, guidance and implementation. A new Renewable Energy Division under MEMD was formed recently[17].

MOFPED

The Ministry of Finance, Planning and Economic Development (MOFPED) plays a key role in the energy market. Apart from the overall national macro-economic management, development planning and resource mobilization it is also in charge of budgetary allocation and disbursement. Specific funding to the energy sector is channeled through the Bank of Uganda to the banks that lend to project developers and private users depending on the funding mechanism. Its programs are subject to approval by the Parliament of Uganda.

DWD

The Directorate of Water Development (DWD) provides permits for water extraction for hydro power plants. The local governments including district authorities, city councils and divisions, municipalities and lower level governments carry out approval, planning, implementation and monitoring of all activities under their jurisdiction.

ERA

The Electricity Regulatory Authority (ERA) is the national regulatory body in the power sector. It issues licenses for generation, transmission and distribution of electricity.

NEMA

The National Environment Management Authority (NEMA) enforces environment impact assessments and issues environmental permits.

UNBS

The Uganda National Bureau of Standards (UNBS) develops, adopts and enforces standards for trade, industry and consumer protection.

URA

The Uganda Revenue Authority (URA) is in charge of taxation and customs.

UIA

The Uganda Investment Authority (UIA) facilitates investments.

REB/REA

The Rural Electrification Board (REB) with its secretariat, the Rural Electrification Agency (REA), is the key player in planning increased rural electricity access.

UETCL

The Uganda Electricity Transmission Company Limited (UETCL) as a public company owns and operates the high voltage transmission grid (above 33 kV) and acts as supplier, exporter, importer, and sole buyer of bulk power.

Further information on each of these institutions can be obtained from the corresponding websites given in chapter 7.

3 RENEWABLE ENERGY POLICY FRAMEWORK CONDITIONS

Uganda is a signatory of the EAC Customs Union treaty, which offers a common external tariff to gradually develop into a free trade area. Uganda is also a member of the Common Market for East and Southern Africa (COMESA). Uganda's policies are clearly aligned with the regional market. During the latest Ugandan budget period for example, the import duty on unsealed deep cycle batteries for use with solar equipment was cut by all the EAC countries.

The Energy Policy for Uganda was published in 2002 with its stated goal to meet the energy needs of Uganda's population for social and economic development in an environmentally sustainable manner. The policy provides the vision for increased and improved modern energy supply for sustainable economic development as well as improving the quality of life of the Ugandan population.

14 MEMD, AS OF 2007
15 MEMD, AS OF 2007

SHORT BUSINESS INFO

Zero import duty on unsealed solar deep cycle batteries in all EAC countries

3.1 POLICY AND RENEWABLE ENERGY PROMOTION PROGRAMS

In 2003, the Energy Policy for Uganda led to the unbundling of the national utility monopoly of Uganda Electricity Board (UEB) and the creation of separate entities for generation, transmission and distribution (namely UEGCL, UETCL UEDCL). Furthermore, the Electricity Regulatory Authority (ERA) and the Rural Electrification Fund (REF) were established. A clear target and operational modalities for implementing the Rural Electrification Strategy and Plan was set. The nationwide access to electricity is targeted to be increased from 2 % in 2001 to 10 % by 2012. In March 2007, the Government of Uganda approved a Renewable Energy Policy aiming to increase the use of modern RE from 4 % in 2007 to 61 % of total energy consumption by 2017[16].

3.2 DONOR AID ACTIVITIES

Energy for Rural Transformation Program

The main initiative to develop the RE market is the Energy for Rural Transformation (ERT) Program[17]. The ERT Program is a 10-year multi-sector program meant to eradicate poverty and achieve development. The cumulative effect has been an increase of electricity access from approximately 1 % at the beginning of 2001 to 3 % at the end of 2005, which is a positive step towards achieving the 10 % target by 2012. The total funds provided by World Bank, GEF and other donors is 439.3 million USD (with a total of 123.3 million USD for phase I).

The project's objectives are:

- To provide increased access to adequate and reliable supplies of electricity for rural households
- To stimulate increased productivity and income arising from electricity access for rural enterprises

The three ERT components – namely grid extension, independent off-grids and PV systems – were implemented. Implementation of the first phase of ERT ended in February 2009 followed by ERT phase II[18]. Within the second phase, two of the three main components have business opportunities for RE:

Component 2 aims at the installation and operation of independent grid systems in concentrated but remote settlements with a potential for the use of electricity by rural enterprises. Grants will be provided for RE investments where RE, especially for small hydro power, is part of the independent grid.

Component 3 aims at marketing, sales and service of Solar PV systems. The project will provide grants for the installation of PV systems in homes and rural enterprises for relatively dispersed areas that have small loads, where even small independent grid systems are not viable. In addition, technical assistance will be provided for business development and support services.

Administered by the Business Uganda Development Services (BUDS) the program has a group of 17 companies participating in the sales-based performance grant program (see annex 6.1).

Phase II plans were approved by the Steering Committee in late October 2008. The Government of Uganda has applied for funding from the World Bank in February 2009 amounting to 75 million USD, which was approved by the World Bank on 7 April 2009[19]. The first tender was already issued end of March 2009 for the ‚Supply, Installation, Commissioning and Maintenance of Solar Photovoltaic Energy Packages for Health Centers' in several districts.

The organizations that played a key role in phase I will still be active, namely the Bank of Uganda (BOU) for the financing, The Private Sector Foundation (PSFU) to implement business to business support (support of private entities engaged in operation and maintenance of grid extension projects) and the Rural Electrification Agency (REA) for the provision of subsidies for grid extensions, mini-grids and PV systems. The official target figures are shown in chapter 5.2 Solar Energy.

German Development Cooperation

Since August 2007, energy has been one of three focal areas of the Ugandan-German bilateral development cooperation. Main part of the cooperation is the Promotion of Renewable Energy and Energy Efficiency Program (PREEEP), which is being implemented on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ) with cofinancing from the Dutch Government and ACP–EU Energy Facility. It works closely with all relevant Ugandan stakeholders (the Government, NGOs, the private sector, the media, and training and research institutions) on developing sustainable energy policies, improving energy efficiency and widening access to modern energy in rural areas. Along with policy advisory, the program has three main components: biomass, rural electrification and energy efficiency. The program supports through training, demonstration and implementation of projects the dissemination of improved stoves, micro hydro power, PV systems and energy efficient measures. Significant emphasis is given to awareness raising and capacity building. As a result of the program, until mid-2009 nearly 600,000 improved cook stoves have been disseminated as well as about 70 institutions have been equipped with solar PV systems[20].

Other donor countries with activities in the area of energy include Japan, Sweden and Norway. While the latter is involved in the large hydro power generation project at Bujagali falls, the former two countries are involved in transmission grid extension. The Swedish International Development Agency (SIDA) is also providing funds for energy audits and energy efficiency measures in public buildings.

16 MEMD, AS OF 2007
17 ENERGY FOR RURAL TRANSFORMATION, BUDS – ERT AND MEMD, ERT FACT SHEET, AS OF 2009
18 SEE ALSO WORLD BANK, AS OF 2009
19 FOR FURTHER INFORMATION SEE WORLD BANK, HTTP://WEB.WORLDBANK.ORG › PROJECTS & OPERATIONS › BROWSE BY – COUNTRY/AREA › UGANDA
20 GTZ – PREEP, AS OF 2009

3.3 MARKET RISKS

Uganda operates an open and liberalized business environment. Government policy is to encourage commerce by establishing favorable general conditions for trade. Investors are given bounteous incentives and there are no restrictions on capitalization of projects or on transfer in or out of capital.

For an international company intending to market RE equipment and technologies, the easiest avenue is through local representation using the following marketing methods: local distributors, international tender, local tender or importers on their own account. The use of manufacturer's representatives and agents is widespread although it is necessary to be conscious of free riders.

In general, the Government and the donors are the major consumer of goods and services. All procurements and contracts are handled by respective procurement committees in each Ministry and governmental body. This is regulated in the Public Procurement and Disposal of Public Assets Act 2003, which does not accept direct procurement, yet emphasizes competitive and transparent bidding in an attempt to stem corruption through kick-backs. Frequent legal and administrative petitions alleging unfair procurement practices, however, often cause severe delays and even cancellation of contracts.

Tariffs in Uganda differ by commodity and are based on the Harmonized System (HS) as specified by the Uganda Revenue Authority. There are no taxes levied on renewable energy equipment[21]. Problems may, however, arise in the classification of accessories.

The development and enforcement of standards is mandated to the Uganda National Bureau of Standards (UNBS) that is also responsible for inspection and approval of all imports at entry. Sale of substandard equipment is, however, still a problem. Manufacturers and traders may patent their inventions and register their trademarks in Uganda at The Registrar of Companies. Uganda is a party to the Paris Convention for the Protection of Industrial Property Rights.

Other business considerations worth noting are the following:

Skilled Personnel and Awareness

There is a shortage of qualified technical personnel in the country. There is also a low level of awareness of RE technologies among the population due to low literacy levels. Opportunities exist to link up with the Makerere University in Kampala that has recently started a RE master degree course and has been carrying out various capacity building activities. The ERT project has also trained some 30 technicians in 17 firms (listed in the annex) in the area of installation and maintenance of SHS.

Land Rights

Acquiring land for the development of energy infrastructure is an expensive and slow process.

Importation

Uganda being a land locked country, imports have to be air lifted, landed at the ports of Mombasa in Kenya or Dar es Salaam in Tanzania on the Indian Ocean, which entails higher transportation costs and/or extra customs procedures in Kenya or Tanzania and possible delays and/or pilferage.

4 STATUS AND FUTURE OUTLOOK FOR RENEWABLE ENERGIES

The potential of RE is relatively untapped in Uganda. Currently, the private sector started to develop the market supported by various international programs. The following table gives an overview for RE business opportunities, which will be explained in more detail in the following subchapters:

TABLE 4

Economic Potential of RE Technologies

PROJECT	INVESTMENT CLIMATE	FINANCING OPPORTUNITIES
Large hydro (700 MW, about 1,270 million USD)	Favorable as PPP or IPP	Government is committed to build hydro plant through an energy fund and to grant concession to the private sector for operation
Mini and micro hydro (70 MW, about 204 million USD)	Several available as mini grids or IPPs	Subsidies available from REA under the ERT program
Cogeneration (45 MW, about 50 million USD)	Possible joint ventures with sugar plantations owners	Subsidies available from REA under the ERT program
Geothermal (300 million USD)	Several sites earmarked for studies and development as IPPs	Government and direct investment
Household electrification (400,000 households, about 1,650 million USD)	Open for private sector operated distributors, grid extension contractors, PPPs and IPPs for mini grids and private sector distributors	Donor-financed grants as well as Government ERT financing and community-based initiatives, which are all based on the target set for 10 % rural electrification; it involves a combination of grid extension, mini grids and SHS
Solar water heaters (30,000 m² installed,, about 10 million USD)	Open for private sector distributors	Government and donor grants for communities, Government institutions (schools, health centers etc.) and end-users
Biofuels (720,000 m³/year, about 18 million USD)	Open for direct private investment, especially for local farmers	Government to promote production of biofuels from non-food plant materials

Source: MEMD, as of 2007

21 SEE URA IN THE INTERNET

4.1 BIOMASS/BIOGAS

Energy for cooking and water heating in rural areas is mainly covered by biomass like firewood, shrubs, grasses, forest wastes and agro-industrial residues such as bagasse, husks, trash from sugar, oil milling and grain milling. Trading in charcoal contributes to the rural incomes, tax revenue and employment. Most urban households, institutions and commercial entities also rely on biomass. Biomass consumption per capita is 240 kg/year for firewood and 120 kg/year for charcoal. Furthermore, crop residues and agro-industrial residues including husks, bagasse and oil residues play a significant role (about 5 %) in Uganda's energy consumption. In total, biomass accounts for 92 % of the nation's energy consumption.

The use of improved stoves is currently promoted by the MEMD with support of the PREEEP Program funded by German Development Cooperation. About 600,000 units had been distributed by June 2008 in various country districts. The activity is also supported by the Dutch Government with additional funding.

Currently, three factories in Uganda – namely Kakira Sugar Works Ltd., Kinyara Sugar Works Ltd. and Sugar Corporation of Uganda Ltd. – run cogeneration plants based on bagasse. The total capacity is 22 MW. Out of this, 12 MW from Kakira Sugar Works is supplied to the grid. The rest is used for internal power supply of the sugar companies.

In July 2003, the company signed a Power Purchase Agreement (PPA) to sell electricity to Uganda Electricity Transmission Company Ltd. (UETCL) after an extension of its cogeneration plant. With the increased production capacity to 4,000 tons of cane per day, this led to increased production of bagasse. The Government of Uganda under the ERT program phase I offered a subsidy worth 3,300,000 USD to support the project. The total cost of the extension works was 8,000,000 USD with private equity of 1,608,215 USD and the rest of the funding through a loan from the World Bank. The subsidy was through a refinance scheme offered through the East African Development Bank but administered by the Bank of Uganda[22]. The feed-in tariff was fixed in 2008 by the regulator without a significant assessment of the actual costs of bagasse cogeneration.

According to the Renewable Energy Policy 2007, bagasse cogeneration from sugar production is targeted at 35 MW by 2012 and at 67 MW by 2017.

SHORT BUSINESS INFO

- The biomass consumption per capita is 240 kg/year of firewood and 120 kg/year of charcoal.
- 360,000 improved stoves have been already installed.
- The potential for biogas digesters is 250,000 cattle keeping households.

Biogas technologies do not have a strong demand in Uganda. Attempts have been made by the MEMD but with limited success. More that 50 % of the estimated 500 existing biogas plants are not operating. There is limited statistics on the actual number in operation. With over 250,000 „zero grazing" farming households (method were cattle is kept in one place), there is potential for small household biogas digesters in the countryside. In addition, commercial dairy farmers and piggeries could support several thousand larger biogas plants to cater for their own thermal and electricity needs.

4.2 SOLAR ENERGY

The average solar radiation is 5.1 kWh/m² per day on a horizontal surface. Solar energy technologies have generated keen interest in the high income and commercial sectors of the Ugandan economy. Many solar energy companies have sustained activity in the market and several new ones keep emerging. A list of companies is provided in annex 5.1.

A small commercial market exists for solar thermal systems. High-income urban households as well as hotels and resorts are the typical client of such systems, and the interest in the technology has soared in the last years.

Due to their reliability and quick payback, solar thermal systems of about 100–150 liters per day (LPD) for domestic use and 3,000 LPD systems for hotels are in high demand. Several companies are involved in marketing and installation of these systems. A range of technologies is installed depending on the major international manufacturers that are represented locally. Almost all systems are flat plate collectors. Prices on the market vary depending on the type of the technology and the brand or the manufacturer, however, a typical 200 LPD system costs 2.0 million to 3.0 million UG Shs, while a 300 LPD system costs 3.5 million to 4.8 million UG Shs.

SOLAR HOT WATER HEATER – EXAMPLE

ENERGY TYPE	PRICE
Investment costs of domestic 3 kW electric heater	300,000 UG Shs
Annual energy consumption at 2 hours daily:	2,190 kWh
Annual electricity cost 2,190 kWh x 426 UG Shs/kWh x 1.18 (VAT):	1.11 million UG Shs
Investment costs of 150-liter solar water heater:	1.88 million UG Shs
Payback period:	17 months

The total annual new installed PV capacity is estimated at 200 kWp for households, institutions and commercial use. Under the ERT program, 20 companies benefited from business development support, including sales grants of 10 to 15 % (see annex 6.1). The system costs were reduced from 20 USD/Wp to 16.5 USD/Wp because of the subsidy[23].

Since 2002, companies have installed nearly 5,000 institutional and household systems under the ERT phase I program. In total, 3,799 Solar Home Systems were installed with a total capacity of 187 kWp. The system sizes range between 14 Wp and 200 W. Around one-third of the systems were large systems (> 200 Wp). 635 systems had a capacity of around 50 Wp and the majority was below 30 Wp. Additionally, 1,928 institutional and 192 commercial PV systems were installed with a total power of 1,223 kWp.

22 MEMD, AS OF 2007
23 MEMD, AS OF 2008.

PLANNED IMPLEMENTATIONS UNDER PHASE II OF THE ERT PROGRAM ARE:

SHS (average 30 Wp)	20,000 systems	600 kWp
Non-project institutional systems (average 465 Wp)	1,000 systems	465 kWp
Schools (average 455 Wp)	560 systems	255 kWp
Health centers (average 835 Wp)	464 systems	387 kWp
Water pumping (a. 13 kWp)	30 systems	392 kWp
TOTAL	22,054 SYSTEMS	2,099 KWP

Approximately 16 million people in 3 million households currently use kerosene wick lamps for lighting. There is an interest to market solar lighting to substitute kerosene lamps. The Rural Electrification Strategy and Plan intends to electrify 400,000 households. 20 % out of these shall be electrified with small Solar Home Systems, amounting to some 700 kWp by 2017. This is a 10 % contribution to the rural electrification target by 2017[24].

SHORT BUSINESS INFO

- The demand for solar hot water heaters increases in the cities.
- The total PV market is estimated at 200 kWp per year with 20 PV companies.
- ERT Phase II will finance 20,000 SHS and another 2,000 larger PV systems with a total capacity of around 2 MWp.
- In addition, the Rural Electrification Strategy and Plan aims to install small Solar Home Systems, amounting to 700 kWp by 2017

4.3 WIND POWER

Wind speed is low in most areas of Uganda. The average wind speeds in low heights (less than 10 m) generally range from 2 m/s to about 4 m/s[25]. In some areas with complex terrain, the wind may speed up due to slopes of hills and escapements and tunneling effects. However, very few wind systems exist in Uganda. They are mainly used for water pumping in the remote arid centers in the North East and some cattle keeping areas in the center.

Recent studies[26] also confirm that electricity generation through wind is feasible, especially for small industries in rural areas with windmills in the range of 2.5 kW to 10 kW.

4.4 GEOTHERMAL POWER

There is a total geothermal energy potential estimated at 450 MW. Three potential areas, Katwe-Kikorongo, Buranga and Kibiro situated in the Western branch of the East African Rift Valley, are earmarked for detailed exploration for geothermal development.

The German Federal Institute for Geosciences and Natural resources (BGR) supports the Government of Uganda in the geo-scientific investigations at Buranga geothermal prospect. At the site, the MEMD through the Geological Survey and Minerals Department (GSMD) foresees to produce electricity with support by ARGeo (African Rift Geothermal Development Facility)[27].

4.5 HYDRO POWER

Small Hydro Power

The Ugandan market for small hydro power is growing rapidly. More than 60 mini hydro power sites with a total potential of about 210 MW have been identified through different studies in Uganda. Some of the sites can be developed for isolated grids, others as energy suppliers to the grid. Recently, KfW Entwicklungsbank (German Development Bank) advertised tenders for studies on two projects at Maziba in Kabale and the Bwindi Impenetrable Forest Reserve. Two plants are under construction under the ERT program – a 3.5 MW plant at Nyagak in West Nile and a 294 kW plant (upgraded from 60 KW) at Kisizi. In addition, 16 MW of independent generation are currently in operation at other grid-connected two plants. They are located at the foothills of the Rwenzori Mountains in the West of Uganda. They are operated privately by Kilembe Mines Ltd. (5.4 MW) and Kasese Cobalt Company Ltd. (10.5 MW)[28].

Large Hydro Power

Two hydro power plants at the source of the Nile River provide the bulk of Uganda's electricity supply. The two stations are located at the outlet of Lake Victoria – Nalubale and Kiira – with a total capacity of 380 MW. Both are owned by the Uganda Generation Company Ltd. They are being operated on a 20-year concession by Eskom Uganda Ltd., a subsidiary of Eskom South Africa, which started in 2003. The Government of Uganda is investing in large hydro power through Public-Private Partnership (PPP). The Bujagali hydro power plant of 250 MW is under construction and tenders associated with this project have been issued. In 2008, the construction for the Karuma dam with a 200 MW capacity was started. The Isimba dam, with a hydro power capacity of 100 MW is also in planning. Investment opportunities exist for engineering, supply and services for these projects.

A list of planned projects can be found in annex 7 "Development of Hydro Power Projects on the Nile River"[29].

24 MEMD, AS OF 2002
25 MEMD, AS OF 2007
26 MEMD, AS OF 2007
27 BGR, AS OF 2009
28 MEMD, AS OF 2007
29 ERA, AS OF 2009

5 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

This chapter provides a list of companies and related organizations currently involved in the Ugandan RE market.

5.1 RENEWABLE ENERGY COMPANIES & BUSINESS RELATED ORGANIZATIONS

ERT – Participation in the Sales-based Performance Grants Program: Approved Companies in 2008[30]

COMPANY	CONTACT PERSON/ADDRESS
Uga Solar Supplies Ltd.	Mr. Joseph Mukasa Phone: +256-41-344809 ugasolar@infocom.co.ug
Incafex Solar Systems Ltd.	Mr. Henry Nganwa Phone: +256-414-250008, +256-77-2750008 incafexsolare@africaonline.co.ug
Solar Energy (U) Ltd.	Mr. Richard Kanyike Phone: +256-414-232114, +256-77-2504429 soenergy@africaonline.co.ug
Solar Energy for Africa Ltd.	Eng. Philip Walusimbi Phone: +256-41-250125 gu@africaonline.co.ug
Ultra Tec (U) Ltd.	Mr. Abhay Shah Phone: +256-414-501620, +256-77-2200007 ultratecug@usa.net
Energy Systems Ltd.	Mr. Emmy Kimbowa Phone: +256-414-250920, +256-77-2313470 emmy@energysystemsug.com
Power Options Ltd.	Mr. Musoke Kivumbi Phone: +256-312-261127, +256-77-2455401 poweroptions@africaonline.co.ug
Uganda Electronics & Computer Industries Ltd.	Mr. Charles Mulamata Phone: +256-75-2643027, +256-41-348708 ueci@infocom.co.ug
Kasese Solar Power Ltd.	Mr. Agaba Abbey Phone: +256-483-44413, +256-77-2865080 aruroko@yahoo.com
Magric (U) Ltd.	Mr. Mike Magnay, Ms Jovia Bogere Phone: +256-41-232100 magric@imul.com
Dembe Trading Enterprises Ltd.	Mr. Anil Damani Phone: +256-41-255253 embe@africaonline.co.ug
Victoria Electricity Supply Co. Ltd.	Mr. Fred MWesigye Phone: +256-77-2757712
Solar Sense Ltd.	Mr. Francis S Kibuuka Phone: +256-392-2961267, +256-71-2606088 Fax: +256-414-568778
Ital Trade Ltd.	Mr. Andrea Marinelli Phone: +256-77-2767862, +256-41-266431 italtrade@utlonline.co.ug
Global Solar Systems	Mr. Joel Leku Phone: +256-78-2441536, +256-77-4044619 lekujoel@yahoo.com
Uganda Batteries Ltd.	Ms. Betty Kiguli Phone: +256-41-343150 ublbateries@utlonline.com, nicehse@infocom.co.ug
Uganda Solar Power Supplies Ltd.	Mr. Osbert Tindimwebwa Phone: +256-78-2952020, +256-414-376015 solarpower4all@yahoo.co.uk

30 SEE BUDS-ERT, AS OF 2009

Renewable Energy Companies Active in Uganda

NAME	ADDRESS	TECHNOLOGY	PROFILE
Uganda Electricity Generation Company Ltd.	Abercourt, 2–8 Faraday Rd. P.O. Box 1101 Jinja – Uganda Phone: +256 434 12081 Fax: +256 434 123064	Hydro	Public company that owns governmental hydro power plants
Eskom (U) Ltd.	Nalubale Power Station Box 942 Jinja – Uganda Phone: +256 434 121416 Fax: +256 434 123154	Hydro	Has the 20 year concession to run and maintain the Nalubaale and Kira power stations
Norpak Power Ltd.	Crusader House 1st Floor Portal Avenue Box 7544 Kampala – Uganda Phone: +256 414 340243/4/5 Fax: +256 414 257861	Hydro	Developer of the Karuma hydro power station
West Nile Rural Electrification Company Ltd.	Box 241 Arua – Uganda Phone: +256 47 4620076	Thermal/Hydro	Operates the West Nile power grid and developer of the 3.5 MW Nyagak hydro power plant
Uganda Electricity Distribution Co Ltd.	Amber House Plot 23/33, Kampala Rd. P.O. Box 7390 Kampala – Uganda Phone: +256 31 2330300 Fax: +256 41 4255600 contact@uedcl.co.ug	Distribution (33 kV and lower)	Owns the national electricity distribution network
UMEME Ltd.	Rwenzori House Plot 1 Lumumba Avenue Box 23841 Kampala - Uganda Phone: +256 31 2360600 Fax: +256 41 425151 umeme@umeme.co.ug	Distribution (33 kV and lower)	Has the 20 year concession to run the distribution business
Solar Construct Ltd.	15 Mulwana Rd. P.O. Box 26216 Kampala – Uganda Phone: +256 77 4290505 +256-312264264 info@solarconstruct.com Website: www.solarconstruct.com	Solar thermal	Solar water heater fabrication and installation
Balton Uganda Ltd.	Plot 47/51 Mulwana Rd. P.O. Box 852 Kampala – Uganda Phnoe: +256 31 2502300/+256 753330767 Fax: +256 41 4349887 sales@balton.co.ug Website: www.baltoncp.com	Solar thermal	Engineering firm, Cromagen solar water heaters repairs
Elektrex Ltd.	6th Street Industrial Area Plot 201 P.O. Box 11937, Kampala – Uganda Phone: +256 414 255966 elektrex@gmail.com	Solar PV	Sale of solar PV systems
UltraTec (U) Ltd.	P.O. Box 6832, Plot 4520 Kabalagala Close, Kam- pala – Uganda Phone: +256 772200007, +256 752 200007, +256 712 200007, +256 414 501620 ultratecug@usa.net Website: www.ultratecworld.com	Solar thermal, PV	Solar kits and lanterns, solar heater
Uganda Stove Manufacturers Ltd.	Kayemba Rd. P.O. Box 1265 Kampala – Uganda	Improved stoves	Rocket stove manufacturers
AB Matra Uganda Ltd.	87 First St. P.O. Box 35022 Kampala – Uganda Phone: +256 414 348874, +256 712 330 501 sales@abmatra.com	Solar thermal, PV	Solar kits and lanterns, Solar heater KOTAK URJA Rep.
Magric (U) Ltd.	Plot103 Jinja Road P.O. Box 3218 Kampala – Uganda magric@imul.co Website: www.magric.com	Solar PV	Manufacturing representative of BP Solar (and others)
Kasese Solar Power (Ltd.)	Plot 58 Rwenzori Rd. P.O. Box 299, Kampala – Uganda Phone: +256 483 444413, +256 752 865080 Fax: +25641 4349293 aruroko@yahoo.com	Solar PV	Solar systems distributor
K.K Electrical Engineering Ltd.	Church Hostel Building Plot 50/52 Mbaguta Street, P.O. Box 14 Mbarara – Kampala Phone: +256 772 571888	Solar PV	Solar systems distributor
Incafex Solar Systems Ltd.	Gathani House Plot 9/6 Bombo Road P.O. Box 25995 Kampala – Uganda Phone: +256 41 4250008, +256 41 4231160, +256 41 4251812 incafexsolar@africaonlineco.ug Website: www.incafexsolar.com	Solar PV	Solar systems distributor
Solar Energy for Africa	Plot 40 Bombo Rd. Carol House Box 4155 Kampala Telephone: +256 41 4250125 Fax: +256 41 4250131 solar-sgu@africaonline.co.org Web site: www.solarafrica.com	Solar	Supply and installation of solar PV solar heating systems

NAME	ADDRESS	TECHNOLOGY	PROFILE
Power Options Ltd.	Teachers House 1st floor Suite109 Plot 28/30 Bombo Rd. P.O. Box 33435 Kampala – Uganda Telephone: +256 31 2264264, +256 41 4348442 Fax: +256 41 434842	Solar PV	Solar system distributor
Suntopway Solar (U) Ltd.	Span House Rm 202 Portal Avenue (next to Workers House) P.O. Box 11915 Kampala – Uganda Phone: +256 75 2099999, +256 77 2393531 suntopway@yahoo.com Website: www.suntopway.com	Solar	Supply and installation of solar PV solar heating systems
Boomer Systems	Plot 13/15 Sturrock Rd. Kamokya P.O. Box 70027 Kampala – Uganda Phone: +256 312 277709, +256 77 2401854 Fax: +256 414 542286 boomersystems@yahoo.com boomersystems@37.com	Solar	Supply and installation of solar PV solar heating systems
Girasolar East Africa Ltd	P.O. Box 6946 Kampala – Uganda Phone: +256 31 2279920, +256 77 2697049 Fax: +256 41 4535685 girasolar@girasolar.co.ug Website: www.girasolar.co.ug	Solar	Supply and installation of solar PV solar heating systems
Uganda Solar Power Supplies	8th Street, Industrial Area Kampala – Uganda Phone: +256 782 952020	Solar PV and solar heating	Design, installation and maintenance of solar and backup power systems, lighting water heating, pump-ing systems
Energy Systems Ltd.	Plot 3 William Street, Get In House, Suite #109, P.O. Box 25928 Kampala – Uganda Phone: +256 414 250 920, +256 772 610904 +256 772 313470 Fax: +256 414 349055 emmy@energysystemsug.com Website: www.energysystemsug.com	Solar hybrid systems based on solar, wind, diesel, biomass, etc.	Retail sales, wholesale supplier, importer, mini grids, hybrid systems
African Alternative Energy Solu-tions, Ltd.	P.O. Box 100 Ntinda Kampala – Uganda Phone: +256 782 722 031	Solar PV and solar heating	Consulting, design and installation of hybrid power systems, backup power systems, solar electric power systems, batteries emergency backup
Equatorsun Ltd.	Plot 4643 Kisugu, P.O. Box 71312 Kampala – Uganda Phone: +256 772 602205, +256 312 277719 Fax: +256 312 277719	Solar water heating systems	Supply and installation of solar electric power systems for hospitals, schools, hotels, and domestic applications
GITT Uganda	Plot 4 Pilkington Road, Colline House, Kampala, – Uganda or P.O. Box 6511, Kampala – Uganda Phone: +256 414 375046 or +256-712 503440 Fax: +256 414 348112	Solar PV	Supply, installing and servicing of solar PV systems
Power Consult (U) Ltd.	P.O. Box 9375 Telephone: +256772504551	Solar	Sales supplier
Davis & Shirtliff Solar	Kitgum House, Jinja Road PO Box 22824, Kampala – Uganda Phone: +256 4346337/6 Fax: +256 4346335 d&sug@dayliff.com Website: www.dayliff.com	Solar water heaters and solar pumps	Distributor of Dayliff solar water heaters
The Sugar Corporation of Uganda Ltd. (SCOUL)	Plot 135, 6th Street Industrial Area P.O. Box 1185, Kampala – Uganda Phone: +256-41-25 50 36 Fax: +256 41 34 75 97 scoul@mehtagroup.com Website: www.mehtagroup.com/Sugar.htm	Biomass	Sugar manufacturer
Kakira Sugar Works Ltd.	Kakira Estate, Jinja P.O. Box 121, Jinja – Uganda Contact: Richard Orr Phone: +256 (0) 414 444000 Fax: +256 (0) 414 444333 Mobile: +256 (0) 75 2790055 richardorr@kakirasugar.com Website: www.kakirasugar.com	Biomass	Sugar manufacturer, power export to national grid, confectionery manufacture, tea manufacture, soap manufacture
Kinyara Sugar Works Ltd.	34 Lumumba Avenue P.O. Box 7474, Kampala – Uganda Contact: Jack Mclean Telephone: +256 (0) 36 600200 mcleanj@kinyara.co.ug Website: www.kinyara.co.ug	Biomass	Sugar manufacturers managed by UK Company Booker Tate Ltd. (current capacity 64,000 tons per year)

5.2 LOCAL INSTITUTIONS RELATED RENEWABLE ENERGY BUSINESS

NAME	ADDRESS	PROFILE	ROLE
Uganda Electricity Transmission Company Ltd.	Amber House 29/33 Kampala Rd. P.O. Box 7625, Kampala – Uganda	Public company that owns grid, sole bulk electricity buyer	Operation, maintenance and development of the grid connecting generation facilities to load centers and to neighboring countries
Uganda National Chamber of Commerce and Industry	17/19 Jinja Road P.O. Box 3809 Kampala – Uganda	Organization of private business	Promotion of private business interests as well as partnerships
Private Sector Foundation Uganda	Plot 43 Nakasero Road P.O. Box 7683 Kampala – Uganda Phone: +256 41 342163 230956 Fax: +256 41 259109 prisf@starcom.co.ug	Umbrella organization of business associations	Advocacy, capacity building and management of sales-based incentives on solar systems
Uganda Manufacturers Association	Lugogo Show Grounds P.O. Box 6966 Kampala – Uganda Phone: +256 41 221034/220831 Fax: +256 41 220285	Association of manufacturers	Capacity building, liaison and pressure group, organization of the Uganda International Trade Fair
Uganda Renewable Energy Association	emmy@energysystemsug.com	Association of businesses in the solar/ renewable energy sector	Liaison with Government and donor agencies
Energy Institute of Uganda	Kisozi House Complex P.O. Box 70826 Kampala – Uganda Website: www.energyinstug.org	Industry multidisciplinary organization	Capacity building and awareness raising
FINCA Uganda	Plot 22 Ben Kiwanuka Street P.O. Box 24450 Kampala – Uganda Phone: +256 41 4 231134 Fax: +256 41 340 078 Contact: Fabian Kasi (Country Director) fkasi@finca.or.ug	Financial institution providing financing services mainly for low-income entrepreneurs (to support job creation, asset building and improve living standards)	Village banking and working capital, solar loans, village phone loans, K O Net, savings accounts, money transfers etc.; as an industry leader, FINCA Uganda finances a significant proportion of its activities by mobilizing client savings

6 BIBLIOGRAPHY

- The Uganda Gazette (1999): Electricity Act 1999, No. 56 Vol. XCII, Kampala
- Ministry of Energy and Mineral Development – MEMD (2001): Rural Electrification Strategy and Plan Covering the Period 2001 to 2010, Kampala
- Ministry of Energy and Mineral Development – MEMD (2002): The Energy Policy for Uganda, (www.energyandminerals.go.ug/EnergyPolicy.pdf), Kampala
- Ministry of Energy and Mineral Development – MEMD (2004): Uganda Energy Balance, Kampala
- Ministry of Energy and Mineral Development - MEMD (2005): Annual Report, Kampala
- Ministry of Energy and Mineral Development - MEMD (2006): Annual Report, Kampala
- Ministry of Energy and Mineral Development - MEMD (2007): ERT Quarterly Report, June – September 2007, (www.energyandminerals.go.ug/EnergyDocuments/ERT%20Bulletin%20%20%202007.pdf)
- Ministry of Energy and Mineral Development – MEMD (2007): The Renewable Energy Policy for Uganda, (www.energyandminerals.go.ug/EnergyDocuments/RENEWABLE%20ENERGY%20POLIC9-11-07.pdf), Kampala
- Ministry of Energy and Mineral Development – MEMD (2007): Annual Report, Kampala
- Ministry of Energy and Mineral Development – MEMD (2008): Evaluation of Phase I of the Energy for Rural Transformation, Kampala
- Ministry of Energy and Mineral Development – MEMD (2009): ERT Fact Sheet, (www.energyandminerals.go.ug/ERT_Fact_Sheet.pdf)
- Uganda Bureau of Statistics – UBOS (2006): 2002 Uganda Population and Housing Census. Analytical Report, Abridged Version, (www.ubos.org/nada/index.php?editable=no&page_type=catalog) Kampala
- Uganda Bureau of Statistics – UBOS (2008): Statistical Abstract, Kampala
- Uganda Bureau of Statistics – UBOS (2008): 2005/06 Uganda National Household Survey, (www.ubos.org/nada/index.php?editable=no&page_type=catalog), Kampala
- Uganda Bureau of Statistics – UBOS (2009): Statistical Abstract, (www.ubos.org/onlinefiles/uploads/ubos/pdf%20documents/2009Statistical_%20Abstract.pdf), Kampala
- Ministry of Finance, Planning and Economic Development – MOFPED (2008): Background to the Budget, Kampala
- Ministry of Finance, Planning and Economic Development – MOFPED (2008), Uganda's Economic and Financial Overview 2007/08, (www.finance.go.ug/docs/Uganda%27s%20Economic%20and%20Financial%20Overview%202007-08.pdf)
- National Environment Management Authority (2007): State of the Environment Report for Uganda 2006/07, Kampala
- Uganda Investment Authority – UIA (2007): Brief Guide to Investing in Uganda, (www.ugandainvest.com/uia2.php?uhpl=guide&&uhpl1=Guide)
- Uganda Investment Authority – UIA (2008): Energy Sector Profile, (www.ugandainvest.com/uia2.php?uhpl=mining_and_energy&&uhpl1=Mining)
- Rural Poverty Portal (2009): Rural poverty in Uganda (www.ruralpovertyportal.org/web/guest/country/home/tags/uganda)
- Central Intelligence Agency – CIA (2009): World Fact Book, Uganda Oil Consumption (www.cia.gov/library/publications/the-world-factbook/geos/UG.html)
- Central Intelligence Agency – CIA (2009): World Fact Book: Uganda, (www.cia.gov/library/publications/the-world-factbook/geos/UG.html)
- Bundesanstalt für Geowissenschaften und Rohstoffe – BGR (2009): African Rift Geothermal Facility (ARGeo), (www.bgr.de/geotherm/projects/argeo.html)
- World Bank (2009): Uganda – Second Energy for Rural Transformation (ERT II) Project, (http://go.worldbank.org/KEP8IXU940)

Websites

- Electricity Regulatory Authority ¬ ERA: (www.era.or.ug). The site provides a wide range of information on legislation, licensing, project opportunities, tariffs and power statistics.
- Rural Electrification Agency – REA: (www.rea.or.ug). The site provides information on channels for the private sector and local communities to access rural electrification subsidy funds for projects. It also provides an Investor's Guide.
- Business Uganda Development Scheme – Energy for Rural Transformation – BUDS-ERT: (www.psfuganda.org/buds-ert.asp, as of 2009). The site provides information on the ERT Program and business-related issues.
- GTZ/PREEP: (www.gtz.de/en/themen/umwelt-infrastruktur/energie/16464.htm). The site provides a description of the GTZ activities in Uganda and links to other GTZ projects in the country.
- Ministry of Energy and Mineral Development – MEMD: (www.energyandminerals.go.ug). Official government site on energy policy issues, providing policy documents, annual reports, energy balance and project documents.
- Uganda Investment Authority – UIA: (www.ugandainvest.com). The site provides information on guidelines, investment incentives and other information on investing in Uganda.
- UMEME Ltd.: (www.umeme.co.ug). The site provides information on Uganda's electricity distribution network and other information regarding network operations.
- Global Energy Network Institute – GENI: (www.geni.org). The site provides information on national energy grids including Uganda's national grid.
- Unimaps.com: (http://unimaps.com/uganda/mainmap.gif). The site provides information on maps and maps of African countries including Uganda in particular.
- World Bank: (http://web.worldbank.org)

7 ANNEX

FIGURE 2

Country Map of Uganda

Source: Unimaps.com, http://unimaps.com/uganda/mainmap.gif, as of 2005

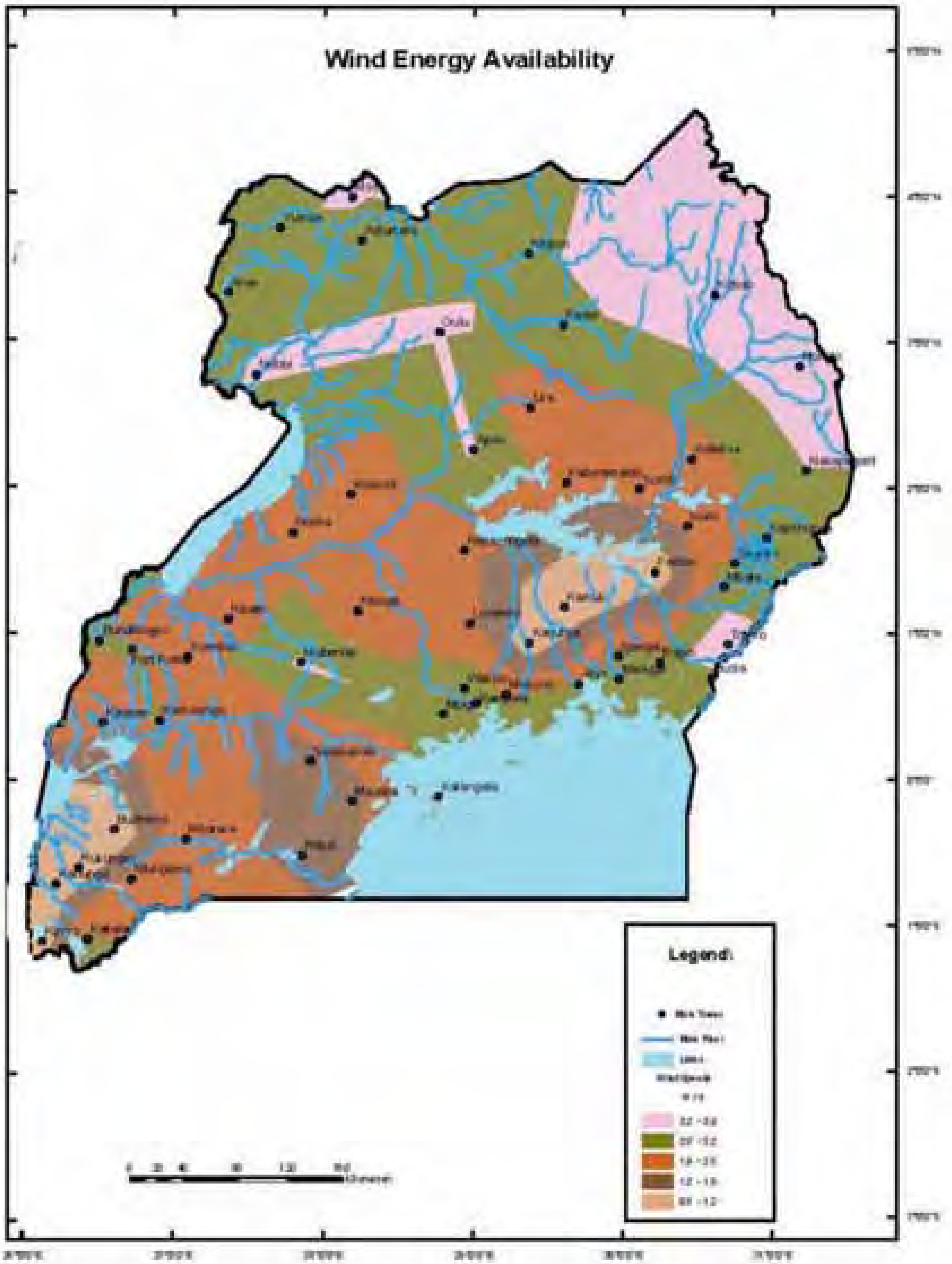
FIGURE 3

Electricity Network of Uganda

Source: UIA, as of 2008

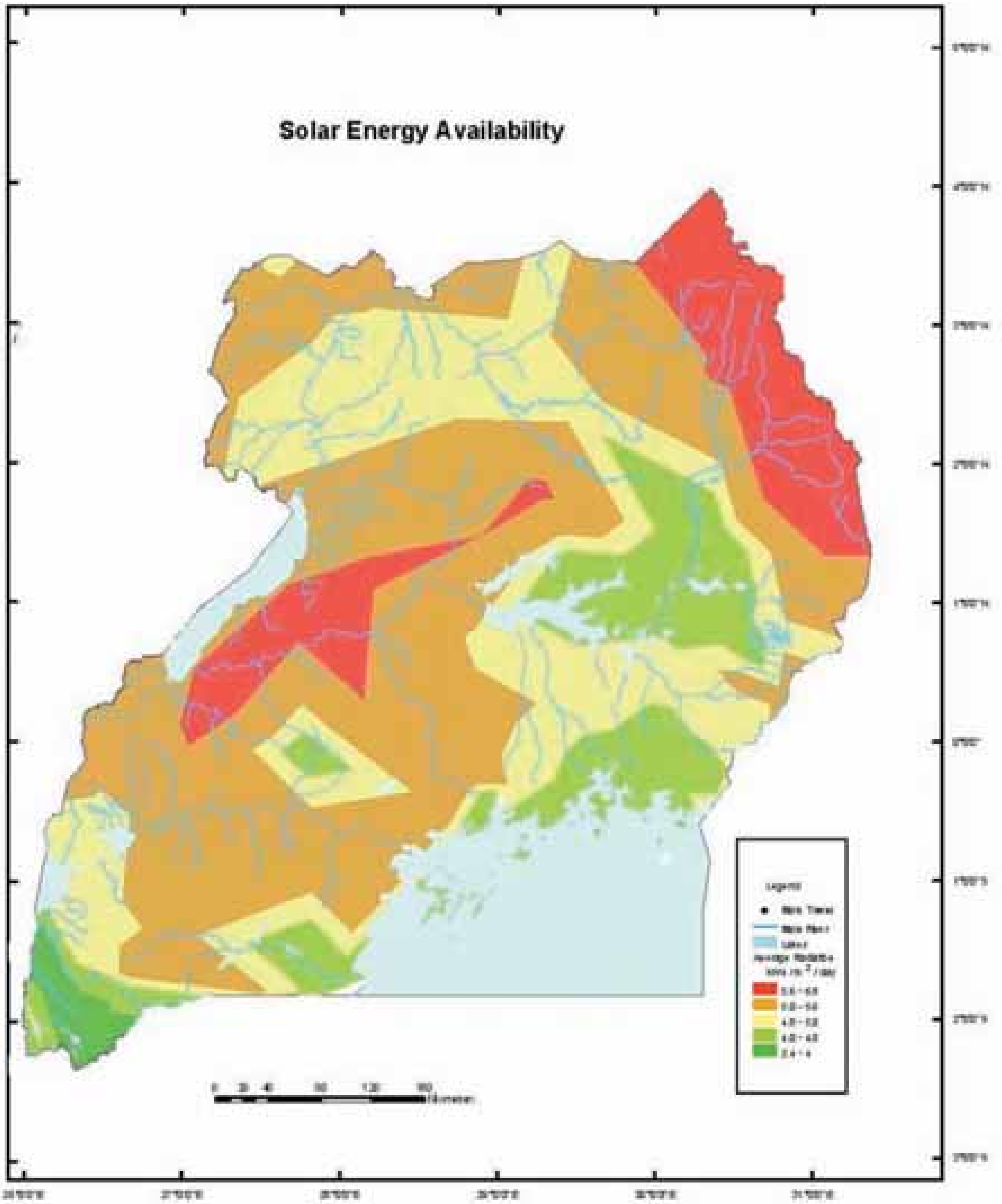
FIGURE 4

Wind Energy Sources



Source: MEMD, as of 2007

FIGURE 5
Solar Radiation

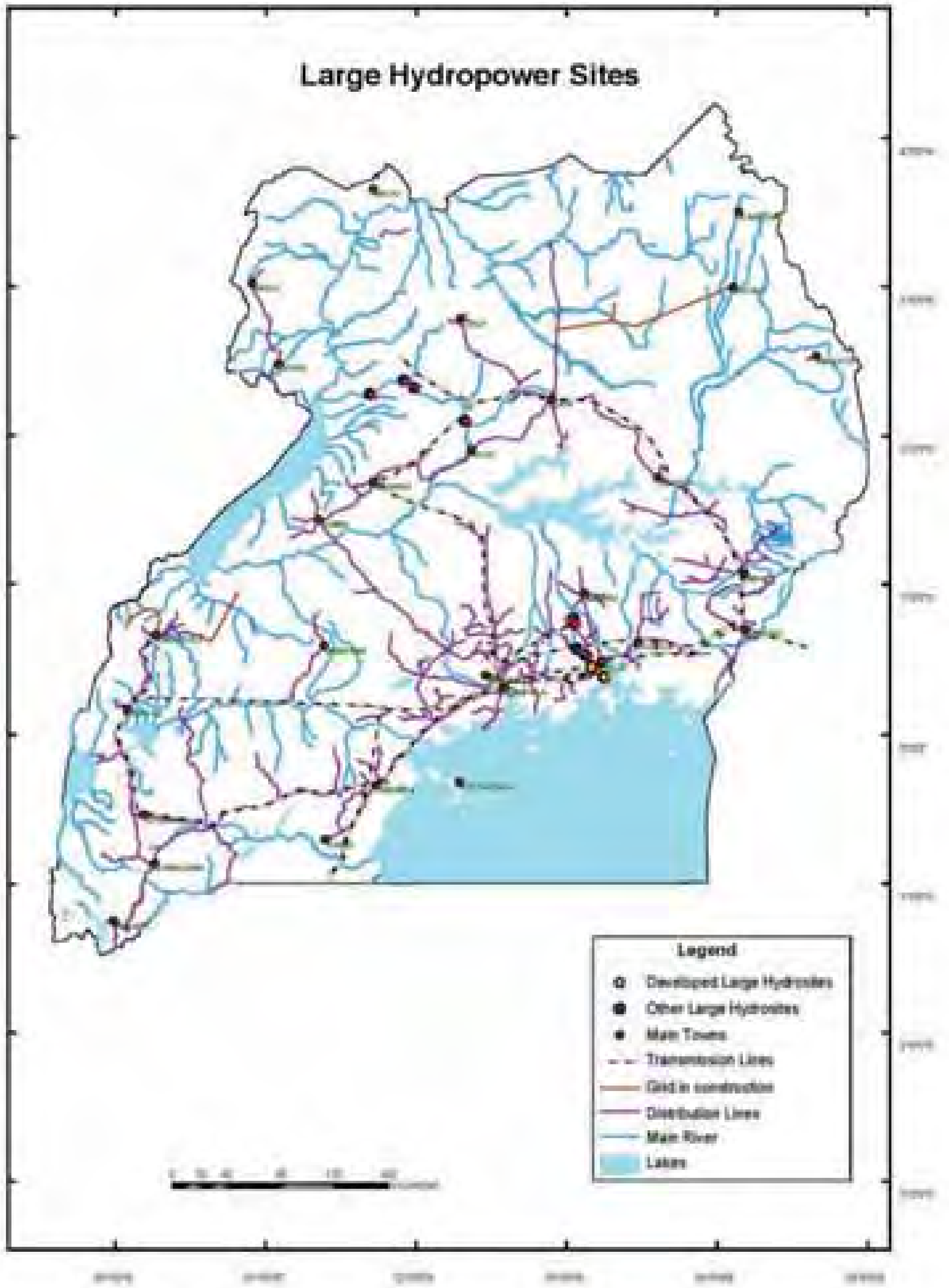


Source: MEMD, as of 2007

FIGURE 6
Geothermal Sources

Source: MEMD, as of 2007

FIGURE 7
Large Hydro Power Sources



Source: MEMD, as of 2007

FIGURE 8
Mini Hydro Power Sources

Source: MEMD, as of 2007

TABLE 5

Feed-In Tariff Schedule for Renewable Energy Generation under 20 MW Hydro Power (US Cent/kWh)

	YEAR 1 _6	YEAR 7–20	SIMPLE WEIGHTED AVERAGE
Peak	12.00	9.00	9.90
Shoulder	6.40	5.40	5.70
Off-peak	4.00	1.50	2.25
Average	7.20	5.33	5.89

TABLE 6

Cogeneration with Bagasse (US Cent/kWh)

	YEAR 1–6	YEAR 7–20	SIMPLE WEIGHTED AVERAGE
Peak	12.00	8.00	9.60
Shoulder	6.00	4.50	5.10
Off-peak	4.10	4.00	4.04
Average	7.03	5.25	5.96

TABLE 7

Development of Hydro Power Projects on the Nile River

SITE	LOCATION	INSTALLED CAPACITY (MW)	POTENTIAL CAPACITY (MW)	STATUS
Nalubale	Jinja	180	180	In operation
Kiira	Jinja	200	200	In operation
Bujagali	Jinja	0	320	A plant of 250 MW capacity is under construction (due to be operational in 2011) by Bujagali Energy Limited (a joint venture of Industrial Promotion Services Ltd (Kenya) and US-based Sithe Global Power LLC)
Kalagala	Jinja	0	350	Feasibility study complete
Karuma	Masindi/ Apac	0	200	Feasibility study complete; NORPAK Power Ltd. is to develop Karuma with due diligence
Ayago South	Gulu/ Masindi	0	234	Preliminary studies available
Ayago North	Gulu/ Masindi	0	304	Preliminary studies available
Murchison	Gulu/ Masindi	0	642	Preliminary studies available, but has adverse environmental effects
Isimba	Kamuli	0	87	Estimate
Bugumira	Kamuli	0	109	Estimate

Source: MEMD, as of 2007

TABLE 8

Non-Nile Mini/Micro Hydro Power Sites

NAME	DISTRICT	STATUS	INSTALLED (MW)	POTENTIAL (MW)
Maziba	Kabale	Out of operation-needs rehabilitation (KfW financing the rehabilitation)	1.00	1.00
Kuluva	Moyo	In operation, feeding Kuluva Hospital	0.12	1.00
Kagando	Kasese	In operation, feeding Kagando Hospital	0.06	1.00
Kisiizi	Rukungiri	In operation at 60 kW; expansion to 294 kW is in progress under the ERT program	0.06	0.30
Mobuku I	Kasese	Operated by Kilembe mines; supplies Kilembe and feeds into the main grid	5.40	5.40
Mobuku III	Kasese	Operated by Kasese Cobalt Co. and feeds into the main grid	10.50	10.50
Muzizi	Kibale/Kabarole	Under development by SN Power Invest AS; permit granted November/December 2004 for 12 months; feasibility study still ongoing		20.00
Warugo	Bushenyi	Pre-feasibility study carried out by UNIDO	0	3.50
Rwizi	Mbarara	Pre-investment studies carried out	0	0.50
Kakaka	Kabarole	Feasibility studies carried out by SWECO (Swedish engineering firm), Eco Power has applied for permit	0	7.20
Nshungyezi	Mbarara	Electricity Distribution Management (Namibia) has permit to develop the site	0	20.00
Nyamabuye	Kisoro	Developer is the Uganda Sustainable Energy Company Limited (USEC); permit granted in February 2005; feasibility study was conducted by Norplan; USEC is yet to start on pre-investment study	0	2.20
Siti	Kapchorwa	Developer Mt. Elgon Power Company; permit issued in July 2002 and extended until September 2004	0	3.30
Sipi	Kapchorwa	Developer Mt. Elgon Power Company; permit issued in July 2002 and extended until September 2004	0	2.50
Anyau/ Olewa	Arua	WENRECO has exclusive rights to the site through the West Nile License	0	1.50
Haisesero	Kabale	Estimate	0	1.00
Kitumba	Kabale	Estimate	0	0.20
Mpanga	Kabarole	Estimate	0	0.40
Nyakibale	Rukungiri	Estimate	0	0.10
Leya	Moyo	Estimate	0	0.12
Amua	Moyo	Estimate	0	0.18
Mvepi	Arua	Estimate	0	2.40
Ela	Arua	Estimate	0	1.50
Agoi	Arua	Estimate	0	0.35
Ngusse	Kibale	Estimate	0	0.40
Kikagati	Mbarara	Old power plant used to operate at 1 MW; China Shang Sheng Industrial Company to rebuild and expand plant to 20 MW; permit granted on 29 July 2005	0	20.00
Sezibwa	Mukono	Estimate	0	0.50
Tokwe	Bundibugyo	Developer Uganda Energy for Rural Development (UERD)	0	0.10
Mgiita	Bundibugyo	Estimate	0	0.15
Miria Adua	Arua	Estimate	0	0.10
Ishasha	Rukungiri	Feasibility studies carried out by consultant; Eco Power has applied for a permit and is carrying out pre-investment studies	0	6.50
Buseruka	Hoima	Feasibility studies done by Hydromax; 12 months of the permit granted; effective 1 August 2005	0	10.00
Nengo Ridge	Kanungu/ Rukungiri	Developer SN Power Invest AS; permit granted November/December 2004 for 12 months	0	7.50
Bugoye	Kasese	Developer SN power invest AS; permit granted November/December 2004 for 12 months	0	11.00
Mobuku II	Kasese	Developer SN power Invest AS; permit granted November/December 2004 for 12 months	0	13.00
Kyambura	Bushenyi	Pre-feasibility studies being carried out by Eco Power	0	0.00
Muyembe Sirinutyo	Sironko	Developer Mt. Elgon Power Company; permit issued July 2002 and extended until expiry in September 2004	0	2.60
Ririma	Kapchorwa	Developer Mt. Elgon Power Company; permit issued July 2002 and extended until expiry in September 2004	0	1.20
Mahoma	Kamwenge/Kabarole	Developer Uganda Energy for Rural Development, permit granted in November/December for 12 months	0	3.00
Rwebijoka	Kabarole	Developer Uganda Energy for Rural Development; permit granted in November/December for 12 months	0	1.00

NAME	DISTRICT	STATUS	INSTALLED (MW)	POTENTIAL (MW)
Mitano	Kanungu/Rukungiri	Estimate	0	2.50
Rwempungu	Bushenyi	Estimate	0	2.30
Cresta	Ibanda	Estimate	0	2.00
Rwenzori	Kasese	Estimate	0	3.00
Mpanga Escarpment	Kamwenge	Estimate	0	14.00
Rwigo	Bundibugyo	Estimate	0	0.00
Nyahuka	Bundibugyo	Estimate	0	0.70
Nkussi Escarpment	Hoima/Kibaale	Estimate	0	11.00
Nkussi at Pachwa	Hoima/Kibaale	Estimate	0	0.38
Waki	Hoima/Masindi	Developer SN Power Invest AS; permit granted November/December 2004 for 12 month; feasibility study by Norplan	0	5.00
Sonso	Masindi	Estimate	0	1.40
Waisoke	Masindi	Estimate	0	1.70
Izizi	Masindi	Estimate	0	1.60
Esia	Adjumani	Developer Adjumani Rural Electrification Company	0	1.00
Kochi	Koboko	Estimate	0	0.91
Nyarwodo I	Nebbi	Estimate	0	0.00
Nyagak I	Nebbi	Feasibility study completed and ready for development; WENRECO was awarded concession in March 2003; conducting a Resettlement Action Plan (RAP); construction expected to begin January 2007	0	3.50
Nyagak II	Nebbi	Estimate	0	3.00
Ora	Arua	Estimate	0	0.90
Manafwa	Manafwa	Estimate	0	0.75
Simu	Sironko	Estimate	0	2.60

Source: MEMD, as of 2007

TABLE 9

Large Hydro Power Sites at Nile River

SITE	LOCATION	INSTALLED CAPACITY (MW)	MAX. POTENTIAL CAPACITY (MW)	STATUS
Nalubale (Owen Falls Dam)	Jinja	180	180	In operation
Kiira (Owen Falls Extension)	Jinja	200	200	In operation
Bujagali	Jinja	250	320	IPS Consortium has started construction to generate 250 MW
Kalagala	Jinja	0	350	Feasibility study complete
Karuma	Masindi/Apac	200	200	Feasibility study complete; NORPAK Power Ltd. to develop site
Ayago South	Gulu/Masindi	0	234	Preliminary studies available
Ayago North	Gulu/Masindi	0	304	Preliminary studies available
Murchison	Gulu/Masindi	0	642	Preliminary studies available, but has adverse environmental effects
Isimba	Kamuli	0	100	Estimate
Bugumira	Kamuli	0	109	Estimate

Source: MEMD, as of 2007

TABLE 10

Ongoing Energy Programs in Uganda

PROJECT	INSTITUTION INVOLVED	DESCRIPTION	FUNDING	STATUS
Energy for Rural Transformation (ERT)	Ministry of Energy and Mineral Development (MEMD)	A ten-year program that aims at increasing rural access to energy from the present 1 % to 10 % in ten years through three means: i) grid extension ii) IPPs (for mini grids) and iii) solar energy	World Bank and GEF have funded WENRECO hydro power, Kakira co-generation and Kisiizi hydro power projects; market development and capacity building in installation of solar home systems, electrification of pilot schools and health centers as well as water supply schemes	Phase I ending (covering institutional development, baseline studies, pilot projects in 12 districts, business development, establishment of refinancing scheme); Phase II to begin (emphasis on implementation and financing of projects)
Energy Advisory Project/ Promotion of Renewable Energy and Energy Efficiency Programme (PREEP)	German Development Cooperation/GTZ	A project based at the MEMD provides energy policy advisor services and facilitates improved access to modern sustainable energy services for the Ugandan economy and the Ugandan population, especially the poor	Provided support to the dissemination of improved stoves, solar home systems through private companies and NGOs; has disseminated 600,000 stoves, electricity saving lamps to more than 10,000 households; some 69 institutions have been equipped with solar PV systems since September 2006	Phase III of the Energy Advisory project ran from June 2005 to May 2008; the new program on promotion of RE and energy efficiency started in 2008 and its first phase will be until May 2011 (funding available amounts to 5.9 million €)
Rural Electrification Projects	KfW Entwicklungsbank	Investment financing in RE projects	WENRECO, grid extension in West Nile (2007–2009), 4.0 million €; rehabilitation of Maziba Hydro Power Plant 1 MW (2007–2009), 2.5 million €; transmission line Entebbe–Mutundwe (2008–2010); mini hydro power plants in West Nile, 4 million €	Feasibility studies advertised and being undertaken
African Development Bank (AfDB)	AfDB	Investment in large hydro power projects	Bujagali hydro power project (2007–2011), 110 million USD; Bujagali Interconnection Project (2008–2010), 28 million USD; Rural Electrification Project (2009–2012), 30 million USD; Buseruka mini hydro power project (2008–2011), 8–10 million USD	

Source: data compiled by the author, as of 2009

Renewable Energies in Central Asia

Regional Report on Potentials and Marktes – 8 Country Analyses

Energy-policy Framework Papers,
Section »Energy and Transport«

gtz Promotion of Renewable Energies

On behalf of
Federal Ministry
for Economic Cooperation
and Development

IMPRINT

Authors of Country Chapters

Azerbaijan	Islam Rafibeily (LLM & MSc Geo.)
	Dr. Ing. Klaus Jorde
	Axel Biegert (Dipl. Economist & Pol.)
Georgia	Grigol Abramia (Dipl. Env. Management & Lit.)
	Dr. Ing. Klaus Jorde
	Axel Biegert (Dipl. Economist & Pol.)
Kazakhstan	Dr. Ing. Klaus Jorde
	Axel Biegert (Dipl. Economist & Pol.)
	with contributions by Gulnar Daniyarova (MSc. Econ. & Management)
Kirgistan	Olga Terenteva (LL.M, MA Finance, BA Engl. & Lit.)
	Dr. Ing. Klaus Jorde
	Axel Biegert (Dipl. Economist & Pol.)
Mongolia	Axel Biegert (Dipl. Economist & Pol.)
	Dr. Ing. Klaus Jorde
Tajikistan	Dr. Ing. Klaus Jorde
	Axel Biegert (Dipl. Economist & Pol.)
Turkmenistan	Kurban Balliyev (Eng. Water Management & Dipl.)
	Dr. Ing. Klaus Jorde
	Axel Biegert (Dipl. Economist & Pol.)
Uzbekistan	Dr. Ing. Klaus Jorde
	Axel Biegert (Dipl. Economist & Pol.)

Review/Coordination

Dr. Ing. Klaus Jorde
Entec Consulting & Engineering AG
St. Gallen, Switzerland
www.entec.ch

Axel Biegert (Dipl. Economist & Pol.)
INTEGRATION Umwelt & Energie GmbH
Graefenberg, Germany
www.integration.org

Editor

Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of

Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff

Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

FOREWORD

Background

In recent years a large number of developing and emerging countries have changed the structure of their energy sectors, often accompanied by a liberalization of their markets. In many cases, **Renewable Energies (RE)** are a more and more important strategic component for the countries' diversification of their national energy supply.

A growing energy demand deriving from the increasing energy consumption of growing economies worldwide, accompanied by volatile prices for fossil fuels and by increasing environmental and climate challenges, boosts the demand for RE technologies. RE have a **competitive advantage** because they provide a long-term energy supply (for electricity, heating or cooling) based on locally available RE sources and thus help to reduce dependency on energy imports. In addition, RE provide appropriate technological solutions for the electrification of rural or semi-urban areas where they can be used independently from grid-connection. RE are a key for the provision of modern energy services in these areas and contribute to the local economic and social development.

While the technical potential for RE resources such as wind, solar, hydropower, biomass or geothermal energy is considered high in most developing and emerging countries, these regions are still faced with significant barriers for the development of commercially driven and sustainable RE markets. The lack of appropriate policies and the respective business environment are constraints that restrict the dissemination of RE in these countries. The success of comprehensive policy frameworks for the promotion of RE – such as RE feed-in-tariffs or incentive instruments like tax relieves – can be observed in more and more countries, for example Germany or France. However today, also developing countries and emerging markets such as South Africa, Kenya or the Philippines reveal the **significance of adequate policy frameworks for favorable market conditions**. Investments in RE markets, in particular by the private sector, very much depend on the existence of these national or regional framework conditions, incentives and financing options on the one hand, but also on sufficient **transparency and knowledge about these conditions**, which are thus part of the bottleneck for the deployment of RE.

Objective

Current and accurate information and data availability are – as stated above - important prerequisites for the development of RE energy markets and a broader dissemination of commercial activities – particularly in markets where information is scarce and where framework conditions are under transition. **The Regional Reports on Renewable Energies comprising 30 country analyses on RE potentials and markets in West Africa, East Africa and Central Asia** are a substantial contribution to the dissemination of comprehensive and precise knowledge on RE markets and related investment options and thus help to further pave the way for the promotion of RE in these regions.

As such the publication **addresses potential businesses and investors** – including manufacturers, technology providers, wholesalers, suppliers, project developers, operators, services companies, planning offices, consultancy firms, as well as financing institutions. The Regional Reports are both meant for those who are already active in the assessed RE markets, but also for those exploring new markets for their business activities. Of course, the publication also serves as a database with country-specific insights into the assessed African and Central Asian regions for interested actors from the public and civil sector.

The **geographical scope** of this publication is twofold: the **Regional Reports on Renewable Energies** focus on **West Africa and East Africa** which are mainly represented by developing countries and economies, and on Central Asia as a region predominantly characterized by **countries in transition**. All of these regions are promising markets for the RE industry and for potential investors as they offer remarkable, but still largely untapped RE potentials. Although market conditions which spur the promising RE potentials still need to be improved in almost all of the assessed countries, positive trends for the promotion and deployment of RE can be observed in many cases. Even in those countries, where the policy level still needs to be convinced of RE, political reformers more and more commit to take action for RE on the rise.

Deliverables

The **Regional Reports on Renewable Energies** showcase comprehensive, but still selective information on the specific characteristics of the energy sectors of the **30 assessed countries – 17 in West Africa, 5 in East Africa and 8 in Central Asia**. Key facts and figures on these energy markets and their RE potential is given in the **executive summary** of each regional report.

Each country analysis comprises an **introduction to the socio-economic, geographical and political background** of the country. It also includes an **overview** on the **national energy sectors**, including figures on power generation capacities, energy consumption and price levels as well as information on relevant market structures. This is followed by a presentation of the respective energy policy framework conditions. The chapter on **the status quo of RE** presents data on country-specific technical and economic RE potentials, as well as and on current RE investment projects and possible **RE business opportunities**. In addition, the report gives information on market challenges and risks. A snapshot of the **relevant actors of the energy sector** (private, as well as public, civil and scientific) is also included and serves as a source for identifying potential (business) partners for RE projects. Finally, each country analysis includes a **bibliography** and an **annex** containing additional graphs and figures on RE sources and technologies.

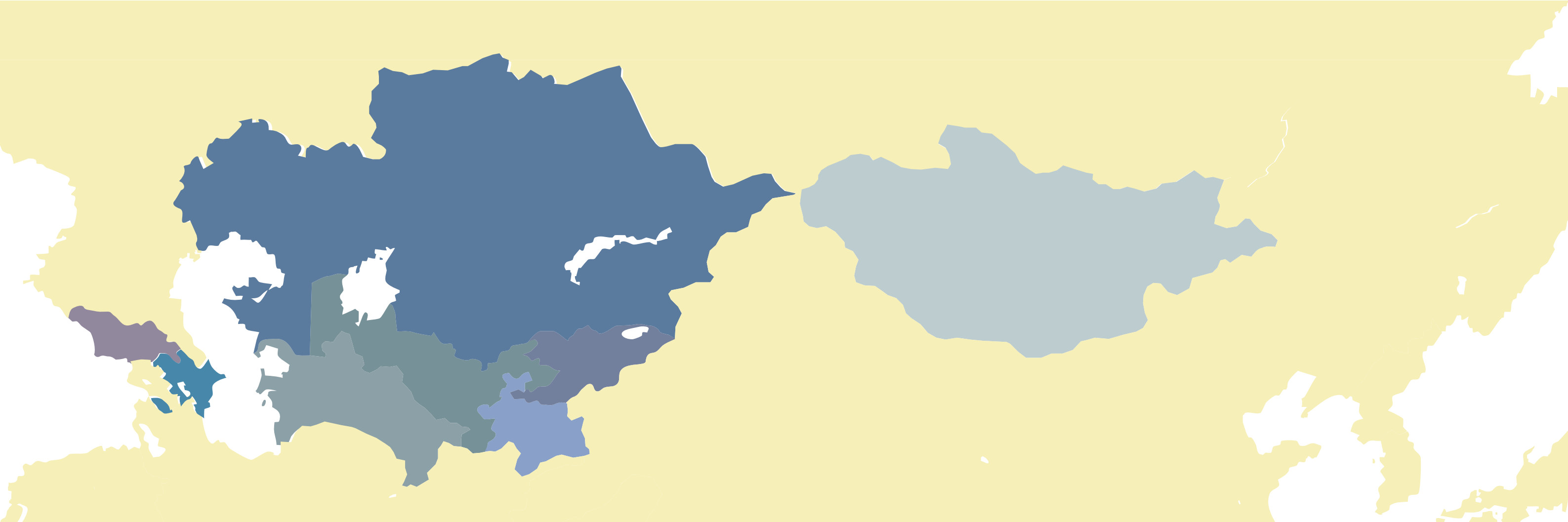
The presented regional reports series is part of the Energy-policy Framework Papers of the "Energy and Transport" section of Deutsche Gesellschaft für Technische Zusammenarbeit (gtz) GmbH.

The Regional Reports are also available for free of charge download on the GTZ website:
http://www.gtz.de › Themes › Sustainable Infrastructure › Energy › Renewable Energy › Further information › Downloads; or
http://www.gtz.de/de/themen/umwelt-infrastruktur/energie/4552.htm

The editorial team – Eschborn, December 2009

Acknowledgements
The editorial team – also on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ) – would like to thank all contributors, in particular all authors and coordinators (especially Anton Hofer of WIP, Rafael Wiese of PSE AG and Dr. Klaus Jorde of Entec AG) who have contributed to this publication by sharing their valuable insights and experiences.

Special thanks also to Rolf-Peter Owsianowski for his efforts to identify appropriate local experts as authoring contributors, to Barbara Meder for editing of the reports and to "die Basis – Kommunikation. Ideenwerk. Design." for the design of the publication.



CONTENTS REGIONAL REPORT CENTRAL ASIA

NOTE:

Main references/indications of sources are provided in the respective country chapters and not in this summary of the country chapters.

REGIONAL REPORT SUMMARY – BASED ON THE 8 COUNTRY CHAPTERS

AZERBAIJAN, GEORGIA, KAZAKHSTAN, KYRGYZSTAN, MONGOLIA, TAJIKISTAN, TURKMENISTAN, UZBEKISTAN

Author of the Regional Report Summary
Dr. Ing. Klaus Jorde
Entec Consulting & Engineering AG
St. Gallen, Switzerland
www.entec.ch

ACRONYMS AND ABBREVIATIONS

REGIONAL REPORT SUMMARY

DB	DOING BUSINESS
CPI	CORRUPTION PERCEPTIONS INDEX
MW	MEGAWATT
RE	RENEWABLE ENERGY
PV	PHOTOVOLTAIC
US CENT	UNITED STATES CENT

1 INTRODUCTION AND GENERAL OVERVIEW

The potential for using Renewable Energies (RE) differs strongly among the eight Central Asian countries. Some of them have huge oil and gas reserves while others are endowed with large hydro power, wind or solar resources depending on their climatic and topographical conditions. The common feature shared by all of them is that their political and economic development was influenced by the former Soviet Union to a large extent. Azerbaijan, Georgia, Kyrgyzstan, Kazakhstan, Uzbekistan, Tajikistan and Turkmenistan are former Soviet Republics. Mongolia was the only independent state, although it had very close ties to the Soviet Union as well.

All economies were affected by painful transitions from centrally planned to market economies. The eight countries are recent members of the Commonwealth of Independent states, except Mongolia and Georgia, which has withdrawn in 2008, and Turkmenistan, which is not a full member.

As a result of their political and economic history, the energy systems of these countries were mainly developed to serve the energy needs of the united energy system of the Soviet Union. They are often not ideal for the energy needs of their present economies. A related result is that their occasionally vast potential of renewable energy sources remains largely untapped, with the exception of large hydro power. The majority of the existing energy infrastructure including generation facilities and transmission networks is in disrepair or inefficiently operated causing huge energy and financial losses.

Meanwhile, after almost twenty years of transition, these countries have overcome the economic trough and are now back to a robust growth pattern going along with increasing political stability. There is a growing awareness in the region of the potential of renewable energy sources and most Governments have formulated policies for the increased development or RE. However, apart from smaller initiatives, there is still little initiative from the private sector to invest in RE projects. The key findings of each country are given below.

2 OVERVIEW OF THE ENERGY SITUATION AND RENEWABLE ENERGY POTENTIAL OF EACH COUNTRY

Georgia

The Government of the Republic of Georgia has enacted a renewable energy promotion program for power plants up to 100 MW offering long-term purchasing agreements, favorable feed-in-tariffs and license-free electricity generation for power plants up to 10 MW. Under the program, the Government is tendering 91 potential new hydro power sites with capacities ranging from 0.6 MW to 99 MW. Second on the hit list are small- and medium-scale wind energy plants. Feasibility studies are available. Georgia has the best investment climate of the eight countries. However, investor confidence has suffered after the armed conflict with Russia in 2008. Rankings with regards to the Ease of Doing Business Index (DB)[1] and the Corruption Perceptions Index (CPI)[2] are: DB 11/CPI 66.

Mongolia

The Republic of Mongolia strives to reduce its heavy dependence on imports of Russian petroleum and electricity and has recently passed a renewable energy law. Private investors are offered pre-defined feed-in-tariffs ranging from 5 US Cent for hydro power to 18 US Cent for PV electricity. Stand-alone renewable energy supply systems are attractive for nomadic households. There are also numerous isolated grids in rural centers where small hydro power or wind could replace diesel generators. The investment climate is fair to good, although corruption remains a risk factor. Rankings for Mongolia are: DB 60/CPI 120.

Azerbaijan

The Republic of Azerbaijan is richly endowed with oil and gas resources, but these resources will be depleted within a few decades. The country is therefore diversifying its energy sector. A renewable energy law was introduced in 2004 with no market development impact so far due to a lack of funding and political will to enforce the provisions of the law, as well as very low feed-in-tariffs. Small hydro power is the most promising field for RE with hundreds of sites that potentially could be developed. Unfortunately, only few feasibility studies exist. Second most promising is the development of wind power plants at the Caspian Sea border. The investment climate is fairly good, but corruption is also rather high. Consequently, Azerbaijan's rankings are: DB 38/CPI 143.

Kazakhstan

Kazakhstan has enormous gas and oil resources, which have largely prevented the development of a market for renewable energy so far. Nevertheless, the country has embarked on a strategy and passed legislation to promote RE resources targeting a 5 % share of RE in the energy balance by 2024. Wind energy is the most promising renewable resource in Kazakhstan but all other renewable energy sources have an interesting potential as well. RE projects could be particularly attractive in isolated rural areas, which often suffer from energy shortage. Doing business in Kazakhstan is considered less easy, and foreign investors usually require support from local law experts. Corresponding rankings are: DB 63/CPI 120.

Kyrgyzstan

Kyrgyzstan generates most of its electricity from abundant hydro power resources. However, the country is suffering from a serious energy crisis due to decreasing inflows into the large reservoirs. There is still a huge unutilized hydro

1 WORLD BANK, DB 2010 (WWW.DOINGBUSINESS.ORG/FEATURES/HIGHLIGHTS2010.ASPX), RANKINGS FROM 1–183, WITH FIRST PLACE BEING THE EASIEST.

2 TRANSPARENCY INTERNATIONAL, CPI 2009 (WWW.TRANSPARENCY.ORG/POLICY_RESEARCH/SURVEYS_INDICES/CPI/2009), RANKINGS FROM 1–18, WITH FIRST PLACE BEING THE LEAST CORRUPT.

power potential and also a considerable solar energy potential. While Kyrgyzstan is officially promoting the increased development of renewable energies, it could not yet attract the interest of private investors to develop smaller potentials. This is caused by the lack of a clear legal and regulatory framework and poor data on the existing potentials. The general business climate is fairly good, but corruption is still rampant. Thus, rankings for Kyrgyzstan are: DB 41/CPI 162.

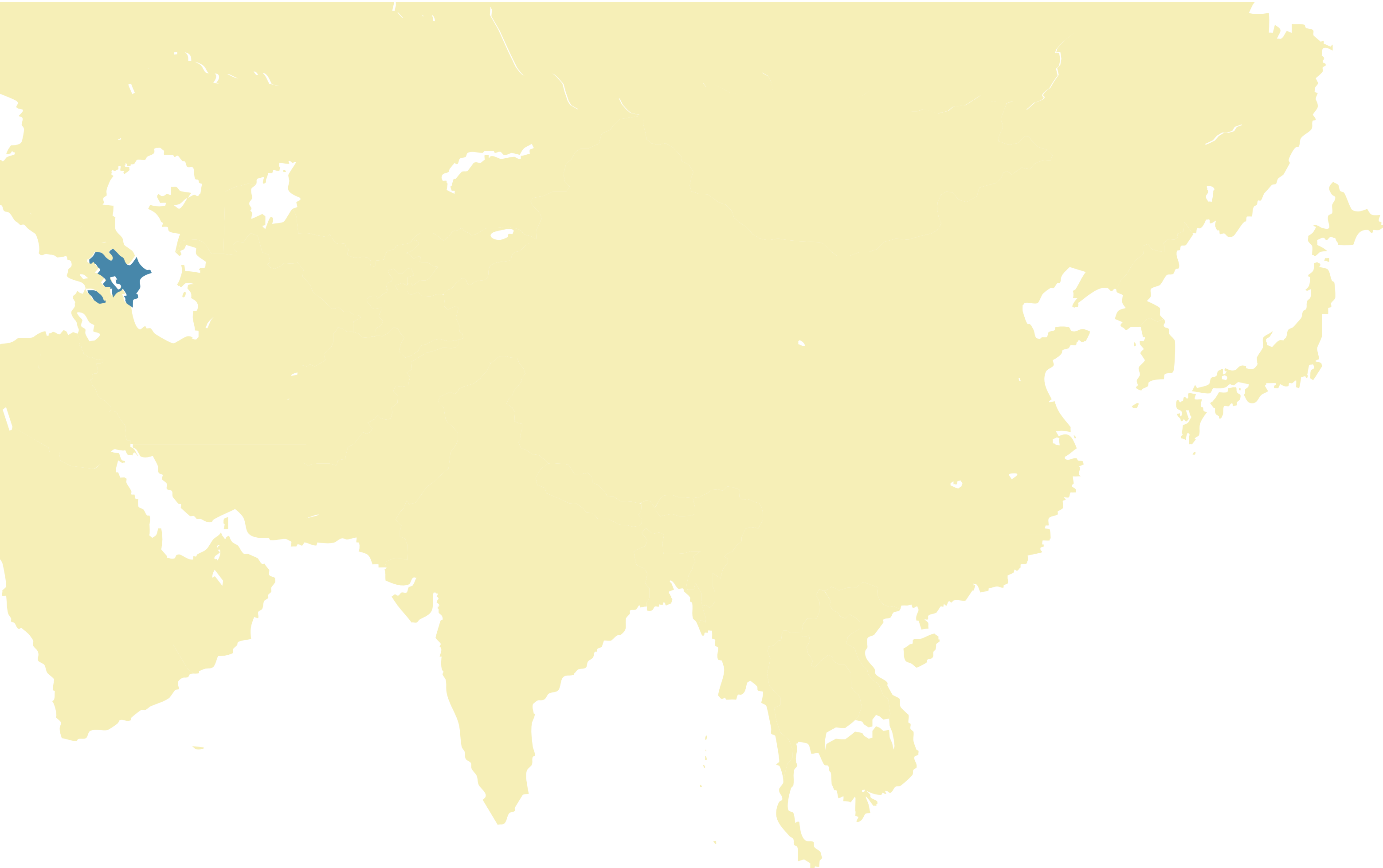
Tajikistan
Tajikistan has an enormous hydro power potential of which a small part is being exploited by large hydro power plants. There are also plenty of opportunities for small hydro power development including isolated grids to supply energy to rural communities who often suffer from fuel shortages. While Tajikistan generally acknowledges the need for developing RE sources, the lack of official power purchase tariffs and a poor regulatory framework are strong disincentives for private investors to enter the RE market. The general conditions for small foreign investors in Tajikistan are rather difficult. Enterprises can be fully foreign owned, but obtaining and extending business licenses can be complicated and expensive. Tajikistan's rankings are: DB 152/CPI 152.

Uzbekistan
Uzbekistan is richly endowed with fossil energy sources, and the development of renewable energy does not yet enjoy high priority on the Government's agenda with the exception of hydro power. Climatic conditions are especially favorable for utilizing solar energy. The promotion of RE is only rudimentarily addressed in the existing legislation providing virtually no real incentive for small investors. The difficult business environment is a further disincentive. Extensive state controls and rampant corruption hinder the functioning of markets and the development of the private sector. Rankings for Uzbekistan are: DB 150/CPI 174.

Turkmenistan
Turkmenistan has tremendous wind power potential and high solar potential as well, but this is overshadowed by the well-known wealth coming from oil and gas. Currently, electricity generated in thermal power plants is supplied free-or-charge to domestic consumers, which is virtually a knockout criterion for any RE solutions. This is particularly unfortunate as the wind potential is so large that it could even rival the republic's natural gas reserves. There are energy efficiency and energy saving programs in place, and the Government is officially supporting the development of RE technologies. The development of a market for RE would, however, require much more commitment from the Government. The business environment of Turkmenistan is one of the worst in the world. Without having a close relationship to a high-ranking Government official, it is very difficult to do business. Thus, Turkmenistan's rankings comprise: DB not ranked yet/CPI 168.

3 CONCLUSION

The experiences with renewable energy technology are still very limited across all countries in Central Asia, with the exception of large hydro power. The countries with a conductive business environment have a more or less clear legislation regarding the promotion of RE technology. The lack of experience in applying these legislative prerequisites for concrete investment projects, however, adds to the investment risks particularly for small investors, who may not have the resources to fight through legal uncertainties. Besides the domestic promotion programs in the countries, supportive risk-reducing measures from donor countries may be required to trigger the utilization of RE sources by small foreign investors. Moreover, donor support will also be required to review and support the improvement of existing renewable energy legislation and regulatory frameworks in these countries.



COUNTRY CHAPTER: REPUBLIC OF AZERBAIJAN

Authors and Coordination of Country Chapter

Islam Rafibeily (LLM & MSc Geo.)

Dr. Ing. Klaus Jorde
Entec Consulting & Engineering AG
St. Gallen, Switzerland
www.entec.ch

Axel Biegert (Dipl. Economist & Pol.)
INTEGRATION UMWelt & Energie GmbH
Graefenberg, Germany
www.integration.org

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS AZERBAIJAN REPUBLIC

ACRONYMS AND ABBREVIATIONS AZERBAIJAN REPUBLIC

ADB	Asian Development Bank
BP	British Petroleum
CAR	Central Asian Region
CDM	Clean Development mechanism
CER	CO2 Emission Reduction
CIS	Commonwealth of Independent States
EBRD	European Bank for Reconstruction and Development
EU	European Union
f.o.b.	Free On Board
GDP	Gross Domestic Product
DL	Distribution Line
HPP	Hydro Power Plant
HVL	High Voltage Lines
HVN	High Voltage Network
IBRD	International Bank for Reconstruction and Development
IPP	Independent Power Producer
JSC	Joint Stock Company
KfW	Kreditanstalt für Wiederaufbau (KfW Bankengruppe)
MED	Ministry of Economic Development
MIE	Ministry of Industry and Energy
NATO	North Atlantic Treaty Organization
OSCE	Organization for Security and Cooperation in Europe
PfP	Partnership for Peace
PCA	Partnership and Cooperation Agreement
PREGA	Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement
PV	Photovoltaic
RE	Renewable Energy
SOCAR	State Oil Company of Azerbaijan Republic
TL	Transmission Line
TPP	Thermal Power Plant
UN	United Nations
USD	United States Dollars
VAT	Value Added Tax
WB	World Bank

MEASUREMENTS

°C	degree celsius
€	Euro (1 € = 1.07 manat)
GWh	gigawatt hour (1 GWh = 1,000,000 kWh)
kJ	kilojoule (1 kj = 1,000 joules)
ktoe	kilotons of oil equivalent (1ktoe = 11.63 GWh)
kV	kilovolt
m	meter
m^3	square meter
MW	megawatt (1 MW = 1,000 kW)
s	second
TWh	terawatt hour (1 TWh = 1,000,000,000 kWh

1 SUMMARY

The Republic of Azerbaijan has abundant resources of oil and gas, which are used for domestic consumption, including electricity generation, and also for export. The second source for electricity generation consists mainly of large Hydro Power Plants.

The government is generally committed to increase the use of Renewable Energy (RE), particularly small hydro power and wind, to be prepared for the future development, when fossil resources start declining. There is a significant potential of RE resources in certain regions of the country and in particular a considerable potential for solar energy in the whole of Azerbaijan.

In theory, the legal and regulatory terms and conditions for private and independent power producers appear to be favorable, especially since electricity from wind and small Hydro Power Plants is guaranteed to be purchased completely. Reality, however, shows that there is no existing market for RE, and the process of granting licenses to private investors has not been practiced yet. It is therefore unpredictable what is going to happen if someone applies for a private power-generating license.

First activities in this direction, however, can be observed at large private companies. Serious obstacles for private investments are the low tariffs for RE which are set and guaranteed by law. There are no additional incentives at present, although some legal provisions seem to support this type of investment.

In general, the business climate invites foreign investments in the energy sector, but up to today this is mostly restricted to the large gas and oil industry. Overall Azerbaijan could be an interesting future market for activities concerning RE.

2 COUNTRY INTRODUCTION

2.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Azerbaijan is located in the Caucasus region of Eurasia on the western shore of the Caspian Sea in the southeastern part of the Greater Caucasus mountains. The Lower Caucasus stretches along the western border, Russia is on its northeastern border, Georgia in the North West. Armenia borders it to the West, Iran to the South and a 10 km border with Turkey is in the South West (Nakhichivan Autonomous Republic).

The highest point in Azerbaijan is the mt. Bazardeuzeu in the Caucasus range with an altitude of 4,465 m. The country has plenty of oil and gas resources, much of which lies underneath the Absheron Peninsula and offshore underneath the Caspian shelf.

FIGURE 1

Map of Azerbaijan

The climate of Azerbaijan is characterized by nine climatic zones. It alternates between extreme zones in the northern and western mountains and pleasantly moderate zones along the Caspian Sea. While semi-desert and dry steppe climates cover the central lowlands in Kur, a cold climate with heavy precipitation all year long predominates in the southern hills of the Great Caucasus.

Daytime temperatures vary between 22 °C and 30 °C through spring and summer (mid-April to October) while average temperatures between 5 °C and 10 °C can be expected from December to march.

Water covers only 500 km² of the total area of the country. The biggest river is Kur, which flows from Turkey through Georgia and Azerbaijan into the Caspian Sea. The total length of the river is 1,515 km. The world's largest lake, the Caspian Sea, covers an area of 400,000 km² and has a maximum depth of 1,025 m. The second biggest river is Araz, located in the South and forming the border with Iran. medium-size rivers are the Qaniq (Alazan), Qabirli (Iori) in the North West, Terter in the West and Samur in the North, which is forming the border with Russia. There are plenty of small rivers within the country. The country's rivers, excluding Kur, are not navigable. The average density of the river system of Azerbaijan is 0.39 km/km². In the plains, however, the density is as low as under 0.05 km/km².

There are several shallow lakes in the lowland of Azerbaijan such as Sarisu (67.0 km²), Aghgoel (56.2, km²), mehman (35.0 km²), Boyukshor (9.2 km²), and Hadjigabul (8.4 km²).

Ten water reservoirs have been constructed in order to regulate the river flow and to provide water for irrigation. The largest of them are mingechevir, Shemkir, Araz and Serseng (on the Terter River). The building of these reservoirs is one of the measures that has been undertaken in order to manage and control the utilization of water and energy resources.

The large reservoirs are designed for various purposes, while most smaller ones are used exclusively for irrigation. The four largest reservoirs (mentioned above) are also used as a hydro energy resource.

The mingechevir reservoir with an area of 605 km² is the largest accumulation of water in Azerbaijan. It was won by damming the Kur in western Azerbaijan. The waters of the reservoir provide hydroelectric power and irrigation of the Kur–Araz plain.

2.2 POLITICAL AND ECONOMIC DEVELOPMENT

Azerbaijan – with a majority of the population speaking Turkish and being Shiite muslims – was briefly independent from 1918 to 1920. It regained its independence after the collapse of the Soviet Union in 1991. Azerbaijan joined the Commonwealth of Independent States (CIS) in 1993. After the political and economic crises of the early 90s, a drastic reduction of production and hyperinflation were characteristic for all post-Soviet Republics. The situation stabilized a few years later and a new economy growth occurred. The oil development strategy has become a crucial factor of this development. The signing of contracts with the world's biggest companies for the exploration and development of oil and gas fields of Azerbaijan and the construction of the Baku-Tbilisi-Ceyhan oil pipeline (which officially started operation in 2006) provided a significant foreign investment flow into the country.

Despite a 1994 cease-fire, Azerbaijan has yet to resolve its conflict with Armenia over the Azerbaijani Nagorno-Karabakh region (largely Armenian populated). The Nagorno-Karabakh region in the South West of Azerbaijan declared itself independent from Azerbaijan in 1991, but it is not recognized by any nation and therefore considered a legal part of Azerbaijan. Azerbaijan has lost 16 % of its territory and has to support some 600,000 internally displaced persons as a result of the conflict. Corruption is ubiquitous, and the Government has been accused of authoritarianism. Although the poverty rate has been reduced in recent years, the promise of widespread wealth from the development of Azerbaijan's energy sector remains largely unfulfilled.

There is one autonomous region on the territory of the Azerbaijan Republic – the Nakhchivan Autonomous Republic. Azerbaijan is important to the EU as the country is the EU's largest trade partner in the Caucasus region, primarily for oil. Trade has been steadily increasing since 1993, while there was a general decline during that period across the Commonwealth of Independent States. The integration into the EU is one of the strategic directions of Azerbaijan's international policy. The Partnership and Cooperation Agreement (PCA, adopted in 1999) provides for wide-ranging cooperation in the areas of political dialogue, trade, investment, economic, legislative and cultural cooperation. It constitutes the core of the technical assistance and reflects its ideology. A special envoy of the European Commission is currently present in the country, which is also a member of the United Nations, the OSCE, the Council of Europe, and the NATO Partnership for Peace (PfP) program. On 17 January 2001, Azerbaijan became a member of the Council of Europe.

Baku, the capital of Azerbaijan, is the main seaport of the Caspian Sea. more than a third of the population is concentrated here. The occupation of a part of the country by Armenia is a heavy economic burden.

The national currency of Azerbaijan is the manat. In January 2006, a new denomination of the manat was introduced with the conversion rate of 1:5000. Currently, the new manat fluctuates around 0.8 €. With the booming economy, the manat tends to get stronger thus causing the pressure upwards on the inflation rate.

Since Azerbaijan gained its independence, the oil sector has been on the rise. The explored oil reserves in the coastline area have been estimated at up to 650 million tons. The exploration of these oil fields is the key to the future of Azerbaijan's energy sector and its economy in general. Over the past years, however, the country's economic policy has also aimed at the development of other sectors, one of them being the energy sector in general. The dynamics of investments into the energy sector development is shown in the table below.

The current focus of government policy is aiming at the development of the non-oil sector, targeting the stability of the country's economy after the oil boom. To support this policy, the following state programs have been launched: the State Program for Poverty Reduction and Economic Development 2003–2005 (launched in 2003), the measures for Acceleration of Social and Economic Development (launched in 2003) and the State Program for the Socio-economic Development of Regions 2004–2008 (launched in 2004). Under preparation is a new State Program for Poverty Reduction and Sustainable Development 2006–2015.[1]

According to the programs, the existing generating capacities of the country's power system are expected to reach 6,500–7,000 MW by 2015 through the construction of new thermal and Hydro Power Plants, the modernization of the existing generating units and the utilization of renewable power sources (small Hydro Power Plants, wind, solar power, thermal water etc.). The system will have a generating capacity of 29–30 billion kWh by 2010 and 37–38 billion kWh by 2015.

The power demand is expected to grow by 4.7 % annually through 2015. Therefore, the demand in 2015 will have increased by the factor 1.7 as compared to 2004. Thermal power plants will make an effort to reduce the fuel used to generate 1 kWh of electric power from 386 grams of conventional fuel to 260 grams by the construction of new generating capacities and the modernization of the old generating units.

To ensure the sustainable power supply, new power transmission and distribution lines will be constructed. Existing transmission lines will be reconstructed together with necessary sub-stations. Similar works will be conducted in the distribution sector. System power losses will be reduced.

SHORT BUSINESS INFORMATION

Over the past years, Azerbaijan's economic policy has aimed at the development of the energy sector in general. main strategy of the future development of the electric energy sector is hydro power development and the construction and renovation of the transmission and distribution grid including sub-stations.

Institutional reforms have started several years ago and still continue in Azerbaijan. These reforms have as a common aim the strengthening of ministries and state committees as well as reorganizing state bodies and namely their functions by transforming some of them into joint-stock companies fully owned by the Government. The latest example is the former Committee on Amelioration and Water Business, which was initially converted into a State Agency attached to the Ministry of Agriculture and later into a joint-stock company.

The Ministry of Economic Development (MED) was founded in 2001 as the result of a merger of five previous Ministries and other government bodies – the Ministry of State Property, the Ministry of Economics, the Ministry of Trade, the State Committee for Anti-monopoly Policy and Support for Enterprise and the Agency for Foreign Investment Promotion. In 2005, the State Property Privatization Department was de-coupled from the structure of the MED. The Charter of the New State Committee for management of State Property was signed by the President in 2005. As a consequence, Azerbaijan was cited as one of the top 10 reformers by the World Bank's 2008 Doing Business report.

As a result of the measures taken by the Government of Azerbaijan, the investment climate in the republic has become increasingly more favorable and foreign investment into the social and economic sectors constantly grew and is still growing. This is an important factor in the continuation of a stable social and economic development in the country. The growth rates of economic indices as shown in tables 2 and 3 are expected to average 15 % per year until 2015.

TABLE 1

Investments in the Energy Sector of Azerbaijan

YEAR	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Amount (Mio USD)	8,9	17,4	18,8	57,4	76,4	86,6	162,5	40,3	9,6	212,2	645,8

Source: Ministry of Finance, as of 2006 (www.maliyyegov.az)

1 SOURCE: WEBSITE OF THE PRESIDENT OF THE AZERBAIJAN REPUBLIC (WWW.PRESIDENT.AZ)

TABLE 2

Growth Indicators for Azerbaijan

INDICATORS (MILLION USD)	2003	2004	2005	2006	2007	2008*
Gross Domestic Product	5,781.5	6,900.9	10,130.7	14,592.0	21,693.4	14,971.1
Non-oil GDP	3,598.1	4,241.2	4,898.5	5,727.0	7,712.9	4,825.4
Capital investments	2,881.6	3,915.0	4,388.3		54,808.1	29,475.1

Source: State Statistical Committee of Azerbaijan (www.azstat.org)
*January–June 2008

TABLE 3

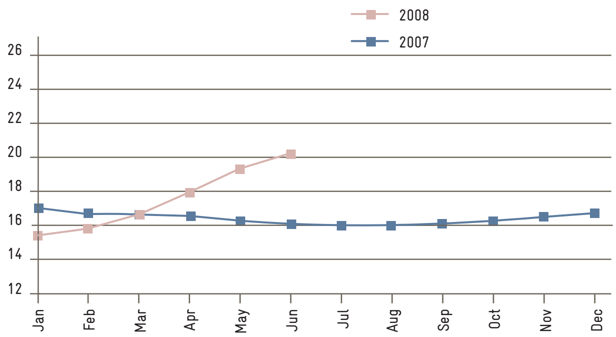
State Budget and Foreign Investment

YEAR	2003	2004	2005	2006	2007
Budget revenue	991.4	1198.3	1662.7	3139.9	4859.3
Budget expenditure	998.3	1214.3	1731.8	3065.9	4902.1
Foreign investment	3371.0	4575.0	4893.0	5053.0	6760.0

Source: National Bank of the Republic of Azerbaijan, the State Committee on Statistics of the Azerbaijan Republic, as of 2007

FIGURE 2

Annual Inflation Rate in Azerbaijan



Source: Central Bank of Azerbaijan (www.nba.az), as of 2008

LAND AREA:	86,6 thousand km2
POPULATION:	8,2 million (as of July 2009)
BIGGEST CITY AND POPULATION:	Baku (3 million)
LANGUAGE:	Azerbaijani (90,3%)
CLIMATE:	Alternates between extreme zones in the northern and western mountains and pleasantly moderate zones along the Caspian Sea
TEMPERATURES:	5–10°C (December to march), 22–30°C (mid-April to October) Altitude: –26 m to 4,465 m
RIVERS:	8,359 rivers of various lengths, the longest being Kura River (1,364km), Aras River (1,072km)
ECOSYSTEM AREAS:	Forests (3.2%), shrub land, savannah, grassland (17%), cropland and crop/natural vegetation mosaic (64%), urban and built-up areas (0.8%), sparse or barren vegetation, snow and ice (2%), wetland and water bodies (2%)
GDP – PER CAPITA (PPP):	9,500 USD (as of 2008)
INFLATION RATE:	20,8% (as of 2008)
AGRICULTURAL PRODUCTS	Cotton, grain, rice, grapes, fruit, vegetables, tea, tobacco, cattle, pigs, sheep, goats
INDUSTRIES:	Petroleum and natural gas, petroleum products, oilfield equipment, steel, iron ore, cement, chemicals and petrochemicals, textiles
ELECTRICITY – PRODUCTION:	19.35 billion kWh (as of 2007)
ELECTRICITY – CONSUMPTION:	15.68 billion kWh (as of 2007)
ELECTRICITY – TARIFFS:	0.06 manat/kWh
NATIONAL ELECTRICITY CAPACITY:	6,500–7,000 MW expected until 2015
NATIONAL ELECTRICITY CAPACITY:	6,500–7,000 MW expected until 2015
NATURAL RESOURCES:	Petroleum, natural gas, nonferrous metals, bauxite, gold, silver, iron, copper, titanium, chromium, manganese, cobalt, molybdenum, complex ore, antimony
OIL – PRODUCTION:	875,200 barrels/day (as of 2008)
OIL – EXPORT:	528,900 barrels/day (as of 2007)
OIL – CONSUMPTION:	126,000 barrels/day (as of 2008)
OIL – PROVEN RESERVES:	7 billion barrels (as of 1 January 2009)
NATURAL GAS – PRODUCTION:	241 billion cubic feet/year
NATURAL GAS – PROVEN RESERVES:	30'000 Billion Cubic feet
EXPORTS:	30.59 billion USD (as of 2008)
EXPORTS – COMMODITIES:	Oil and gas 90%, machinery, cotton, chemicals and petrochemicals
EXPORTS – PARTNERS:	Italy 24.9%, USA 17.6%, Germany 10.8%, France 10.1%, Czech Republic 6.2%, Canada 4.9% (as of 2008)
IMPORTS:	7.5 billion USD f.o.b. (as of 2008)
IMPORTS – COMMODITIES:	Machinery and equipment, oil products, foodstuffs, metals, chemicals
IMPORTS – PARTNERS:	Russia 18.9%, Turkey 18.2%, Germany 8.5%, China 6.3%, UK 6.2%, Ukraine 5.3%, Italy 4.5% (as of 2008)

Source: CIA World Fact Book, as of 2009

3 ENERGY MARKET IN AZERBAIJAN

90 % of the overall energy market in Azerbaijan depends on fossil resources. The rest is characterized by a small number of large Hydro Power Plants. Other RE are only used in forms of domestic consumption of firewood.

In September 1994, a 30-year contract was signed between the State Oil Company of Azerbaijan Republic (SOCAR) and 13 oil companies, among them Amoco, BP, Exxon, LUKoil and Statoil. As Western oil companies are able to tap deepwater oilfields untouched by the Soviet exploitation, Azerbaijan is considered one of the most important spots for oil exploration and development in the world.

CONTRACT OF THE CENTURY

An agreement has been signed in the Gulistan Palace of Baku on 20th September 1994, which was later named "Contract of the Century" due to its tremendous importance. Production sharing agreements related to the development of Azeri/Chirag/Guneshli deepwater oil fields have been reflected on 400 pages and 4 languages. 13 companies (Amoco, BP, mcDermott, Unocal, SOCAR, LukOil, Statoil, Exxon, TPAO, Pennzoil, Itochu, Ramco and Delta) from 8 countries (Azerbaijan, USA, Great-Britain, Russia, Turkey, Norway, Japan and Saudi Arabia) have participated in signing of the Contract of the Century. This Contract has paved the way towards to the signature of another 26 contracts with 41 oil companies from 19 countries.

Azerbaijan is self-sufficient in energy production. The country fully meets its domestic demand for energy by its own natural resources. Besides, oil and gas are main export products. During the last years, the generation capacity was sufficiently increased, which allowed to create export potential of electricity as well.

3.1 IMPORTANT PLAYERS OF THE AZERBAIJAN ENERGY MARKET

The Parliament of the Azerbaijan Republic exercises legislative power by adopting laws, ratifying international agreements and conventions etc. In accordance with the constitutional separation of the state power, the Parliament does not exercise management and control functions. Laws set the general framework of rules in the energy sector.

The Ministry of Industry and Energy (MIE) functions as the central executive body for formulating and providing Azerbaijan's national policy in the fields of industry and energy. The Ministry is also responsible for the supervision, regulation and control of the efficient use of the fuel and energy complex and issues special permissions (licenses) in cases provided for by the legislation. The MIE prepares the annual fuel and energy balance and prepares and implements state programs on perspective development in the industry and energy sector. The MIE is also responsible for the development of renewable resources in the Azerbaijan Republic.

The Ministry of Economic Development (MED) is responsible for the preparation and implementation of socio-economic development programs, the coordination of activities related to economic reforms, economic regulations etc. The Minister of Economic Development is the chairman of the Tariff Council. The Tariff Council approves of wholesale and retail tariffs for electric power as well as for its transmission. The mED temporarily provides supervision on the three electric power distribution companies Bakielectricnetwork, Sumgayitelectricnetwork and Shekielektricnetwork.

The "Azerenergy" Joint Stock Company (JSC) was established by the reorganization of "Azerenergy" State Company in 1996. The main functions of Azerenergy are:

- Power generation
- Power transmission via high voltage transmission lines (500, 330, 220 and 110 kV)
- Dispatch control
- Power distribution (excluding Baku and the Sumqayit and Sheki regions)

There is also a scientific research and design institute under the authority of Azerenergy.

There are 10 electrical power distribution companies in Azerbaijan (excluding Nakhchivan Autonomous Republic):

- Bakielectricnetwork supplies electricity in Baku and Absheron peninsula
- Sumqayitelectricnetwork supplies electricity in Sumqayit and the coastal districts of the republic situated to the north of Sumqayit
- Shekielektricnetwork supplies electricity in North West region
- 7 electrical power distribution companies supply power to the remaining 41 regions of the republic, these companies are subordinate to Azerenergy.

The distribution companies buy electric power from Azerenergy and sell it to commercial or industrial users and population alike.

The energy system of Nakhichivan Autonomous Republic is out of Azerenergy's sphere of influence. In this territory, the management of the energy system is carried out by the Agency of the Nakhichivan Autonomous Republic.

3.2 PRIMARY ENERGY CONSUMPTION, TRANSMISSION AND PRICES

Reliable data on the total primary energy consumption could not be identified. Available statistical data do not clearly differentiate between primary and secondary energy. Therefore, some quantities are counted twice, e. g. when natural gas (which is a primary energy) is used to generate electrical power (which is a secondary energy). One recent number on total primary energy consumption that can be found amounts to 12.8 mio toe.[2]

According to data received from government agencies in Azerbaijan, the sources of primary energy are 79 % from oil, 15 % from natural gas and 6 % electricity. About 80–90 % of the electricity is generated from natural gas. It is unclear, however, if this proportion is counted towards the natural gas percentage, the electricity percentage or both.

Transmission and Distribution System

Azerbaijan's electricity grid is not connected to the Central Asian Integrated System. Within the country, all cities and villages are grid-connected and electrified. Almost all customers are metered. The new metering system, based on smart-card platforms, has been introduced in Ganja city, and the installation of these new meters is continued in other cities and villages. The rate of collection in 2008 was remarkably over 80 % as compared to 38.6 % in 2006 and 68.0 % in 2007.

Mostly single circuit transmission lines are used in Azerbaijan. The voltage levels and lengths of transmission (TL) and distribution (DL) lines are listed in the Annex. most of the electricity grid is old and needs to be renovated. A new 220 kV TL in the South of Azerbaijan and the 330 kV Khachmaz substation in the North have been constructed. A new project, a 330 kV TL from the center to the South (over a length of about 150 km) is started and another one 220 kV double circuit TL from mingachevir to Absheron (255 km from West to East) will be started in 2009.

Losses in the transmission system are currently 3.7 %, in the distribution system losses are 14.7 %.

Electricity Sector and Natural Resources

The electricity generation in Azerbaijan is up to now entirely based on gas, heavy oil and hydro power. The state-owned joint stock company Azerenergy has a monopoly on power generation in Azerbaijan. Currently, it operates eleven thermal power plants (TPPs) with a combined installed capacity of 4,944 MW and six Hydro Power Plants (HPPs) with a total installed capacity of over 900 MW. These power plants turn out about 20–23 billion kWh per year (see figure 3), which is sufficient to cover domestic demand and to create some export potential.

The core of the power plant network in Azerbaijan is the group of thermal power plants that run on natural gas and black oil (mazut): the Azerbaijan TPP, the Albayramli (Shirvan) TPP, and the Shimal TPP. The primary source of hydroelectric power is the Kur River where the Hydro Power Plants mingachevir, Shamkir and Yenikend are located. The Annex holds list of the power plants included in the unified electricity network of Azerbaijan.

Today, the electric energy system has an average annual surplus capacity of 200–250 MW. The system is targeting to increase its export potential to 1,000 MW within 2–3 years. At the same time, some shortages of capacity in peak load hours still occur during the winter season.

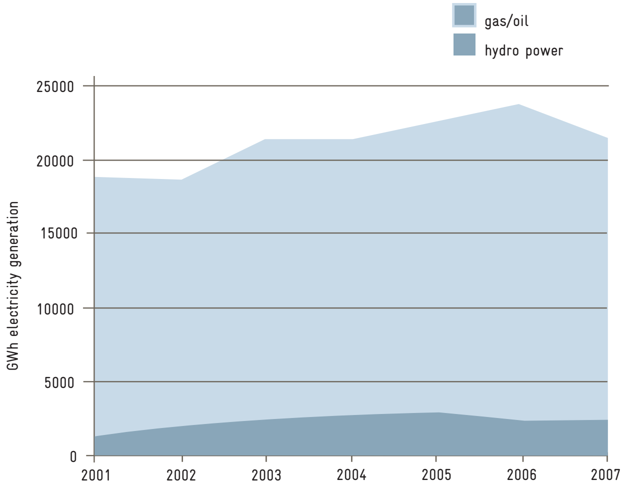
Around 60 % of the electricity is consumed the Absheron Peninsula (in the East of the country), while the main generation facilities are located to the West of Azerbaijan, thus increasing technical losses and fuel transportation costs since fuel sources are located on the Absheron Peninsula and offshore.

Azerbaijan's major mineral wealth lies in its oil and gas reserves. Offshore hydrocarbon structures in the Caspian Sea account for most of the country's oil and gas production. Azerbaijan's proven crude oil reserves were estimated to range from 7 to 13 billion barrels. Azerbaijan has proven natural gas reserves of roughly 850 billion m^3, and BP estimates that the country has about 1.4 trillion m^3 of proven gas reserves.

Prices

The prices (tariffs) of energy are regulated by the Tariff Council. Tariffs approved by decisions of the Council are as follows:

FIGURE 3
Electricity Generation in Azerbaijan



Source: diagram by the author with data collected from Azerenergy JSC, as of 2007

The price for electricity has increased significantly since 2006 for some consumer groups. Before that and since then the prices have been stable. Today, the prices are equal for all consumers at 0.06 manat per kWh. Details can be found in the Annex.

Growth Predictions for the Energy Sector

The energy sector in general is showing very significant growth rates, which are mostly due to the export of oil and gas products. The domestic consumption including the electricity demand shows only moderate growth rates with no clear trend. The population of the country is already connected to the grid and electricity has been accessible and inexpensive in the past. Therefore, there is already a high level of electrification throughout the country. Recent tariff jumps have slowed the growth in consumption, but the general economic growth will be followed by changes in the lifestyle of the population and will lead to an ongoing increase of the electricity demand in the country.

2 NATIONMASTER, 2004 (SELECT ENERGY › PRIMARY ENERGY CONSUMPTION, MILLION TOE); DATA INDICATED AS OF END OF 2004

ELECTRIC ENERGY TARIFFS	FOR 1 KVH IN MANAT (WITH VAT) 1 € = 1.07 MANAT (AS OF 30 APRIL 2009)
1. Wholesale tariff	
Azerenergy JSC generation	0.0410
Private small HPP generation	0.0250
Wind PP generation	0.0450
2. Retail tariff	
All consumers	0.0600
3. Transit tariffs	0.0020

Source: Tariff Council of the Azerbaijan Repulic, (www.tariff.gov.az), as of 2009

4 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

In general, all political plans to increase the share of Renewable Energies are in the initial stage. Azerbaijan focuses on small hydro power and wind energy. The Government's support for the development of RE sources is proclaimed in the legal regulations, but neither proper mechanisms nor subsidies or government grants exist.

SHORT BUSINESS INFO

The feed-in tariffs, as described in chapter 3, are too low to stipulate private investments in RE projects without additional incentives.

Azerbaijan is part of the European Energy Charter, a framework for international cooperation between European and other industrialized countries aiming to develop the energy potential of Central and Eastern European countries and ensuring security of energy supply for the European Union.

4.1 NATIONAL STRATEGIES AND PROGRAMS TO SUPPORT RENEWABLE ENERGIES TO SUPPORT RENEWABLE ENERGIES

The State Program on the Use of the Alternative and Renewable Sources in Azerbaijan Republic has been approved in 2004. The program stipulates conducting feasibility studies in the field of RE and the development of small hydro- and wind projects. The implementation of the measures has been planned to last from 2004 to 2013. Unfortunately, this program was not supported with the necessary funding and a lot of measures have not implemented within the fixed schedule. In general, private partnerships in the field of RE are welcome and correspond to the strategy of the responsible Ministry, the MIE . There are no restrictions for foreign investors, but the Government's permission is needed.

4.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

The Azerbaijan legislation on electrical power consists of laws of the Azerbaijan Republic, decrees of the President, resolutions of the Cabinet of Ministers and by-laws (instructions) of the central bodies of executive power (ministries and other State agencies).

The following laws in the energy sector have been adopted by the Parliament:

- Law on Utilization of Energy Resources 30.05.1996
- Law on Electric Energy 03.04.1998
- Law on Gas Supply 30.06.1998
- Law on Energy 24.11.1998
- Law on Electrical Power and Heat Stations 28.12.1999

Source: Compilation of Laws of the Azerbaijan Republic

There are no specific laws on RE in Azerbaijan, but some provisions concerning the matter are reflected in the laws about energy in general:

Law on Utilization of Energy Resources from 30 may 1996:
- Portions of the Fund of Rational Power Utilization shall be spent among other purposes also for "utilization of the Renewable Energy sources" (Article 15).
- Subsidies from the Fund may be granted to enterprises for "examination of the Renewable Energy sources" (Article 16).
- State power standards shall determine " [...] proper demands for the energy resources and the renewable power sources." (Article 19).
- Law on Power from 24 November 1998:
- One of the objectives of state policy with regard to power is "use of renewable power sources" (Article 3).

Law on Electrical and Heating Power Stations from 28 December 1999:

- "Construction of power plants which run with Renewable Energy sources can be subsidized by the State".
- At the same time "unlimited purchase of energy produced at these (small) plants is guaranteed." (Article 3).

In accordance with Article 3 mentioned above, the following plants are deemed as small:

- Solar power plants which produce electrical and heating energy
- Wind power plants with a capacity from 10–100 kW, which generate electrical energy and are located at a distance from immovable property of any third person in accordance with relevant norms and standards
- Hydro Power Plants with a capacity from 50–10,000 kW, which are located at a stable water stream (steady stream) and immediately provide returning of used water to its bed
- Power plants, which produce electrical and heating energy by means of gas or other fuel about 80 % of which is extracted from biomass, excluding natural firewood

There are no special provisions that support rural electrification by law.

SHORT BUSINESS INFO

There are no standard procedures in place for small scale independent power producers.

Clean Development mechanism (CDM)

The Azerbaijan Republic has ratified the Kyoto Protocol in 2000. The authorized State body responsible for the implementation of the UN Convention on Climate Changes, the keeping of the parameters of the Kyoto Protocol and the coordination of CDM in Azerbaijan is the Ministry of Ecology and Natural Resources. Business entities can conduct negotiations and conclude agreements on selling CO_2 emission reductions (CERs). Azerenergy has concluded two agreements with foreign partners concerning the right on selling CERs based on market prices.

5 POTENTIAL FOR RENEWABLE ENERGIES AND PRESENT USE

Azerbaijan is a country with vast fossil energy resources. But Azerbaijan's oil reserves will only be exploitable for the next twenty to thirty years. Recent studies by the German Kreditanstalt für Wiederaufbau (KfW Bankengruppe) and the European Bank for Reconstruction and Development (EBRD) have shown that Azerbaijan has a significant potential for the development of alternative and renewable sources of energy. Initial surveys suggest that the Absheron peninsula has a good potential for wind energy, while the mountainous areas in the North and South West including Nakhchivan are endowed with attractive small hydro power resources.

The Azerbaijani Government has recognized this challenge and launched new initiatives for the use of alternative energy. These alternative energy sources can be developed with profits generated by the exploitation and sale of the country's oil reserves.

Reasons for the development of RE are the shrinking fossil fuel resources and the escalation of fossil fuel prices in the future as well as the ongoing growth of electricity consumption in the country.

In theory, there are sufficient reasons to promote the development of RE. In reality, however, there is no market for RE in Azerbaijan so far. The following chapters therefore focus on the possibilities and potentials of using mainly Renewable Energies.

5.1 BIOENERGIES

There is a considerable potential for the use of bioenergy from agricultural or forest wastes. Some statistical data have already been collected in order to evaluate the bioenergy potential (see Annex)[3].

Solid Biomass

About 14,400 km^2 of the country's area is forest, equaling merely 3.2 % of the overall territory. The residuals from wood production or wood related processes are therefore very limited with less than 7,000 m^3 in 2004. At the same time, there are significant agricultural activities in the country, which could provide residues for biomass combustion. Azerbaijan is the largest of the republics of the former Soviet Union and fourth in the world in the production of raw cotton. The population of Azerbaijan is already using cotton and cereal crop waste as a fuel in private household equipment. No large-scale projects were identified, however, although in general it is feasible to further utilize these residues in larger applications.

Liquid (Bioethanol or Biodiesel)

In general, Central Asian regions that now grow cotton have the potential to grow an indigenous plant, camelina sativa (also known as false flax, wild flax, linseed dodder, German sesame or Siberian oilseed) as a source for biofuel production. Camelina could possibly replace cotton crops because it needs less water and is drought-resistant. Presently, no projects could be identified in Azerbaijan.

Biogas

Reconstruction of treatment systems for municipal sewage in Baku and other large cities for the further utilization of biogas has been envisioned. There is potential in Azerbaijan to extract biogas from livestock waste and domestic urban waste. There are presently 200 garbage dumps with a total area of about 900 ha in Azerbaijan. About 6–6.5 million m^3 of solid waste are accumulated each year in this area. Volumes of solid waste and methane emissions from dumps in major cities were calculated as follows:

In accordance to a rough estimation of the Ministry of Ecology and Natural Resources, methane gas emission from livestock waste averages up to 40 million m^3 per year. Taking into account that 60 % of livestock is farm-owned, about 24 million m^3/year of the gas could be collected and utilized.

There is no systematic database on existing projects. At the same time, it may be noted that an interest of using biomass to produce energy has increased among private farmers. One project is now developed at the farm Shahin LLC in the Quba region.

TABLE 4

Solid Waste Volumes

BAKU	30,400 tons	42.8 million m^3
GANJA	5,100 tons	7.2 million m^3
SUMQAYIT	4,900 tons	6.9 million m^3
MINGACHEVIR	1,600 tons	2.3 million m^3
SHIRVAN	1,200 tons	1.7 million m^3
NAKHCHIVAN	1,200 tons	1.7 million m^3

Source: Institute of Energy Research and Disine, Azerenergy JSC, without year

3 SOURCE: INSTITUTE OF ENERGY RESEARCH AND DISINE, AZERENERGY JSC

BIOGAS PROJECT, SAHIN FARM

PROJECTED OUTPUT	
Biogas	132,000 m³/year
Biofertilizer	1,100 tons/year
Electricity	264,000 kWh/year

Source: Institute of Energy Research and Disine, Azerenergy JSC, without year

5.2 SOLAR ENERGY

The solar energy potential in Azerbaijan is huge due to favorable climatic conditions. The table below shows data of three locations in Azerbaijan: Artem-Island, minguechaur and Nakhichevan. The first is located near Apsheron at Caspian Coast, the second in the North West part of the country, and the third in the Azerbaijan enclave between Armenia and Iran. In the Annex a map of annual sunshine hours across Azerbaijan can be found.

The number of sun hours per year varies, depending on the area. Seasonal changes occur. In the Kur-Araz lowland, the numbers of sun hours average 2,200–2,400 per year, reaching up to 2,800 hours in areas along the Araz River.

Source: NASA, as in EBRD, 2009

In the Kur-Araz lowland as well as on the Absheron peninsula and Nakhchivan, the solar radiation reaches up to 0.8–1.2 kW per square meter.

In general, this radiation is perfectly suitable for use for solar-thermal applications (water heating mostly) and photovoltaic (PV) power generation. The generation costs for electricity from PV are still too high to be competitive with the low electricity tariffs in Azerbaijan. As long as there are no strong financial incentives, there will be no private investment in PV installations. Presently, the utilization is limited to only one or two facilities for water heating of individual and isolated houses.

The use of solar energy could be difficult due to the high rate of air pollution and frequent sand storms, particularly on the Absheron peninsula.

5.3 WIND POWER

Climatic conditions favor the use of wind power in Azerbaijan. On the Absheron peninsula, average wind speeds vary between 7 and 8 m/s. These speeds were recorded on 280 days of the year. moreover, facilities for offshore wind power could be constructed in the Caspian Sea. They could border the oil platforms that can be seen by the dozen from Baku's piers.

The average wind speed depends roughly on the distance from the Caspian Sea. A wind map and average values for some specific areas can also be found in the Annex. In the coastal regions, the average speed is around 6 m/s, slows down to 4 m/s moving away from the sea and drops to 2 m/s

TABLE 5

Annual Solar Radiation

REGIONAL ANNUAL RADIATION [KWH/A]	ON HORIZONTAL SURFACES	ON NORMAL SURFACES
Artem Island	1,577	1,406
Minguechaur	1,432	1,322
Nakhichevan	1,723	1,817

Source: EBRD, 2009

in sub-mountain areas and 1 m/s in other regions. On an annual cycle, strong winds most often blow in the spring/summer season lasting from march to July. The number of windy days in this region is between 245 and 280 per year.

Wind power could supply many smaller towns and villages, especially in the densely inhabited area around Baku. Connecting wind power plants with the electricity network has not yet been technically standardized. But in the Baku area, the grid is readily available everywhere and no additional costly large-scale electricity network would have to be created, so it would be possible to maintain stable energy costs in the long run. Since electricity prices tripled in 2007, the alternative of wind power is becoming competitive because the price for that type of electricity is uncoupled from oil and gas prices.

Despite many advantages and a generally positive attitude, there is no finalized and installed wind project in Azerbaijan. Two projects however are intended to be implemented or have already been started:

- A wind park with a capacity of 20 MW in the Qobustan rayon is planned be constructed by the Korean STX Company as fixed in a contract between the company and the MIE. As of 2009, the contract has not been signed yet.
- A wind park plant in the Siyazan rayon is presently being constructed. Two wind generators with a capacity of 0.87 MW each have already been installed.
- Yet another wind park is already planned. The South Korean company KEPKO is presently negotiating details for the construction of a facility in Baku's Garadag district with the MIE.

In general, wind energy projects could primarily be developed in the Qobustan region and coastal zones including sea sites. While Absheron is the windiest region, the high prices of land particularly near Baku will hinder the progress of business.

5.4 GEOTHERMAL ENERGY

Studies on geothermal resources in Azerbaijan were carried out in 1964–1970 and later in 1980–1989. Some potential was identified in seven areas, a complete list can be found in the Annex. The temperatures of the water sources are generally too low for technical use for power generation. Possible applications include mineral water spas and heating purposes, especially for greenhouse heating.

As a consequence, there are no geothermal projects in Azerbaijan except for geothermal waters used for balneal purposes (hot hydrogen-sulfide wells in the Talish-Lenkaran area and mineral springs in Nakhchivan). Hot waters from mineral springs of the mountainous Qarabagh area were used for heating of the resort Isti Su (meaning "Hot Water"). This area is now under occupation by Armenia. more information can be found in Ramazanov (1994).

5.5 HYDRO POWER

The development of small Hydro Power Plants is the most promising component in the RE sector. The region between the Large and Small Caucasus is rich in mountain streams and lakes. With a number of small plants installed, this RE source is already being used. According to statements from the Ministry of Energy, negotiations are currently underway to increase their number. Under existing conditions, it is technically and economically feasible to develop a vast potential of small creeks, use drops on the irrigation canals and water releases from reservoirs, which will permit construction of small HPPs.

In the former Soviet Union and today's Central Asian Region, the definition of small Hydro Power Plant is anything with a capacity below 10 MW. Smaller Hydro Power Plants are referred to as mini or micro Hydro Power Plants, equaling a capacity of less than 1 MW or 100 kW respectively. This report is covering all categories, as far as information is available. Where technical potentials are mentioned, the sources of those estimates usually do not clearly specify what they mean by small HPP. Therefore the numbers found do vary.

Hydro Power Plants with a capacity between 1 and 10 MW are usually built and operated by utilities or larger companies, not so much by small private investors. Hydro Power Plants smaller than 1 MW are often built by private investors or Independent Power Producers (IPPs).

A number of still existing small Hydro Power Plants in Azerbaijan were built in the 1950s and 60s. Due to poor maintenance and inexpensive energy from thermal plants and large Hydro Power Plants, the existing smaller Hydro Power Plants were largely neglected and are therefore in a very poor state or even completely dismantled.

The estimates of the usable potential in small hydro power are varying, depending on the source, and not very conclusive and reliable. The PREGA report mentions a total hydro power potential (including large sites) of 40,000 GWh, of which 5,000 GWh are technically usable potentials for small HPPs. This would refer to an installed capacity around 1,000 MW. Another report published by the ADB specifies more reliable results on the most promising 21 sites with capacities between 400 kW and 20 MW and a total of more than 150 MW. A list of those sites and a map of the locations can be found in the Annex.

Another estimation of the physical potential of small hydro power ranges from 200 MW to 400 MW. This estimation is mostly based on the opinion of individual specialists taking into account the number of small mountain rivers and the theoretical possibility to construct cascades of small power plants on each river.

Azerenergy JSC has prepared a program on hydro power development including small hydro power. Prospective sites where power plants can be constructed have been identified. The total capacity is estimated at more than 1,300 MW. Financing sources for the program have not been identified yet and the feasibility of the sites was not investigated. Two projects have been started so far, namely the Sheki and mughan HPPs. Those are the sites 6 and 8 on the list of 21 recommended sites in the ADB report. There are also activities on the Yukhari Shirvan and Bash mil irrigation canals (sites 1 and 2 of the ADB report).

The conclusion drawn from patchy information is, that there is a significant potential for small hydro power development in the country. While there is some systematic information on small hydro power, there are no systematic studies on potentials for mini and micro hydro power. It is clear those potentials for sites with capacities of just a few kW up to a few hundred kW must be existent and those could be developed by private power producers.

6 MARKET RISK ANALYSIS AND BARRIERS FOR MARKET ENTRY

Probably the biggest obstacle for an entry into the Azerbaijan energy market is that no activities in the RE market have been developed so far. While most relevant laws and regulations are in place, none of them have ever been applied so far. The pioneers in the market most likely will face regulatory and administrative hurdles when they start applying for licenses and have to negotiate with the power distributors. A general obstacle is that RE has to compete with very low market prizes from large hydro power and fossil fuels, but since tariffs are set, this is at least an obstacle that is defined and known and can be included in the financial analysis of any planned activity.

6.1 GENERAL SITUATION

The registration of a new business is not difficult. In accordance with the new rules applied since 2008, the registration of enterprises is based on a one-window approach. In order to be registered, founders of firms or other entities as well as individual businessmen have to apply to the relevant regional body of the Ministry of Taxes only.

Corruption

The corruption level is fairly high, with Azerbaijan listed on position 158 out of 180 on the 2008 Corruption Perceptions Index. It appears a situation where people are ready to pay for anything and it is considered to be normal.

Availability of Local Know-How

The quantity of highly educated people is high. At the same time a lack of engineering-technical staff and career laborers appears. Over the last 15 years, young people primarily aimed to become lawyers, economists and doctors.

All high schools in Azerbaijan are named "University" or "Academy". They are education entities only and practically do not conduct any research. Of course, collaboration with universities is not prohibited and may be welcome, but scarcely will be successful.

Local Acceptance

There are equal status and conditions both for local and foreign entrepreneurs. No restrictions or exclusive rules for foreign business exist. Non-natives, however, do not have property rights on land in Azerbaijan, but they can rent and use land and other property.

6.2 BUSINESS DEVELOPMENT

Foreigners and entities as well as physical persons are allowed to set up companies. The required registration can be acquired in one step. If the kind of activity is to be licensed, the license or special permission has to be obtained from the relevant authority. Foreign entities and physical persons can own 100 % of the shares of a company or its majority or less without any restrictions. There may be anti-monopoly limitations, which concern both foreign and local investors. In cases stipulated by the bank legislation, the capital of foreign banks in Azerbaijan can be limited.

All natural persons in Azerbaijan are allowed to directly contact foreign investors, conclude transactions, create joint ventures etc. ministries or other governmental bodies implement relationships with foreign investors in accordance with their responsibilities. No single governmental body is exclusively responsible to contact foreign investors.

The governmental institutions responsible for the regulatory situation in the RE field are the Cabinet of Ministers, the MIE and the Tariff Council, which is responsible to fix unified prices.

In general, it is difficult to say how easy it is to get a license for a business in the energy field. It depends on the kind of activity the license has to be obtained for. In case of power plants, no such licenses have been issued, yet. There is no information available on how simple and predictable it will be to get one.

If some of the legal and regulatory provisions are not acceptable or reasonable, they may not apply in practice. In spite of that, investors can freely act while they comply with rules adopted in business practice of Azerbaijan, generate profit and transfer it without limitation. Both, local and foreign investments are protected by the following Laws of the Azerbaijan Republic:

- Law on Protection of Foreign Investments from 15 January 1992
- Law on Investment Activity from 13 January 1995

Source: Compilation of Laws of the Azerbaijan Republic, as of 2009

6.3 INTELLECTUAL PROPERTY RIGHTS

Intellectual property rights are protected under the Law on Copyright and Allied Rights from 5th June 1996. Besides, Azerbaijan has adopted and ratified the relevant international treaties.

6.4 TAXATION

The Tax Code of Azerbaijan regulates State taxation in Azerbaijan. If any provision on taxes stipulated in other laws contradicts to Tax Code of such provision, it shall not be applicable. Besides, there is the Law on Local Taxes, which defines municipality taxes. Compulsory payments to Social Protection Fund are regulated by the Law on Social Protection.

STATE TAXES ARE

Income tax of physical persons

AMOUNT OF MONTHLY TAXABLE INCOME	TAX RATE
Up to 2,000 manats	14 %
Over 2,000 manats	280 manats + 35 % of the amount exceeding 2,000 manats
Profit tax of legal entities	22 % (in general)
Value added tax	18 %
Excise tax	rates defined by the Cabinet of Ministers
Property tax of legal persons	1 % of the value of the fixed assets
Land tax of legal persons	rates defined dependently on profitability of land

Source: data compiled by the author

The Tax Code establishes the maximum rates for all state taxes. They can be annually reduced by law after approval of the state budget. Additionally, there are local or municipal taxes such as:

- Land tax of physical persons
- Property tax of physical persons
- mining tax on raw materials for local construction
- Profit tax of enterprises that are in property of municipalitie

Import/Export

There are no general restrictions for import and export. Import and export of goods and services are regulated by the Custom Code of Azerbaijan Republic, as well as by the Rules on Regulation of Import/export Transactions in the Azerbaijan Republic" approved by a Decree of the President from 24 June 1997.

Custom duties and fees are defined by the Cabinet of Ministers. Import duty rates vary from 0 up to 15 % depending on type of goods and equipment.

All imported goods must pass customs in accordance with the legislation. One of the important documents for customs clearance is the certificate of origin. In some cases, an expertise of goods or an agreement between the seller and the purchaser may be required.

7 BUSINESS INFORMATION AND CONTACTS

Ministry of Industry and Energy (MIE)
Baku, Azerbaijan, Government Building
Phone: (+994 12) 498 78 56, 598 16 75, 598 03 84,
Fax: (+994 12) 598 16 78
E-mail: pressa@MIE.gov.az

Ministry of Economic Development (MED)
23, Niyazi Str, AZ1066, Baku, Azerbaijan
Phone: (+994 12) 492 41 10
Fax: (+994 12) 492 58 95
E-mail: office@economy.gov.az

Ministry of Ecology and Natural Resources
100 A,B.Aghayev str.
Baku city, Azerbaijan
Contact phone numbers:
498-23-46; 439-11-11
www.eco.gov.az/en

Ministry of Finance (MF)
AZ 1022, Baku Azerbaijan, S.Vurgun Str, 83
Phone: (+994 12) 493 81 03
Fax: (+994 12) 493 05 62
Web: maliyye.gov.az; finance.gov.az
E-mail: info@maliyye.gov.az
www.maliyye.gov.az/index_en.jsp

Ministry of Taxes of the Republic of Azerbaijan
AZ1073, 16, Landau Str., Baku,
Azerbaijan Republic
Phones: (99412) 4038970
Fax: (99412) 4038971
E-mail: office@taxes.gov.az
www.taxes.gov.az

State Oil Company of Azerbaijan Republic (SOCAR)
73 Neftchilar Av, Baku, AZ1000 Azerbaijan
Phone: (+994 12) 4921789
Fax: (+994 12) 4971167
E-mail: info@socar.az

Azerenergy Joint Stock Company (JSC)
10 Academician Abdulkarim Alizade str.,
AZ 1005, Baku, Azerbaijan
Phone: (+994 12) 492 31 09; 493 10 89
Fax: (+994 12) 492 63 55
E-mail: azerenerji@azerenerji.com

RENEWABLE ENERGY – RELEVANT INSTITUTIONS

Ministry of Industry and Energy (MIE)
Department of Renewable and Environment
Head: mirmehdi mirseyidov (+994 12) 493 82 14

Azerenergy Joint Stock Company (JSC)
Energy Research Institute
Director: Nariman Rahmanov (+994 12) 431 39 83
Institute of Energy Research and Disine
Director: Nurali Yusifbeyli (+994 12) 431 42 08

Academy of Science:
Institute of Radiation Problems
Director: Adil Garibov
AZ1143, Azerbaijan Republic, Baku, F. Agayev, 9
Phone: (+994 12) 439 33 91, (+994 12) 438 32 24;
Fax: (+994 12) 4398318
E-mail: nukl@box.az

Laboratory of Transformation of Renewable Energy Sources
Head of Laboratory: Parviz Rzayev
Phone: (+994 12) 438 32 24; (994 12) 439 33 89
Fax: (+994 12) 439 83 18
Main area of activity: Application of wind and solar-hydrogen powering for different technological processes.

Wind Power Engineering Group
Head of Group: Shamil Shahbazov
Phone: (+994 12) 438 32 24; (+994 12) 439 33 89
Fax: (+994 12) 439 83 18
Main area of activity: Wind and solar power engineering

8 BIBLIOGRAPHY

- Asian Development Bank – ADB (2005): Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement (PREGA) – Azerbaijan Country Report
- Asian Development Bank – ADB (2007): Renewable Energy Development Project – Final Report (ADB TA 4726-AZE)
- Ramazanov (1994): Azerbaijan's Geothermal Energy Potential, IGA News, no. 16/1994, p. 5Central Intelligence Agency – CIA (2009): World Fact Book, Azerbaijan (www.cia.gov/library/publications/the-world-factbook/geos/aj.html)
- Nationmaster (2004): Azerbaijan. Energy statistic (viewed in November 2009, www.nationmaster.com/red/country/aj-azerbaijan/ene-energy&all=1)
- European Bank for Reconstruction and Development – EBRD (2009): Renewable Energy Initiative. Azerbaijan. Country Profile (https://ws99.myloadspring.com/sites/renew/Shared%20Documents/2009%2-0Country%20Profiles/Azerbaijan.pdf)

9 ANNEX

FIGURE 9.1

Climatic Zones of Azerbaijan

Source: unknown

TABLE 9.2

Development of the GDP

YEARS	MILLION MANAT	MILLION USD	PER CAPITA	
			Manat	US $
1995	2m133.8	2,415.2	282.1	319.3
1996	2,732.6	3,180.8	357.5	416.1
1997	3,158.3	3,960.7	409.2	513.2
1998	3,440.6	4,446.4	441.5	570.6
1999	3,775.1	4,583.7	480.1	582.9
2000	4,718.1	5,272.8	595.1	665.1
2001	5,315.6	5,707.7	665.2	714.3
2002	6,062.5	6,235.9	752.9	774.4
2003	7,146.5	7,276.0	880.8	896.8
2004	8,530.2	8,680.4	1,042.0	1,060.3
2005	12,522.5	13,238.7	1,513.9	1,600.4

Source: IMF Data and Statistics, as of 2008

TABLE 9.3

Electric Power Plants of Azerbajan*

POWER PLANT NAME	POWER PLANT TYPE	NUMBER OF UNITS	POWER PLANT CAPACITY (MW)	
			Installed	Available
Azerbaijan Thermal Power Plant (AzDRES)	condensing steam turbine	8	2,400	2,000
Alibayramli (Shirvan) Thermal Power Plant	condensing steam turbine	7	1,050	900
Shimal Thermal Power Plant	combined cycle (gas turbine + recovery boiler + steam turbine)	1	400	350
Baku Heat and Power Plant 1	gas turbines + recovery boilers	2	106	100
Baku modular Thermal Power Plant	drive system – reciprocating internal combustion engine	12	104	104
Astara modular Thermal Power Plant	drive system – reciprocating internal combustion engine	10	87	87
Sheki modular Thermal Power Plant	drive system – reciprocating internal combustion engine	10	87	87
Khachmaz modular Thermal Power Plant	drive system – reciprocating internal combustion engine	10	87	87
Nakhchivan modular Thermal Power Plant	drive system – reciprocating internal combustion engine	10	87	87
Mingachevir Hydro Power Plant	hydro	6	400	360
Shamkir Hydro Power Plant	hydro	2	380	190
Mingechaur Hydro Power Plant	hydro	6	400	360
Varvara Hydro Power Plant	hydro	3	16	10
Yenikend Hydro Power Plant	hydro	4	150	100
Terter Hydro Power Plant*	hydro	2	50	–
Araz Hydro Power Plant	hydro	2	22	22
Sangachal modular Thermal Power Plant (commissioning date: 24 December 2008)	drive system – reciprocating internal combustion engine	18	300	300
Total capacity			5782	4944

Note: *) The Terter Hydro Power Plant is located on a territory temporarily occupied by Armenia.

TABLE 9.4

Generation expansion program (2008–2015)*

NAME OF STATION	UNIT NO.	TYPE OF POWER STATION	TYPE OF FUEL	INSTALLED CAPACITY (MW)	DATE OF COMMISSIONING
Sumqayit	3	combined cycle	gas	516	2009
Quba	12	piston (engine)	gas	104	2009
Janub	6	combined cycle	gas, mazut	780	2010
Azerbaijan	8	steam turbine	gas, mazut	600	2010
Fizuli	2	hydro	–	25	2010
Tovuz	2 (4)	hydro	–	380	2014
Small HPPs	(intended)			30	2009–2012

TABLE 9.5

Transmission and Distribution System*

VOLTAGE LEVEL	LENGTH	NUMBER OF LINES
500 kV	450 km	2 TL
330 kV	1,207 km	14 TL
220 kV	1,230 km	19 TL
110 kV	2,484 km	175 TL
35 kV	4,800 km	350 DL
6–10 kV	37,900 km	3,200 DL
0.4 kV	61,000 km	60,000 DL

TABLE 9.6

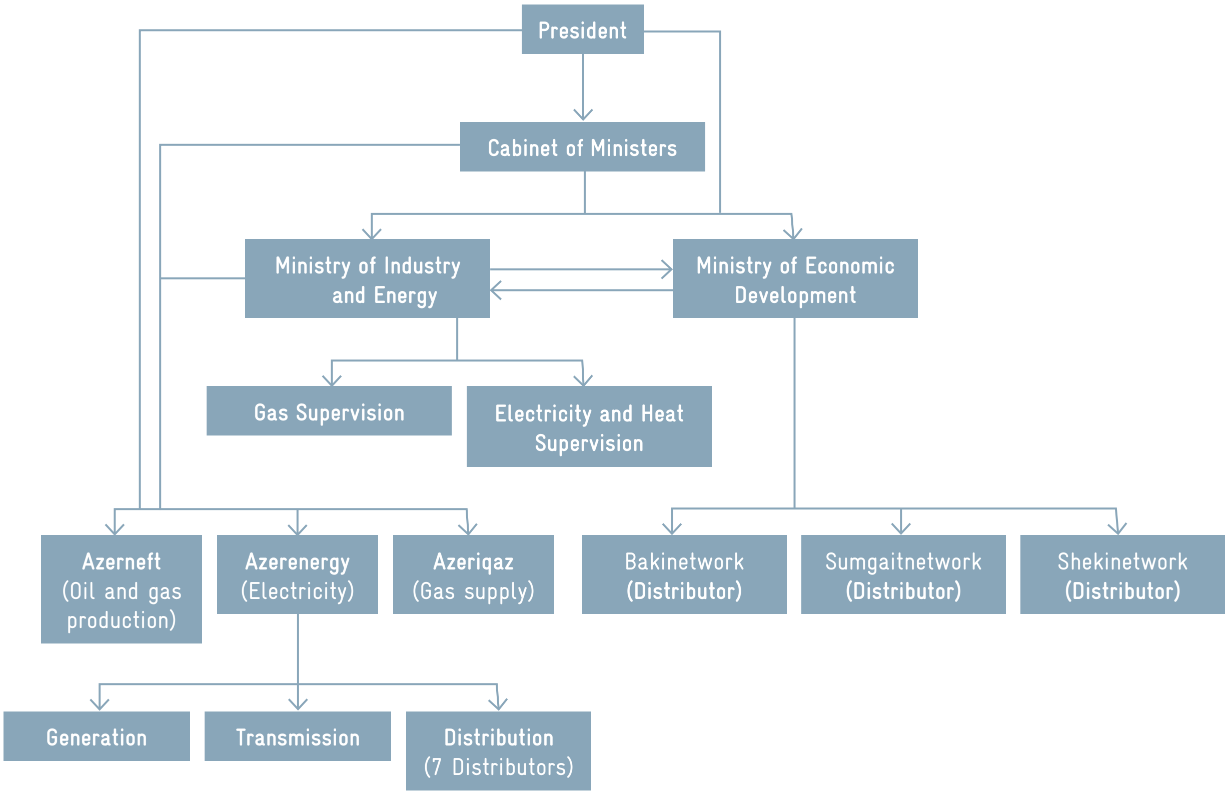
Tariff Increases for Electricity Consumers*

USERS	2006	2007*
HOUSEHOLD	0.019	0.060
INDUSTRY AND CONSTRUCTION	0.026	0.060
BUDGETARY ORGANIZATIONS	0.026	0.060
AGRICULTURE	0.026	0.060
TRADE AND SERVICES	0.050	0.060

* Sources Tabels 9.3 – 9.6 and 9.8: compiled by the authors from various data sources

FIGURE 9.7

Schematic Structure of Energy Sector Management



Source: unknown

TABLE 9.8

Geothermal Sites Identified in Azerbaijan

NAME OF AREA	PROVEN RESOURCES (M^3/DAY)	TEMPERATURE (°C)	EXTENT OF MINERALIZATION (G/L)
1. Yalama-Khachmaz	570,000 21,000–25,000	40–85	3.0–25.0; up to 42
2. Talish-Lenkaran	25,600	31–64	7.0–43.0
3. Kur Lowland*	242,000 100,000	30–71	4.4–40.0
4. mountainous Qarabagh	4,000–5,000	30–74	n.a.
5. Absheron Peninsula*	20,000	40–80	n.a.
6. major Caucasus	2,000	30–50	n.a.
7. Nakhchivan Autonomous Republic	3,000	40–50	n.a.

* mostly iodine-bromide water

FIGURE 9.9
Map of Geothermal Areas

Source: unknown

TABLE 9.10

Biomass Production of Azerbaijan

BIOMASS RESOURCE TYP	TOTAL PRODUCTION	PRODUCTION DENSITY
Percent of total land area covered by	14 %	
Forests	17 %	
Shrublands savanna and grasslands	64 %	
cropland and crop/natural vegetation mosaic	1 %	
Urban and built-up areas	2 %	
Sparse or barren vegetation; snow and ice	2 %	
Wetlands and water bodies	14 %	
Primary crop production, ton	(avg. 1999–2001 ton)	(ton/1000 ha)
Total primary crops (rank among COO)	7,806,794 (18)	901 (19)
Top 10 primary crops		
Mixet grasses, Legumes	2,600,000	300
Maize for forage & silage	1,200,000	139
Wheat	1,189,327	137
Potatoes	479,325	55
Tomatoes	370,678	43
Apples	281,767	33
Watermelons	252,579	29
Vegetables and Roots, Fodder	231,667	27
Barley	208,967	24
Vegetables fresh (misc)	133,000	15
Animal units, number	(number)	(number/1000 ha)
Cattle	1,933,270	223
Poultry	12,972,000	1,498
Pigs	22,900	3
Equivalent animal units	2,072,150	239
Annual roundwood production	(1996 – 98,000$m^{3)}$	(m^3/ha)
Total	n.a.	n.a.
Fuel	n.a.	n.a.
Industrial	n.a.	n.a.
Wood-based panels	n.a.	n.a.
	(1996 – 98,000metric tons)	(metric tons/ha)
Paper and paperboard	n.a.	n.a.
Recovered paper	n.a.	n.a.

Source: EBRD, 2009

TABLE 9.11.1

Average Wind Speeds in Absheron Region – Windy (5–8 m/s)*

RAYONS (CITIES AND VILLAGES)	AVERAGE WIND SPEED (M/S)
Shubani village	8,0
Guzdek village	7,5
Sumqayit city	7,0
Puta village	6,7
Pirallahi island	6,6
Bina village	6,4
Jilov island	6,4
Bakucity	6,3
Oily Rocks (oil-field in the see)	6,2
Mardakan village	5,9
Mashtaga village	5,8

TABLE 9.11.2

Average Wind Speeds in Absheron Region – Relatively Windy (3–5 m/s)*

PANOHS (CITIES AND VILLAGES)	AVERAGE WIND SPEED (M/S)
Neftchala	4,2
Nabran	4,1
Terter	4,0
Mingachevir	3,8
Alat	3,8
Qazimammad	3,7
Ganja	3,3
Maraza	3,2
Salyan	3,1
Bilasuvar	3,0
Jadrail	3,0

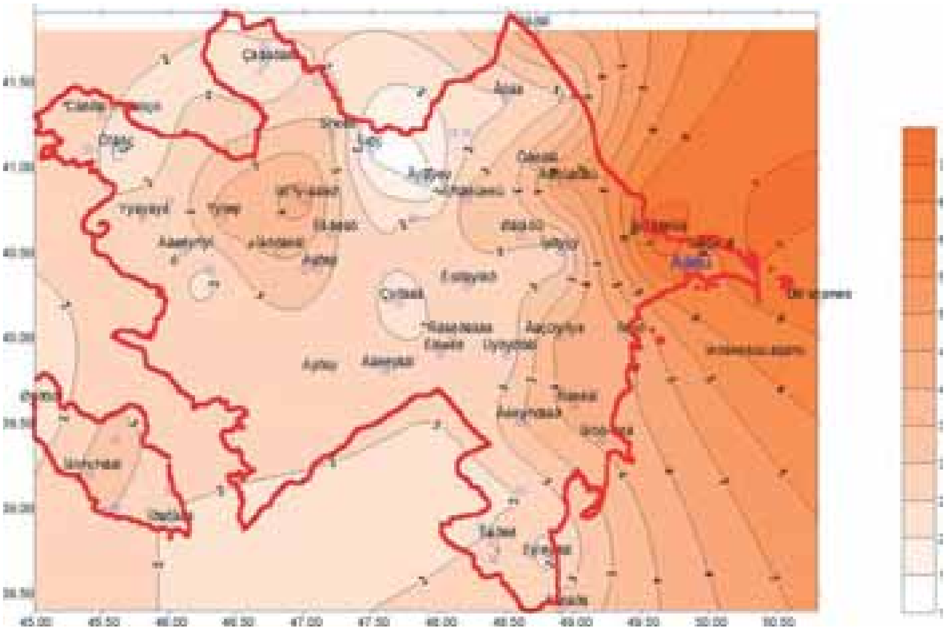
TABLE 9.11.3

Average Wind Speeds in Absheron Region – Weakly Windy (1–3 m/s)*

1.	RAYONS (CITIES AND VILLAGES)	AVERAGE WIND SPEED (M/S)
2.	Imishli	2,9
3.	Astara	2,8
4.	Jalilabad	2,8
5.	Shahbuz	2,7
6.	Nakhchivan	2,6
7.	Shamakhi	2,6
8.	Lerik	2,6
9.	Yevlakh	2,6
10.	Julfa	2,5
11.	Gedabey	2,4
12.	Agstafa	2,4
13.	Kurdemir	2,3
14.	Khachmaz	2,3
15.	Sheki	2,3
16.	Dashkesan	2,2
17.	Beylagan	2,2
18.	Shemkir	2,2
19.	Geokchay	2,1
20.	Sabirabad	2,1
21.	Quba	1,9
22.	Kelbajar	1,8
23.	Zardab	1,8
24.	Aqdam	1,8
25.	Lenkaran	1,8
26.	Fizuli	1,7
27.	Yardimli	1,6
28.	Qazakh	1,3
29.	Zaqatala	1,3

FIGURE 9.12

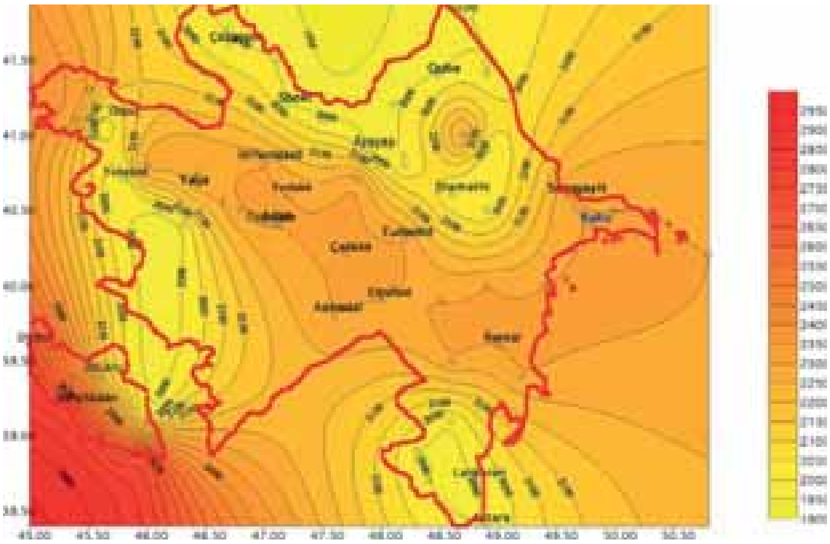
Wind Speed map for Azerbaijan



* Sources Tabels 9.11.1 – 9.11.3 and Figure 9.12 unknown

FIGURE 9.13

Sunshine map for Azerbaijan



Source: unknown

TABLE 9.14

Identified Sites for Small Hydro Power Plants in Azerbaijan

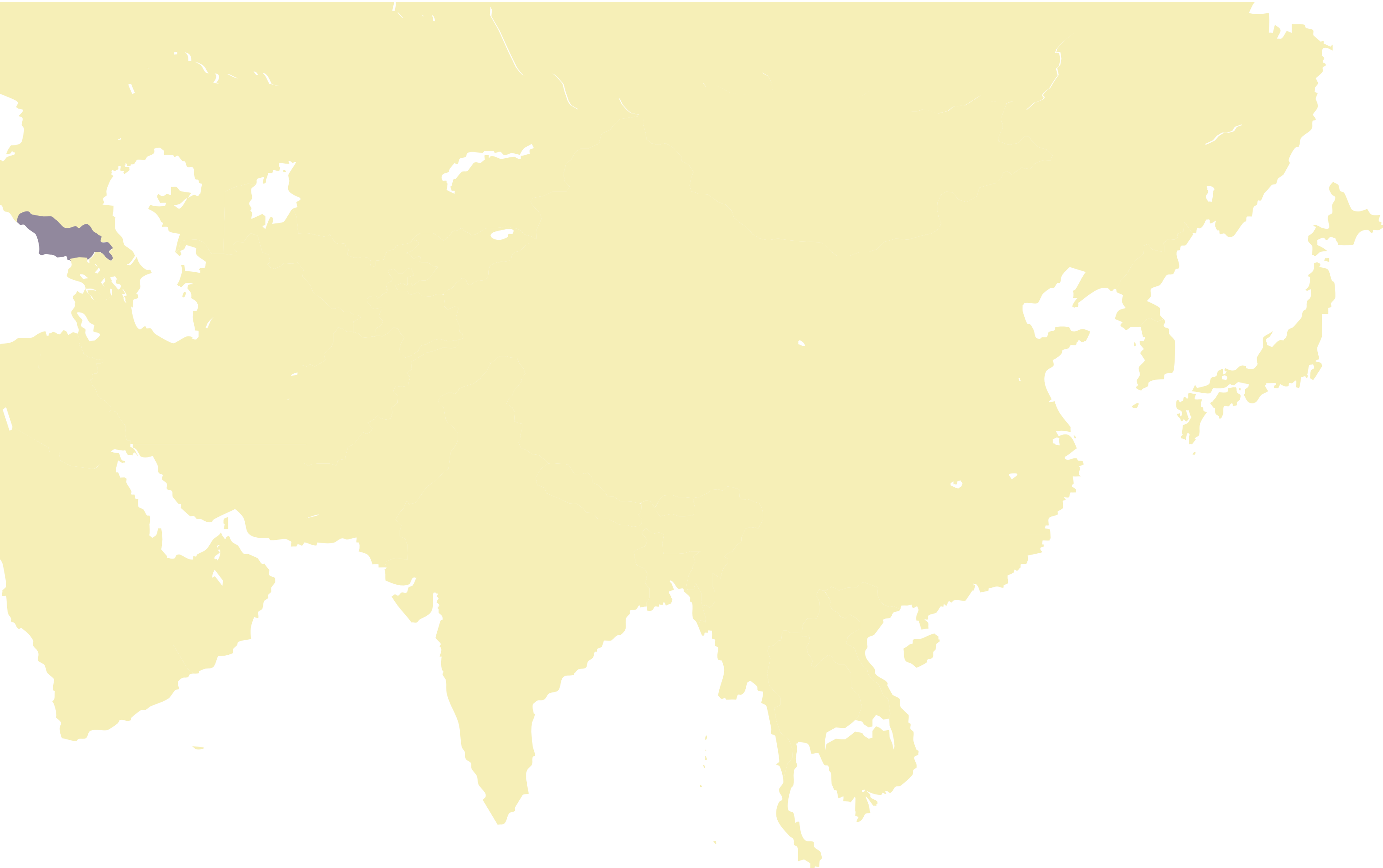
N°	SITE NAME (SHPS)	TYPE OF POWER PLANT	NET HEAD, EST. (M)	FLOW (M³/S)	POWER (KW)
1	Yukhari Shirvan	Irrigation channel	12.5	30	2,869
1a	Yukhari Shirvan	Irrigation channel	9.5	78	5,670
2	Bash Mil	Irrigation channel	33.3	80	20,354
3	Varvara	River	5.9	429	19,335
4	Yukhari Karabakh	Irrigation channel	18.1	125	17,264
5	Katekh	River	29	19.8	4,394
6	SHP Sheki	Rehabilitation	179	0.94	1,287
7	Quba	River	41.8	1.18	377
8	Mugan	Irrigation channel	7.1	21	1,145
9	Chichakli	River	83.1	1.38	878
10	Chinarli	River	29.6	3	680
11	Nugadi	River	66	1.5	758
12	Valishchay	River	36.1	10.5	2,900
13	Akstafachay	River	23.8	14	2,544
1	Akstafachay	River	28.5	6	1,308
15	Ayrichay	River	5.7	20.8	907
16	Qusarchay 6	River	29	7.5	1,664
17	Lenkaranchay 3	River	31	10.4	2,467
18	Arpachay	River	50.8	28.5	11,084
19	Vayhir	River	40.4	13.2	4,078
20	Alindjachay 6	River	10.4	46	3,645
21	Alindjachay 7	River	11.6	46	4,079

Source: ADB, without year

FIGURE 9.15

Overview of Potential SHP Sites in Azerbaijan

Source: ADB, without year



COUNTRY CHAPTER: REPUBLIC OF GEORGIA

Authors and Coordination of Country Chapter

Grigol Abramia
(Dipl. Env. Management & Lit.)

Dr. Ing. Klaus Jorde
Entec Consulting & Engineering AG
St. Gallen, Switzerland
www.entec.ch

Axel Biegert (Dipl. Economist & Pol.)
INTEGRATION UMWelt & Energie GmbH
Graefenberg, Germany
www.integration.org

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS GEORGIA

ACRONYMS AND ABBREVIATIONS

GEORGIA

ADB	Asian Development Bank
CAR	Central Asian Region
CCA	Common Country Assessment
CENN	Caucasus Environmental NGO Network (CENN)
CDM	Clean Development Mechanism
CHP	Combined Heat and Power Plant
CIS	Commonwealth of Independent States
CO_2	Carbon Dioxide
DDP	Distribution Demonstration Project
EBRD	European Bank for Reconstruction and Development
EEC	Energy Efficiency Centre
ESCO	Energy System Commercial Operator
FSU	Former Soviet Union
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse Gas Emissions
GNERC	Georgian National Electricity Regulatory Commission
GNIA	Georgian National Investment Agency – GNIA
GSE	Georgian State Electro System
GWEM	Georgian Wholesale Electricity Market
HPP	Hydro Power Plant
HV	High Voltage
HVL	High Voltage Lines
HVN	High Voltage Network
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IEA	International Energy Agency
JSC	Joint Stock Company
MB&C	Metering, Billing and Collection
MDG	Millennium Development Goals
NATO	North Atlantic Treaty Organization
O&M	Operation and Maintenance
PREGA	Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement
RAO UES	Russian energy company
RE	Renewable Energy
SPP	Small Power Plant
SHPP	Small Hydro Power Plant
SJSC	State Joint Stock Company
UDC	Unified Dispatch Center
UEDC	United Energy Distribution Company
UNDAF	UN Development Assistance Framework
UNDP	United Nations Development Program
UPSCAR	United Power System of Central Asia Republics
USAID	United States Aid
USD	US Dollar
US	United States
VAT	Value Added Tax
WB	World Bank

MEASUREMENTS

°C	degree Celsius
km	kilometer
km^2	square kilometer
km^3	cubic kilometer
kV	kilovolt (1kV = 1,000 V)
kWh	kilowatt hour
l	liter
m	meter
m^3	cubic meter
mm	millimeter
MW	megawatt (1 MW = 1,000 kW)
GWh	gigawatt hour (1 GWh = 1,000,000 kWh)
TWh	terawatt hour (1 TWh = 1,000,000,000 kWh)
kj	kilojoule (1 kj = 1,000 Joules)
ktoe	kilotons of oil equivalent (1 ktoe = 11,630,000 kWh)

1 SUMMARY

Georgia has vast resources of almost all types of Renewable Energy (RE) – solar, wind, geothermal, hydro and biomass. The achievable annual potential of all RE sources is estimated at 15,000 GWh per year. This is enough energy to meet over a third of Georgia's annual primary energy needs. Apart from large hydro power resources, only a very small part of this potential is currently used. Below, please find an overview of the largely untapped achievable potentials:

TABLE 1

Untapped Achievable Potentials

	ACHIEVABLE POTENTIAL
Small hydro power	5,000 GWh
Wind energy	5,000 GWh
Biofuels	3,000–4,000 GWh
Solar energy	60–120 GWh
Geothermal energy	3,000 GWh

Source: data compiled by the author from different sources

The Georgian Government has been implementing a major restructuring of the energy sector since 2004. The main objective for the long-term policy is to fully satisfy the country's overall demand for electricity with domestic hydro resources. Besides tendering a number of new large Hydro Power Plants, the Ministry of Energy seeks foreign investors for the development of new small and medium Hydro Power Plants. On its official website, the Ministry of Energy has published a list of 91 potential sites with prospective capacities ranging from 0.6 MW to 99 MW[1]. Investors can be benefit from a guaranteed purchasing agreement for the first 10 years of operation.

Since the Rose Revolution in 2003, Georgia has been making enormous progress towards the improvement of the investment climate. Today, the World Bank (WB) ranks Georgia 11th in the world in terms of ease of doing business, ahead of many industrialized countries like Japan and Germany. Investor confidence has, however, suffered after the armed conflict between Russia and Georgia in August 2008. Russia's role as the main geopolitical player in the region has strengthened, and the relationship between the two states will play an important role in Georgia's the future economic development.

1 SEE WEBSITE OF GEORGIA'S MINISTRY OF ENERGY: WWW.MINENERGY.GOV.GE/?LANG=ENG

2 COUNTRY INTRODUCTION

2.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Georgia is located in the Caucasus region of south-western Asia with a land area of 69,700 km². It is bordered to the West by the Black Sea (with a coastline of 310 km), to the South by Turkey and Armenia, to the East by Azerbaijan and to the North by Russia. Mountains are the dominant geographic feature of Georgia. The northern border with Russia roughly runs along the crest of the Greater Caucasus mountain range – a commonly acknowledged boundary between Europe and Asia with highest peaks above 5,000 m. The southern part of the country is bounded by the Lesser Caucasus Mountains with elevations of less than 3,500 m.

Native Georgians constitute about 84 % of Georgia's current population of 4.6 million people (as of 2009). Other major ethnic groups include Azeris (6.5 %), Armenians (5.7 %), Russians (1.5 %) and numerous smaller groups. The country with the capital of Tbilisi (Tiflis) consists of nine administrative regions and two autonomous republics (Abchazia and Ajaria). Abchazia and the autonomous administrative district of South Ossetia have officially declared their independence, but are only recognized by Russia, Nicaragua, Venezuela and Transnistria.

The climate of Georgia is extremely diverse, considering the nation's small size. There are two main climatic zones, roughly separating the eastern and western parts of the country. Much of western Georgia lies within the humid subtropical zone with annual precipitation ranging from 1,000–4,000 mm. The climate of the region varies significantly with elevation, and while many of the lowland areas of western Georgia are relatively warm throughout the year with average temperatures from 5–12 °C, the foothills and mountainous areas experience cool, wet summers and snowy winters.

Eastern Georgia has a transitional climate from humid subtropical to continental. Annual precipitation ranges from 400–1,600 mm – considerably less than that of western Georgia due to influences by dry air masses from Central Asia.

FIGURE 1

Map of Georgia

2.2 POLITICAL AND ECONOMIC DEVELOPMENT

Georgia has been an independent republic since its separation from the former Soviet Union in 1991. Georgia's main economic activities include the cultivation of agricultural products such as grapes, citrus fruit and hazelnuts, the mining of manganese and copper and output of a small industrial sector producing alcoholic and non-alcoholic beverages, metals, machinery, aircrafts and chemicals. Tourism is an increasingly significant part of the Georgian economy. About a million tourists brought 313 million USD to the country in 2006. The services sector contributed 59.6 % to the country's Gross Domestic Production (GDP) in 2008 followed by industry 27.9 % and agriculture 12.5 %[2].

The country's economic transition from a centrally planned economy to a market economy was a difficult process. Like all post-Soviet states, Georgia faced a severe economic collapse, where its GDP fell by 20 % per year between 1990 and 1995. The civil war and military conflicts in South Ossetia and Abkhazia aggravated the crisis. The country embarked on a slow pace of economic growth between 1998 and 2003 (3–3.5 %). This growth, however, was not enough to benefit the country's impoverished majority. By 2003, an estimated 52 % of Georgians were living below the official poverty line. Growing dissatisfaction ultimately triggered Georgia's 2003 Rose Revolution – a national uprising that brought down the regime of Eduard Shevardnadze.

Since the end of the Rose Revolution, the Saakashvili Government has been achieving a remarkable progress: From administrative chaos, the virtual non-existence of an open national economy and the stranglehold of mafia-like organizations, Georgia has moved rapidly to reconstitute the state's authority, abandon the structures and practices that made corruption endemic, launched a campaign to fight criminality, liberalized the national economy and opened it up to new disciplines and opportunities to play in global markets. Within a period of four years, Georgia had not only constructed a proper state, but had also emerged as one of the world's fastest growing and most rapidly transforming econoMIEs.

The improved business environment led to a remarkable inflow of foreign capital fuelling the country's economy. The World Bank recognized Georgia as the world's fastest-reforming economy in its 2008 Doing Business Report, ranking in the same league as countries like Germany, Sweden and Estonia. GDP growth was above 9 % from 2005 to the first quarter of 2008[3].

Despite its internationally recognized borders, the country had to struggle to gain control over its territory since gaining independence. In August 2008, the conflict around the internationally not recognized republics of Abkhazia and South Ossetia escalated in a short war with Russia. The war caused severe damage to Georgia's economic and financial system, a total collapse of military infrastructure, stopped direct investment flow into the country and significantly undermined the status of Georgia as safe and stable energy transit country[4]. In combination with the global financial crisis, GDP growth dropped to 2.1 % in 2008 and is projected to further decrease to -4 % for 2009 before increasing again to 2 % in 2010[5].

2 CIA, AS OF 2009
3 WORLD BANK GROUP/IFC, AS OF 2008/2009
4 TRANSPARENCY INTERNATIONAL GEORGIA/BP GEORGIA, AS OF 2008
5 IMF, AS OF 2009

The roots of the war with Russia are related to Georgia's geo-strategic location as an energy corridor for East Caspian resources (Kazakh oil and Turkmen gas) to western countries via Turkey. This is probably the most important reason for the growing US and EU influence in Georgia, notably through proposed EU and NATO membership, the US military assistance program and the construction of the Baku-Tbilisi-Ceyhan pipeline. These projects have strained Tbilisi's relations with Moscow. The armed conflict between Russia and Georgia made it obvious that Russia's role as the main geo-political player in the region has strengthened and that the safety of the South Caucasian transit infrastructure depends on the kind will of Russia. Meanwhile, Georgia's strategic location has also lost some importance since the Caspian countries have now access to alternative routes towards China and Iran.

SHORT BUSINESS INFO

Since the Rose Revolution, Georgia has been reconstituting the state's authority, abandoning the structures and practices that made corruption endemic, launching a campaign to fight criminality, liberalizing the national economy and opening it up to new disciplines and opportunities to play in global markets.

The World Bank recognized Georgia as the world's fastest-reforming economy in its 2008 Doing Business Report, ranking in the same league as countries such as Germany, Sweden and Estonia.

LAND AREA:	69,700 km²
POPULATION:	4.6 million (as of 2009)
DENSITY:	66 inhabitants/km²
BIGGEST CITIES AND POPULATION:	Tbilisi (1.48 million), Kutaisi (186,300)
LANGUAGE:	Georgian
CLIMATE:	Warm and pleasant; Mediterranean-like on Black Sea coast
AVERAGE ANNUAL TEMPERATURE:	In lower areas 5–12 °C, at 2,500 m above sea level <0 °C
ALTITUDE:	Sea level to Mt'a Shkhara 5,201 m
RIVERS:	26,000 rivers
ECOSYSTEM AREAS:	Forests (48 %), shrubland, savannah, grassland (11 %), cropland and crop/natural vegetation mosaic (39 %), urban and built-up areas (1 %), sparse or barren vegetation, snow and ice (1 %), wetland and water bodies (1 %)
INFLATION RATE:	11 % (as of 2008)
AGRICULTURAL PRODUCTS	Citrus fruit, grapes, tea, hazelnuts, vegetables, livestock
INDUSTRIES:	Steel, aircrafts, machine tools, electrical appliances, mining (manganese and copper), chemicals, wood products, wine
ELECTRICITY – PRODUCTION:	7,287 GWh (as of 2006)
ELECTRICITY – CONSUMPTION:	5,669 (as of 2006)
ELECTRICITY – TARIFFS:	8 USc/kWh
NATIONAL ELECTRICITY CAPACITY IN OPERATION:	4,388 GW
ELECTRIFICATION RATE:	n.a.
NATURAL RESOURCES:	Forests, hydro power, manganese deposits, iron ore, copper, minor coal and oil deposits, natural gas
OIL – PRODUCTION:	0.98 thousand barrels/day (as of 2007)
OIL – EXPORT:	2 thousand barrels/day (as of 2007
OIL – CONSUMPTION:	12.9 thousand barrels/day (as of 2006)
OIL – PROVEN RESERVES:	0.035 billion barrels (as of 2008)
NATURAL GAS – PRODUCTION:	1 billion cubic feet/year (as of 2005)
NATURAL GAS – PROVEN RESERVES:	300 billion cubic feet (as of 2008)
EXPORTS:	2.76 billion USD (as of 2008)
EXPORTS – COMMODITIES:	Scrap metal, wine, mineral water, ores, vehicles, fruits and nuts
EXPORTS – PARTNERS:	Turkey 13 %, US 11.2 %, Azerbaijan 6.3 %, UK 5.4 %, Bulgaria 5.1 %, Ukraine 5 %, Armenia 4.8 %, Turkmenistan 4.5 %, Canada 4.2 % (as of 2007)
IMPORTS:	7.3 billion USD (as of 2008)
IMPORTS – COMMODITIES:	Fuels, vehicles, machinery and parts, grain and other foods, pharmaceuticals
IMPORTS – PARTNERS:	Turkey 14 %, Russia 12.3 %, Ukraine 8.5 %, Azerbaijan 7.3 %, Germany 6.8 %, US 5 %, Bulgaria 4.6 % (as of 2007)
EXCHANGE RATE:	1 € = 2.5 Lari (as of 2009)

Source: CIA World Fact Book, as of 2009; IEA, as of 2006

3 ENERGY MARKET IN GEORGIA

Georgia imports nearly all its needed supplies of natural gas and oil products. The share of energy in the GDP of Georgia is three times greater than in the developed countries of Europe. The competitiveness of Georgia's economy is, therefore, particularly affected in times of high energy prices. The country, however, has a considerable hydro power potential, which can reduce its dependency on energy imports, if better developed.

Although Georgia does not own large-scale oil and gas resources, it can generate revenues from oil and gas transit because of its geo-strategic location. Despite its lucrative location, Georgia has been struggling to secure a basic energy supply for its citizens since its independence from the former Soviet Union. The civil war and the economic crisis in the early years of independence destroyed many state-owned energy assets, while the remaining resources were severely damaged or abandoned in disrepair. The last sabotage against the electricity infrastructure took place in the period 2004–2005. Since then, the Saakashvili Government managed to stabilize the electricity sector. Generation units and transmission lines are being rehabilitated with budgetary funds and the assistance of foreign donors.

The Parliament's Resolution on the Main Directions of Georgia's Energy Sector Development, adopted in 2006, identified the transfer of energy units in private ownership as a main component in improving the country's energy sector. Besides that, the state energy policy focuses on energy efficiency and saving, namely (i) on the reduction of energy consumption and loss in industrial and communal areas and (ii) the examination and implementation of measures necessary for creating cogeneration systems and for the utilization of Renewable Energy sources (hydro, wind)[6]. Critics, however, say that there is too little political will to enforce that policy[7].

3.1 IMPORTANT PLAYERS OF THE TURKMEN ENERGY MARKET

The majority of the Georgian energy sector is privatized and mostly in the hands of Russian-Georgian business groups. Despite the possible danger during and after the military conflict between Russia and Georgia in August 2008, Russian-Georgian business groups stayed in business and did not stop supplying the population with electricity and gas. When the military conflict was over, the Georgian government positively evaluated the activities of energy companies during the conflict and expressed readiness to continue receiving investments from Russia.

RAO Telasi is the power distribution company of Tbilisi and has been in the Georgian energy market since 2003, when Inter RAO UES[8] bought 75 % of stocks from the US firm AES with the remaining 25 % of stocks belonging to the municipality of Tbilisi. As part of the deal, RAO UES purchased the 600 MW Mtkvari gas fired power station from AES. RAO Telasi has signed electricity purchase agreements with the Enguri, Khrami and Zhinvali Hydro Power Plants.
Energo Pro is a Czech Company, which entered the Georgian energy market in 2007 and has been supplying the Georgian regions with electricity ever since. Besides the distribution network, the company owns several hydroelectric power stations with a joint capacity of 354 MW. The company cannot meet consumer needs with only its own generation; therefore it also purchases electricity from Enguri and other hydroelectric power stations.

Georgian National Electricity Regulatory Commission (GNERC) is responsible for the regulation of the power sector as well as the natural gas sector. GNERC is set up as an independent legal body with its Commission Chairman appointed by the President of Georgia. The Commission has the authority to grant licenses and deal with licensees concerning generation, transmission and distribution within the Electricity and Natural Gas Sectors of Georgia. GNERC also has the mandate to set tariffs for generation, transmission and distribution. The commission is to provide attractive terms and conditions for new private HPP investors.

Electricity System Commercial Operator (ESCO) was set up in 2006 with a mandate to be the market maker in the electricity system in Georgia. ESCO provides medium- and long-term purchase agreements with operators of power plants and trades with electricity in Georgia and neighboring countries. ESCO guarantees the purchase of all electricity from newly built HPPs, which nominally reduces market risk. Questions remain regarding the viability of ESCO in the medium term, as its predecessor, the Georgian Wholesale Electricity Market (GWEM), had to file for bankruptcy in 2004 because of the persistent lack of payment from its customers.

3.2 PRIMARY ENERGY CONSUMPTION, TRANSMISSION AND PRICES

In 2006, the total primary energy supply in Georgia was 3,344 ktoe (38,890 GWh). The total final consumption was 2,509 ktoe (29,179 GWh). 71 % of the supplied primary energy in 2006 was imported, out of which 41 % was natural gas and 23 % oil products[9]. Local biofuels (mainly in the form of firewood) play an important role in primary energy supply. The consumption of firewood is in the same range as the consumption of electricity produced through the hydro power stations. Firewood is mainly consumed in rural areas for cooking and heating purposes. The consumption of firewood is very inefficient due to the widespread practice of using woodstoves of very low efficiency (35–40 %). Transmission and Distribution System

The gap between primary energy supply and consumption indicates that a significant part of energy is lost due to outdated distribution networks and theft. IEA estimates these losses in the range of 10 % (as of 2006) of the total primary energy supply (distribution losses and theft) which indicates that there is still a considerable need for technical and political measures to make the energy sector more efficient[10].

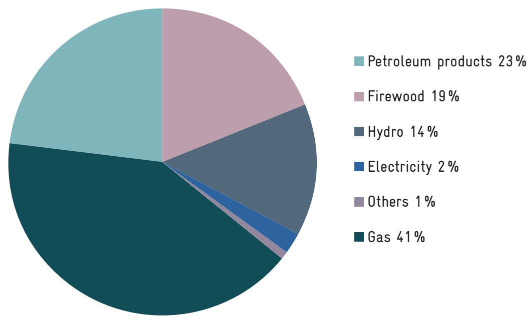
6 RESOLUTION ADOPTED BY THE PARLIAMENT ON 7 JUNE 2006
7 TRANSPARENCY INTERNATIONAL GEORGIA/BP GEORGIA, AS OF 2008

8 INTER RAO UES IS A RUSSIAN ENERGY COMPANY ENGAGED IN POWER GENERATION AND ELECTRICITY TRADING.
9 IEA, AS OF 2006
10 WORLD EXPERIENCE FOR GEORGIA, AS OF 2008

FIGURE 2

Composition of Total Energy Supply

Total Primary Energy Supply and Consumption

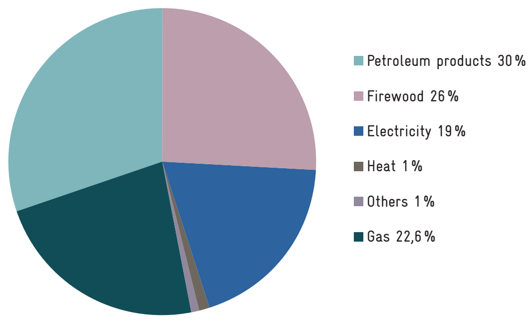


Source: International Energy Agency (IEA), as of 2006

FIGURE 2.1

Composition of Total Energy Supply

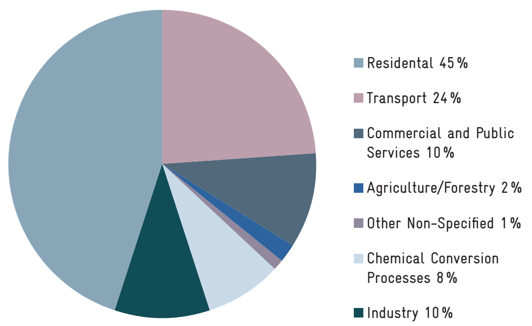
Total Final Consumption



Source: International Energy Agency (IEA), as of 2006

FIGURE 3

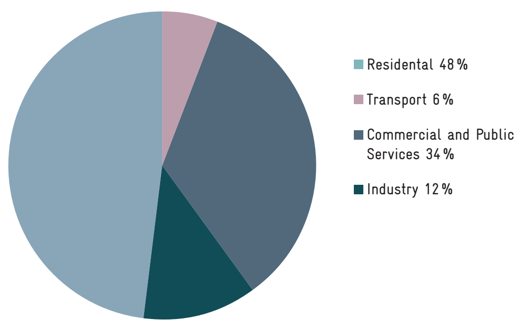
Final Energy Consumption by Sector



Source: International Energy Agency (IEA), as of 2006

FIGURE 4

Final Electricity Consumption by Sector



Source: International Energy Agency (IEA), as of 2006

The Figure below shows the energy consumption by sector. The consumption by the residential sector is particularly large with 45 % of the total consumption, while the consumption in the industry sector is particularly low with only 10 %.

Electricity Sector

The installed electricity generation capacity in Georgia totals 4,470 MW of which 62 % are located in Hydro Power Plants. The other 38 % are located in thermal power plants mainly used to meet peak and winter demand. The average annual electricity generation in the 2000–2006 period totaled 8,180 GWh, of which 72.5 % was hydroelectricity, 13.5 % was generated in thermal power plants and 14 % was imported (see Annex 2).

A number of power plants have been privatized in recent years. Inter RAO UES purchased the 600 MW Mtkvari gas fired power station, while Energo Pro bought 6 medium-sized Hydro Power Plants with a total installed capacity of 361 MW in 2007. Other power plants are scheduled to be privatized. However, most of the important generation assets, such as the 1,300 MW Enguri HPP generating almost one third of the country's electricity, remain state-owned. Other assets are partly controlled by Georgian municipalities[11].

About 15 % of the generated electricity are used by the energy sector itself (e. g. for pumped storage) and 13 % are lost in the distribution network or by theft. Although losses are still significant, huge progress was made by improving the network in recent years. Final Electricity consumption totaled 5,669 GWh in 2006[12]. The figure below shows electricity consumption by sector.

Until recently, Georgia's electricity sector suffered from a surplus of hydraulic energy compared to system demand during the months of May–July. In this period, the water discharge in rivers strongly increases, and electricity usage considerably decreases. Specialists estimate the amount of excessive energy at approximately 700–800 GWh annually, or about 10 % of in-country electricity generation. The main reason for this situation is that Georgian power plants were planned and constructed for peak operation in the united energy system of the Soviet Union. After the breakdown of the Soviet Union and the isolation of the Georgian energy system, some of the capacity remained unused in the summer. This was a serious problem, which generally hindered the development of energy generation in Georgia, to say nothing about generation from new prospective small or big HPPs.

This situation changed in 2007, when the newly created market maker ESCO managed to develop an export potential by arranging seasonal energy swaps with neighboring countries. Today, almost all surplus hydroelectricity can be sold which will positively influence the development of small hydro power and other grid-connected RE solutions in the future.

11 ECON, AS OF 2007

12 IEA, AS OF 2006

Natural Resources

Water resources

Water resources take the first place among the natural riches of Georgia. The total length of Georgia's rivers is estimated 60,000 km. Around 300 Rivers are significant in terms of energy production. Their technical hydroelectric potential is estimated at 90,000 GWh per year. The total renewable water resources of Georgia are estimated 63.3 km³.[13]

Oil and Gas

Georgia does not have significant oil and gas resources. The country's eleven oilfields with confirmed reserves of 28 million tons have yet to be explored. Larger oil reserves are assumed to exist. The oil potential of the Black Sea shelf is estimated at 70 million to 1.3 billion barrels. Oil extraction and exploration works are conducted by both Georgian and foreign companies. In 2008, the crude oil production in Georgia totaled 52.800 tons, while the natural gas production totaled 17.000 toe[14].

Coal

There are no significant coal deposits in Georgia.

Transmission and Distribution System

The transmission network in Georgia has been one of the major weaknesses of the electricity system. Much of the capacity is already utilized, and the construction of the larger planned HPPs (Khodoni and Namakhvani) will require significant investments in new transmission capacity, especially for eventual exports to the Turkish market.

The backbone of the transmission grid is the 500 kV line connecting the main generation assets in Georgia with the Russian transmission network. The line is partly owned by RAO UES (50 %) and partly by the Georgian state (50 %). The Government also owns the transmission company of Georgian State Electro System (GSE), which is responsible for operating and maintaining the 35–300 kV grid and ensuring that new generation facilities are connected to the grid.

Historically, the losses in the transmission system in Georgia were very high, peaking in 2002 at almost 16 % of total electricity transferred. The reasons for these exceptionally high losses were mismanagement of the system, theft and lack of investment in upgrading the network. Meanwhile, losses have been reduced to less than 2 %, comparable with transmission losses in the well-maintained European grid.

There are five distribution companies in Georgia. Two have approximately 1 million customers each: Telasi (responsible for Tbilisi and 75 % owned by RAO UES) and United Energy Distribution Company (UEDC; responsible for distribution outside Tbilisi and fully owned by Energo Pro). Adjara and Kakheti are smaller distribution companies, both in the process of being integrated into UEDC after being purchased by Energo Pro. There is also a state-owned distribution company in Abkhazia, outside the control of the central Government in Tbilisi.

The newly created market maker, Energy System Commercial Operator (ESCO), is responsible for ensuring grid stability.

Prices

The January 2006 explosions on a gas pipeline between Russia and Georgia severely strained Russian-Georgian relations. In view of these tensions, Russia increased the natural gas price from 110 to 235 USD per 1,000 m3. Naturally, such an increase in prices would be reflected in consumer tariffs on electricity and gas. The average tariff for electricity is now in the range of 8 US Cent per kWh. In order to create additional guarantees for social protection and for the promotion of rational consumption of electricity, rigid step tariffs were introduced: for the consumption of up to 100 kWh, for 101–300 kWh and for more than 301 kWh[15].

The average regulated generation tariff in Georgia is relatively low with approximately 2.8 US Cent/kWh. Generation tariffs, however, fluctuate widely between different power plants. The tariffs for power producers in Georgia are set by the independent regulator of GNERC, which is committed to facilitate private sector investments in the sector. Investors in new HPPs are allowed to negotiate the rate of return on equity with GNERC before committing to a project, which should ensure acceptable returns, especially when CDM credits are factored in. The returns - GNERC is operating with – are without CDM credits.

Power producers have two options when selling their electricity: (i) entering into a direct contract with a customer or (ii) selling the electricity to the ESCO for the price set by GNERC. After amendments to the Electricity Market Rules in June 2007, ESCO guarantees the purchase of all electricity from newly built HPPs. The expected average generation cost for new hydro in the first 7 years of operation would be in the range of 6–8 US Cent/kWh, falling to 2–3 US Cent/kWh after 7 years[16].

Import and Export of Energy

Georgia imports almost all natural gas and oil products consumed in the country. However, it provides an important part of the land corridor along which major volumes of Caspian oil and gas are transported in transit to European and Mediterranean markets.

Georgia is a net exporter of electricity during summer while it imports electricity in winter. Imports totaled 756 GWh in 2006 as opposed to exports of 140 GWh in the same year[17]. With new HPPs in the planning stage it is expected that Georgia will become a net exporter of electricity by 2011. The market maker ESCO is responsible for the contracting related to electricity export and import.

Growth Predictions for the Energy Sector

The electricity generation demand is forecasted to grow with a 0.6 GDP elasticity ratio. Although the times of double digit GDP growth rates may be over for the years to come, there is no doubt that Georgia will find back on a growth path requiring additional generation capacity.

13 INDEXMUNDI (WWW.INDEXMUNDI.COM/GEORGIA/) AS OF 2008
14 GNIA, AS OF 2009
15 TRANSPARENCY INTERNATIONAL, AS OF 2008
16 ECON, AS OF 2007
17 IEA, AS OF 2006

The easiest way to enhance generation capacity is the rehabilitation and upgrading of existing sites. While Georgia has approximately 1,600 MW of hydro power capacity actually generating electricity at the moment, the installed capacity is around 2,700 MW. The rehabilitation and upgrading of HPPs could bring as much as 2,200–2,500 GWh of additional hydroelectricity online. This is the least costly way to expand generation capacity and is given priority by the Government. Many of these rehabilitations are already underway.

Besides that, the Government is promoting 7 new HPPs with a total generating capacity of approximately 6,000 GWh. Thus, in a few years there will be more than 8,000 GWh of new electricity available with a considerable part of it being excess electricity. There are two possible markets for electricity excess: (i) export markets and (ii) the promotion of Georgia as a location for electricity intensive industry[18].

4 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

4.1 NATIONAL STRATEGIES AND PROGRAMS TO SUPPORT RENEWABLE ENERGIES TO SUPPORT RENEWABLE ENERGIES

As mentioned in the last chapter, the development of alternative energy sources (wind, solar and geothermal energy) is an objective of Georgia's State Energy Policy. This objective is also mentioned in the existing Law on Electricity and Gas[19]. However, no specific targets were defined for the share of energy to be generated by renewable sources. There were discussions about drafting a more specific RE law[20] in 2008. After the war from August 2008, however, these initiatives seem to have lost momentum.

The Government of Georgia has approved of a Renewable Energy 2008 State Program[21], which regulates and supports the construction of new RE projects in Georgia with a capacity up to 100 MW. The program is designed to attract foreign investments. The program is largely focusing on the development of small and medium Hydro Power Plants. The Tax Code enacted in 2005 does not provide any tax benefits for the production, use, import and implementation of equipment for the production of RE or power saving equipment.

There are a number of relevant international documents for the development of RE sources in Georgia. These include the Energy Charter Treaty[22], the Framework Convention on Climate Change and the Kyoto Protocol[23], the Energy Community Treaty[24], the European Neighborhood Policy[25] and others.

For Georgia, who has joined or requested membership to organizations that execute and/or bide by these regulating documents, the implementation of the recommendations and opportunities given by these documents is both beneficial and in some cases mandatory. In addition to providing technical assistance and guidance, several of these international energy agreements offer financial incentives and project financing opportunities for Georgia to develop RE projects and undertake energy sector reforms to harmonize its energy legislation with international standards.

International institutions are playing the leading role in development of RE in Georgia up to now. USAID, the United Nations Development Program (UNDP), the German development Bank of KfW, the Global Environment Facility (GEF), EBRD, the Norwegian Government and others are supporting a great number of activities including pilot projects, policy analysis, trainings and more.

SHORT BUSINESS INFO

Although the development of RE is an objective of Georgia's Energy Policy, there are no specific targets for the share of energy to be produced by RE.

4.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

On 7 June 2007, the Parliament of Georgia adopted the Resolution on Main Directions of Georgia's State Energy Policy, which defines the concept of the state energy policy as well as the ways and means of its implementation. The Resolution is based on the Law of Georgia on Electricity and Gas (adopted in 1997). The main objectives of the policy are:

- Full satisfaction of the industrial and communal demand for electricity by maximum utilization of local hydro power resources in the electricity sector
- Development of alternative energy sources (wind, solar and geothermal energy)
- Diversification of electricity and gas supply sources
- Inclusion of the country's energy sector into the regional infrastructure through participation in region-wide export-import operations. For this purpose, existing electricity transmission lines and gas pipelines have to be repaired or new ones must be constructed.
- Development of an energy corridor connecting Europe to Asia, which has to encompass West-East (from Caspian to the Black Sea to the European Union) as well as North-South directions

These objectives shall be achieved through the development of a commercially profitable economic model attractive to private investors by means of:

- Simplifying licensing and other bureaucratic procedures and creating a favorable business environment for local and foreign companies that are interested in investing in the sector
- Gradual liberalization and deregulation of the electricity market, which ultimately will be reflected in direct

18 ECON, AS OF 2007
19 SEE GEORGIAN LAW ON ELECTRICITY AND NATURAL GAS (WWW.MINENERGY.GOV.GE/INDEX.PHP?M=205&LANG=ENG), AS OF 1997
20 WELLER, J./PIERCE ATWOOD LLP, AS OF 2008
21 MINISTRY OF ENERGY OF GEORGIA , AS OF 2008
22 ENERGY CHARTER SECRETARIAT, AS OF 2009
23 UN FRAMEWORK CONVENTION ON CLIMATE CHANGE – UNFCCC (HTTP://UNFCCC.INT/)
24 EUROPEAN UNION, AS OF 2006
25 EUROPEAN COMMISSION – EC, AS OF 2004

contracting between wholesale electricity producers and wholesale buyers
- Introduction of new market rules insuring the separation of rights and obligations and responsibilities among actors in the sector[26]

The Ministry of Energy has achieved remarkable improvements with the above policy. Improvements over the last few years include a more regular supply of electricity for most parts of the country, the rehabilitation of Enguri HPP and other HPPs, the rapid reduction in transmission losses and a much improved collection rate for the distribution companies. The development of RE in Georgia is regulated by the following legal and regulatory documents:

- Law on Electricity and Natural Gas
- Main Directions of State Policy in Georgian Energy Sector
- Renewable Energy 2008 State Program
- Law on Use of Natural Resources
- Law on Forest Use
- Tax Code
- Customs Code
- Electricity Market Rules
- Gas Market Rules
- Legal Acts of the Ministry of Energy
- Legal Acts of GNERC
- Presidential Decree on Development of Non-traditional Energy Sources in Georgia

It should be noted that the above mentioned legal acts and regulations are not enough to create a sufficiently favorable environment for the development of all RE sources, which creates barriers in attracting investments in this field. Only electricity generation is addressed to some extent by Georgia's legislation.

There has been a series of changes to the Law on Electricity and Natural Gas as well as in Electricity Market Rules that are directed to creating a favorable environment for small grid-connected plants. Under recent amendments, for example, small hydroplants can sell all of their output to ESCO at average ESCO tariff.

In general, electricity generation, transmission, dispatch and distribution without a valid license are forbidden according to the Law on Electricity and Natural Gas. Exemptions are made for individuals generating electricity for their own consumption and whose generating facility is not connected to the transmission or distribution grids. Moreover, small power plants declared as power plants up to 10 MW do not require a generation license[27]. The Georgian National Energy Regulatory Commission (GNERC) has the authority to grant licenses and also regulate activities of licensees, importers, exporters, commercial system operator and suppliers within the electricity and natural gas sectors of Georgia. Licensing procedures and rules are regulated by four main documents. These are:

- Georgian Law on Electricity and Natural Gas
- Georgian Law on Licenses and Permits
- GNERC Resolution #3 on Licensing Rules in Electricity and Natural Gas Sectors from 23 August 1999
- GNERC Resolution #12 On Administrative Procedures of the Georgian National Energy Regulatory Commission from 7 August 2003

Clean Development Mechanism (CDM)

Georgia ratified the UN climate change agreements in 1994, established a National Climate Protection Program in 1996 and acceded the Kyoto Protocol in 1999. Georgia meets the eligibility requirements to sell emission reductions from projects in the international carbon market under the Clean Development Mechanism (CDM). In 2005, the Ministry of Environmental Protection and Natural Resources has been appointed as the Designated National Authority for executing the CDM. In the same year, a Coordination Board for the implementation of the CDM was created[28].

Georgia has no obligatory quota for reducing greenhouse gases under the Kyoto Protocol. In fact, after the disintegration of the Soviet Union (and the resulting collapse of the region's energy intensive industries), Georgia's greenhouse gas emissions were substantially reduced from 46 million tons of CO2 in 1990 to 14 million tons in 1997[29].

Georgia has considerable potential to develop a large number of CDM projects, especially in the RE and energy efficiency sectors. Georgia will have the possibility to generate tens of millions of dollars in carbon revenue over the next few years by leveraging investments in the energy, waste, forestry and agricultural sectors. Carbon reduction revenue is potentially available for projects that:

- Increase the efficiency of power generation including the rehabilitation and modernization of existing Hydro Power Plants
- Make use of RE technologies
- Minimize emissions associated with gas transportation and distribution
- Decrease losses in power transmission and distribution
- Increase energy efficiency in the residential sector

On 31 August 2007, the first Emission Reductions Purchase Agreement (ERPA) was signed with participation from the International Bank for Reconstruction and Development, the Community Development Carbon Fund and the Energy Efficiency Centre of Georgia. As of December 2009, there were four CDM projects validated with a total average annual emission reduction of 273,177 tons CO_2[30].

26 TRANSPARENCY INTERNATIONAL, AS OF 2007
27 THE LAW ONLY MENTIONS THAT SPP DO NOT REQUIRE A GENERATION LICENSE OR A LICENSE IN GENERAL. IT IS NOT FURTHER SPECIFIED WHETHER FEEDING ELECTRICITY INTO A GRID IS SUBJECT TO LICENSING OR NOT FOR SPPS.
28 WORLD EXPERIENCE FOR GEORGIA, AS OF 2008
29 TRANSPARENCY INTERNATIONAL, AS OF 2008
30 IGES, CDM PROJECT DATABASE, AS OF 2009

5 POTENTIAL FOR RENEWABLE ENERGIES AND PRESENT USE

Georgia has vast resources of almost all types of RE – solar, wind, geothermal, hydro and biomass. The achievable annual potential of all RE sources is estimated at 15,000 GWh. This is enough energy to meet over a third of Georgia's annual primary energy needs. Apart from large hydro power, only a very small part of this potential is already developed.

5.1 BIOENERGIES

Georgia has a considerable potential of biomass resources. It is conditioned by its geographical position and a favorable climate for growing forests and agricultural products. In some regions, it is even possible to have two yields per year.

Unfortunately, the current use of biomass in Georgia is rather inefficient and unsustainable. Firewood consumption is estimated at 8 million m^3 per year, which covers almost 50 % of the population's energy demand. This consumption is far above sustainable forest development level, which should not exceed 1 million m^3 per year. Therefore, the RE potential of forest and forest residues must be set to 1 million m^3 of bark energy, amounting to approximately 2,700 GWh.

The total energy potential of corn cultures' residues amounts to 1,300 GWh/year, i.e. 112,000 toe. The total energy potential of residues from farming and poultry breeding is 6,900 GWh/year.

Residential waste is another type of biomass. 900,000 tons of waste per year accumulate in the Tbilisi and Kutaisi dumps according to municipal data. An estimated 90 million m^3 biogas can be obtained by re-treating these residues; this would equal 64 million m^3 of natural gas.

Approximately 160 million m^3 of biogas can be annually obtained from the sewage water cleaning station of Tbilisi (with a population of 1.2 million). The resulting biogas energy is estimated to be 1,000 GWh/year equaling 100 million m^3 of natural gas.

Therefore, the technical potential of the major biomass sources in Georgia amounts to 12,500 GWh. The achievable potential is estimated at 3,000-4,000 GWh. This estimate does not incorporate the potential of farming energy crops. For comparison, one can note that the total annual electricity generation in Georgia is in the range of 8,000 GWh.[31]

Apart from firewood, which is used for cooking and heating, and a few donor supported biogas initiatives, the biofuel potential remains untapped.

5.2 SOLAR ENERGY

The climatic conditions of Georgia are favorable for utilizing solar energy. Most regions of the country have 250–280 days of sunshine per year. Direct and global radiation reaches daily values of 3.5 to 5.3 kW/m² and an annual average of 1,550 kW/m². The potential of solar energy, however, is strongly seasonal and varies by a factor of more than four from mid-summer to mid-winter. The achievable potential of solar energy in Georgia is estimated at 60–120 GWh annually.

The conversion coefficient of PV modules is approximately 12–15 % and about 60–95 % for water heating collectors. Based on these estimates, one can calculate that on average about 190 kWh of electric energy can be annually obtained from one m² surface of solar PV panels and 1,200 kWh of thermal energy (hot water) from solar water heating panels.

The use of solar energy in Georgia still low, but during the last decade, solar water heaters became increasingly popular. The cheapest systems provide about 110 l/day of hot water at a temperature of 60 °C. The 180 l/day systems cost approximately 1,800–2,000 USD. For water heating systems, the investment payback period is about 3–9 years; these are most profitable in applications where hot water expense is high and the main load is in summer (swimming pools, hotels).

Although more than 70 % of this potential is realizable in the months of April through September, solar power can contribute to reducing energy dependence by almost completely replacing the need for gas currently used for hot water supply throughout the year.

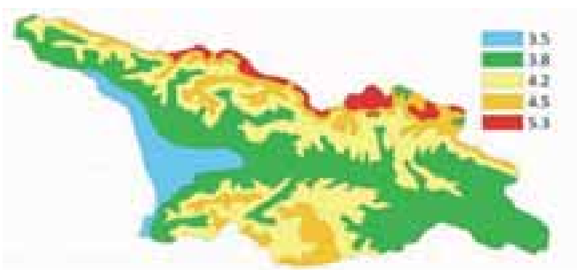
There are a number of specialized private companies doing the installation of solar systems, namely SpecHelioTbomontaji, Ekoeni, Aido, Solar House etc. Some of them manufacture cheap systems locally. Most of the systems, however, are imported. Currently there are no legal acts or tax benefits supporting the development of solar energy use in Georgia.

5.3 WIND POWER

The potential of wind energy has been analyzed by the Wind Energy Research Center of Karenergo. The analysis was based on existing meteorological data (30 years of synoptic observations) and their own perennial measurements and gives only the intensiveness of the wind and dynamics of seasons on the land area of Georgia. The findings were compiled in the Wind Energy Atlas of Georgia.[32] The figure below shows the annual average wind speeds in Georgia. The analysis did not address important parameters for the planning of wind energy projects such as security, environmental protection or civil expediency. Based on the data in the Wind Energy Atlas, the technical potential of wind energy was assessed. The calculations have shown that about 2,000 MW of capacity and 5,000 GWh energy per year can be obtained.

FIGURE 5

Distribution of Daily Solar Irradiation in kW/m²/day



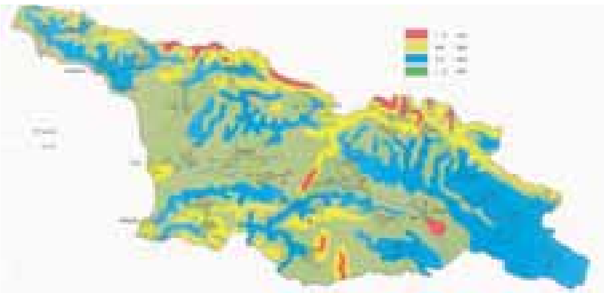
Source: Sustainable Energy Center – "Sun House", Tbilisi, Georgia, as of 2009

31 WORLD EXPERIENCE FOR GEORGIA, AS OF 2008

32 KARENERGO, AS OF 2004

FIGURE 6

Average Wind Velocities and Directions per Year



Source: Karenergo, as of 2004

Karenergo proposed a number of promising locations for medium- and large-scale wind farms in the range of 30–630 MW. Many of these potential wind farm sites show a favorable seasonal output pattern with maximum output in winter. This conforms best with seasonal domestic energy demand in Georgia, indicating that wind energy has good potential to offset external energy dependence in winter. There are other local places with high wind potential that are not reflected in the Karenergo report.

Currently, there is no wind energy capacity used in Georgia except for some small units (up to 6 kW each). In 2007, an MOU was signed between the Government of Georgia and the Georgian-American company of Karidani concerning the construction of a 24 MW wind plant in the suburbs of Tbilisi.

Feasibility studies of wind energy utilization in the Kutaisi and Mounteen-Sabueti regions were carried out by Japanese companies (Nichimen Corporation and Tomen Corporation) in 1999 and 2000. It was proved that the construction of wind power plants can be cost effective in these regions and will make a significant contribution to the country's overall energy balance.

Furthermore, the wind energy research center of Karenergo has developed several business plans for wind farm development in other locations in order to attract potential investors. Despite the positive conclusions made by foreign experts, the aforementioned projects have not been developed for a variety of reasons. The main reasons were:

- A wind power utilization tradition does not exist in Georgia; therefore, it was difficult to obtain state support
- A guarantee of the generated energy purchase does not exist
- The electricity tariff was deliberately low in that period

The last two points above have been addressed in the Renewable Energy 2008 State Program. Although implicitly focusing on hydro power, the Program can also be applied to the development of wind farms up to an installed capacity of 100 MW. Under that Program, investors are offered a guaranteed purchasing agreement with ESCO in which the tariff is determined based on negotiation with the investor and GNERC.

5.4 GEOTHERMAL ENERGY

In Georgia, thermal water has been used for hygienic and balneology purposes for centuries. Its utilization for energy purposes began in 1951. The forecasted reserve of thermal waters comprises 350 to 400 million m³/year corresponding up to 11,630 GWh of thermal energy[33]. There are more than 250 natural and artificial water channels with average temperatures from 30–110 °C. Their overall withdrawal comprises 160,000 m³/day (58 million m³/year). These water channels are grouped in 44 deposits.

More than 80 % of the geothermal deposits are in Western Georgia. In the Zugdidi-Tsaishi geothermal area, there are now 9 productive, 7 re-injection and 3 observation borehole wells which are considered to be exploitable. It is known that there are two independent horizons containing thermal water in the deposits from which it is possible to obtain up to 30,000 m³ of thermal water in case of re-injection per day.

The use of geothermal sources is already developed to a considerable extent. As the temperatures of geothermal sources are not very high, they are mostly used for heating and hot water supply. Poti, the main port city in Georgia, could be supplied with geothermal water through the Kvaloni and Menjisi water deposits. In Tbilisi, the output of geothermal water of 4,000 m³ per day is used to supply around 100 residential blocks. The prices are not regulated and determined by the supplier. In other locations the geothermal water is used by the neighboring population in an unorganized way.

There are projects in the planning stage to better utilize and expand the use of thermal waters from the existing wells in Zugidi and Tbilisi. The feasibility of these and other projects requires further study in order to determine economically viable options and volumes of geothermal energy utilization.

In order to promote the use of geothermal energy in other locations it is necessary to implement a number of policy measures including:

- Transparent rules for obtaining licenses for geothermal wells
- Clear regulations on land use and property rights for wells and pipe routes
- Clear definitions on price regulations and subsidies for different groups of consumers

33 N. TSERTSVADZE, G. BUACHIDZE, O.VARDIGORELI, AS OF 1998

TABLE 2

Existing Geothermal Installations in 2005

GEOTHERMAL	INSTALLE CAPACITY	DIRECT IN
District	37	29
Greenhouse	165	1,17
Fish pond	25	13
Acricultrural	4	3
Industrial	7	5
Bathing	9	6
total	249	1,75

Source: International Geothermal Association, as of 2009

5.5 HYDRO POWER

In Georgia there are 360 rivers with considerable energy potential. The total theoretical hydroenergy potential is in the range of 150,000 GWh per year. The technically available potential has been estimated at 81–90,000 GWh per year including the total hydroenergy potential of small Hydro Power Plants (SHPP) of 40,000 GWh/year and their technical potential estimated at 19,500 GWh per year. Although hydro power contributes more than 70 % to the country's electricity production, only about 15 % of the technical potential has been developed so far.

The development of a small hydroelectric generation industry in Georgia started in the late 1920s. Over 300 SHPPs, most of them run-of-river schemes, were constructed until 1970 with capacities ranging from 20 kW to 10 MW. In the 1960s, Georgia was integrated in the central grid delivering power to all Soviet Republics whereupon small and less efficient SHPPs were displaced by large-scale Hydro Power Plants and thermal power plants. Only those SHPPs operating in remote locations with no grid access were kept operating. The others were taken out of operation and abandoned. At present, only 15 % of all SHPPs of the Soviet era are still operating.

Following Georgia's independence in 1991, the privatization process of state-owned assets began. Many surviving SHPPs were transferred from state ownership to the private sector. The USAID sponsored Rural Energy Program is supporting the rehabilitation of existing SHPP in Georgia[34].

Besides tendering a number of new large HPPs[35], the Ministry of Energy pursues another initiative for the development of new small and medium Hydro Power Plants directed at foreign investors. On its official website, the Ministry of Energy has published a list of 91 potential small hydro power sites with a prospective capacity ranging from 0.6 MW to 99 MW. Most of these HPPs are expected to be run-of-the-river facilities. Investors interested in investing in Greenfield HPPs from the list have the possibility to download additional information for each location ranging from situation maps, topographical maps, technical data, economic calculations etc[36].

Investors can benefit from the incentives provided through the Renewable Energy 2008 State Program[37]. Under the program, new Hydro Power Plants up to 100 MW are offered a guaranteed purchasing agreement with ESCO for the first 10 years of operation in which the tariff can be negotiated between the investor and GNERC. Alternatively, SHPP operators, i. e. HPPs with a capacity up to 10 MW, have the opportunity to sell electricity directly to consumers at tariffs negotiated bilaterally or even to export without the need for an export license. In any case, however, operators have to agree to supply only domestic customers during the three winter months in a year.

The difficulties of SHPPs are caused by several factors listed below:

- SHPPs (especially newly built ones) are not competitive with large and medium capacity power plants in the cost of generation.
- SHPPs have profound seasonality and dependence on river run-off conditions.
- They have an unfavorable annual generation profile, with maximum production in summer when power generation exceeds the consumption demand.
- SHPPs have undefined power-wheeling tariffs.
- Transmission and distribution network connection fees are not defined.

SHORT BUSINESS INFO

The annual potential of RE sources is estimated to be approx. 15,000 GWh, enough to meet over a third of Georgia's annual primary energy needs.

6 MARKET RISKS AND BARRIERS FOR MARKET ENTRY

6.1 GENERAL SITUATION

Corruption

Georgia has improved its performance in fighting corruption, but corruption is still perceived as significant. From 2005 to 2009 Georgia has advanced from rank 130 to 66 out of 180 countries in Transparency International's Corruption Perceptions Index[38]. The World Bank's Anti-Corruption in Transition 3 Report places Georgia among the countries showing the most dramatic improvement in the struggle against corruption. The government has fired thousands of civil servants and police, and several high-level officials have been prosecuted for corruption-related offences[39].

Availability of Local Know-how

Like all former Soviet republics, Georgia has a good educational system producing well-qualified specialists in a broad spectrum of subjects. More than 60 % of the workforce have completed a secondary education and 30 % have completed a tertiary education[40].

34 USAID/WINROCK INTERNATIONAL, AS OF 2006
35 ANNEX 3 PROVIDES A LIST OF THE NEW LARGE HPPS.
36 MINISTRY OF ENERGY OF GEORGIA, AS OF 2009
37 MINISTRY OF ENERGY OF GEORGIA, STATE PROGRAM RENEWABLE ENERGY, AS OF 2008
38 SEE WEBSITE OF TRANSPARENCY INTERNATIONAL AT WWW.TRANSPARENCY.ORG
39 HERITAGE FOUNDATION, AS OF 2009
40 WORLD BANK, AS OF 2009

Local know-how in the field of RE is available at numerous local organizations. There is also a multitude of international organizations pursuing projects in various fields of RE development in Georgia.

Local Acceptance

A considerable number of pilot projects in the field of RE were implemented in recent years. There were no reports that certain technologies were not accepted for social reasons. If technologies failed, the reasons were mostly related to technical and maintenance issues.

6.2 BUSINESS DEVELOPMENT

Since the Rose Revolution in 2004, Georgia has made enormous progress toward improving the business climate. In 2006, the World Bank ranked Georgia as the number one economic reformer in the world because within one year it has improved from rank 112 to 18 in terms of ease of doing business. By 2010, Georgia will have advanced even further and will rank at 11 ahead of industrialized countries as Japan (15), Sweden (18), Switzerland (21) and Germany (25)[41].

The overall freedom to conduct a business is relatively well-protected under Georgia‘s regulatory environment. Starting a business takes an average of three days, as compared to the world average of 38 days. Obtaining a business license requires less than the world average of 18 procedures and 225 days. Closing a business is relatively simple.

Foreign and domestic investments receive equal treatment. Exceptions may be made for investments in certain sectors. Foreign firms may participate freely in privatizations, though transparency has been an issue. Residents and non-residents may hold foreign exchange accounts. There are limits and tests for international payments and current transfers. Capital transactions are not restricted, but must be registered. Foreign individuals and companies may buy non-agricultural land. Only domestic entities may buy agricultural land, but agricultural land can be purchased by forming a Georgian corporation that may be up to 100 % foreign-owned.

There are a number of barriers (listed below) that need to be addressed by the Georgian Government in order to allow a more rapid development of RE sources:

- The market for renewable electricity needs to be developed. Although Georgia does not produce enough energy to satisfy domestic demand, there is an excess of electricity from hydroplants in summer; thus there is no internal need for additional electricity from wind farms or SHPPs on the grid during this season.
- A sound and reliable legal framework for RE development needs to be formulated. Otherwise the frequency and quality of legislation changes may have a discouraging effect on investment decisions.
- Information on the benefit developers and local communities can derive from RE development and utilization should be made widely available.
- The fees and rules for grid connection, power wheeling tariffs, long term tariff methodology and other regulatory documents need to be developed.

Although the changes to the law on electricity and natural gas provide incentives to new RE plants, there is still a need for further conceptual and technical improvements to make these provisions fully effective and beneficial.

The few existing provisions in legislation in support of RE development need to be expanded and supplemented by adequate implementation mechanisms such as special legislation, supplementary regulatory documents, tax incentives, implementation agencies and information campaigns. The initiatives for RE development should be coordinated under a state strategy, plan for energy sector development and be based on sound market principles and transparency.

6.3 INTELLECTUAL PROPERTY RIGHTS

Judicial corruption is still a problem despite substantial improvement in efficiency and fairness in the courts. Both foreigners and Georgians continue to doubt the judicial system‘s ability to protect private property and contracts. The enforcement of laws protecting intellectual property rights is weak.

6.4 TAXATION

Georgia has a moderate Income Tax and a low Corporate Tax. The top Income Tax rate is a flat 25 %, and the corporate tax rate is 15 % as compared to 20 % as of January 2008. Other taxes include a Value Added Tax (VAT), a Tax on Interest and a Tax on Dividends. In the most recent year, the overall tax revenue was 21.7 percent of the GDP.

7 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

Ministry of Energy of Georgia
Baratashvili 2, 0105 Tbilisi
Phone: (+995 32) 35 78 00
Fax: (+995 32) 35 78 00/28
E-mail: mail@minenergy.gov.ge
Department of International Relations and Investment Projects
Phone: (+995 32) 35-78-25
Website: www.minenergy.gov.ge

The Ministry of Energy provides information about possible investment projects for foreign investors and related legal requirements and supporting programs.

GNERC – Georgian National Energy Regulatory Commission
Al. Kazbegi Ave No.45, 0177 Tbilisi
Phone: (+995 32) 31 10 43
Fax: (+995 32) 24 10 40.
E-mail: mail@gnerc.org
Internet: www.gnerc.org

41 WORLD BANK GROUP/IFC, AS OF 2009

GNERC has the authority to set tariffs grant licenses for electricity generation, transmission and distribution.

ESCO – Electricity System Commercial Operator
Al. Kazbegi Ave No.45, 0177 Tbilisi
Phone: (+995 32) 31 14 70/31 14 71
Fax: (+995 32) 31-17-49
E-mail: office@esco.ge
Internet: www.esco.ge

ESCO provides power purchase agreements (PPA) with operators of power plants and purchasing guarantees for investors in new power plants smaller than 100 MW.

Georgian Chamber of Commerce and Industry
Berdznis Str. 29, Tbilisi
Phone: (+995 32) 72 07 10
Fax: (+995 32) 72 31 90
E.Mail: info@gcci.ge
Internet: http://gcci.ge/

ABCO Georgia – Business Consulting
Head Office: 7, Kipshidze Str., Tbilisi 0162, Georgia
Phone: +(995 32) 250085; 999077
Fax: +(995 32) 933539
E.Mail: abco@caucasus.net
Internet: www.abco.caucasus.net

RENEWABLE ENERGY: RELEVANT INSTITUTIONS

Energy Efficiency Centre (EEC)
19, D.Gamrekeli Str. VI floor, 0160 Tbilisi
Phone: (+995 32) 242540; 242541
Fax: (+995 32) 242542
E-Mail: eecgeo@eecgeo.org
Internet: www.eecgeo.org/

Caucasus Environmental NGO Network (CENN)
27, Betlemi Str., 0105 Tbilisi
Phone: (+995 32) 75 19 03; 75 19 04; 75 19 06
Fax: (+995 32) 75 19 05
E-Mail: info@cenn.org
Internet: www.cenn.org

Karenergo Scientific Wind Energy Center
Tsereteli Ave. 63-2-57, Tbilisi
Phone: (+995 32) 35 15 51, 899 50 93 93;
Fax: (+995 32) 35 15 51
E-Mail: karenergo@gol.ge
Internet: www.gol.ge

Geothermia Ltd. – Geothermal Consulting
Phaliashvili Str. 87/3, Tbilisi
Phone: (+995 32) 525499
Fax: (+995 32) 001153

Institute of Water Management and Engineering Ecology
Chavchavadze 60, Tbilisi
Phone: (+995 32) 224094

Solar Water Heating System Providers

Sustainable Energy Center - Sun House
0159, Tbilisi, Georgia
Phone: (+995 32) 516 804
Phone/Fax: (+995 32) 525 969
E.Mail: sun@sun.org.ge
Internet: www.sun.org.ge

Specheliotbomontaji JSC
Kvemo Alekseevka, Navtis Hevi
meladzen@gmail.com
Phone: (+995 99) 452 210

AYDIO
Agmashenebeli Alley 10 km, 0131 Tbilisi
Phone: (+995 32) 516 416

8 BIBLIOGRAPHY

- Bodewig, K. (2007): Economic and Political Transition in Georgia, NATO 2007 Annual Session Report 170 ESCEW 07 E rev 2 (www.nato-pa.int/default.Asp?SHORTCUT=1171)
- G. Tsertsvadze, N. Buachidze, O. Vardigoreli (1998): Thermal Waters of Georgia, Tbilisi
- Central Intelligence Agency – CIA (2009): The World Fact Book – Uzbekistan
- ECON (2007): The Electricity Sector in Georgia – A Risk Assessment
- Energy Charter Secretariat (2009): 1994 Energy Charter Treaty (www.encharter.org/index.php?id=28&L=0.)
- European Commission (2004): European Neighbourhood Policy (http://ec.europa.eu/world/enp/documents_en.htm)
- European Union (2006): The Energy Community Treaty. Official Journal of the European Union L 198/32, 20.7.2006 (http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_198/l_19820060720en00180037.pdf)
- Heritage Foundation (2009): Index of Economic Freedom – Georgia
- Georgian National Investment Agency – GNIA (2009): Invest in Georgia (www.investingeorgia.org)
- Institute for Global Environmental Strategies – IGES (2009): IGES CDM Project Database (www.iges.or.jp/en/cdm/report_cdm.html)
- IndexMundi (2008): Georgia (www.indexmundi.com/georgia)
- International Energy Agency – IEA (2006): Statistics by Countries
- International Monetary Fund – IMF (2009): Caucasus, Central Asia Feel Crisis Impact, but Set for Modest Upturn, IMF Survey online (www.imf.org)
- Karenergo (2004): Wind Energy Atlas of Georgia, Volume 1, Regional Estimations (http://minenergy.gov.ge/index.php?m=377)
- Ministry of Energy Georgia (2009): various documents and data on Georgia's energy sector and policy published on the Ministry's website (www.minenergy.gov.ge/?lang=eng)
- Ministry of Energy of Georgia (2009): Potential Hydro Power Sites in Georgia. Interactive Map (http://hpp.minenergy.gov.ge/)
- Ministry of Energy of Georgia (2008): State Program Renewable Energy 2008 (www.georgia.gov.ge/pdf/2009_03_27_22_25_33_1.pdf)
- The President of Georgia/E. Shevardnadze (1997): Georgian Law on Electricity and Natural Gas, (www.minenergy.gov.ge/index.php?m=205&lang=eng), Tbilisi
- Transparency International Georgia/BP Georgia (2008): The Energy Sector and Georgia's Functions as a Transit State after the Russian-Georgian Armed Conflict in August 2008 (www.transparency.ge)
- Transparency International Georgia/BP Georgia (2008): National Policy of Georgia on Developing Renewable Energy Sources (www.transparency.ge)
- Transparency International Georgia/BP Georgia (2008): Georgia's State Policy of Georgia on the Effective Utilization and Preservation of Energy (www.transparency.ge)
- Transparency International (2008): State Policies of Georgia in the Energy Sector: Tariffs on Electricity and Gas (www.transparency.ge)
- Transparency International Georgia/BP Georgia (2008d): Georgia's State Policy in the Electricity Sector, Brief History and Ongoing Processes (www.transparency.ge)
- Transparency International (2007): Georgia's Energy Policy, Overview of Main Directions, (www.transparency.ge)
- Transparency International (2007): Georgia's Power Sector: Energy Crossroads in Uncertain Transition (www.transparency.ge)
- USAID/ Winrock International (2006): Rural Energy Programme Georgia (http://winrock.ge)
- Weller, J., Pierce Atwood LLP (2008): Draft Renewable Energy Law for Georgia, (http://winrock.ge/files/inga_outline_of_re_law.ppt), Batumi
- World Bank (2008): World Development Indicators 2008 – Composition of GDP (www.worldbank.org)
- World Bank Group/ International Finance Corporation – IFC (2008/2009): Doing Business. Georgia (www.doingbusiness.org/ExploreEconoMIEs/?economyid=74)
- World Bank (2009): Education at a Glance: Georgia
- World Bank Group/ International Finance Corporation – IFC (2009): Doing Business. Economy Rankings (www.doingbusiness.org/economyrankings/)
- World Experience for Georgia (2008): Energy Efficient Potential in Georgia and Policy Options for Its Utilization (http://weg.ge)
- World Experience for Georgia (2008): Renewable Energy Potential in Georgia and the Policy Options for Its Utilization (http://weg.ge)

Websites

- Ministry of Energy of Georgia (www.minenergy.gov.ge/?lang=eng)
- International Geothermal Association (www.geothermal-energy.org)
- Transparency International (www.transparency.org)
- UN Framework Convention on Climate Change – UNFCCC (http://unfccc.int/)
- Sustainable Energy Center – "Sun House" – Tbilisi, Georgia (www.sun.org.ge/)

9 ANNEX

ANNEX 1

TABLE 3

Key Economic Indicators of Georgia 2002–2006

INDICATOR	2002	2003	2004	2005	2006
A) Income and Growth					
1. GNI per Capita (Atlas method, currend USD)	730	860	1,050	1,300	1,590
2. GDP Growth (%)	5.5	11.1	5.9	9.6	9.4
B) Saving and Investment (current and market prices, % of GDP)					
1. Gross Capital Formation	25.5	27.7	28.3	28.6	28.0
2. Gross National Saving	19.3	18.3	21.5	17.8	13.0
C) Money and Inflation (annual change)					
1. Consumer Price Index (average annual % change)	5.6	4.8	5.7	8.2	9.0
2. Reserve	9.9	13.9	44.3	19.7	19.2
3. Broad Money (M3)	18	22.7	42.6	26.4	39.3
D) Government (% of GDP)					
1. Revenue (including grants)	16.7	16.2	22.0	23.4	26.7
2. Expenditure and Onlending	17.8	17.5	19.7	25.0	28.7
3. Overall Fiscall Balance (cash basis)	(1.0)	(1.6)	(0.3)	(2.5)	(2.2)
E) Balance of Payments					
1. Merchandise Trade Balance (% of GDP)	(14.4)	(16.0)	(17.7)	(18.9)	(26.0)
2. Current Account Balance (% of GDP)	(6.2)	(9.4)	(6.7)	(10.8)	(14.9)
3. Merchandise Exports (USD) Growth, annual % change	9.0	37.4	37.9	32.8	11.5
4. Merchandise Imports (USD) Growth, annual % change	2.0	33.1	39.2	32.5	38.7
F) External Payments Indicators					
1. Official reserve assets (USD million) in months of current year's imports of goods	202	196	387	479	939
2. External public and publicly guaranteed debt	23.4	12.6	11.6	7.2	6.7
3. External public and publicity guaranteed debt	53.3	46.4			
G) Memorandum					
1. GDP (GEL million)	7,456	8,564	9,824	11,621	13,784
2. Exchange Rate (end of period)	2.09	2.075	1.825	1.725	1.7135
3. Population (million)	4.6	4.6	4.5	4.5	4.5

Source: ADB, as of 2006/2007

ANNEX 2

TABLE 4

Installed electricity capacity in Georgia 2006

TITEL	MW	OWNERSHIP
Ltd Engurhesi	1300	State owned
JSC Tbilsresi TPP*	950	State owned (phase out 2011)
AES Mtkvari TPP*	600	Private (RAO UES)
Ltd Vardnilhesi Cascade	340	State owned (located in Abhasia)
JSC Khrami-1+2	227	State owned (managed by RAO UES)
JSC Vartsikhehesi	184	State owned
Energy Invest CCGT TPP*	150	Private
LTD Zhinvalhesi	130	In the process of being privatised
JSC Lajanurhesi	112	Private (Energo Pro)
JSC Dzevrulahesi	80	Private (Energo Pro)
JSC Gumathesi	67	Private (Energo Pro)
Ltd Rionhesi	48	Private (Energo Pro)
JSC Shaorhesi	38	Private (Energo Pro)
Ltd Zahesi	37	Private
Ltd Khadori	24	Private
Ltd Chitakhevihesi	21	Private
JSC Tboelektrocentrali	18	Private
Ltd Ortachalahesi	18	State owned (under privatisation)
Ltd Atshesi	16	Private (Energo Pro)
Ltd Satskhenhesi	14	Private
JSC Tetrikhevihesi	14	State owned
Ltd Bzhuzhahesi	12	Private
Other HPPs	70	Mostly private
Total	4470	

Source: ECON, as of 2007

TABLE 5

Annual Average Electricity Generation by Source in Georgia 2000–2006

ELECTRICITY PRODUCERS	AVERAGE TWH 2000-6	IN % OF TOTAL
Enguri HPP	2,57	31,44 %
Imports	1,15	14,03 %
A-E-S Mtkvary TPP	0,72	8,80 %
Varcixe HPP	0,66	8,13 %
Varduil HPP	0,4	4,83 %
Tbilsresi TPP	0,34	4,14 %
Jinvali HPP	0,33	4,02 %
Rioni HPP	0,3	3,73 %
Xrami-2 HPP	0,2	2,46 %
Gumati HPP	0,19	2,35 %
Xrami-1 HPP	0,18	2,17 %
Lajanuri HPP	0,16	1,90 %
Dzevrul HPP	0,13	1,64 %
Shaori HPP	0,1	1,26 %
Energy Invest TPP	0,04	0,55 %
Other HPPs	0,7	8,55 %
Total average	8,18	100 %

Source: ECON, as of 2007

ANNEX 3

TABLE 6

Potential of Small and Medium Hydro Power Projects in Georgia

NAME OF HPP	RIVER	INSTALLED CAPACITY (MW)	AVERAGE ANNUAL OUTPUT (GWH)	INVESTMENT COST (MIN USD)
Abuli	Paravani	12.5	81.8	21.9
Alpana (Sairme)	Rioni	73	398.9	131.4
Arakali	Paravani	10.8	63.1	19.4
Avani	Avanis khevi	4.6	18.6	7.8
Bakhvi 1	Bakhvistsqali	19.4	87.3	34.9
Bakhvi 2	Bakhvistsqali	24	139	36
Bakhvi 3	Bakhvistsqali	7	44.3	12.6
Boriti	Dumala	6.4	33.8	10.9
Chelti 1	Chelti	4.8	25	8.2
Chelti 2	Chelti	4.8	25.09	8.2
Cheshura	Cheshura	7.5	32.4	11.3
Tskhimra	Tekhuri	29	159.6	52.5
Dariali	Tergi	99	542.4	178.2
Duruji	Duruji	1.7	10.7	2.96
Erjia	Tekhuri	24.4	136.6	41.5
Poka	Paravani	0.6	3.1	1
Stori	Stori	11.8	56.8	20
Stori 3	Stori	13.7	60.6	24.7
Gubazeuli 6	Gubazeuli	7.8	38.3	8.3
Iori	Iori	9.7	54	19.4
Jejora	Jejora	15.8	86.6	28.4
Jonouli	Jonouli	13	66.5	22.8
Jria	Qvirila	9.2	53.1	18.4
Lebarde 1	Lebarde	4.6	19.8	9.1
Lebarde 2	Tekhuri	4.2	17.5	8.3
Lekarde	Magana	20	107	36
Lesulukhe	Tsachkuru	5.7	24.9	11.4
Lecheka	Tekhuri	18.8	118.7	33.8
Magana	Magana	20.6	106.38	37.1
Marelisi	Bjholiskhevi	4.6	19.7	7.8
Medani	Chanistqali	4.4	22.9	8.8
Merisi	Akavreta	11.5	56.7	20.1
Nakra	Nakra	29.2	162.5	52.5
Nakra 1	Nakra	19.6	102.6	34.3
Nenskra 1	Nenskra	22.4	116.4	38.1
Nenskra 2	Nenskra	24.4	125.1	41.5
Nenskra 3	Nenskra	24.4	122.9	41.5
Nenskra 4	Nenskra	46.2	234.1	78.5
Nenskra 5	Nenskra	29.6	149.4	50.3
Ninotsminda	Paravani	8.2	47.1	14.8
Nobulevi	Tekhuri	18.5	107.4	33.3
Ksani 1	Ksani	4	14.9	6.8
Ksani 2	Ksani	2.8	10.5	4.8
Ksani 3	Ksani	3.2	11.1	5.4
Ksani 4	Ksani	3.6	12.2	6.1
Ksani 5	Ksani	8.5	30.8	14.4
Samquirstsqali 1	Samquirstsqali	12.4	70.6	21.7
Samquirstsqali 2	Samquirstsqali	22.2	123.1	39.9
Sakhvlari	Shavitsqali	5.3	23.2	9
Somitso	Jejora	24.3	144.3	43.7
Stori 1	Stori	14	69.4	25.2
Stori 2	Stori	11.4	50.5	20.5
Skhalta	Skhalta	5.3	29	10.6
Tazara	Shavitqali	6	26.2	10.2
Tergi	Tergi	14.6	65.3	26.3
Tekhuri 1	Tekuri	3.5	10	5.3
Tekhuri 2	Tekuri	3.5	10	5.3
Tekhuri 3	Tekuri	3.5	10	5.3
Tekhuri 4	Tekuri	3.5	10	5.3
Tekhuri 5	Tekuri	3.5	10	5.3
Tekhuri 6	Tekuri	3.5	10	5.3
Uraveli	Uraveli	5	19.2	8.5
Tsablari 1	Tsablaristsqali	7.7	43.2	11.6
Tsablari 2	Tsablaristsqali	12	65.7	20.4
Chala	Qvirila	9.1	45.6	18.3
Khala	Chakvistsquali	13	92.4	22.8
Khan-Tsablari 3	Khans Tsablaris	9.4	58	15
Khani 7	Khanistsqali	7.3	46.1	12.1
Kheledula 1	Kheledula	18.8	94.3	33.8
Kheledula 2	Kheledula	21.6	102.8	38.9
Kheledula 3	Kheledula	44.3	229.4	79.7
Khobi	Khobistsqali	50	246.9	90
Khobi	Khobistsqali	25	132.8	45
Khobi	Khobistsqali	11.1	59.4	20
Khumpreri	Khumpreri	16.4	66.5	28.7
Khunevi	Dzirula	11.3	61.6	19.8
Qvirila 3	Qvirilstsqali	5.2	20.5	8.8
Zestaponi 1	Qvirila	10.6	43.7	21.2
Zestaponi 2	Qvirila	10.6	43.7	25.4
Zestaponi 3	Qvirila	15.9	59.2	39.8
Zestaponi 4	Qvirila	15.9	59.2	39.8
Bakhvi 4	Bakhvistsqali	1.2	6.9	2
Bakhvi 5	Bakhvistsqali	2	10.9	3.4
Dzegvi	Mtkvari	1.7	82.4	26.7
Truso	Tergi	8.7	40.9	14.8
Kobi	Tergi	11	45.4	18.7
Chkheri	Chkheri	14.6	64.6	26.3
Amali	Amali	14	66.8	23.8
Khdistqali	Khdistsqali	9.3	41.1	15.8
Juta	Juta	8.2	40.8	14
Tsodo	Juta	72	383.7	129.6

Source: Ministry of Energy of Georgia, viewed in 2009 (The related database is accessible via the website of the Ministry of Energy of Georgia (http://hpp.minenergy.gov.ge/))

TABLE 7

Potential of Large Hydro Power Projects in Georgia

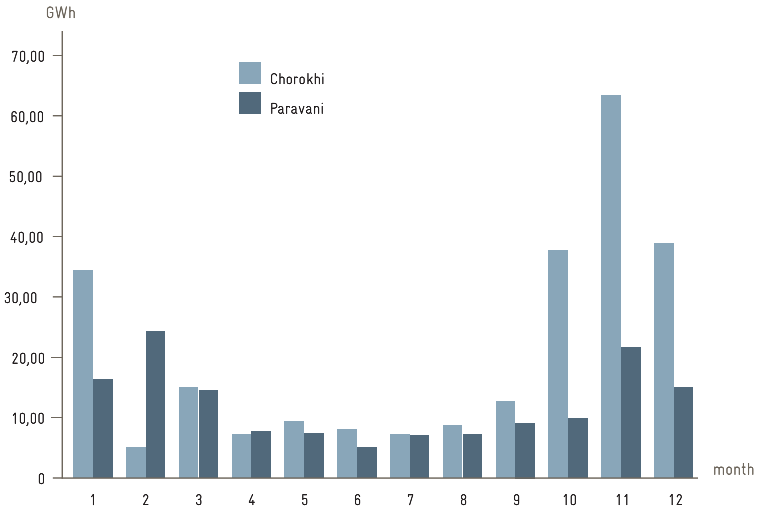
HPP PROJECT	RIVER NAME	PROJECTED INST. CAPACITY (MW)
1 Khudoni	Enguri	700
2 Namakhvani-Namakhvani	Rioni	250
3 Namakhvani-Zhoneti	Rioni	100
4 Namakhvani-Tvishi	Rioni	100
5 Oni Cascade	Rioni	276

Source: Ministry of Energy of Georgia, viewed in 2009

ANNEX 4

FIGURE 7

Seasonal Output of Wind Power Stations



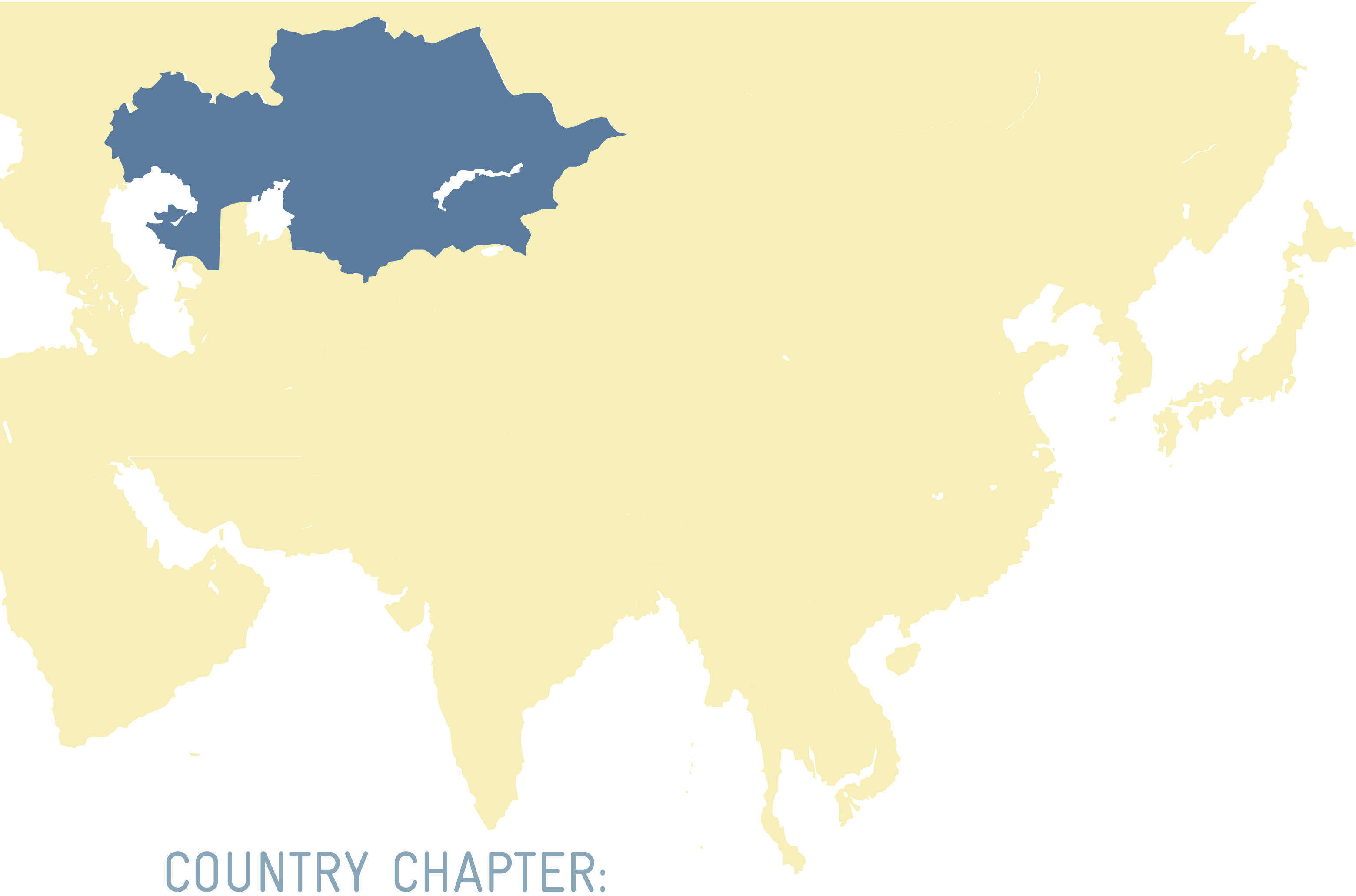
Source: Ministry of Energy of Georgia, viewed in 2009

TABLE 8

Most Promising Sites for Wind Power Stations

LOCATION	CAPACITY (MW)	ANNUAL ENERGY (BILLION KWH)
Poti	90	0,21
Chorokhi	90	0,24
Kutaisi	150	0,34
Tskhratskaro	100	0,26
Gori-Kaspi	200	0,48
Paravani	120	0,29
Rustavi	60	0,15
Djvari	30	0,075
Goderdzi	60	0,17
Likhi	630	2
Mukhrani	90	0,2
Tbilsi	150	0,35

Source: USAID/Ministry of Energy of Georgia, viewed in 2009



COUNTRY CHAPTER:
REPUBLIC OF KAZAKHSTAN

Authors and Coordination of Country Chapter

Dr. Ing. Klaus Jorde
Entec Consulting & Engineering AG
St. Gallen, Switzerland
www.entec.ch

Axel Biegert (Dipl. Economist & Pol.)
INTEGRATION UMWelt & Energie GmbH
Graefenberg, Germany
www.integration.org

With contributions by **Gulnar Daniyarova** (MSc. Econ. & Management)

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS

ACRONYMS AND ABBREVIATIONS
REPUBLIC OF KAZAKHSTAN

ADB	Asian Development Bank
CDM	Clean Development Mechanism
CIS	Commonwealth of Independent States
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GoK	Government of Kazakhstan
EBRD	European Bank of Reconstruction and Development
F.O.B.	Free On Board
HPP	Hydro Power Plant
IC	Interagency Commission
ICWC	Interstate Commission for Water Coordination
JSC	Joint Stock Company
KEGOC	Kazakhstan Electricity Grid Operating Company
MEMR	Ministry of Energy and Mineral Resources
MDG	Millennium Development Goals
NATO	North Atlantic Treaty Organisation
OSCE	Organization for Security and Cooperation in Europe
RE	Renewable Energy
RERC	Renewable Energy Resource Centre
SGP	Small Grants Program
UN	United Nations
UNDP	United Nations Development Program
USD	United States Dollars
USc	United States Cent
USSR	Union of Soviet Socialist Republics
VAT	Value Added Tax

MEASUREMENTS

°C	degree Celsius
GWh	gigawatt hour (1 GWh = 1,000,000 kWh)
kJ	kilojoule (1 kJ = 1,000 joules)
km	kilometer
ktoe	kilotons oil equivalent (1 ktoe = 11,630,000 kWh)
kV	kV
m/s	meters per second
m^2	square meter
m^3	cubic meter
MW	megawatt (1 MW = 1,000 kW)
Toe	tons of oil equivalent
TWh	terawatt hour (1 TWh = 1,000,000,000 kWh)

1 SUMMARY

The Republic of Kazakhstan has enormous resources in fossil fuels, mainly gas and oil. These resources are also utilized to generate almost 90 % of the electricity. Additionally, a small number of Hydro Power Plants are in operation. As a consequence of the abundance of domestic fossil resources and the centralized energy sector in the former Soviet Union, other sources of energy, also available in large quantities, have not been developed. Only recently has the Government started to initialize the utilization of Renewable Energy (RE) resources, namely considerable potentials of hydro power (large and small), wind and solar energy.

The legal situation in Kazakhstan favors private companies, including foreign investors, to invest into the energy sector. Therefore the oil & gas sector has attracted vast investments from abroad. Dealing with local agencies and authorities regarding licenses, permits and taxes, however, can become very difficult. Foreign investors therefore usually have to team up with Kazakh partners and employ a large number of local accountants and attorneys to deal with administrative, regulatory and tax issues.

The result of this situation is that there are only very small pilot projects in the RE field so far, which are handled by large donor organizations in collaboration with the Government or by large international investors. Based on its natural potentials, Kazakhstan could become a highly attractive region for RE in the future.

2 COUNTRY INTRODUCTION

Kazakhstan declared itself independent in December 1991 as the last of all Soviet republics. It is the ninth largest country in the world and is until today ruled by its Soviet era communist leader. Kazakhstan is considered to be the dominant state in Central Asia and is a member of many international organizations including the United Nations, NATO's Partnership for Peace, the Commonwealth of Independent States and the Organization for Security and Cooperation in Europe (OSCE).

FIGURE 1
Map of Kazakhstan

2.1 GEOGRAPHY AND CLIMATIC CONDITIONS

The Republic of Kazakhstan is located at the border of two continents, Europe and Asia, at longitude 45–87° East and latitude 40–55° North. Kazakhstan stretches from the Caspian Sea and the Volga plains in the West to the Altai Mountains in the East and from the foothills of the Tien Shan in the South and South East to the West Siberian lowland in the North. The length of the territory from East to West is more than 3,000 kilometers and from North to South around 1,700 kilometers.

The capital of Kazakhstan is Astana. Kazakhstan is administratively divided into 14 regions with 2 major cities – Almaty (formerly Alma Ata) and Astana – which have a special status due to their national significance, and the territory of Baikonur, which is the location of the Space Launch Center that is leased by the Russian Federation.

There are different types of landscapes in Kazakhstan. Forest/steppe and steppe land comprise 10 % of the territory, semi-desert and desert land about 60 % and highland about 5 %. All agricultural lands are characterized by low precipitation, ranging from 15 to 320 mm. There are major inland waterways in Kazakhstan, the biggest being the Caspian Sea, the Aral Sea and Lake Balkhash. The percentage of land and water is 98 % to 2 %. The climate is primarily continental. The average elevation is about 200 m, the highest point is Mount Khan Tengry (7,010 m), the lowest Vpadina Karagiye (132 m).

2.2 POLITICAL AND ECONOMIC DEVELOPMENT

The Republic of Kazakhstan is a unitary state with a presidential form of governance. Nursultan Nazarbayev has been the President of the Republic of Kazakhstan since 1991 and the chairman of the Supreme Soviet since 1990. The bicameral Parliament consists of the Senate (47 seats of six-year terms) and the Mazhilis (107 seats of five-year terms). While Kazakh is the state official language, Russian is the language for international communication.

The Gross Domestic Product (GDP) until 2008 was around 141 billion USD or 9,075 USD per capita. The industry share is 29 % of the GDP. The annual growth of the GDP was about 8–9 %. There was, however, a sharp decrease following the economic crisis in 2008. More information can be found in the Annex.

Kazakhstan is one of the ten largest countries in the world. The country has the largest resources of uranium and lead in the world, the second largest resources of zinc and chromate ores, the fourth largest resources of copper and the seventh of gold. Moreover, it counts among the countries with the largest resources of coal, manganese, tungsten, molybdenum, gold, phosphorites and iron.

Kazakhstan owns about 0.5 % of the world's mineral energy resources, equaling 90 billion tons of oil equivalent (toe). This number includes 70 % coal, 22 % oil and oil condensate and 8 % gas. Since 2000, stable growth in production and consumption of coal, oil and gas has been observed.

The other important economic sector is agriculture. Kazakhstan has 220 million hectares of agricultural land, including 24 million hectares of arable land (10.8 %); 5 million hectares of haying land (2.2 %) and 189 million hectares of pasturable land (85.0 %). Kazakhstan is among the top ten world exporters of grain and flour. Cotton export comprises 15 % and leather and wool export 25 % of the total agricultural export. Oil and grain are the most important products to export from the country.

Kazakhstan is one of the most sparsely populated countries in the world with a density of 5.7 people per square kilometer. The population living in urban areas comprises 52.6 %. With regard to inequality, UNDP's Human Development Report 2006 has ranked Kazakhstan 79 out of 177 countries. There is a discrepancy between the rural and urban population incomes. While 32 % of the rural population lives below the poverty line, the urban rate is only 16 %. Only a very small fraction (3.5 %) of the rural settlements do not have access to energy and electricity.

Kazakhstan has good trade relationships with other Central Asian countries. The Russian Federation is the biggest oil and gas exporter in Central Asia. The Central Asian energy transmission system includes the national electric power systems of Kyrgyzstan, Tajikistan, Uzbekistan and Turkmenistan as well as the southern part of Kazakhstan. Kazakhstan is importing and exporting electricity.

LAND AREA:	2,725,000 km^2
POPULATION:	15.66 million (as of 2008)
DENSITY:	5.7 inhabitants/km^2
SHARE URBAN/RURAL POPULATION:	52.6% vs. 47.4%
BIGGEST CITIES AND INHABITANTS:	Capital of Astana (0.6 million), Almaty (1.3 million), Aktyubinsk (0.3 million), Karaganda (0.4 million), Shymkent (0.6 million)
LANGUAGE:	Kazakh, Russian
CLIMATE:	Continental
TEMPERATURES:	In summer, the temperatures can reach more than 53°C, and in winter, the temperatures can sink as low as –58°C In the South, the average temperature in winter is about –19°C and in summer about 25°C. In the East, the average temperature in winter is about –17°C and in summer about 20°C. In the West, the average temperature in winter is about –10°C in and in summer about 26°C. In Central Kazakhstan, the average temperature in winter is about –17°C and in average about 28°C.
ALTITUDE:	132m to 7,010 m, average elevation is 200 m
RIVERS:	Irtysh (1,698 km), Bukhtaarma (405 km), Ili (768 km)
ECOSYSTEM AREAS:	Forests (2%), shrub land, savannah, grass land (61%), cropland and crop/natural vegetation mosaic (29%), urban and built-up areas (0.1%), sparse or barren vegetation, snow and ice (4%), wetland and water bodies (3%)
GDP – PER CAPITA (PPP):	11,563 USD (as of 2008)
INFLATION RATE:	10,8% (as of 2008)
AGRICULTURE:	Kazakhstan is the biggest exporter of grain and flour. Cotton export comprises 15% and leather and wool export comprises 25% of the total agricultural export.
INDUSTRIES:	The industry's share is 39.4% of GDP. The products comprise oil, coal, iron ore, manganese, chromite, lead, zinc, copper, titanium, bauxite, gold, silver, phosphates, sulphur, iron and steel, tractors and other agricultural machinery, electric motors, construction materials
ELECTRICITY – PRODUCTION:	71.6 billion kWh (as of 2006)
ELECTRICITY – CONSUMPTION:	61.8 billion Wh (as of 2007)
ELECTRICITY – TARIFFS:	2.5 USc/kWh
NATIONAL ELECTRICITY	18.8 GW
NATURAL RESOURCES:	The world's largest reserves of barite, lead, tungsten and uranium; the second largest of chromite, silver and zinc; the third largest of manganese, significant deposits of copper, gold and iron ore
OIL – PRODUCTION:	1,444,000 barrels/day (as of 2007)
OIL – EXPORT:	1,213,000 barrels/day (as of 2007)
OIL – CONSUMPTION:	231,000 barrels/day (as of 2007)
OIL – PROVEN RESERVES:	35 billion barrels
NATURAL GAS – PRODUCTION:	906 billion cubic feet/y
NATURAL GAS – PROVEN RESERVES:	65,000 billion cubic feet
EXPORTS:	66.57 billion USD F.O.B. (as of 2008)
EXPORTS – COMMODITIES:	Gas, Oil and oil products 59%, ferrous metals 19%, chemicals 5%, machinery 3%, grain, wool, meat, coal (as of 2001)
EXPORTS – PARTNERS:	China (15.5%), Germany (11.5%), Russia (11.2%), Italy (7.2%), France (6.7%)
IMPORTS:	37.5 billion USD F.O.B. (as of 2008)
IMPORTS – COMMODITIES:	Machinery and equipment, metal products, food
IMPORTS – PARTNERS:	Russia (35.4%), China (22.1%), Germany (8%) (as of 2007)
EXCHANGE RATE:	1 Tenge = 0.005 Euro (as of 2009)

Source: CIA World Fact Book, as of 2009

3 ENERGY MARKET OF KAZAKHSTAN

The power sector is one of the best developed sectors in Kazakhstan's economy. The country is rich in reserves of fossil fuel – 4 % of the global fuel reserves – and covers 99 % of its energy from fossil sources. Kazakhstan also has significant resources of RE in form of hydro power, solar, wind and biomass. Except for hydro power, however, these resources have not been widely used so far. The fuel energy sector's production contributes about 17 % of the GDP.

Kazakhstan has privatized all of its power plants, but the sale of regional electricity distribution companies has proceeded more slowly. Moreover, the majority of the distribution networks has not yet been privatized. The Kazakhstan Electricity Grid Operating Company (KEGOC) has granted management rights to several private companies, but maintains control over high-voltage transmission lines, substations and the central dispatching apparatus.

The policy is focused on energy saving and optimization of the current electric plants with fossil energy sources. The state budget provides the capital to optimize the national power sector.

The Kazakh energy sector is attempting some restructuring. In 2008, load balancing has received more focus, which requires information on real-time energy demand. This process calls for advanced modeling software on the consumers and producer's side and also improved coordination in the dispatch centers.

The main problems people are facing with regard to energy and electricity is the low capacity of the centralized power stations in the southern part. High transmission losses (25–50 %) and the deterioration of transmission lines cause electricity shortages in remote rural areas.

SHORT BUSINESS INFO

Despite the low cost and the abundant availability of fossil power resources, there are also legislative initiatives in support of RE.

3.1 IMPORTANT PLAYERS OF THE KAZAKH ENERGY MARKET

The Ministry of Energy and Mineral Resources (MEMR) is the main agency responsible for the formation of the state policy in the area of electric power, mineral resources, coal mining, petrochemistry and oil and gas.

Electric power is produced by more than sixty electric power stations with different types of property. Most power producers in Kazakhstan are private companies with a foreign share of the property. The biggest electric power stations of Kazakhstan are presented in the Annex.

KEGOC JSC is the system operator of the Unified Grid System of Kazakhstan. The company is responsible for the transmission of electricity on an interregional and interstate level and manages the operational dispatch control over the unified Kazakh grid.

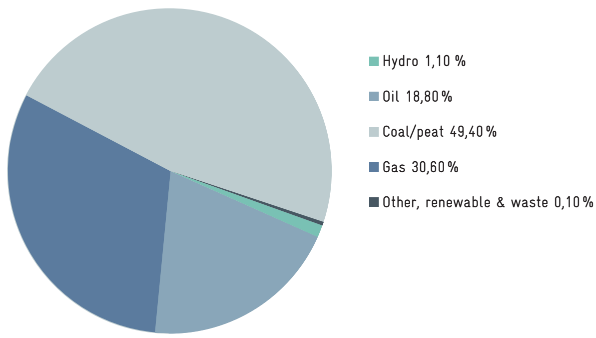
Import and export operations are controlled by the Ministry of Industry and Trade of the Republic of Kazakhstan.

3.2 PRIMARY ENERGY CONSUMPTION, TRANSMISSION AND PRICES

Primary energy in Kazakhstan depends almost entirely on fossil resources, namely coal, oil and gas. The share of RE, mostly hydro power, is slightly above 1 % only. New forms of RE and waste are practically not used. Primary energy consumption dropped from a maximum of 78,000 ktoe in 1992 to less than 40,000 in 1999 and has climbed back to 6,000 ktoe in 2006. The shares of total primary energy supply in 2006 are indicated in figure 2. It should be mentioned that there was no information available on the use of traditional fuel sources such as firewood for domestic use.

FIGURE 2

Primary Energy Sources in Kazakhstan



Source: IEA, 2006

Transmission and Distribution System

KEGOC is responsible for transmission and dispatch control. The regional and inter-state electricity transmission lines operate at 220 kV and more. The electric power network on voltages of 220–500 and 1,150 kV forms the Single Electric System of Kazakhstan. Inter-system connections with the energy systems of the Russian Federation, Kyrgyz Republic and Republic of Uzbekistan are based on 110, 220 and 500 kV lines.

The combined length of electricity transmission lines on voltages between 0,4 and 1,150 kV is 464,000 km and there are 3,419 electric power substations with a total capacity of 63 MW.

About 1 % of the population is not connected to the grid in rural regions. The losses of energy in the transmission and distribution process are 25–50 %.

Electricity Sector and Natural Resources

In 2006, the electricity generation in Kazakhstan was 71.6 billion kWh. About 70 % of the total generation comes from coal, 10.6 % from gas, 4.9 % from oil and 14.6 % from hydro power[1]. The structure of primary energy supply in 2005, the dynamics of the energy supply of 1990–2005 and the energy balances for 2005 are presented in the annex. Less than 2 % of the total energy is imported.

1 DATA FROM THE NATIONAL GRID COMPANY KEGOC JSC

The main power consumer is the industry with 68.7 % of the total consumption, while households account for 9.3 %, the service sector for 8 %, transportation for 5.6 % and agriculture for 1.2 %. The installed capacity for power generation in Kazakhstan equals 18,773 MW. There are no seasonal variations of the power supply.

The current status of the Kazakh electricity sector is characterized by a centralized system with power plants up to 4,000 MW concentrated close to coal deposits. Combined power/heat generation plants also serve for industrial purposes. The share of hydro Power Plants (HPPs) with storage capacity is insufficient to balance the load effectively.

A vertical hierarchical system of supervisory control is exercised by the Central Supervisory Control department, regional control centers and consumers' control centers.

The available generating capacities do not provide sufficient power. While the total installed capacity of the existing power plants is about 18.7 GW, the available capacity is only 14.6 GW because of the age and poor maintenance situation of the existing power plants, which are all over 25 years old. The northern zone including Akmolinskaya, East-Kazakhstani, Kostanaiskaya and Pavlodarskaya has excessive power reserves of 1,980 MW or 7.6 billion kWh annually, the surplus is transmitted to other regions of Kazakhstan and exported to Russia. The western zone (the Atyrau, Mangistau and West Kazakhstani regions) observes a capacity deficit of 77 MW or 0.2 billion kWh, which is covered by imports from Russia. The eastern zone (the Almaty, Zhambyl, Kzyl-Orda and South-Kazakhstani regions) tends to experience considerable deficits of capacity, 956 MW or 4.8 billion kWh, which is compensated by power transmission from the northern zone and import from Central Asian republics. The central zone including the Karaganda region sees a capacity deficit of 619 MW. In the Aktobe region the deficit is 325 MW.
Thus, all the regions of Kazakhstan, except for the power-excessive northern zone suffer from regional deficit of capacity and power. A map of the transmission grid is presented in the Annex.

Kazakhstan is very rich in accessible mineral and fossil fuel resources. The development and exploitation of petroleum, natural gas and minerals has attracted over 40 billion USD of foreign investment to Kazakhstan since 1993 and accounts for some 57 % of the nation's industrial output. Kazakhstan currently has the 11th largest proven reserves of both oil and natural gas and is also an exporter of diamonds.

Oil explorations have shown that the deposits on the Caspian shore only represent a small part of a much larger deposit. It is assumed that 3.5 billion tons of oil and 2.5 trillion m^3 of gas can be found in that area. The overall estimate of Kazakhstan's oil deposits is 6.1 billion tons. Much of the crude oil extracted is exported to Russia because of Kazakhstan's limited processing capacity.

Because of Kazakhstan's natural richness of traditional resources the RE potential, which is also available, has been widely neglected in the past.

Prices

The legislation does not regulate prices for the generation of electricity except for energy generating organizations that dominate. The transmission and distribution of electricity is a KEGOC monopoly, therefore tariffs are set by the regulatory body. Tariffs for generation, transmission, distribution and supply of heat are also regulated.

Electricity prices are 0.067 USD/kWh for private consumers and 0.052 USD/kWh for the industrial sector. Prices for other energy resources can be found in the Annex. There are no special tariffs for RE.

Non-payment of electricity bills, an inadequate collection system and a lack of market-based transportation tariffs are obstacles for the promotion of large-scale investments in Kazakhstan's transmission and distribution sector. Under the former Soviet Union, Kazakhstan utilized a system of fixed electricity tariffs that were unrelated to production costs and investment needs.

Kazakhstan's State Anti-Monopoly Committee is working to bring electricity tariffs in line with those in other countries and to allow the market to determine transmission tariffs.

Import and Export of Energy

In general, Kazakhstan has sufficient resources of fossil fuels to cover its own demand as well as to export large amounts. Due to insufficient processing capacities and regional differences, oil and gas are also imported. Numbers on quantities can be found in the Annex.

Export of electricity to Russia amounted to 3.6 billion kWh in 2007, import from Russia 2.2 billion kWh in the same period. Import from Kyrgyzstan was 1.2 billion kWh. The dynamics of 2000–2007 generation and consumption and energy import and export are presented in the Annex.

Growth Predictions for the Energy Sector

The Development Plan of the Power Industry of Kazakhstan published by the Ministry of Energy and Mineral Resources in 2007 predicts the following growth in electricity consumption:

TABLE 1

The Dynamics of Power Consumption and Production

YEARS	2006	2010	2015
Power consumption, billion kWh	71.8	91.5	124.0
Power production, billion kWh	71.5	85.0	94.5
Deficit, billion kWh	0.3	6.5	29.5

Source: MEMR, as of 2007

4 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

There is a general government strategy for the period from 2007 to 2024 to support sustainable economic development in general, which includes ecologically effective power generation and in particular the use of RE and power from waste.

The Republic of Kazakhstan has ratified more than twenty international environmental treaties. Based on these, a national environmental regulatory basis was developed, which includes a package of national laws, presidential decrees and resolutions of the Government, the responsible Ministries, local agencies and executive bodies.

As a result, the current political mechanisms generally support the use of RE resources. This is part of the concept of the Republic of Kazakhstan's transmission towards sustainable development for the period of 2007–2024. The laws including the Law on Electric Power Industry and the Law on Power Saving refer to the necessity of development and usage of RE resources. Chapter IV of the Law on Power Saving determines the usage of RE resources as follows:

1. Utilization of renewable power resources is considered to be the priority of power development programs and resolution of environmental issues in Kazakhstan.

SHORT BUSINESS INFO

By law, Kazakhstan is clearly devoted to support the development of the RE power sector. Many practical questions are not resolved and implementation therefore is lagging.

2. In the Republic of Kazakhstan, necessary legal and economic conditions are created to integrate Renewable Energy resources into the power balance and develop power facilities on their basis.
3. An authorized body coordinates and is responsible for the elaboration and implementation of programs for involving Renewable Energy resources into the power balance.

4.1 NATIONAL STRATEGIES AND PROGRAMS TO SUPPORT RENEWABLE ENERGIES

The Government of Kazakhstan has ratified a number of programs and strategies that provide the political framework for RE power generation:

Relevant programs and strategies:

- Strategy 2030
- Strategy of Industrial Innovative Development for the Period of 2003–2015
- Ecological Code
- Concept of the Transition for a Sustainable Development for the Period 2007–2024
- Concept for Ecological Safety for the Period of 2004–2015
- Concept of Further Development of Market Relations in the Power Industry

Approved programs in the electric power industry:

- State Program of Electric Power Development for 2030
- Sectoral Program for the Development of a Single Electric Power Grid for the Period up to 2010 with Perspective up to 2015
- Action Plan on the Development of the Electric Power Industry for the Period of 2007–2015

4.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

To improve the legislation regarding issues of sustainable development and the use of RE, the Ministry of Environmental Protection – in cooperation with the Ministry of Energy and Mineral Resources and supported by a UNDP Project on wind power – developed the concept and the Draft Law on Support of Usage of Renewable Energy resources.

Some relevant direct and indirect incentives are provided by the state to support the development of the RE market:

- A Renewable Energy resources certificate system has been introduced. The producers of RE shall issue RE certificates and sell them to the power producing institutions through the Agency on Renewable Power, which is the administrator of the certificates. This shall be done in order to balance the costs of power from traditional as well as RE resources.
- Tenders are announced for the Kazakh development in the field of RE power in accordance with the Ecological Code.
- The control of the compliance with ecological requirements while extracting and using non-RE resources is to be enhanced.
- The tax regime for the mineral wealth users in accordance with the Tax Code has been tightened since 2009.
- A strategy of effective use of power and RE resources for the purpose of the sustainable development until 2024 was introduced.
- The Council on Sustainable Development of the Republic of Kazakhstan is asked to pay more attention to the issue of RE development.

Basically, there are no special provisions regarding permits and licenses for independent power producers or investors in RE. For the construction of facilities serving the generation of RE, the same requirements apply as for other facilities and buildings. In order to obtain the required licenses, the following institutions need to be contacted:

- centers of real estates registration
- public utilities, including the heating networks
- power networks and telecommunication services
- departments of architecture and land use
- fire services
- departments of ecology and nature

SHORT BUSINESS INFO

The regulatory framework required to attract private investors to the RE power sector is presently developed under the auspices of a UNDP project on wind power.

The commissioning of a construction project shall be authorized after being approved by the above-mentioned institutions and being compliant with the project documentation. The project institutions are subject to licensing in the Republic of Kazakhstan.

Laws and Enactments:

- Law on Electric Power of 30 June 2004
- Law on Power Saving of 25 December 1997
- Order of the Minister of Power and Mineral Resources of 30 September 2004 comprising rules on organization and functioning of the retail market for electric power as well as access and service provision on this market
- Resolution of the Government on Wind Power Development of 25 August 2003
- Order of the Minister of Power and Mineral Resources of 19 March 2008 comprising rules of functioning of balancing the market of electric power
- Order of the Minister of Power and Mineral Resources of 12 June 2006 comprising rules on approval of maximum tariffs for services and production of the subjects of natural monopolies

A Draft Law on Renewable Power and the National Program of Wind Electric Power Development until 2015 with the Perspective until 2024 is currently being developed.

Clean Development Mechanism (CDM)

Despite the misconception of economic impediments, the Government of Kazakhstan and local authorities pay more and more attention to environmental issues. In cooperation with international organizations and donor countries, the development of large-scale umbrella projects and programs is implemented. The following four priorities have been determined: (i) the creation of an ecologically safe environment, (ii) a balanced use of natural resources, (iii) the conservation of biological diversity and (iv) environmental education to achieve these goals.

The Hydrocarbon Initiative launched in 1997 by several Ministries has its focus on the reduction of greenhouse gas emissions. Power saving became another priority in this initiative.

In March 1999, Kazakhstan signed the Kyoto Protocol without joining Annex 1 (which requires a commitment to reduce green house gas emissions) and Annex B of the Protocol. Consequently, Kazakhstan did not take on any quantitative obligations on emission abatement. Later, in May of 1999, Kazakhstan declared its intention to join Annex 1 of the Convention. The Interagency Commission (IC) on ratification issues and fulfillment of obligations of the Kyoto Protocol was formed in 2000 with nine participating Ministries. Since then the IC has held four meetings and developed a number of resolutions and recommendations none of which includes any commitment to greenhouse gas reduction from the energy sector.

5 POTENTIAL FOR RENEWABLE ENERGIES AND PRESENT USE

The present share of RE in Kazakhstan is very small, with the exception of some hydro power use. The main reason is the low price of fossil energy. Due to the growing power deficit and ecologically oriented projects of donor organizations and state initiatives, however, private companies have recently started to enter the Kazakh market. These initiatives are described later on in this chapter.

There is a big potential of RE resources in Kazakhstan as presented in table 2. The numbers date back to 1996 and the estimates on technical and economic potentials are most likely underestimated.

TABLE 2

Energy Potentials

ENERGY POTENTIAL	GROSS POTENTIAL [BILLION KWH]	TECHN. POTENTIAL [BILLION KWH]	ECON. POTENTIAL [BILLION KWH]	ANNUAL ELECTRICITY PRODUCTION [BILLION KWH]
Hydro power	163	62	27	11
Geothermal	54,000	54	0.54*	n. a.
Wind	2,000,000	1,820	1.71	n. a.
Solar	1,000,000	1,000	0.01*	n. a.
Total	3,054,163	2,936	28.71	11

* assumption for renewable sources – international stimulated factor 1.8
** assumption for renewable sources – international stimulated factor 1.8
Source: estimation of Dukenbaev, 1996

5.1 BIOENERGIES

Kazakhstan has a substantial potential for the production of different agricultural crops, which can be processed for energy purposes, in particular bioethanol and biodiesel as ecologically sound fuel for combustion engines. Table 3 shows estimates of available raw materials.

TABLE 2

Projected Annual Potential

BIOFUEL POTENTIALS	PROJECTED ANNUAL POTENTIAL [BILLION KWH]
Timber waste	2.3
Straw of cereal crops	2,326
Cattle waste	0.6
Sewage	0.02
Total	2328.92

Source: estimation of Dukenbaev,1996

Solid Biomass

It is assumed that solid biomass (e.g. wood, cotton stalks or dung) are being used for domestic heat supply and cooking purposes mostly in rural areas, but no quantitative data are available.

Liquid (Bioethanol or Biodiesel)

There is presently one producer, Biohim Co., of bioethanol in Kazakhstan. Biohim plans to build three more biofuel plants. According to data published by Biohim, the potential for biofuel development is huge. From 36 ktons/year, Biohim plans to increase the production to 480 ktons/year. Biohim is operating a large plant in northern Kazakhstan producing bioethanol with a capacity of 57 ktons/year. The production has access to the neighboring countries and European markets. The markets of Kazakhstan regarding the consumption of liquid biofuels, however, are not developed.

The Ministry of Agriculture of Kazakhstan is preparing to regulate the production of biofuel, which requires the coordination of different state agencies. There will also be safety requirements and regulations on biodiesel and gasoline with bioethanol components.

Biogas

Some activities based on a UNDP funded project were identified. The project involved the design, construction and installation of biogas facilities by certain enterprises, farms and institutions within a community. Local farms contributed agricultural waste products, which are used to produce biogas in small domestic digesters. The farmers received gas to use for cooking and lighting and also gained fertilizer, which increases crop productivity.[2]

5.2 SOLAR ENERGY

In Kazakhstan there are 2,200–3,000 sunshine hours per year. The energy of the sunshine equals 1,300–1,800 kW/m^2 annually. The most promising regions for utilizing solar energy are the Aral Sea region, the Kzyl-Orda oblast and the southern Kazakhstan oblast. The territory of Kazakhstan has a continental climate with significant seasonal differences; sunshine in winter is less than summer sunshine.

Solar Photovoltaic

Based on the high theoretical potential, solar energy development is one of the promising fields of RE resources in Kazakhstan. The present use of solar energy is not quantitatively known, but there are some private initiatives in the field of PV energy use in the market of Kazakhstan. A number of organizations are selling the respective equipment. These companies mainly offer components imported from Germany, Japan and China. Households and administrative entities are the main users of these devices. The design of large entities using power saving technologies will also be developed here. A construction project of an ecologically friendly administrative building for a business center is planned in Almaty. The Square Meter Group is the developer.

Solar Thermal Energy

Private households mainly in rural regions use solar-thermal energy. A market for the equipment, however, is not existent.

5.3 WIND POWER

Being a country located in the northern hemisphere's wind belt, Kazakhstan theoretically has a high wind energy potential. Wind power energy is the most promising RE resource in Kazakhstan. The highest wind power resources are located in the Dzhungarian Gates region, the Almaty oblast (17,000 kW/m^2/year), Yermentau, Akmolinskaya oblast (3m700 kW/m^2/year), Fort Shevchenko, Coast of Caspian Sea (4,300 kW/m^2/year), and Korday, Zhambyl oblast (4,000 kW/m^2/year). The analysis of the seasonal differences of wind speed shows an increase in generation in winter and a decrease in the summer period.

Table 5 shows an overview of possible installations.[3] There is also a map of wind speeds in the Annex.

TABLE 4

Annual solar insolation

REGIONAL ANNUAL SOLAR INSOLATION	ON HORIZONTAL SURFACE [KWH/YEAR]	ON SURFACE NORMAL TO SUNLIGHT BEAMS [KWH/YEAR]
Shevchenko	1,491	1,515
Aral Sea	1,690	1,985
Almaty	1,449	1,492

Source: EBRD, 2009

TABLE 5

Perspective Regions for Wind Power Development

LOCATION OF POTENTIAL WIND FARM PROJECTS	REGION	NUMBER OF WIND GENERATORS	PROJ. INST. CAPACITY [MW]	ANNUAL PROD. [BILLION KWH]
Mangystau mountains	West	8,000	210	0.4
Peak Karatau	South	7,800	190	0.23
Chu-Ili mountains	South	6,800	180	0.27
Mount Ulutau	Central	3,400	90	0.13
Erementau mountains	Central	2,100	50	0.01
Mugojary mountains	West	400	10	0.01
Djungarian gates	South	1,100	200	0.66
Total		29,600	930	1.71

Source: unknown

2 MORE INFORMATION CAN BE FOUND AT INFORSE-EUROPE, 2004–2006

3 THE SOURCE OF THESE DATA IS UNKNOWN. THE NUMBER OF WIND FARMS OBVIOUSLY REFERS TO VERY SMALL UNITS WITH MODERN TECHNOLOGIES; THE UNITS WOULD HAVE MUCH HIGHER CAPACITIES.

The larger part of the Kazakh territory has medium wind speeds (3.5–6 m/s), stronger winds are found in the western part with wind speeds of more than 6 m/s. Areas with low wind intensity are located in the southern part of Kazakhstan. Most of the considered territories are characterized by low density of population and practical unfitness for agriculture. There are several initiatives to develop wind farms:

- In 1997–1998, the Government of the Netherlands provided financial assistance for the implementation of the Wind Energy in Kazakhstan Project with the objective to evaluate the potential for wind energy development. As a conclusion, Kazakhstan was from the wind resources point of view classified as one of the most appropriate countries in the world to develop wind energy.
- A project of the UNDP and the Kazakh Government is the Wind Power Energy Market Development Initiative (2004–2007). The objective of this project is to promote the development of a wind energy market in Kazakhstan by assisting the Government to formulate a National Program on Wind Energy Development, providing information for building the local capacity to develop wind energy products in Kazakhstan and to organize their financing. This includes site mapping and the expansion of the wind speed measurement program. The program is meant to facilitate the construction of a first 5 MW wind farm to prepare ground and reduce the risks for further investments. Monitoring, analyzing and disseminating the experiences and lessons learnt during the implementation of the project are also intended. In the project schedule, the legislative basis for RE resources use shall be prepared including price recommendations for adoption by the Ministry of Energy and Mineral Resources.
- Under the leadership of the Indian Company of NEPC India Ltd., two pilot wind power plants with a capacity of 250 kW each were built in Kentau city in the south Kazakhstan region, jointly with the Akimat (local executive body) of the South Kazakhstan region. If their profitability is proved in practice, such plants will be installed in other districts of the region. The project is under implementation.
- The new National Program of Wind Power Development for the Period of 2008–2015 with a perspective up to 2024 is run by the Ministry of Energy and Mineral Resources and the UNDP. The program envisages the construction of pilot wind power stations with a 5 MW capacity before 2010 and the construction of wind power stations of 2,000 MW on the territory of Kazakhstan before 2024.
- In 2009, a Memorandum of Understanding between UNDP in Kazakhstan and JSC Samruk-Energo on the development of RE sources of energy and wind/sun power station construction projects was signed. The joint activity will focus on the wind power engineering capacity development and work out of proposals for the legal and technical base of wind power engineering development in Kazakhstan. Feasibility studies are to be prepared for the construction of wind power stations in the Dzhungar gates, Shelek corridor, Fort-Shevchenko. There are plans to establish a Wind Power Engineering Development Association in Kazakhstan.

5.4 GEOTHERMAL ENERGY

According to studies, the technical potential of geothermal energy in Kazakhstan is estimated at 54 TWh.[4] There is, however, no information available how much of this potential is technically usable. Table 6 provides an overview.

TABLE 6

Share of Geothermal Resources

LOCATION OF GEOTHERMAL RESOURCES	SHARE [%]	PROJECTED POSSIBLE INSTALLED CAPACITY [MW]	PROJECTED ANNUAL PRODUCTION [BILLION KWH]
Mangystau	36	n.a.	n.a.
West Kazakhstan Oblast	19	n.a.	n.a.
Aktobe	13	n.a.	n.a.
Atyrau	11	n.a.	n.a.
Kzyl Orda	7	n.a.	n.a.
Others	14	n.a.	n.a.
total	100	0	0

Source: estimation of Dukenbaev, 1996

The geothermal field of Kaplanbek (near the city of Chimkent) with thermal water of temperatures around 80 °C is used for heat supply of residential buildings. Near the city of Almaty, thermal water with temperatures between 80 and 120 °C is used for heating green houses in winter and for air conditioning in summer. Only 33 % of the geothermal water has temperatures above 90 °C. A map of geothermal resources can be found in the Annex. More information can also be found on the EBRD webpage.

5.5 HYDRO POWER

The estimated physical potential of Kazakh hydro energy is 163 Billion kWh, the estimated technical potential 62 Billion kWh and the estimated economical exploitable potential 27 Billion kWh. The Annex presents more detailed information. Most of the hydro energy resources are located in three major districts: the Irtysh river basin with its main tributaries (Bukhtarma, Uba, Ulba, Kurchum, Kardzhil), the south eastern zone with the Ili river basin and the southern zone basins of the Syrdaria, Talas and Chu rivers. The hydro power potential of these individual big rivers in Kazakhstan is also presented in the Annex.

Hydro power accounts for approximately 12 % of Kazakhstan's total electricity generating capacity. The average annual hydro power generation is around 7.78 TWh. By absolute indices of potential hydro resources, Kazakhstan ranks third amongst the CIS countries.

Large Hydro Power

Presently, there are 15 large hydro power stations with a total capacity of 2,270 MW in operation including 8 large HPPs with more than 10 MW and 7 smaller HPPs (with ess than 10 MW (see Annex for list). Kazakhstan has sought international funding for some of its large hydro electric projects, particularly to complete its 300 MW Moinak HPP on the Charyn River, east of the former capital of Almaty. Moreover,

4 DUKENBAEV, AS OF 1996

a number of other large projects are under construction with participation of international investors.

Small Hydro Power

The estimated potential of small hydro energy is about 96 Billion kWh, the estimated economical exploitable potential about 10 Billion kWh. The resources are located in East Kazakhstan, Zhambyl, Almaty and the southern Kazakhstani oblast. Indicators of the perspective small hydro power stations are presented in table 7.

TABLE 7

Potential for Small Hydro Power Projects

REGIONS OF POTENTIAL HP PROJECTS	NUMBER OF PROJECTS	PROJECTED INSTALLED CAPACITY [MW]	ANNUAL PRODUCTION [BILLION KWH]
East Kazakhstani oblast	68	349	1.7
Almaty oblast	n.a.	1,762	8.7
Southern Kazakhstani oblast	112	421	1.8
Zhambyl oblast	77	175	0.7
total	180	2,532	12.2

Source: estimation of Dukenbaev, 1996

According to EBRD, there are also programs for small hydro power development in Kazakhstan. These include the reconstruction and renovation of existing small HPPs, adding small HPPs to existing water management projects with small dams and reservoirs and the construction of new small HPPs for power supply in remote areas. Favorable factors for the development of small HPPs are:

- Interest of regional authorities in small hydro
- Private investors of small hydro are provided with state short-term credits
- There are some privileges (tax holidays) in realization of investment projects

Other Initiatives

There are a number of small initiatives targeting the use of RE, such as: The Renewable Energy Use for Potable Water Supply in Remote Villages of Depressed Region Project has a total budget of 115,000 USD and is funded by GEF. The project goal is to promote wind and solar water pumping systems for clean water supply in a remote village of the poverty-stricken Aral Sea basin in Kazakhstan. At the same time this pilot initiative will promote RE use for similar initiatives in rural areas of Kazakhstan. The project consists of the following two parts:

1. Renewable Energy Use (Solar Energy) for Mobile Electrification in Remote Villages of the Depressed Region in Kazakhstan – Village of Bogen
2. Renewable Energy Use for Potable Water Supply in Remote Villages of the Depressed Region in Kazakhstan – Capacity Building and Renewable Energy Resource Centre (RERC)

The GEF Small Grants Program in Kazakhstan (with a total budget is 116,670 USD) is composed of the following modules:

- Biogas (clean rivers)
- Demonstration of solar energy use as an alternative for water and premises heating purposes in the Kyzylorda maternity house
- Energy created by wind
- Planning grant for Water Warmed by Sun Project proposal development
- Planning grant for the pre-project activity “Energy Created by Wind”
- Water of Life

6 MARKET RISK ANALYSIS AND BARRIERS FOR MARKET ENTRY

Large amounts of foreign investment have flown into Kazakhstan’s economy, about 60 billion USD in 1991–2006, 75 % of that into the traditional fossil energy sector. There are some projects in the field of RE financed by foreign and international foundations.

6.1 GENERAL SITUATION

During the past few years, Kazakhstan has made some progress in transforming its economy to create a more transparent, less regulated and more market-driven business environment. Nonetheless, this progress has been progressively undermined by a number of developments, which have caused an increased concern for foreign investors and their governments alike. In general, a cumbersome bureaucracy, a changing and unevenly enforced legislation and a weak judiciary greatly complicate the process of doing business in Kazakhstan.

Legal and Regulatory Risks

There are a number of relevant concerns for foreign investors. The Constitution of Kazakhstan restricts the independent power of the judiciary significantly, which is subordinate to the executive. Foreign investors are not guaranteed the benefit of an impartial process regarding legal issues.[5]

Increased concerns are raised over interpretation of laws by the Central Government, which often is not in line with that of local officials, especially in the implementation of Kazakhstan’s system of taxation and collection of revenues. Kazakhstan has limitations on work permits for foreign managers and technical staff, which greatly hinder the ability to rotate workers in and out which is often required on short notice.

Frequent harassments occur by local and national financial police and other taxation authorities through generally intrusive inspections. Quite often, the settlement of these cases with the tax authorities has led to criminal charges by local governmental officials as a pressure tactic.

Foreign concerns are raised over the Kazakh Government’s attempts to reinterpret existing contracts, particularly in the oil and gas and electricity generation sectors.

In general, many foreign companies are successful because

5 INFORMATION TAKEN FROM THE FEDERATION OF INTERNATIONAL TRADE ASSOCIATIONS FITA, (WWW.FITA.ORG), AS OF 2009

they accept the above mentioned conditions as a cost of doing business in this country and they all do well by employing a large staff of attorneys, accountants and other helpful resources devoted to insure protection in Kazakhstan. Foreign businesses are pleased that Kazakhstan's banking sector is well run and that they are free to repatriate their overseas income.
Corruption

The Worldwide Corruption Perceptions Index published by Transparency International ranks Kazakhstan 145 out of 180 countries. Kazakhstan reaches 2.2 points out of 10, with the factor 10 indicating basically no corruption. Corruption increases the cost and difficulty of doing business for foreign and local firms alike.

Availability of Local Know-how

After the disintegration of the USSR, the educational system has undergone changes and still keeps changing. The high-tech branch is not well developed. Therefore, know-how support at a local level is provided mainly with international funds in the form of grants. Know-how in the field of RE is delivered from abroad, meaning that the country has practically no know-how or information of its own in this field.

Local Acceptance

Foreign investors form the basis of the industrial and banking sector of Kazakhstan. At the level of small and medium size businesses, there are many joint companies having the same business conditions as the local companies.

Intellectual Property Rights

In the area of intellectual property, Kazakhstan has signed all relevant international agreements. Kazakhstan has a National Institute of Intellectual Property and a Committee on Intellectual Property Rights, which can be consulted in English.[6]

6.2 BUSINESS DEVELOPMENT

To start a business in Kazakhstan it is necessary to define the organizational and legal form of the enterprise and to be registered with the Justice Department, the Statistics Agency and the Tax Department. If the intended activity demands licensing, it is necessary not only to obtain licenses, but also corresponding permissions. The greatest difficulty for a business start is the lack of an adequate research of the market, low demand and low solvency of the population and problems caused by the often changing legislation.

There are no particular obstacles for foreigners to start a business. There is, however, a serious restriction on land leasing to foreign citizens and foreign organizations – land cannot be leased for more than 10 years and cannot become the property of a foreign citizen or a foreign organization.

The Kazakh banking system has been developing rapidly before the global crash and the National Bank has introduced deposit insurance in its campaign to strengthen the banking sector. Several major foreign banks have branches in Kazakhstan. Since the beginning of global financial crisis, the stability of the financial sector has been falling and there is a high dependency on foreign capital.
Potential investors in the RE business will have to expect considerable bureaucratic obstacles because of the dependency of the country on the oil capital and its influence, the low cost of traditional energy sources and high corruption levels.

Taxation

The country has embarked upon an industrial policy designed to diversify the economy away from over-dependence on the oil sector by developing its manufacturing potential. The policy changed the Corporate Tax Code to favor domestic industry as a means to reduce the influence of foreign investment and foreign personnel.

Value Added Tax is 12 %. Company Tax Rates are 20 %. Capital gains are treated as normal income and taxed at the standard Corporate Tax Rate of 20 %. Tax benefits are granted to companies carrying out their activities in 4 special economic zones: Astana City, Information Technology Park, Aktau Sea Port and Ontustyk. These benefits concern income tax and can consist of a tax exemption on land and property. There are also tax benefits for the petrochemical industry, companies producing and selling very high value added products as well as for those who have signed investment contracts with the government.

For companies from some countries there is a double taxation agreement with Kazakhstan, which is aimed to reduce the tax burden.[7]

Import/Export

Taxes apply to the export of certain products and also on the import of some products. The tax policy is directed on import replacement. The list of import products on which the VAT is not compensated is defined in the tax code.

6 INFORMATION TAKEN FROM THE FEDERATION OF INTERNATIONAL TRADE ASSOCIATIONS FITA, WWW.FITA.ORG
7 FOR MORE INFORMATION SEE FITA WEBPAGE AND KADYROV, 2006

7 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

Ministry of Justice of the Republic of Kazakhstan
The Left Bank, House of the Ministries, Entrance 13
010000 Astana
Phone: office (7172) 74-07-37, central fax (7172) 74-09-54
Phone hotlines (valid for all regions) – 119
E-Mail: news@minjust.kz
Website in English with many links and the possibility to ask questions: www.minjust.kz/en

Agency of Statistics of the Republic of Kazakhstan
Left Bank of Ishim River, Dom Ministerstv, Entrance 4
Astana City
Kazakhstan
Phone: (7172) 749016, fax: (7172) 749494
E-Mail: statistika@stat.kz
Website with link to business registration (in Russian only): www.eng.stat.kz/Pages/default.aspx

Ministry of Finance of the Republic of Kazakhstan
Website: http://mf.minfin.kz/index.php?lang=eng

Tax Committee of the Ministry of Finance of the Republic of Kazakhstan
Pobedy Avenue 11
010000 Astana
Phone: (7172) 71-80-02
Call center: 8 (7172) 58-09-09
E-Mail: info@mgd.kz
Website with English version:
www.salyk.kz/eng/Pages/default2.aspx

RENEWABLE ENERGY – RELEVANT INSTITUTIONS

	NAME OF ORGANIZATION	AREA OF COMPETENCE	ADDRESS AND CONTACT	CONTACT PERSON
1	Ministry of Energy and Mineral Resources (MEMR)	Regulation of energy and mineral resources	Kabanbay Batyr Avenue 15 000001 Astana E-Mail: ayan@memr.kz	
2	Agency of the GoK on Regulation of Natural Monopolies, Department of Heat and Power Engineering Regulation	Regulation of the prices of heat and power for private use prices	Bukeykhan Street 14 01000Astana Phone: 7 (7172)591637 Fax: 7 (7172) 21547 E-Mail: kense@arem.kz	Shkarupa Anatoliy, Director of the Heat and power regulation department
3	KEGOC JSC Kazakhstan Electricity Grid Operating Company	National grid operator/company	Bogenbai Batyr Avenue 7/010000 Astana Phone: 7 (7172) 319522, 970426 Fax: 7 (7172) 970455 E-Mail: kegoc@kegoc.kz Website: www.kegoc.kz	
4	Ministry of Industry and Trade		Transport Tower 010000 Astana Phone: 7 (7172) 241642 Fax: 7 (7172)241901 Website: www.mit.kz	
5	Kazakhstani Research Center of Climate Change	Non-Governmental Organization	Seyfullin Str. 597 050022 Almaty Phone: 7 (727) 2558395 Website: www.ecoclimate.kz	
6	Climate Change Coordinate Center	Non-Governmental Organization	20 Abay Avenue, office 120, Astana info@climate.kz	
7	Kazselenergoproject	Academia and Education	Raiymbek Avenue 193 050050 Almaty Phone: 7 (727) 2 33-34- 06/2333553	
8	UNDP, Small Grants Programm (SGP) of GEF		Almaty UN Common Premises Tole Bi Street 67 050000 Almaty Phone: 7 (727) 2582643; 2582442 Fax: 7 (727) 2582645 E-Mail: registry.kz@undp.org	
9	Astana UN House/Liaison Office		Bukei Khan Avenue 26 01000 Astana Phone: 7 (7172) 592550 Fax: 7 (7272) 592540 E-Mail: registry.kz.astana@undp.org	

8 BIBLIOGRAPHY

- Aslanjan, G. S, Good Fellows C.Л. (2001): Financial Aspects of Expansion of Use of Non-conventional Energy Sources Power System
- Dukenbaev, K. (1996): Energetika of Kazakhstan – Technical Aspects
- Dukenbaev, K. (1996): Energetika of Kazakhstan and a Way of its Integration to Economy
- European Bank for Reconstruction and Development – EBRD (2009): Kazakhstan. Country Profile (http://ebrdrenewables.com/sites/renew/countries/kazakhstan/profile.aspx)
- International Energy Agency – IEA (2006): Regular Review of Energy Efficiency Policies in Kazakhstan
- International Energy Agency – IEA (2006): Statistics by Country. Kazakhstan: Statistics (www.iea.org/stats/countryresults.asp?COUNTRY_CODE=KZ&Submit=Submit)
- Kadyrov (2006): The Tax System of the Republic of Kazakhstan: General Information (www.worldwide-tax.com/articles/kazakhstan1.asp)
- Makarov, A. A. (1998): World Power and the Euroasian Power Space – Energoatomizdat
- Ministry of Energy and Mineral Resources – MEMR (2007): Development Plan of the Power Industry of Kazakhstan
- Nekrasov, V. G. (1994): Perspectives of Bioenergetics Use in Kazakhstan – Power and Fuel Resources
- Renewable Energy & Energy Efficiency Partnership – REEEP (2009): Fresh Wind from Kazakhstan: New Renewable Energy Law (www.reeep.org)
- The International Network for Sustainable Energy – INFORSE-Europe (2004-2006): Creation of Kazak Biogas Training Center ‚Azure Flame' Project in 2004-2006 (www.inforse.org/europe/kz_biogas.htm)

Websites

- www.climate.kz
- www.fita.org
- www.iea.org
- www.memr.gov.kz/
- www.nauka.kz/diss/detail.php?ID=190388
- www.powerexpo.kz/ru/2006/power_resources/
- www.reep.ru
- www.zakon.kz/our/news/news.asp?id=30161968
- www.ebrdrenewables.de or http://ebrdrenewables.com/sites/renew/countries/kazakhstan/profile.aspx

9 ANNEX

TABLE 9.2

GDP Development 2004–2008**

SUBJECT DESCRIPTOR	GDP CURRENT PRICES (BILLION USD)	GDP PER CAPITA CURRENT PRICES (USD)	GDP BASED ON PURCHASING-POWER-PARITY OF COUNTRY GDP (BILLION CURRENT INTERNATIONAL DOLLAR)	GDP BASED ON PURCHASING-POWER-PARITY PER CAPITA GDP (CURRENT INTERNATIONAL DOLLAR)
2004	43.1	2,862	116.5	7,734
2005	57.1	3,785	131.7	8,732
2006	81.0	5,260	150.5	9,778
2007	104.8	6,748	168.3	10,837
2008	141.1	9,075	179.8	11,563

TABLE 9.3

Kazakh Export and Import of Oil, Gas and Coal in 2007**

	OIL (MILLION TONS)	GAS (BILLION M^3)	COAL (MILLION TONS)
Extraction	67,0	18,0	94,4
Export	60,0	7,3	26,0
Import	3,4	3,3	0,0
Internal consumption	10,4	14,0	68,4
Export partners	Russia, European Union, China, Azerbaijan	Russia	Russia, Ukraine
Import partners	Russia	Uzbekistan, Turkmenistan	

TABLE 9.4

Prices for Power Resources Used by Private and Industrial Use in October 2008 (Tariffs for renewable resources are not determined.)**

RESOURCE	PRIVATE SECTOR		INDUSTRIAL SECTOR	
	KZT	USD	KZT	USD
Electric power, 1 kWh	8.0	0.067	6,2	0.052
Natural gas, 1,000 m^3	5,613.8	46.800	–	100.000–140.000*
Diesel fuel, 1 l	56	0.460	49	0.410
Gasoline, 1 l	100	0.833	100	0.833
Brown coal, 1 m^3	–	–	–	–
Oil "Brent", 1 barrel	–	–	–	100.790*

* price for export

TABLE 9.5

Hydro Power Resources in Kazakhstan**

REGION	NUMBER OF CONSIDERED RIVERS	TOTAL LENGTH OF RIVERS (THOUSAND KM)	HYDROENERGY RESOURCES (BILLION KWTH)
East Kazakhstan	818	21.7	72.1
Southern Kazakhstan	1,257	37.6	92.0
Northern Kazakhstan	16	5.9	1.5
Central Kazakhstan	57	11.0	1.5
West Kazakhstan	25	6.9	2.8
Total	2,174	83.1	163.0

** Sources Tables 9.2–9.5: compiled by the author from various data sources

Characteristics of Big Rivers

NAME OF RIVER	LENGTH OF RIVER (KM)	FALLING OF RIVER (M)	MID-ANNUAL FLOW/ MAXIMUM BY LENGTH (M^3/SEC)	CAPACITY (THOU-SAND KWT)	ENERGY (BILLION KWTH/YEAR)
Irtysh	1,698.0	336	924,0	2,263	19,825
Karakabe	154.0	1,838	40.6	192	1,679
Akkabe	106.0	1,988	18.4	102	895
Kaldjir	123.0	1,045	21.5	162	1,381
Kurchum	218.0	2,164	62.1	433	3,791
Bukhtarma	405.0	2,290	243.0	847	7,419
Ulba	98.0	388	98.0	165	1,449
Uba	286.0	483	170.0	461	4,040
Ili	768.0	191	463.0	808	7,079
Khorgos	160.0	2,719	16.3	307	2,174
Usek	142.0	2,726	17.9	491	4,306
Tekes	179.0	1,702	35.0	–	682
Charyn	346.0	2,609	35.6	–	3,810
Chylyk	240.0	3,649	33.0	–	4,126
Talgar	108.0	3,478	10.8	–	1,700
Lepsy	418.0	2,681	24.2	–	1,526
Tentek	180.0	3,144	46,9	–	3,027
Syrdarya	1,692.0	290	603	–	10,046
Arys	346.5	925	19,4	–	702
Talas	321.9	405	15,8	–	581
Chui	970.0	924	59,2	–	4,353

Source: unknown

FIGURE 9.6

Map of the East Kazakhstan Hydro Power Stations

Source: unknown

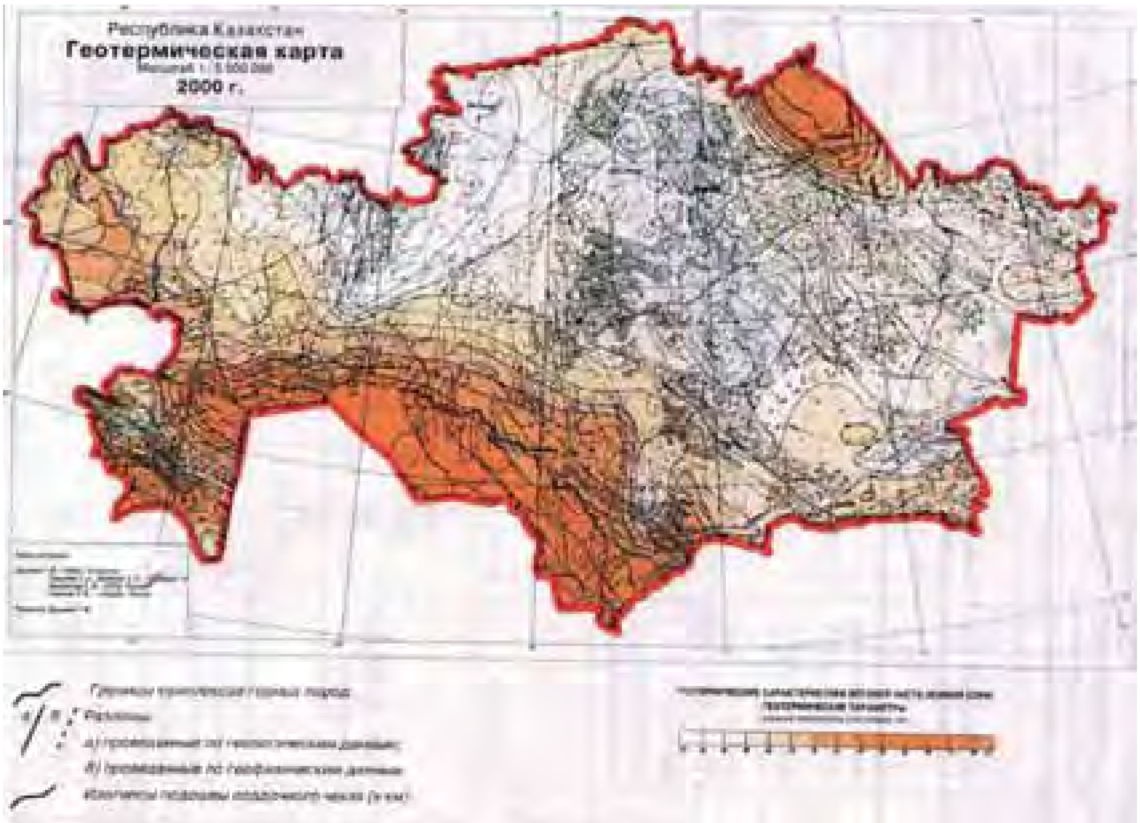
FIGURE 9.7

Wind Power Map of Kazakhstan

Source: unknown

FIGURE 9.8

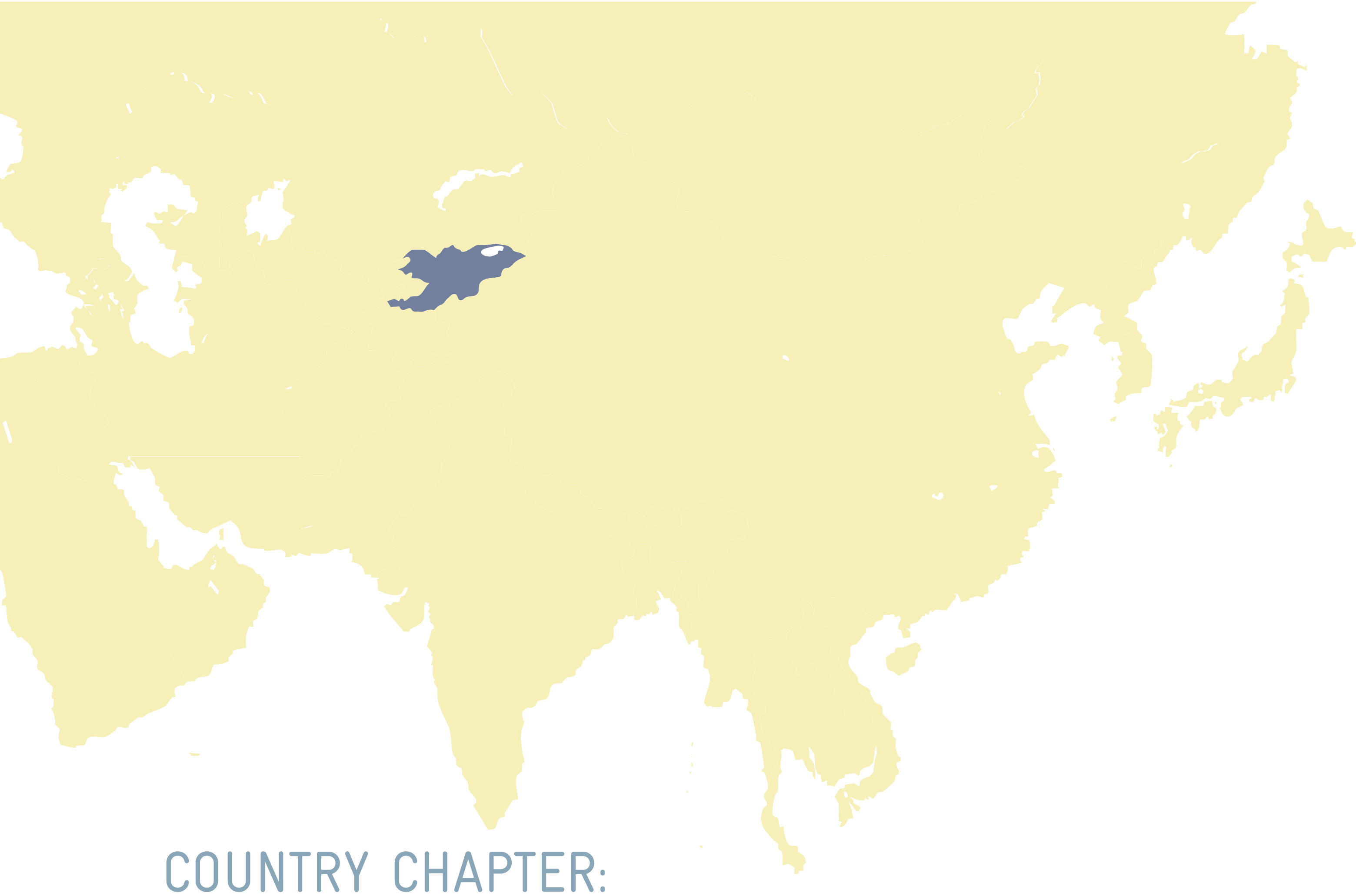
Geothermal Power Map of Kazakhstan



Source: unknown

FIGURE 9.9
Electricity Infrastructure in Kazakhstan

Source: unknown



COUNTRY CHAPTER: KYRGYZ REPUBLIC

Authors and Coordination of Country Chapter
Olga Terenteva (LL.M, MA Finance, BA Engl. & Lit.)

Dr. Ing. Klaus Jorde
Entec Consulting & Engineering AG
St. Gallen, Switzerland
www.entec.ch

Axel Biegert (Dipl. Economist & Pol.)
INTEGRATION UMWelt & Energie GmbH
Graefenberg, Germany
www.integration.org

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS

ACRONYMS AND ABBREVIATIONS
REPUBLIC OF KYRGYZ REPUBLIC

ADB	Asian Development Bank
CAR	Central Asian Region
CCA	Common Country Assessment
CDM	Clean Development Mechanism
CHP	Combined Heat and Power Plant
CIS	Commonwealth of Independent States
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse Gas
DDP	Distribution Demonstration Project
EBRD	European Bank for Reconstruction and Development
EPC	JSC Electric Power Plants (GenCo)
FSU	Former Soviet Union
GEF	Global Environment Facility
GHG	Greenhouse Gas Emissions
HPP	Hydro Power Plant
HV	High Voltage
HVL	High Voltage Lines
HVN	High Voltage Network
IBRD	International Bank for Reconstruction and Development
ICWC	Interstate Commission for Water Coordination
IDA	International Development Association
IEA	International Energy Agency
IPP	Independent Power Producers
JICA	Japan International Cooperation Agency
JSC	Joint Stock Company
KNG	Kyrgyz Nefte Gas
KPC	Kyrgyz Petroleum Company
MB&C	Metering, Billing and Collection
MDG	Millennium Development Goals
MEIFR	Ministry of Energy, Industry and Fuel Resources
NEG	National Electric Grid of Kyrgyzstan
NGO	Non Governmental Organization
NPRS	National Poverty Reduction Strategy
O&M	Operation and Maintenance
PCCAR	Power Council of Central Asia Republics
PREGA	Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement
PRSP	Poverty Reduction Strategy Paper
PV	Photovoltaic
UDC	Unified Dispatch Center
UNDP	United Nations Development Program
UNDAF	Development Assistance Framework
UNFCCC	United Nations Framework Convention on Climate Change
UPSCAR	United Power System of Central Asia Republics
UN	United Nations
USAID	United States Aid
USD	United States Dollars
VAT	Value Added Tax
WB	World Bank
WTO	World Trade Organization

MEASUREMENTS

kV	kilovolt (1kv = 1,000 V)
MW	megawatt (1MW = 1,000 kW)
GWh	gigawatt hour (1 GWh = 1,000,000 kWh)
TWh	terawatt hour (1 TWh = 1,000,000,000 kWh)
kJ	kilojoule (1 kJ = 1,000 Joule)
ktoe	kilotons of oil equivalent (1ktoe = 11,630,000 kWh)
m	meter
km^2	square meter
km	kilometer
kWh	kilowatt hour
h	hour

1 SUMMARY

The Kyrgyz Republic generates most of its electricity from abundant hydro power resources in the mountainous areas. Due to an increasing demand and inflows into the large storage reservoirs that are lower than the average there is a serious energy crisis, which is enhanced by the slow deterioration of existing facilities and equipment. Other Renewable Energies (RE) are presently not exploited except for some very small private initiatives. There is still a vast potential of unutilized small, medium and large hydro power. The country does not have sufficient resources to develop this potential. While the large potentials are being tackled by international companies, the smaller ones are not being utilized because of the lack of a clear legal and regulatory framework, including tariffs and the licenses for the construction and operation.

There are also potentials for other RE sources, mostly solar, but no systematic data on physical, technical and economic potentials are available.

Presently, the major players are international donors and NGOs but while these efforts are locally effective and helpful they do not mitigate the general situation in the country and do not support the overall provision of a safe, reliable and accessible energy supply from sustainable sources for the people, especially in rural areas.

While Kyrgyzstan is officially promoting the increased development of RE, has signed most relevant international treaties and its national legislation promotes investment from foreign and resident investors alike, the reality for private investors is still too insecure to attract the increased efforts required to develop the existing resources. It is also necessary that the country promote the collection and analysis of fundamental data on the total amount and spatiotemporal distribution of technical potentials of various Renewable Energies.

2 COUNTRY INTRODUCTION

2.1 GEOGRAPHY AND CLIMATIC CONDITIONS

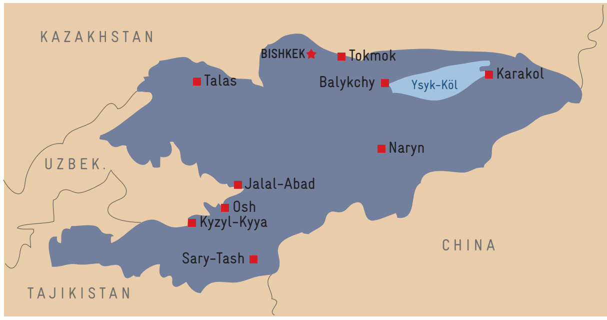
The Kyrgyz Republic (Kyrgyzstan) is located in the heart of Central Asia bordering Kazakhstan in the North and North West, Uzbekistan in the South West, Tajikistan in the South and China in the South East. Kyrgyzstan is a rugged country with the Tien Shan mountain range covering approximately 95 % of the whole territory. The mountain tops are covered with perennial snow and glaciers.

The country's generally mountainous terrain has an average elevation of 2,750 meters above sea level. 94 % of the country is over 1,000 m above sea level and about 41 % is over 3,000 m.

Kyrgyzstan is a landlocked country with a dry continental to polar climate in high Tien Shan Mountains, subtropical climate conditions in Southwest (Fergana Valley) and temperate climate in the Northern foothill zone.

FIGURE 1

Map of Kyrgyzstan



2.2 POLITICAL AND ECONOMIC DEVELOPMENT

After gaining independence, Kyrgyzstan was progressive in carrying out market reforms such as an improved regulatory system and land reforms. Kyrgyzstan was the first Commonwealth of Independent States (CIS) country to be accepted into the World Trade Organization. Much of the Government's stock in enterprises has been sold. Drops in production had been severe after the breakup of the Soviet Union in December 1991, but by mid-1995, production began to recover and exports began to increase. The economy is heavily weighted towards gold export, and a drop in output at the main Kumtor gold mine sparked a 0.5 % decline in Gross Domestic Product (GDP) in 2002 and a 0.6 % decline in 2005.

The Government made steady strides in controlling its substantial fiscal deficit, nearly closing the gap between revenues and expenditures in 2006, before boosting expenditures more than 20 % in 2007–08. The Government and international financial institutions have been engaged in a comprehensive medium-term poverty reduction and economic growth strategy. In 2005, Bishkek agreed to pursue a much-needed tax reform and, in 2006, became eligible for the Heavily Indebted Poor Countries (HIPC) initiative. Progress in fighting corruption, further restructuring of domestic industry and success in attracting foreign investment are key elements to future growth. GDP grew more than 6 % per year in 2007–08, partly due to higher international gold prices, but growth is likely to decline from that level in 2009, due to declining demand and lower commodity prices in the wake of the international financial crisis.

SHORT BUSINESS INFO

The Kyrgyz Government is developing anti-crisis measures aimed at (i) load shedding, (ii) an increased production at Combined Heat and Power Plants (CHPs), (iii) imports of electricity and attracting investments into new generation facilities including small hydro power and (iv) the development of RE to improve the power supply and to reduce the deficit.

The Central Asian Republics (CARs) have large water and energy resources, but their distribution is highly skewed. The two largest rivers, the Amu Darya and Syr Darya with an annual average flow of 116 km^3/year originate from snowmelt and rainfall in the mountainous upstream countries of Tajikistan and the Kyrgyz Republic. The rivers then run for about 1,500 km through the arid plains of the downstream countries of Uzbekistan, Turkmenistan and Kazakhstan towards the Aral Sea. In terms of primary energy resources, Kazakhstan has significant reserves of hydrocarbons (oil and gas and coal); Uzbekistan has considerable amounts of gas and some oil and coal, whereas Turkmenistan has substantial reserves and production of natural gas. In contrast, the Kyrgyz Republic and Tajikistan have negligible amounts of commercially exploitable fossil fuels, but enjoy generous water resources with an abundant hydro power potential.

The integrated water and power system developed under the Soviet system soon came under pressure given the new political and economic realities in the CARs. The main transboundary water and energy issue that has emerged concerns the operation of the Toktogul Reservoir where a conflict has arisen between the energy needs of the Kyrgyz Republic, the irrigation needs of the downstream riparian areas and the timing of environmental flows to the Aral Sea.

LAND AREA:	191,000 km²
POPULATION:	5,43 million (as of July 2009)
DENSITY:	26 inhabitants/km²
BIGGEST CITIES AND INHABITANTS:	Bishkek (0.75 million), Osh (0.2 million)
LANGUAGE:	Kyrgyz 64.7 % (official), Uzbek 13.6 %, Russian 12.5 % (official), Dungun 1 %, other 8.2 % (1999)
ALTITUDE:	132 m to 7,439 m (Pik Pobedy)
RIVERS:	more than 40,000 rivers and streams with Naryn River 807 km being the longest river within the country
ECOSYSTEM AREAS:	Forests (4 %), shrub land, savannah, grassland (56 %), cropland and crop/natural vegetation mosaic (27 %), urban and built-up areas (0.4 %), sparse or barren vegetation, snow and ice (7 %), wetland and water bodies (4 %)
GDP – PER CAPITA (PPP):	USD 2,200 (as of 2008)
INFLATION RATE:	24.5 % (as of 2008)
AGRICULTURE – PRODUCTS:	Tobacco, cotton, potatoes, vegetables, grapes, fruits and berries; sheep, goats, cattle, wool
INDUSTRIES:	Small machinery, textiles, food processing, cement, shoes, sawn logs, refrigerators, furniture, electric motors, gold, rare earth metals
ELECTRICITY – PRODUCTION:	15.62 billion kWh (as of 2006)
ELECTRICITY – CONSUMPTION:	8.99 billion kWh (as of 2006)
ELECTRICITY – TARIFFS:	1.5 US Cent/kWh
NATIONAL ELECTRICITY CAPACITY IN OPERATION:	3600 MW
NATURAL RESOURCES:	Abundant hydro power; significant deposits of gold and rare earth metals; locally exploitable coal, oil, and natural gas; other deposits of nepheline, mercury, bismuth, lead, and zinc
ELECTRIFICATION RATE:	965 barrel/day (as of 2007)
OIL – PRODUCTION:	0.28 thousand barrels/day (as of 2007)
OIL – EXPORT	2,534 barrel/day (as of 2005)
OIL – CONSUMPTION:	12,330 barrel/day (as of 2007)
OIL – PROVEN RESERVES:	40 million barrel/day (as of 2008)
NATURAL GAS – PRODUCTION:	18 million m³ (as of 2007)
NATURAL GAS – PROVEN RESERVES:	5,663 billion m³ (as of 2008)
EXPORTS:	USD 1.85 billion (as of 2008)
EXPORTS – COMMODITIES:	Cotton, wool, meat, tobacco, gold, mercury, uranium, natural gas, hydro power, machinery, shoes
EXPORTS – PARTNERS:	Russia 29.4 %, Switzerland 16.2 %, Kazakhstan 15.1 %, Afghanistan 12.3 %, China 7.6 %, Uzbekistan 5.8 % (as of 2008)

Source: CIA World Fact Book, as of 2009

3 ENERGY MARKET IN THE KYRGYZ REPUBLIC

3.1 IMPORTANT PLAYERS OF THE KYRGYZ ENERGY MARKET

After the country's independence, the Kyrgyz Government initiated an unbundling of the existing power system in 2000. The formation of a new joint stock company, JSC Electric Power Plants, took place in September 2001. This company owns the hydro power stations in Toktogul cascade, the two thermal power stations in Bishkek and Osh and various heat plants. The Joint Stock Company (JSC) National Grid is the legal successor to Kyrgyzenergo and includes the national dispatching center, all High Voltage (HV) transmission lines of 110 kV and higher, any 35 kV lines that are an integral part of the transmission network and all associated substations. It can play a neutral and common role in an unbundled sector, although generation at this stage remains a near monopoly. Four state-owned distribution companies were formed:

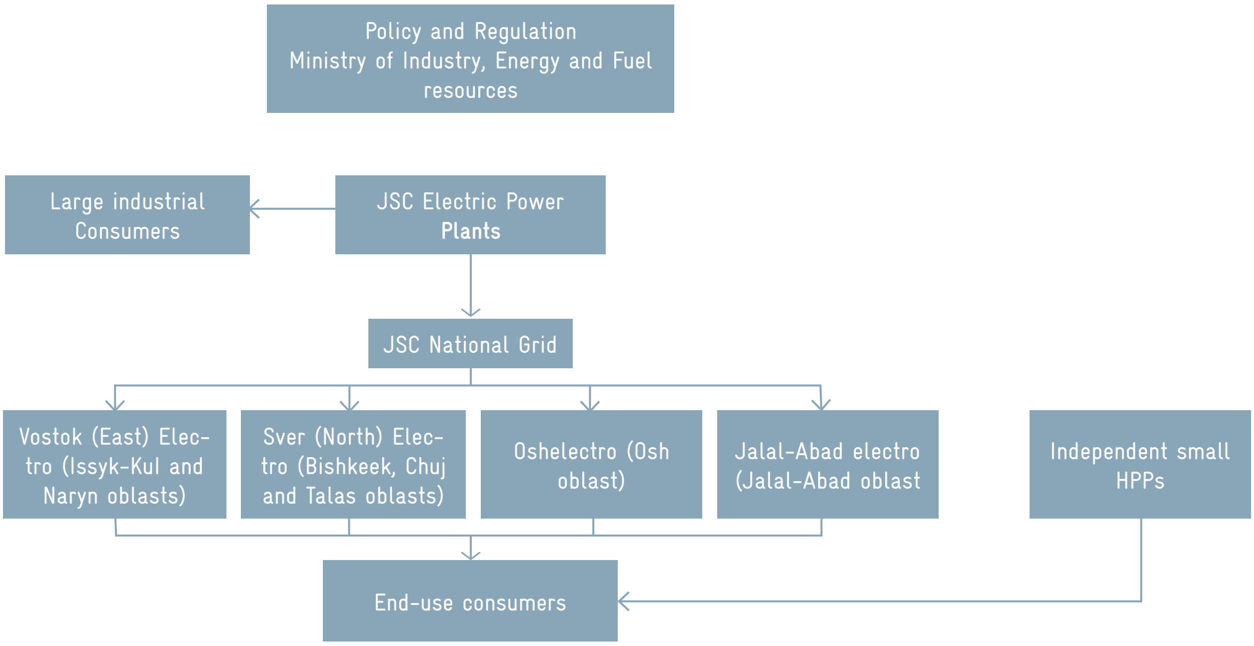
- Severo (North) Electro (Bishkek, Chui and Talas Oblasts)
- Vostok (East) Electro (Issyk-Kul and Naryn Oblasts)
- Oshelectro (Osh Oblast)
- Jalal-Abadelectro (Jalal-Abad Oblast)

The scheme below shows the unbundled power system: one generating company, one transmission company and four distribution companies. The Ministry of Industry, Energy and Fuel Resources regulates the tariffs.

The transmission company functions as a common carrier and the generation company handles exports. Except for some small hydro power generators, there are no Independent Power Producers (IPP).

The Electricity Law and the Electricity Market Rules set regulations for basic requirements in the market interaction of electricity generation, transmission and distribution organizations as well as in the operation of all the economic entities engaged in electricity generation, transmission, distribution and sales, both in the domestic market and for exports, irrespective of their ownership.

FIGURE 2
Kyrgyz Power Sector



Source: unknown

SHORT BUSINESS INFO
There is no feed-in tariff for electricity from RE sources and the effective legal framework does not provide an apparent support to such projects.

Bulk electricity sales and purchases between the generation and distribution organizations, importers and large industrial consumers are based on power purchase contracts. Distribution companies and independent small producers sell electricity to end-users under a standard contract on supply of electricity developed and approved by the Government. The transmission company is not permitted to sell and purchase electricity.

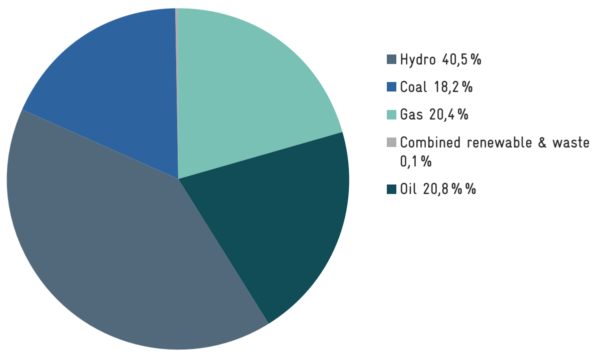
The Kyrgyz Republic was the first country in the CIS to establish an independent regulatory agency for economic regulation of the energy sector – the State Energy Agency. In 2007, regulatory functions were taken over by the newly established Ministry of Industry, Energy and Fuel Resources. Standard power purchase contracts are now developed and approved by the sector regulator. Normally, the contracts are executed for one year. It is allowed to conclude long-term contracts if they are approved by the sector regulator.

3.2 PRIMARY ENERGY CONSUMPTION, TRANSMISSION AND PRICES

In 2005, the total primary energy consumption in the Kyrgyz Republic was 2798 ktoe as estimated by the International Energy Agency (IEA). See the following figures for the share of total primary energy supply in 2005:

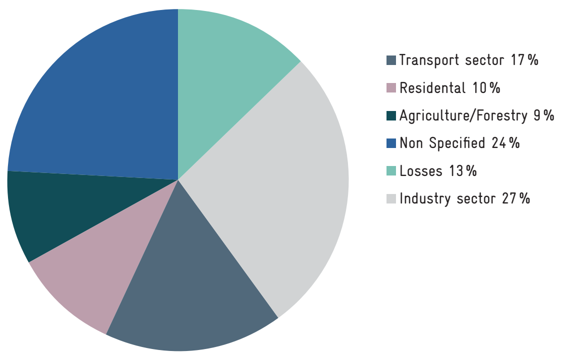
45.8 % of the total primary energy supply is domestic production and 54.2 % is imported. See the annex for the share of domestic production, import and export.

FIGURE 3
Share of Total Primary Energy Supply



Source: International Energy Agency, as of 2005

FIGURE 4
Major Consumer Groups for Primary Energy



Source: International Energy Agency, as of 2005

According to the Energy Law, the Department of Regulation of the Power Sector under the Ministry of Industry, Energy and Fuel Resources is given the responsibility to establish pricing and tariff mechanisms. The tariff setting procedure, however, is still a politically sensitive issue in the Kyrgyz Republic and existing electricity and heat tariff levels do not cover the costs of providing services. Furthermore, there are over twenty categories of customers who enjoy tariff discounts mandated by the Government. In 2008, tariffs for electricity ranged from approximately 1.5 to 2 cent/kWh, depending on the respective customer group.

More detailed tariff schedules and an overview of tariff increases for electricity and heat are attached in the annex.

The Transmission and Distribution System

The high voltage transmission network of the Kyrgyz Republic was designed as part of the Central Asia Interconnected System and configured to meet both regional and national transmission needs. It is, however, essentially the result of uneven distribution of load and generation resources. The bulk of generation is located in the southern part of the country while a very substantial portion of the load is in the northern region in and around Bishkek. This spatial separation and the mountainous nature of the terrain resulted in two well-defined systems, North and South, with a relatively weak link in between that must carry substantial flows of energy.

The distribution system of the Kyrgyz Republic includes all facilities at or below of 35 kV. It includes extensive 6/10 kV and 0.4 kV lines resulting in a design loss in the range of 12 %. This design characteristic leading to relatively high technical loss was accompanied by low construction quality leading to faster deterioration of structures, lines and substations. The redistribution of demand among consumer groups led to the drop in the demand of the industrial and agriculture sectors and rapid growth of residential demand. This higher residential demand was stimulated by very low tariffs displacing more traditional energy resources for heating, hot water and cooking. Since electricity losses are higher in the residential sector, this also contributed to a four-fold increase in losses. This redistribution of demand resulted in a marked increase in the seasonal variation of the load representing a ratio of 3:1 between the month of highest demand (January) and that of lowest demand (May). Overloading of the systems in order to meet the high winter demand during the last ten years has accelerated the deterioration process and increased the number of service interruptions. About 30 % of the distribution systems need to be repaired or replaced.

Moreover, there is a serious problem of non-technical losses through lack of metering, inaccurate metering, fraud and inability of the utilities to properly track power flows and pinpoint problems. The table below represents the electricity balance of the Kyrgyz Republic including the overall level of losses, both technical and commercial.

According to local estimates, approximately 95 % of the population is connected to the grid.

SHORT BUSINESS INFO

The losses in the distribution system are in the range of 40–50 %. Reliability is poor. Tariff collection rates range from 70–80 %.

As mentioned already in section 3.1, there are four electricity distribution companies set up on a regional basis which own and manage 65,000 km of local distribution lines (0.4–35 kV) and serve more than one million households and other consumers. Distribution companies are obliged to provide uninterrupted electric power to all consumers in their respective regions, except in areas served by generating companies if there is a contract for direct supply. The distribution companies are also obliged to buy electricity from generators, except where they themselves generate electricity. The distribution companies can import and export electricity via networks rated at 35 kV or less. Two out of four distribution companies – JSC Oshelectro and JSC Vostokelectro – export limited volumes of electricity to Tajikistan and China respectively. Distribution companies provide collection services for consumers of electricity, which require significant financial assets and modernization of metering and accounting.

Electricity Sector and Natural Resources

The bulk (around 90 %) of the Republic's current total generating capacity is hydro power. The total installed capacity of the Kyrgyz power sector is 3,680 MW, including 2,950 MW from 15 Hydro Power Plants of which 97 % originate from the Naryn Cascade and 730 MW from two Combined Heat and Power plants (CHPs). The actual production, however, is much lower due to deferred maintenance and old equipment waiting to be replaced.

SHORT BUSINESS INFO

The actual electricity deficit is estimated at 2 billion kWh annually and forced the Government to introduce strict limitations of electricity supply.

The CHP plants serve primarily industrial demands for heat and hot water and provide municipal district heating in the two biggest cities Bishkek and Osh.

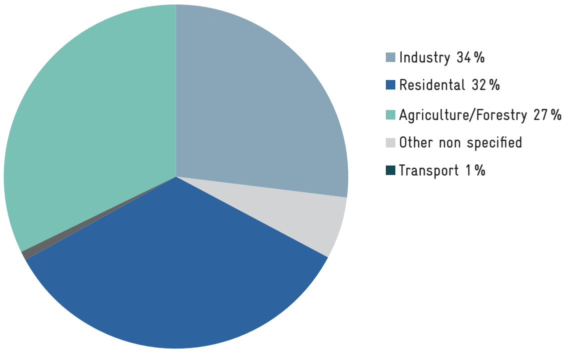
TABLE 1

Kyrgyz Power Sector

GENERATION FACILITY	INSTALLED CAPACITY (MW)	PRODUCTION (GWH)	COMMISSIONING DATE
Toktogul HPP	1,2	4,787	1975
Kurpsay HPP	800	3,457	1982
Tashkymir HPP	450	2,006	1987
Shamaldisay HPP	240	915	1995
Uch-Kurgan HPP	180	973	1962
Atbashi HPP	40	150	1970
Small HPPs	40	50	1958
Bishek CHP-1	678	1,166	1977
Osh CHP	50	49	1986
Total Installed	3,678	13,553	

Source: data compiled by the author

FIGURE 5
Consumer Groups of Electricity



Source: International Energy Agency, as of 2005

In 2005, the total electricity production was 16,415 GWh of which 86,9 % were produced by hydro power, 9,5 % by gas and 3,6 % by coal.

Oil and Gas
Kyrgyzstan contains five oil and gas fields with allegedly considerable resources that are, however, mostly unproved. Since demand for oil and gas is also moderate, Kyrgyzstan could eventually become self-sufficient in oil and gas, but foreign capital is needed. Exploration and production licenses for hydrocarbons and coal are issued by the State Agency for Geology and Mineral Resources. Today, Kyrgyzstan produces minor amounts of natural gas, about 30 million m^3 per year. Demand, on the other hand, sums up to around 700 million m^3 per year, the difference is imported, mostly from Uzbekistan.

Coal
In the country, considerable coal deposits are existing. Probable and possible coal resources are estimated at 6.73 billion tons of hard and bituminous coal and lignite. With recoverable coal resources estimated at 1.3 billion tons, Kyrgyzstan ranks fourth in the former Soviet Union after Russia, Kazakhstan and Ukraine.

The largest consumer of used energy from coal in the country, however, is Bishkek. The CHPs were designed to use coal resources from Kazakhstan, which has to be imported.

Import and Export of Energy
The hydro generation capacity in Kyrgyzstan has to mesh with the needs of the large irrigation schemes that have been built in Uzbekistan and Kazakhstan. The Kyrgyz Republic releases water from the Toktogul Reservoir for irrigation and produces more electricity than is needed for its own purposes during this time of the year. Excess electricity is exported to Uzbekistan and Kazakhstan, which in return supply gas, oil and coal to the Kyrgyz Republic for their thermal plants. Kyrgyzstan has not imported electricity, yet. This year, the Kyrgyz Government is negotiating on the import of electricity from Turkmenistan to mitigate the upcoming energy crisis and to make up for the deficit of domestic generation. In the annex of this country analysis, power export/import data from Kyrgyzstan to other CAR countries can be found.

Growth Predictions for the Energy Sector
There are major problems in the Kyrgyz Republic concerning the demand management of electricity. Low tariffs and weak progress towards the electricity loss reduction provide space for a high growth in demand. One of the recent studies conducted by the SNC Lavalin Company developed two scenarios for a demand forecast: one base case scenario assuming tariff increase and loss reductions whereas the second one is a high growth scenario. The base case scenario envisages a slow growth of 0,6 % in the years 2007–2011, 2,7 % in the years 2012–2014 and then a 3,2 % annual growth. The high demand case projects an annual growth of 3.2 %.

4 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

4.1 NATIONAL STRATEGIES AND PROGRAMS TO SUPPORT RENEWABLE ENERGIES
For many years now, the Kyrgyz Republic has considered the development of its hydro power resources for the export market to be the central foundation of its overall economic development. Therefore, there is keen interest in attracting foreign investors as joint venture partners to complete the construction of several large Hydro Power Plants that were started or planned some years ago. The development of small hydro power resources and other RE resources has always been emphasized as an important and necessary step, but no national plans have ever been consistently and comprehensively elaborated.

SHORT BUSINESS INFO
In 2008, the Kyrgyz Parliament approved the National Energy Program and Strategy for the Fuel and Energy Sector Development until 2025. This Strategy calls for a focus on the small hydro power sector as one of the priorities for the energy sector development.

The Kyrgyz Republic has ratified the following conventions in the field of environment protection:

- The UN Framework Convention on Climate Change and Kyoto Protocol to the UN Framework Convention on Climate Change
- The Convention on Access to Environmental Information and Public Participation in Decision-making on Environmental Issues

In 1999, the Legislative Assembly of Jogorku Kenesh of the Kyrgyz Republic adopted the following laws, thus taking a substantial step towards the development of a comprehensive legislation for environment and rational use of natural resources:

- Law on Environment Protection
- Law on Atmospheric Air Protection
- Law on Ecological Expertise
- Law on Biosphere Territories in the Kyrgyz Republic
- Law on Fauna

In Kyrgyzstan's National Poverty Reduction Strategy (NPRS) it is stated that the sector on electric power production and distribution is and will be the highest priority sector for the country, which provides the Republic's independence in electric power. It is also intended to reduce emissions from thermal-electric systems.

The Poverty Reduction Strategy Paper (PRSP) Progress Report of April 2004[1] mentions that measures for increasing the share of alternative and RE sources from 0.15 % of the total energy produced in 2001 to 3.5 % in 2005 include the development of solar heating systems, production of solar energy collectors for heating and hot water supply.

According to Government Reports, emissions from energy production constitute about 35 % of the total Greenhouse Gas (GHG) emissions. The development of Kyrgyzstan's hydroenergy and non-traditional energy sources is of considerable interest, both for the energy sector development and for simultaneous GHG emission reduction. The National Communication also stresses that a thoroughly planned policy of developing its energy sector would allow the Kyrgyz Republic to become the biggest electricity producer in the region. Not only would the industry be able to meet the current electricity needs of the population, it would also allow to switch to all-electric cooking and heating, thereby replacing the organic fuels which currently take up the greater part of energy consumption.

The forest coverage of currently around 4 % is further decreasing mainly due to illegal logging stimulated by high prices for firewood, which are due to an increasing demand in rural areas without reliable electricity supply. As the forest cover has already been removed from many mountainous areas, floods and mudslides have become common phenomena, thereby further accelerating erosion. The decrease in forest areas also negatively affects the country's rich ecosystems, causing a loss of biodiversity as many species live in the forests.

4.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

Over the last ten years, the Kyrgyz Republic has initiated a series of legal and regulatory reforms designed to improve the financial viability and quality of service of the power sector. These include the passage of the Energy Law and the Electricity Law, the creation of an independent energy regulatory body and the adoption of the Government's Program for restructuring and privatizing the power sector. The respective actions are summarized below:

- Enactment of the Energy Law in 1996
- Establishment of an independent State Energy Agency charged with licensing and tariff setting authorities
- Passage of the Electricity Law in 1997 to establish the legal framework for unbundling and privatizing the power sector

In February 2007, a new law on the structure of the Government of the Kyrgyz Republic was adopted and a new Ministry of Energy, Industry and Fuel Resources (MEIFR) was established. The functions and responsibilities of regulatory oversight of the power sector were given to the Department of Regulation, which is part of the MEIFR.

The Government of the Kyrgyz Republic has passed a large number of basic laws, which together provide the framework to regulate and restructure the power sector. Power generation is currently a virtually Government-owned monopoly (more than 97 % of the installed capacity). Private ownership is now allowed but will occur mainly through private investment in new small-scale generation systems. Transmission is also a Government monopoly, but the Government has agreed to privatize one of the four distribution companies as a pilot project.

The power sector is governed primarily by the Law on Electricity and the Law on Energy. There are also a number of other legislative acts, presidential decrees and Government resolutions regulating the production, transportation, distribution and consumption of electrical and heat energy.

The Law on Energy defines the general principles for energy supply efficiency, including the following provisions for a regulatory oversight in the sector:

- Licensing of production, transportation and distribution of electrical and heat energy as well as gas
- Assessment of tariffs
- De-monopolization of the industry and development of a competitive environment
- Implementation of the state standards within the industry
- Implementation of an economic use of the electrical and heat energy and use of gas and oil
- Construction of energy production or transmission facilities

The Electricity Law establishes the legal framework for regulating the production, transmission, distribution and consumption of electric energy in Kyrgyzstan including:

- General provisions for licensing: With the exception of those entities generating electricity for their own use, all state and all non-state legal entities and individuals are prohibited from engaging in the generation, transmission, distribution or sale of electricity or thermal energy without first obtaining a license issued by the sector regulator. Any activity involving power generators of at least 1,000 kW or more are required to obtain licenses from the sector regulator. The Electricity Law also stipulates that any state or private entities as well as individuals engaging in the import, export or sale of electricity are required to obtain a license.
- Rules on generation licenses: No generator shall be granted exclusive or monopoly rights under the legislation of the Kyrgyz Republic. Energy enterprises can sell the electric or thermal energy they generate to the national grid, distributors or major consumers. The market is open to all businessmen provided that they comply with the licensing requirements, the provisions of the National Energy Program and the legislation of the Kyrgyz Republic. The issuance of any license related to hydroelectric generation must be subject to a prior study concerning the impact on the water use for purposes other than electric generation.

1 IMF, AS OF 2004

The results of the study have to be transmitted to inform the local authorities of the territory in which the hydroelectric station will be constructed or will have effects.
- New generation capacities: The sector regulator shall issue licenses for the construction of power plants and high voltage networks.
- Third party access to the national grid: The holder of a transmission license cannot restrict access to the national grid or impose unreasonable requirements on users of or sellers to the national grid.
- Environmental protection: License holders should bear the cost of preventing or attenuating pollution from their operations in accordance with the environmental protection laws and regulations of the Kyrgyz Republic. The decision to build a new Hydro Power Plant shall be subject to an environmental impact assessment prior to the issuance of a construction permit. The assessment reports must be available to the public and subject to public inquiry in accordance with the legislation of the Kyrgyz Republic.

All hydrotechnical facilities located on Kyrgyz territory and utilizing water resources of the Kyrgyz Republic are regulated by the Land Code, the Water Law of the Kyrgyz Republic and other legal acts. The land plot under each hydro technical facility belongs to the Water Fund.

Payment of water use fees is usually not required if the water used for power generation is released into the same stream or canal it has been diverted from and if the same water is not further utilized in another way.

Transmission fees have to be paid to the owner of the grid (either JSC National Grid or one of the four electrical distribution companies) if existing transmission and distribution facilities are used.

SHORT BUSINESS INFO

There are no standard procedures in place for small scale independent power producers.

Clean Development Mechanism (CDM)

The reduction of greenhouse gas emissions in connection with CDM Projects in developing countries like Kyrgyzstan might be used by the developed countries to fulfill their Kyoto Protocol obligations. The developed countries are allowed to purchase a part of reduced greenhouse emissions from other countries as expenses on such reduction in the developed countries are much higher than in developing ones.

Thus the CDM Projects are aimed to attract investments, to stimulate the transfer of new technologies to the developing countries and at the same time to solve the environmental problem – particularly to mitigate the influences of the climate change. The implementation of projects gives new opportunities to organizations of the country independent from their form of property and institutional subordination to modernize manufactures that reduce greenhouse gas emissions.

The United Nations Development Program (UNDP) has recently launched a new project on CDM. The main project objective is to assist the Kyrgyz Republic to create institutional and technical capacity for an effective management of the commitment under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. The latter provides opportunities for Kyrgyzstan to reduce its GHG emissions in the framework of the CDM Projects funded by the developed countries. Currently, it is too early to discuss any achievements or accomplishments of this project.

5 POTENTIAL FOR RENEWABLE ENERGIES AND PRESENT USE

Low tariffs and abundant hydroelectric power resources have constrained the development of RE sources in the Kyrgyz Republic for years. However, recent initiatives of the Government towards the tariff increase, privatization of some energy facilities and severe climatic changes will change the attitude towards clean energy. Except for hydro, most of the other renewable systems are due to individual efforts.

To date, only a few scattered and largely uncoordinated efforts have been made to develop the country's rich RE resources such as mini/micro hydro power, biogas or solar technologies. The most significant among these initiatives are the Small Community Hydro Project in Jangy-Naukat funded by United States Aid (USAID), Osh Oblast, the Financial Engineering Program for Development of Small hydro power Stations in Kyrgyzstan funded by the Government of Norway, the Renewable Energy Driven Pump Systems Initiative funded by the Nordic Trust Fund, the Ecological Center Issyk-Kul funded by the German Government and the regional project for the Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement (PREGA) co-financed by the Netherlands and the ADB. Furthermore, a number of individual RE installations have been implemented with the support of the Global Environment Facility (GEF) Small Grants Program in Kyrgyzstan, in particular micro hydro power stations, biogas and solar installations.

Recently the UNDP project Promotion of micro hydro power units for Sustainable Development of Mountain Communities in Kyrgyzstan was initiated. This project focuses exclusively on compact micro hydro power generating units with capacities of less than 5 kW, which are operated in isolated mode and are sufficient to supply one or several rural households with electricity. The project also focuses on mountainous areas in or in the vicinity of nature reserves in Kyrgyzstan. The Japan International Cooperation Agency (JICA) is considering the preparation and implementation of biogas projects in the rural areas of the Kyrgyz Republic introducing new technologies through pilot installations.

While all the aforementioned initiatives are highly recommendable in that they are pioneering the introduction of RE technologies in Kyrgyzstan, they lack a holistic approach to specifically address the barriers that are currently hampering the widespread and sustainable introduction and distribution of these technologies in Kyrgyzstan's rural communities. As a consequence, most of the scattered efforts have but a limited impact and therefore cannot significantly mitigate the challenges arising from the increasing use of fossil and local biomass fuel as a source of energy in rural areas in Kyrgyzstan. The majority of the rural population (65 %) has no opportunity to use clean fuels for cooking and heating primarily because of poverty. Therefore, the forests are cut down to use wood as fuel including the best ones and the so-called relic forests. Of the recommended policies for the development of RE systems identified by the World Bank a decade ago, few have been implemented and even fewer successfully. The main reasons for a high interest of the Kyrgyz Republic in a larger share of RE in the energy balance are the following:

- Given the high degree of dependence of the country on imported fuels, the use of RE sources could reduce the country‘s dependence and export bill.
- The high numbers of rural and nomadic population with no access to the electricity grid could be supplied by stand-alone (dispersed) RE systems.

5.1 BIOENERGIES

The technical potentials for bioenergy are not known and the use of bioenergy in its various application forms is limited to a few scattered operations initiated by individuals

Solid Biomass

Since in the rural areas the living conditions are quite bad, people are changing from traditional energy sources like electricity, coal and oil products to dung and wood. This transfer in turn creates significant ecological problems. Dung is used as a fuel rather than a the fertilizer, which leads to soil degradation. The use of wood and bushes for fuel causes a deforestation problem. Solid biomass will become even more popular with the current outages of power, eventual tariff increase and world pricing trends.
Modern solid biomass, such as fuel granules or fuel pellets, is not being utilized.

Liquid (Bioethanol or Biodiesel)

There are no known activities related to bioethanol or biodiesel. No estimates of the potentials are available. In general, Central Asian regions that now grow cotton have the potential to grow an indigenous plant called camelina sativa (also known as false flax, wild flax, linseed dodder, German sesame or Siberian oilseed) as a source for biofuel production. Camelina could possibly replace cotton crops because it needs less water and is drought resistant.

Biogas

Kyrgyzstan‘s dominant agricultural crop is currently wheat. Biomass gasification for fixed-bed power gasifiers has been commercially proven only for wood, charcoal, rice husk and coconut shell feedstock. Among these four, only rice is grown in larger quantities in Kyrgyzstan, but its production is still quite low. The forest product industry also shows little promise for biomass power generation – either for gasification or for direct combustion. Forest cover in the country has fallen from 7 % to nearly 4 % in recent years, and Kyrgyzstan‘s wood products are primarily imported from Russia. Not only is the fuel supply limited, the economics of biomass gasification are also less favorable because disposal costs are low.

National electrification estimates also indicate that the market for power generation gasifiers will continue to be limited because of the availability of low-cost hydro power. The limited fuel supplies, small market potential and the low cost of the alternative (bulk power from the grid) lead to conclusion that biomass power development is currently not an efficient use of scarce development resources.

Kyrgyzstan‘s 9 million hectares of natural mountain pastures and its one million additional hectares of arable valley land helped to make livestock production the mainstay of the country‘s agrarian output. At its peak, Kyrgyzstan provided 40 % of the former Soviet republics wool and exported large amounts of meat and dairy products to neighboring republics. With the dissolution of the Soviet Union and a subsequent disruption of traditional supply and trade links, livestock numbers fell sharply. As a result of the breakup of collectives, there is dispersed ownership of livestock and the econoMIEs of scale needed for economical, grid-connected biogas power generation are clearly absent. Family biogas digesters for cooking and for limited heating purposes show economic potential for the future, however. Rural families in Kyrgyzstan have high numbers of livestock, indicating a significant potential market for household-size digesters. Fossil fuels, primarily imported from Kazakhstan, Russia and Uzbekistan, are costly in Kyrgyzstan and many rural families are going back to the use of animal wastes for cooking or to electricity for cooking and heating whenever possible.

SHORT BUSINESS INFO
Family biogas digesters for cooking and for limited heating purposes show economic potential for the future.

There are around fifty biogas installations in the country. Half of them are operational, the rest is idle. Most of the plants with a capacity of 2–40 m^3 have been constructed by individuals. The main outcome of the installations is gas for cooking and fertilizers. Most of these installations are handmade without proper design, manufacture and maintenance. To respond to these issues, JICA is planning to launch a project aiming at the pilot installations and technology introduction.

5.2 SOLAR ENERGY

Kyrgyzstan is between northern latitudes 39° and 43°. This would not normally be considered advantageous for solar potential. On the other hand, Kyrgyzstan‘s solar energy resources are stable and adequate because of its dry climatic conditions. There are about 2,600 hours of sunshine per year and radia-

TABLE 2
Annual Solar Radiation

REGIONAL ANNUAL RADIATION [KWH/A]	OON HORIZONTAL SURFACES	ON NORMAL SURFACES
Bishkek (plane)	1,540	1,560
Tien Shan (mountainous area 3614 masl)	1,850	1,913

Source: Renewable Development Initiative, as of 2009 tion is 1,500–1,900 kW/m^2 per year.

Kyrgyzstan claims two important industrial installations that produced about 30 % of the needs of the Former Soviet Union (FSU) in crystalline silicon for solid-state devices in the space and defense industries in the past. The Orlovka plant produces single-crystal silicon while the Tash-Kumyr plant, which has not been completed so far, was designed for the production of polycrystalline silicon. The Tash-Kumyr plant is currently producing silicon blocks for a foreign customer on a toll basis.

There aren't any technologies to produce photovoltaic (PV) systems, however. Solar collectors for water heating are used by some resorts in the Issyk-Kul region and by the broad population. There is no local manufacturer of this equipment. Most of the installations are imported from China.

The topography and land use are generally well suited for the use of solar energy. Kyrgyzstan's solar resources have fewer site-specific drawback factors; this could be advantageous for rural electrification, especially for nomadic people using portable PV applications. Kyrgyzstan's direct radiation is high, which is also good for solar water heating applications.

The main barriers for developing solar energy are of economic and institutional origin. The country is not able to mobilize the investments needed. There is no feed-in tariff for electricity from RE sources and no particular legal framework to support such projects. Nevertheless, the President of Kyrgyzstan established the so-called Business Project KUN (kun in Kyrgyz means sun) for RE applications in 1999. KUN is an executive organ of state management under the Government and coordinates the state energy policy in the field of RE. As far as using solar energy, this project only foresees its use in water-heating devices.

SHORT BUSINESS INFO

The President of Kyrgyzstan established the so-called Business Project KUN for RE applications in 1999.

5.3 WIND POWER

There are no special studies on wind energy applications in the Kyrgyz Republic. A countrywide wind-atlas, however, is available, according to which there are some areas with wind speeds between 4–5 m/s. In addition, some technical experts mention the Issyk-Kul region, namely Balykchy town, where the conditions could be favorable for the development of wind installations. This direction needs to be further assessed and evaluated.

Currently there is no operative wind energy capacity in Kyrgyzstan. Moreover, there is no industry association or manufacturer in the country and no specific projects exist. There seems to be a technical potential of 2,500 MW installed capacity, but the feasible potential is uncertain. The most promising areas are in the northern part of the Chui district, the Osh district, the Issyk-Kul and the Djalal-Abad district. Hence, a comprehensive wind resource mapping study and wind monitoring program would be required. Wind resource assessments and mapping tools are available for other developed and developing countries and have been applied there, for example in neighboring China. Although the development of wind resources in the Republic of Kyrgyzstan cannot be supported at this time, the country could benefit from a wind resource assessment and monitoring program also. Bilateral and multilateral aid agencies are the most suitable vehicles for initiating and conducting such a program in Kyrgyzstan.

5.4 GEOTHERMAL ENERGY

Geothermal resources are concentrated in the reservoirs formed in sediments of depressions and in the convective fissured hydrothermal systems of foothills.

The geothermal resources of Kyrgyzstan are small and insufficiently investigated. The application of thermal water is only used for bathing and spas. It is planned to use the thermal water in the area of the city Bishkek and in the valley of the lake Issyk-Kul.

At least 20 geothermal springs were identified and drilled in Kyrgyzstan during the time of the FSU. Examinations of temperature and flow data from these sites indicate low-grade heat resources with temperatures not above 55°C. Ak-Su, in the Karakol region, is the most promising site for geothermal development based on well temperatures and its proximity to a population centre. The 55 °C resource is in the marginal range of economic feasibility for heating purposes. Aside from the low temperature and low flow (83 m^3/h), the site is 10 km away from Karakol meaning the reliability of such a project is very limited.

5.5 HYDRO POWER

Kyrgyzstan, being a mountainous country, has good sources of hydro power, but its potential has not been investigated in detail up to now. Kyrgyzstan's total hydro potential has been estimated to 162 billion kWh, while the technically exploitable resources are estimated at about 73 billion kWh and the economically exploitable to 48 billion kWh. Roughly 11 billion kWh have been exploited. The policy of the formerly planned economy was to focus primarily on the exploitation of large projects. As a result, many small plants (up to 10 MW) that were in operation in the 1950s and 1960s were abandoned. A new study on hydro potential, which examines the main river basins of the country, is currently being undertaken. This study may prove that the real technically and economically exploitable hydro potential of the country (mainly in relation to small hydroelectric projects) is even greater.

Large Hydro Power

It has already been said that the electricity generation depends mostly on large hydro power owned by the state. Additionally, there are three installations run by private businesses:

- JSC Chakan GES, 29 MW
- JSC Kalininskaya GES, 1.4 MW
- Bystrovskaya GES, 9 MW

These companies are grid-connected and experience major problems with the regulatory framework such as tariff setting, transit through the distribution networks and access to new customers. All these issues are also in the scope of the UNDP project Promotion of Micro Hydro Units, which deals with the institutional and regulatory aspects of hydro power.

Small Hydro Power

Despite regulatory problems, there are some individual efforts in the rural mountain areas to run mini and micro installations of up to 10–20 kW. There is a continuous interest from the shepherds and farmers living in areas that are not grid-connected mainly in Issyk-Kul and Naryn regions.

The National Energy Program of the Kyrgyz Republic for 2008–2010 refers to the construction of 92 potential new small Hydro Power Plants (178 MW total output capacity), the restoration of 39 existing but abandoned small Hydro Power Plants (22 MW total output capacity) and the installation of water turbines at 7 existing irrigation reservoirs (75 MW total output capacity).

Upon request from the Kyrgyz Government, the European Bank for Reconstruction and Development (EBRD) has structured a technical cooperation

- to carry out the strategic planning of mini/small (10 MW or less) and medium (30 MW or less) hydro power development in the country
- to recommend investment/regulatory framework enhancements for development of small- and medium-sized hydro power projects
- to prepare pilot projects for implementation together with a possible framework for EBRD financing products as well as public tender assistance for the award of respective concessions

The project is scheduled to start in 2009.

6 MARKET RISK ANALYSIS AND BARRIERS FOR MARKET ENTRY

The highest obstacle for entering into the Kyrgyz RE market is the apparent lack of clear framework conditions for investors, e.g. clear regulations on licensing and tariffs.

6.1 GENERAL SITUATION

Corruption

A survey in 2005, conducted by the international anti-corruption group “Transparency International”, confirmed that graft is a serious problem in Kyrgyzstan, as it ranked in the top 20% of the most-corrupt countries.[2] The Government of the Kyrgyz Republic undertakes some critical actions to reduce the level of corruption.

Availability of Local Know-how

There are two institutions in the Kyrgyz Republic that are educating professionals in the energy sector:

- The Kyrgyz Technical University trains engineers for the power sector and the different power companies in the generating, transmission and distribution sectors.
- The Kyrgyz-Russian University has recently opened a special department on RE systems. This department prepares specialists to design and operate RE systems like hydro, wind and solar.

Kyrgyzstan like many other CIS countries faces high unemployment rates (11.2% in 2008) and low wages. Due to the Soviet education system, however, many of the unemployed have a special and higher education. At the same time, there is a risk that with the upcoming privatization of at least three major power facilities the unemployment rate of the energy professionals will increase even further.

Especially in rural areas there is only very limited technical know-how available on how to properly build, operate and maintain RE systems. Furthermore, while manufacturing facilities with most of the required equipment and machinery are available in Kyrgyzstan, there is a lack of technical and institutional capacities for the local manufacturing and repair of RE systems and the required quality management.

The potential for local manufacturing of RE equipment in Kyrgyzstan is generally regarded as promising, based on the following factors:

- Intact workshop infrastructure: As a result of the efforts to introduce industrial production during the times of the Soviet Union, there are still a number of well-equipped workshops existing in Kyrgyzstan today.
- Low labor cost: Due to the macroeconomic situation, labor costs in Kyrgyzstan are still comparatively low, which favors local production over imports.

On the other hand, the local capacity to manufacture specific products is hampered by a number of factors, such as the lack of qualified workers, lack of vocational training institutions and the general decline of locally manufactured quality equipment, which is being ousted by cheap Chinese imports.

Local Acceptance

Generally, local acceptance of RE systems has been highest in areas with no or only very unreliable electricity supply, but people still prefer to be connected to the grid rather than to an isolated RE system. It can be assumed that with a further deteriorating of the grid all over the country, the acceptance of RE will increase.

6.2 BUSINESS DEVELOPMENT

One of the main directions of the economic policy pursued by the Government of the Kyrgyz Republic is the attraction of direct foreign investments.

Direct foreign investment promotes the creation of new highly technological manufactures, the creation of additional workplaces, the introduction of advanced management techniques etc.

According to Article 14 of the Constitution, foreigners and stateless persons in the Kyrgyz Republic enjoy the rights and freedoms and bear the responsibilities of citizens on the

2 TRANSPARENCY INTERNATIONAL INDICATES RANK KYRGYZSTAN 130 OUT OF 152 FOR IN THE CORRUPTION PERCEPTION INDEX 2005 (SEE TI, AS OF 2005).

basis and in accordance with the conditions and procedures stipulated by laws, state treaties and agreements.

In general, the Kyrgyz Republic and its own legislation follow international laws and treaties.

The existing legal framework satisfies (at least in theory) the basic requirements of private investors. It mainly encourages the development of large hydro power resources for the export market, however. Existing Government resolutions and programs are almost reticent about small-scale hydro power or other RE development and are focused on sites with capacities over several MW.

The absence of power purchase agreements and wheeling agreements tailored for small-scale generators allow all four distribution companies to abuse their geographical monopolistic domination. The Electricity Law provides regulations for the access of third parties to transmission lines, but in reality distribution companies find many ways to prevent small-scale IPPs from supplying customers that are not directly connected to the new generators.

The delayed tariff reform and absence of feed-in tariffs create another challenge for the development of RE.

The Kyrgyz Government recognizes the existing legal and regulatory vacuum for small-scale IPPs. In collaboration with the UNDP, the MIEFR is drafting a new Law on Renewable Energy Development. It is expected that this year the new draft law will be submitted to the parliament for approval.

SHORT BUSINESS INFO

In theory, private investors are allowed to operate in the Kyrgyz energy market. All applicable laws and regulations, however, focus on relatively large hydro power development. In reality, the obstacles caused by missing legal frameworks are difficult to manage for potential IPPs.

6.3 INTELLECTUAL PROPERTY RIGHTS

The legal basis for intellectual property protection in the Kyrgyz Republic is provided by relevant national legislation and international treaties, to which the Kyrgyz Republic is a party. This refers to patents, trademarks, copyrights, computer applications etc.

In addition, since December 1998, the Kyrgyz Republic has been a member of the World Trade Organization (WTO). Developing its own intellectual property legislation, the country takes into account provisions of the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights.

The legislation of the Kyrgyz Republic provides for civil, administrative and criminal liability for violations in the field of intellectual property.

6.4 TAXATION

Taxation in the Kyrgyz Republic is regulated by the constitution of the Kyrgyz Republic, the Tax Code of the Kyrgyz Republic and 42 specific laws, regulations and instructions. The authorized agency responsible for the supervision of timely payment of taxes is the State Committee on Taxes and Duties of the Kyrgyz Republic.

Currently, as many as 17 types of taxes and mandatory payments exist in the Kyrgyz Republic. National taxes are Value Added Tax (VAT), Income Tax, Profit Tax, Excise Tax and Automobile Road Tax.

Value Added Tax is applied to all taxable goods produced in the territory of the Kyrgyz Republic including the imported products. The VAT rate is 20 % except for the excise tax and goods, which are subject to VAT zero rate. The currently applicable legislation specifies the list of items, which are subject to VAT zero rates and also the list of products, works and services, which are exempt from VAT.

Income tax paid by natural persons is uniform and levied on the whole territory of Kyrgyzstan. The taxpayer pays income tax on all income received in Kyrgyzstan from any legal and/or natural person.

According to the Law on Foreign Investments of 24 September 1997, taxation of foreign investors and foreign investments is carried out in accordance with the tax legislation of Kyrgyzstan, which is equally applicable to nationals and foreigners. However, foreign investors who had been registered in Kyrgyzstan before the law came into force enjoy certain privileges (specified in part one of Article 20 and Article 23 of the older Law on Foreign Investments of 28 June 1991) until the end of the validity term referred to therein.

Foreign investors must keep accounting records and accounts following the applicable rules of the Kyrgyz Republic and submit accounts and information to tax authorities, statistical and other bodies in conformity with the established order.

7 RENEWABLE ENERGY BUSINESS NFORMATION AND CONTACTS

At the state level, the main counterparts for economic development are the following:

Ministry of Economic Development and Trade
Bishkek, Chuy Ave., 106
Minister Japarov Akylbek
mert_kg@mail.ru

Ministry of Energy, Industry and Fuel Resources (MEIFR)
Bishkek, Ahunbaev Str., 119
Minister Balkibekov Saparbek
mpe@ktnet.kg

Ministry of Agriculture, Water Resources and Processing Industry
Bishkek, Kievskaya Str., 96 A
Minister Nogoev Arstanbek
agroprod@elcat.kg

State Agency on Environment Protection and Forestry
Bishkek, Toktogula Str., 228
Director Davletkeldiev Arstanbek
demos@intranet.kg

There are some ongoing development projects focused on RE financed by the following donor organizations:

UNDP Micro Hydro Power Development Project
This project aims at the promotion of alternative and RE sources. It has introduced new energy efficiency technologies and uses of alternative RE that can provide villages with regular heating and electricity without considerable financial spending and damage to the eco-balance.
Contact person: Zharas Takenov, Senior International Advisor,zharas.takenov@undp.kg

UNDP CDM Project
The project's main objective is to assist the Kyrgyz Republic in creating institutional and technical capacities for effective management of commitment under the United Nations Framework Convention on Climate Change and the Kyoto Protocol. The latter provides opportunity for Kyrgyzstan to reduce greenhouse emissions in the framework of the CDM Projects funded by the developed countries.
Contact person: Ryspek Satylkanov, Expert on Clean Development Mechanism
juuku@mail.ru

JICA Biogas Project
The main objective of this project is to introduce the new technology through two pilot installations in different regions of the country.
Contact person: Aigerim Karmyshakova, Project assistant
aigerim.karmyshakova@gmail.com

EBRD Project Kyrgyzstan:
Strategic Planning for Small- and Medium-Sized Hydro Power Development:
Mr. Azamat Omorov, Leading Specialist, Power Generation and Transmission Department, Ministry of Industry, Energy and Fuel Resources of the Kyrgyz Republic, 119 Ahunbaeva, 720055 Bishkek, Kyrgyzstan, Tel: +996 312 561113, aomorov@mail.ru

RENEWABLE ENERGY – RELEVANT INSTITUTIONS

Local organizations active in the field of RE and rural development would be the following:

Directorate on Development of Small and Medium Energy Projects
Bishkek, Isanova Str., 60
Director Kulov Felix
office@energetic.kg
hydro power

Kyrgyz Science Technical Center "Energiya"
Bishkek, Akhunbaeva Str., 119
Director Dikambaev Shamil
hydro, solar, wind

Center of Issues of Utilization of Renewable Energy Sources "Kun"
Bishkek,
Director Obozov Alaybek
kun@elcat.kg
Solar, wind

NGO "Fluid"
Bishkek, Alma-Atinskaya Str., 1A,
Director Vedenev Alexey
contact@fluid-biogas.com
Biomass, biogas

Kyrgyz-Russian (Slavic) University
Bishkek, Kievskaya Str., 44
Head of Renewable Energy Department Akkaziev Imil
krsu@krsu.edu.kg
Renewable Energy

Kyrgyz Technical University
Bishkek, Mir Ave., 66
Head of Energy Department Apyshev Joomart
ktu@ktu.aknet.kg
Energy sector

Demonstration Zone for Energy and Water Efficiency
Bishkek, Ahkunabeav Str., 119
Director Shayahmetov Marat
dzb@elcat.kg
small hydro, energy saving

JSC Severelectro
Lebedinovka, Chkalova Str., 3
Director Raimjanov Talant,
Tel: (996 312) 63 12 85
Power distribution company serving Bishkek, Chui and Talas regions

JSC Vostokelectro
Karakol, Fuchika Str., 24
Director Muhamejanov Ryskul,
vostokelectro@rambler.ru
Power distribution company serving Naryn and Issyk-Kul regions

JSC Jalalabatelectro
Jalalabat, Lenin Str., 159
Director Sarbaev Nazir,
jalalabatelectro@mail.ru
Power distribution company serving Jalalabat region

JSC Oshelectro
Osh, Razzakova Str., 19a
Director Bekmurzaev Doskul,
oshelectro@rambler.ru
Power distribution company serving Osh and batken regions

8 BIBLIOGRAPHY

- ADB (2007): Opportunities and Pitfalls in Privatizing Distribution Company Management
- Central Intelligence Agency – CIA (2009): World Fact Book. Kyrgystan (www.cia.gov/library/publications/the-world-factbook/geos/kg.html#top)
- Energy Charter Secretariat (2007): Review of the Investment Climate and Market Structure
- ´Energy Information Agency – EIA (2005): Kyrgyzstan – Energy Balance (www.eia.doe.gov/emeu/world/country/cntry_KG.html)
- GEF/UNDP (2006): Biogas Technologies in Kyrgyzstan
- ´International Energy Agency – IEA (2005): IEA Statistics, Kyrgyzstan (www.iea.org/Textbase/stats/countryresults.asp?COUNTRY_CODE=KG&Submit=Submit)
- International Monetary Fund – IMF (2004): Kyrgyz Republic: Poverty Reduction Strategy Paper Progress Report (www.imf.org/external/pubs/ft/scr/2004/cr04200.pdf)
- Jefferson Institute (2009): Developing the Potential for Energy Efficiency and Alternative Energy in the Kyrgyz Republic (www.jeffersoninst.org/Documents/Kyrgyz_policy_paper.pdf)
- N. N. (1999): Program of Development of Small Hydro Power
- Kyrgyz Republic (2007): Country Development Strategy (http://webapps01.un.org/vaw/uploads/Kyrgyzstan%20-%20National%2-0Development%20Strategy%202007-2010.pdf)
- N. N. (2008): Kyrgyz National Energy Program
- Nationmaster (2009): Map of Kyrgystan (http://images.nationmaster.com/images/motw/commonwealth/kyrgyzstan_rel96.jpg)
- Renewable Development Initiative (2009): Kyrgyzstan Country Profile (http://ebrdrenewables.com/sites/renew/countries/kyrgyzstan/profile.aspx)
- Transparency International – TI (2005): Corruption Perception Index 2005 (www.transparency.org/policy_research/surveys_indices/cpi/2005)
- UNDP (2007): Environment and Natural Resources for Sustainable Development
- US Department of State (2008): Investment Climate Statement – Kyrgyzstan 2008 (www.state.gov/e/eeb/ifd/2008/100902.htm)
- USAID (2002): Assessment of Issues and Proposals for Syrdarya River Basin
- USAID (2002): Support to Electricity Loss Reduction in the Kyrgyz Republic
- World Bank (2004): Regional Electricity Potential Export Study
- World Bank (2004): Water and Energy Nexus in Central Asia
- World Bank (2007): Kazakhstan and Kyrgyzstan: Opportunities for Renewable Energies Development

9 ANNEX

9.1 DEVELOPMENT OF THE GROSS DOMESTIC PRODUCT

TABLE 1

Development of the GDP

YEARS	SUM (BILLION)	US$ (BILLION)	PER CAPITA SUM	PER CAPITA US$
2000	65.358	1.368	4,313.9	307.8
2001	73.883	1.525	4,506.3	321.7
2002	75.367	1.606	4,470.7	380.9
2003	83.872	1.919	4,740.5	435.2
2004	94.351	2.215	5,023.4	478.6
2005	100.899	2.460	4,965.9	546.0
2006	113.800	2.837	5,064.1	713.5
2007	139.749	3.748	5,419.7	895.4

Source: unknown

9.2 PRIMARY ENERGY CONSUMPTION

TABLE 2

Primary Energy Consumption (in ktoe)

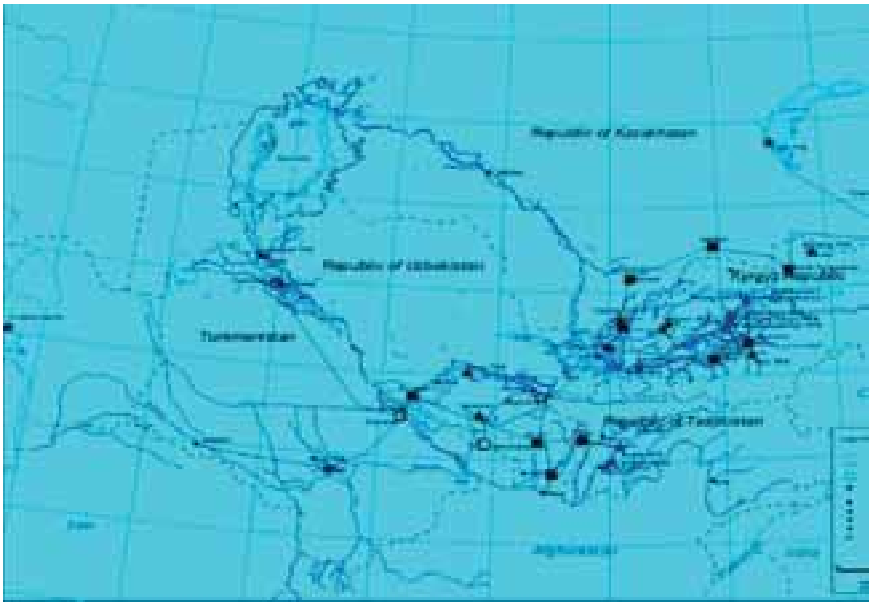
	COAL	CRUDE OIL	PETROLEUM PRODUCTS	GAS	HYDRO	COMBUSTIBLES, RENEWABLES AND WASTE	ELECTRICITY	TOTAL
Domestic production	122	74	0	21	1,226	4	0	1,447
imports	435	5	675	596	0	0	0	1,711
Exports	-4	0	-125	0	0	0	-231	-360
TPES	552	79	550	617	1,226	4	-231	2,798

Source: unknown

9.3 CENTRAL ASIA 500 KV POWER GRID, POWER TRANSMISSION FACILITIES AND DISTRIBUTION FACILITIES

FIGURE 1

Primary Energy Consumption (in ktoe)



Source: unknown

TABLE 3

Power Transmission Facilities in the Kyrgyz Republic

VOLTAGE LEVEL (KV)	LENGTH OF LINES (KM)	NUMBER OF SUBSTATIONS
500	546	2
220	1,453	13
110	4,558	177

Source: unknown

TABLE 4

Power Distribution Facilities in the Kyrgyz Republic

VOLTAGE LEVEL (KV)	LENGTH OF HVL (KM)	NUMBER OF SUBSTATIONS
35	4,318	325
10/6	26,959	19,048
0.4	27,94	-

Source: unknown

9.4 POWER CONSUMPTION AND TRANSMISSION AND DISTRIBUTION LOSSES, POWER IMPORT AND EXPORT

TABLE 5

Power Balance 2004–2007

#	ITEM	UNIT	2004	2005	2006	2007
1	Generation	GWh	14,944	14,686	14,326	14,645
2	import	GWh	54	4	9	0
3	Export	GWh	3,206	2,577	2,441	2,379
4	Output to network	GWh	11,58	11,874	11,71	11,008
5	Losses	GWh	4,926	5,133	4,872	4,534
6	Consumption	GWh	6,609	6,814	6,855	7,258
6.1	Industry	GWh	781	767	814	821
6.2	Budget	GWh	632	625	629	681
6.3	Agriculture	GWh	67	57	70	87
6.4	residential	GWh	3,806	3,933	3,772	3,898
6.5	Others	GWh	780	867	902	1,014
7	Direct customers	GWH	530	538	639	756

Source: unknown

TABLE 6

Power Import/Export

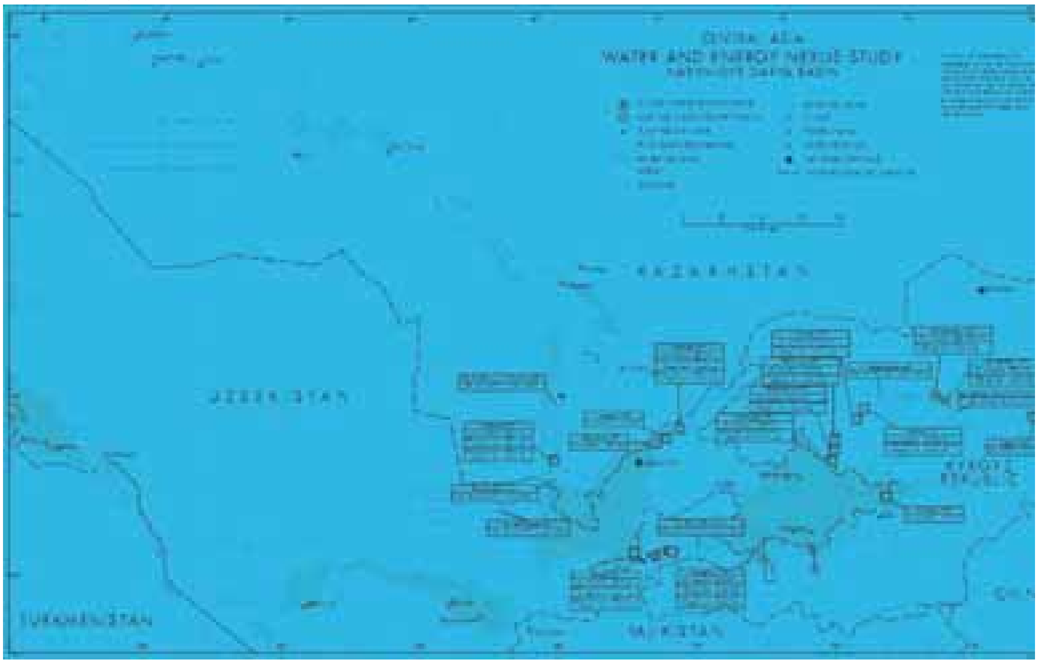
YEAR	TRADE PARTNER	IMPORT (GWH)	EXPORT (GWH)
2006	Kazakhstan	0	2,074.20
	Uzbekistan	0	0
	Tajikistan	0	366.30
	China	0	0.91
2007	Kazakhstan	0	1,215.80
	Uzbekistan	0	868.30
	Tajikistan	0	294.10
	China	0	0.97

Source: unknown

9.5 NARYN – SYRDARYA RIVER BASIN POWER FACILITIES

FIGURE 2

Naryn – Syrdarya River Basin Power Facilities



Source: unknown

9.6 NARYN – SYRDARYA RIVER BASIN POWER GRID

FIGURE 3

Naryn – Syrdarya River Basin Power Grid

Source: unknown

9.7 ELECTRICITY TARIFF RATES

TABLE 7

Electricity Tariff Rates 2008 (excl. taxes and levies)*

I. PER 1 KWH OF CONSUMED ELECTRICITY			
1.1	For residential customers	70	tyiyn
1.2	For agricultural pump station within the limits	68	tyiyn
1.3	For industrial customers	96	tyiyn
1.4	For agricultural customers	96	tyiyn
1.5	For customers financed from local or state budget	100	tyiyn
1.6	For all other customers	102	tyiyn
II. PER 1KW OF APPLIED OR INSTALLED CAPACITY PER MONTH			
2.1	For residential customers for heating purposes (from October 1 to March 31) – per 1 kW of installed capacity	30	som
2.2	For residential customers for sauna and food – per 1 kW of installed capacity	60	som
2.3	For industrial customers throughout the whole year – per 1 kW of applied capacity	45	som
2.4	For agricultural customers with 3-phase input throughout the whole year – per 1 kW of applied capacity	45	som
2.5	For customers financed from local or state budget with 3-phase input throughout the year – per 1 kW of installed capacity	45	som
2.6	For all other customers with 3-phase input, except saunas and food throughout the year – per 1 kW of installed capacity	50	som
2.7	For all other customers for saunas and food throughout the year – per 1 kW of installed capacity	60	som

9.8 HEAT AND HOT WATER TARIFF RATES

TABLE 8

Heat and Hot Water Tariff Rates (Gcal)*

1	Residential for heating	500 som	per 1 Gcal
2	Residential for hot water supply	250 som	per 1 Gcal
3	Others for heating and hot water supply	860 som	per 1 Gcal
TECHNICAL SERVICE OF HEATING SYSTEMS:			
4	Residential	30 som	per 1 Gcal
5	Other customers	40 som	per 1 Gcal

TABLE 9

Hot Water Tariff Rates (ton)*

1	Residential	23,7 som	per 1 ton
2	Others	51,8 som	per 1 ton
TECHNICAL SERVICE OF HEATING SYSTEMS:			
3	Residential	1,38 som	per 1 ton
4	Others	1,84 som	per 1 ton

TABLE 10

Hot Water Tariff Rates (lump sum for 4,8 tons/person/month)*

1	Residential	113,8 som/per person
TECHNICAL SERVICE OF HEATING SYSTEMS		
2	Residential	6,62 som/per person

* Source: unknown

9.9 RESIDENTIAL TARIFF RATES FOR NATURAL GAS

FIGURE 11

Residential Tariff Rates for Natural Gas

REGION	TYPE OF CUSTOMER	RATE (SOM/1,000 M3)
North	Residential customers	7,296.20
	Industrial, budget and commercial customers	8,982.91 (incl. VAT)
South	Residential customers	6,988.72
	Industrial, budget and commercial customers	8,541.94 (incl. VAT)

Source: JSC "Kyrgyzgas", as of 2008

9.10 ADMINISTRATIVE MAP OF THE KYRGYZ REPUBLIC

FIGURE 4

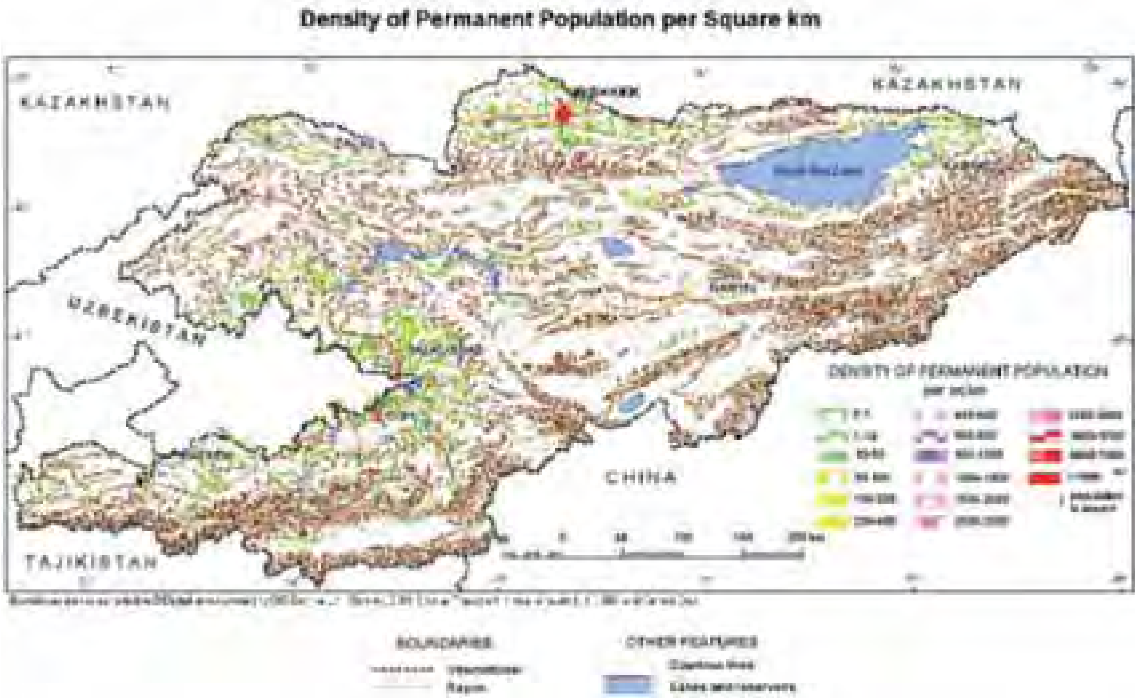
Administrative Map of the Kyrgyz Republic

Source: GIS Services Ltd.,as of 2001

9.11 POPULATION DENSITY MAP OF THE KYRGYZ REPUBLIC

FIGURE 5

Population Density Map of the Kyrgyz Republic

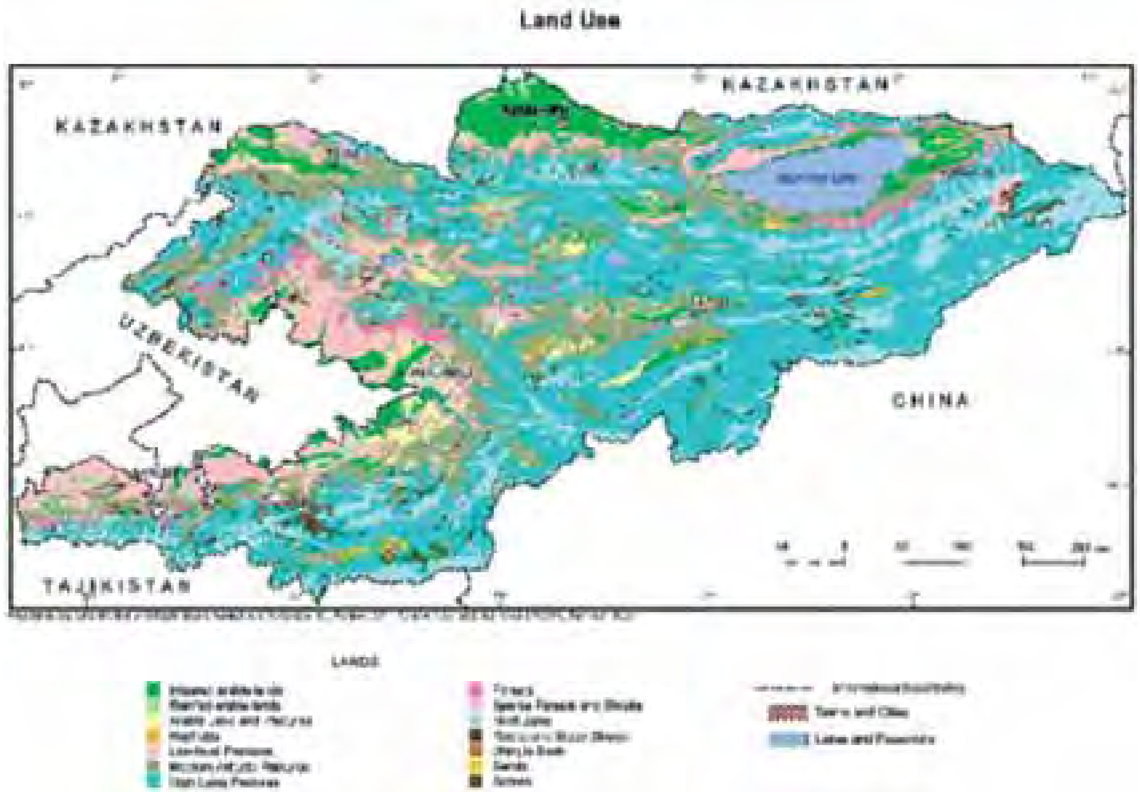


Source: unknown

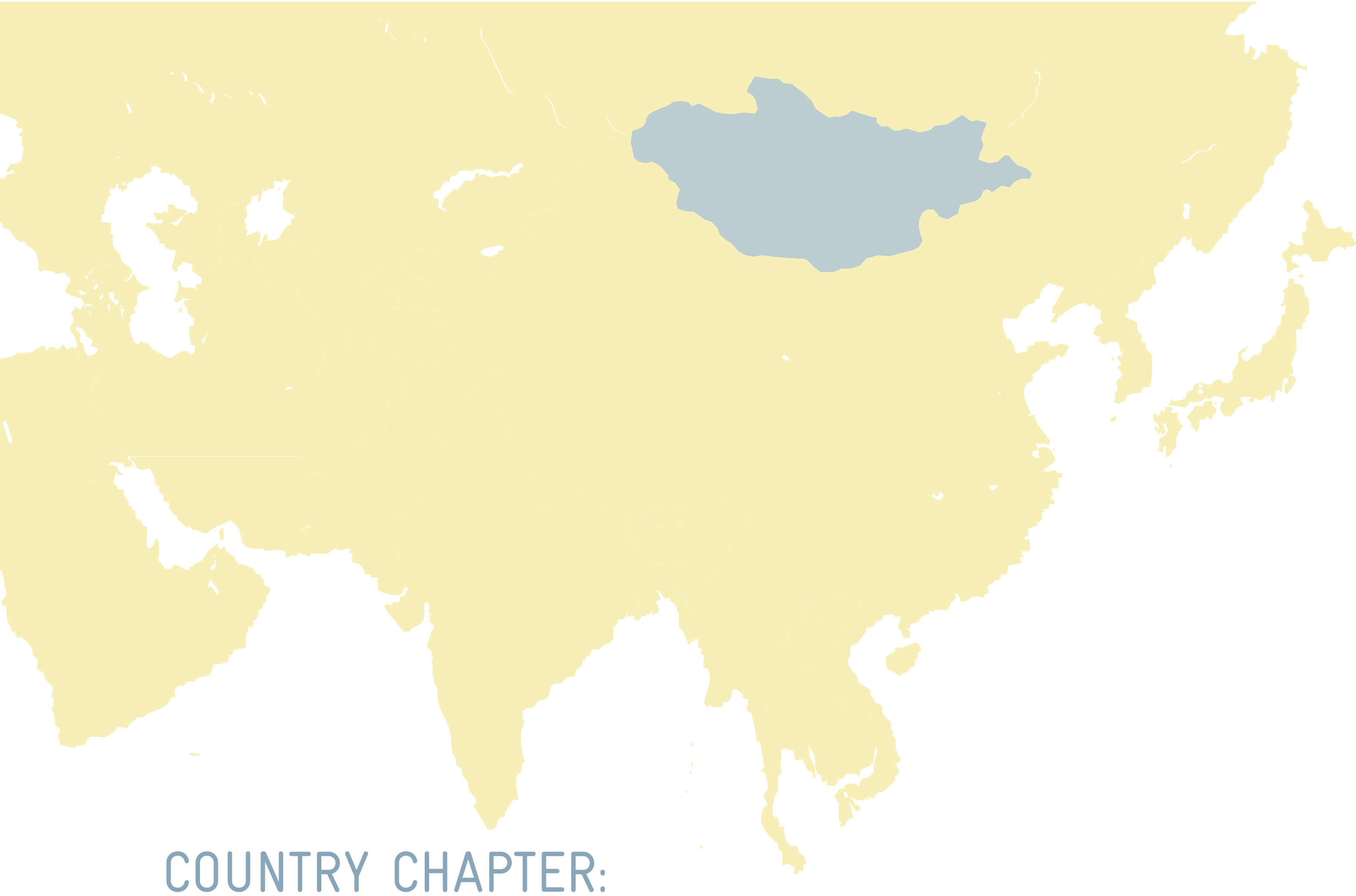
9.12 LAND USE MAP OF THE KYRGYZ REPUBLIC

FIGURE 6

Land Use Map of the Kyrgyz Republic



Source: unknown



COUNTRY CHAPTER: REPUBLIC OF MONGOLIA

Authors and Coordination of Country Chapter

Dr. Ing. Klaus Jorde
Entec Consulting & Engineering AG
St. Gallen, Switzerland
www.entec.ch

Axel Biegert (Dipl. Economist & Pol.)
INTEGRATION UMWelt & Energie GmbH
Graefenberg, Germany
www.integration.org

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS

ACRONYMS AND ABBREVIATIONS

REPUBLIC OF MONGOLIA

ADB	Asian Development Bank
ALGAS	Asian Least Cost Greenhouse Gas Abatement Strategies
CAR	Central Asian Region
C&A	Casals & Associates, Inc.
CCA	Common Country Assessment
CDM	Clean Development Mechanism
CES	Central Energy System
CHPP	Combined Heat and Power Plant
CIS	Commonwealth of Independent States
CNG	Compressed Natural Gas
CSP	Solar Thermal Power
DME	Dimethyl Ether
DNA	Designated National Authority
DoE	Department of Energy
DP	Democratic Party
DUC	Democratic Union Coalition
EA	Energy Authority
ECM	Energy Conservation Measures
EES	Eastern Energy System
ERA	Energy Regulatory Authority
ERDC	Energy Research and Development Centre
FIFTA	Foreign Investment and Foreign Trade Agency of Mongolia
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse Gas Emissions
GTZ	Deutsche Gesellschaft fuer Technische Zusammenarbeit (German Technical Cooperation Agency)
GoM	Government of Mongolia
HH	Household
HPP	Hydro Power Plant
HVL	High Voltage Lines
HVN	High Voltage Network
IBRD	International Bank for Reconstruction and Development
ICWC	Interstate Commission for Water Coordination
IDA	International Development Association
IEA	International Energy Agency
IPP	Independent Power Producer
JICA	Japan International Cooperation Agency
JSC	Joint Stock Company
LPG	Liquefied Petroleum Gas
MB&C	Metering, Billing and Collection
MDG	Millennium Development Goals
MFE	Ministry of Fuel and Energy
MME	Ministry of Mineral Resources and Energy
MNE	Ministry of Nature and Environment
MoF	Ministry of Finance and Economy
MoT	Ministry of Trade
MPRP	Mongolian People's Revolutionary Party
MSY	Mongolian Statistical Yearbook
n.a.	not applicable
NGO	Non-Governmental Organization
NREC	National Renewable Energy Centre
NREL	National Renewable Energy Laboratory
O&M	Operation and Maintenance
OECD	Organization for Economic Cooperation and Development

PPA	Power Purchase Agreement
PRC	People's Republic of China
PREGA	Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement
RE	Renewable Energy
SHS	Solar Home Systems
SUST	State University for Science Technology of Mongolia
TDB	Trade and Development Bank of Mongolia
TAF	The Asia Foundation
UBEDO	Ulaanbaatar Electricity Distribution Company
UN	United Nations
UNCAC	United Nations Convention Against Corruption
UDC	Unified Dispatch Centre
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
USCSP	United States Country Studies Program
USAID	United States Agency for International Development
USD	United States Dollars
VAT	Value Added Tax
WB	World Bank
WES	Western Energy System
WIPO	World Intellectual Property Organization
WTO	World Trade Organization
WTP	Willingness to Pay

MEASUREMENTS

°C	degree Celsius
bbl	barrel
Gcal	giga calorie
GW	gigawatt hour (1 GW = 1,000,000 kWh)
kJ	kilojoule (1 kJ = 1,000 Joules)
ktoe	kilotons of oil equivalent (1 ktoe = 11 630 000 kWh)
kV	kilovolt
kW	kilowatt
kWh	kilowatt hour
l	liter
m	meter
m^2	square meter
MW	megawatt (1MW = 1000 kW)
TWh	terawatt hour (1 TWh = 1,000,000,000 kWh)

APPLIED CURRENCY CONVERSION FACTORS

2004: 1 USD = 1,212 MNT
2005: 1 USD = 1,227 MNT
2006: 1 USD = 1,165 MNT
2007: 1 USD = 1,170 MNT
2008: 1 USD = 1,265 MNT
2009: 1 USD = 1,460 MNT

1 SUMMARY

The Mongolian energy sector is strongly dominated by fossil energy resources. Renewable Energy (RE) resources have remained largely unexploited due to low energy tariffs and the focus on the large local coal resource, which have been perceived as the main strategic energy resource to define the long-term economic development of the country. The development of RE resources has been strongly driven by the Government and international donors. Due to regulatory barriers, missing know-how and financial attractiveness, private investors have not become involved in the sector. The two areas where RE has played an important role are stand-alone electricity supply systems for nomadic households and isolated grid RE-Diesel hybrid systems for rural centers. Moreover, some small and mini Hydro Power Plants and wind farms have been built. RE sources currently represent about 3% of country's total electricity generating capacity. Especially solar, wind and hydro power as well as geothermal energy offer large untapped potentials. The improvement of the information base on technical and economical potentials for energy system design purposes is under progress.

Compared to its neighboring countries, the general investment conditions in Mongolia are quite favorable for international investors and over the last two years, the perspectives for the private sector to develop RE in Mongolia have become more promising. In its attempt to diversify the country's energy supply and reduce its dependence from international petroleum imports, the Government has introduced a feed-in tariff system for RE, allowed for independent power generation to attract private investment and massively extended the grid. The rates for grid-connected RE resources range between 0.05 USD/kWh for hydro power and 0.18 USD/kWh for solar power. As private independent power generation practice is still rudimentary and economic feasibility of RE projects under the current conditions is still to be proved, the cooperation with international donor programs in the form of public private partnership or through joint ventures with local partners might be suitable for international investors to gain first experiences.

2 COUNTRY INTRODUCTION

2.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Mongolia is a landlocked country located between latitudes 41°35' and 52°6' North and longitudes 87°47' and 119°57' East. Its total land border covers 8,114 km, northern borders with Russia 3,485 km and southern borders with China 4,677 km. Mongolia has a total land area of 1.564 million km² and is the 19th largest country in the world. The average altitude is 1,580 m above sea level. The highest point is the Huiten peak in Tavan Bogd Mountain (4,374 m) in the West and the lowest is the Hoh Nuur lake depression in the East (518 m). The capital city Ulaanbaatar is situated 1,350 m above sea level.

Mongolia has a continental climate. The climatic conditions are tough with very cold and dry winter and short summer periods. The average temperature in January is –20 to –30 °C falling well below –50 °C in unfavorable areas. Rainfall decreases from North to South, creating three typical ecological zones with mountain forests in the North, followed by pastural land in the central regional and the desert region in the South. Land usage is that arable land is 1 %, permanent pasture 80 %, forest and woodland 9 % and other 10 % (as of 1993).

FIGURE 1

Map of Mongolia

2.2 POLITICAL AND ECONOMIC DEVELOPMENT

After a decade of transition and despite the numerous crises that have affected the economy, Mongolia has achieved reasonable political and macroeconomic stability. Mongolia has a parliamentary democratic form of government. The country has established the basic institutions and policy framework to enable private sector development that currently accounts for more than 80 % of the economy.

The current political system is a semi-presidential representative democratic republic with a multi-party system and separated legislative, executive and judiciary power adopted in 1992 through the new constitution. The executive branch consists of the president and the Government. The president is nominated by parties and directly elected by citizens for a four-year term and a maximum of two terms. The Government of Mongolia (GoM) is appointed by the unicameral parliament, State Great Hural. The State Great Hural (legislative branch) has 76 seats, and its members are elected by popular voting for four-year terms. It appoints the GoM. Over the last years, there have been two dominating parties: the Mongolian People's Revolutionary Party (MPRP) and Democratic Party (DP). Government changes frequently and changes have the tendency to be accompanied by political tensions.[1] At the last election held in June 2008, the majority of the seats (45) were won by MPRP. 28 seats were won by DP who after rumors established a coalition government. The Green Party and Civil Will Party have won one seat in parliament each, while another one was won by an independent nominee. The judiciary branch is independent. Besides of the Supreme Court determining the interpretation of laws, there is also a constitutional court with nine members to control the conformity of laws with the constitution. Mongolia has no political conflict with neighboring nations. The foreign policy priority of Mongolia is to develop long-term, stable and good neighborly relations with its two adjoining countries, the Russian Federation and the People's Republic of China. Mongolia is a member of international organizations like the WTO, the UN and the ADB.

Mongolia's population is young, sparsely distributed and has been growing rapidly. The estimated population of 2.12 million in 1989 increased to 2.61 million in 2007. At the same time Mongolia has the lowest population density worldwide: 1.9 people per km² only. Nearly every second Mongolian still lives in rural areas (1995 48.1 %; 2002 42.8 %). The majority of the rural population is nomadic and their main source of income is livestock breeding. The lack of job opportunities and poor social infrastructure, however are the main reasons that force a large number of families to migrate to the urban centers, e. g. the capitals of Aimag and Ulaanbaatar. The migration especially of young people not only the increases the difficulties of rural development, but also puts severe pressure on the capitals' infrastructure caused by housing shortage and the fact that large communities live without adequate water supplies, sanitation or transport. Poverty is a serious issue. The proportion of the population below poverty line was still 32.2 % in 2006[2]. In the UN Human Development Index 2006, Mongolia ranks 114th.

Economic activity in Mongolia has traditionally been based on herding and agriculture, but Mongolia also has extensive mineral deposits. Copper, coal, gold, molybdenum, fluorspar, uranium, tin and tungsten account for a large part of industrial production and foreign direct investment. After an economically difficult decade in the 1990s and harsh winters in 2000–2002, Mongolia has experienced good economic growth rates in the last five years – mainly due to the increasing copper prices. The construction sector in the capital is experiencing a boom phase with a growth rate of 6 % and 0.43 Mio m² of new floor area built in 2007. In 2007, Mongolia's GDP reached 3.89 billion USD (4.557.512,1 MNT) and the GDP growth rate was 9.9 %. The main economic partner is the People's Republic of China. Trade with China represents more than half of Mongolia's total external trade – about 70 %

1 IN THE PERIOD BETWEEN 1996-2000 THE CABINET OF GOM CHANGED FOUR TIMES DUE TO INTERNAL CONFLICT OF RULING DEMOCRATIC COALITION AND IN BETWEEN 2004 AND 2008 THREE TIMES DUE TO POLITICAL INTEREST OF A PART OF THE COALITION GOVERNMENT LED BY MPRP.

2 NATIONAL STATISTICAL OFFICE OF MONGOLIA, 2007

TABLE 1
Key Dates & Indicators

INDICATOR	2000	2001	2002	2003	2004	2005	2006	2007
Population (million)	2.40	2.42	2.45	2.48	2.51	2.55	2.58	2.61
Population growth (annual)	0.80 %	0.80 %	1.20 %	1.20 %	1.20 %	1.60 %	1.2 %	1.1 %
GNI per capita, PPP (USD)	1,790	1,890	1,970	2,120	2,380	2,550	2,810	3,160
GDP (billion USD)	1.09	1.17	1.27	1.49	1.81	2.31	3.13	3.89
GDP growth (annual %)	0. %	3. %	4.70 %	7.00 %	10.60 %	7.30 %	8.6 %	9.9 %
Agriculture, value added (% of GDP)	33 %	29 %	24 %	24 %	25 %	25 %	22 %	21 %
Industry, value added (% of GDP)	20 %	21 %	22 %	25 %	30 %	34 %	42 %	35 %
Services, value added (% of GDP)	47 %	50 %	54 %	51 %	45 %	41 %	36 %	44 %
Exports of goods and services (% of GDP)	56 %	55 %	56 %	58 %	67 %	64 %	65 %	n. a.
External debt, total (DOD; million USD)	896	885	1,035	1,472	1,518	1,327	1,444	n. a.
Foreign direct investment, net inflows (BoP, million USD)	54	43	78	131	93	185	344	n. a.
Official development assistance and official aid (million USD)	217	211	208	250	255	221	203	n. a.
Inflation rate (annual)	26.1 %	6.3 %	5.1 %	9.8 %	17.2 %	20.4 %	23.1 %	11.7 %

Source: author's compilation adapted from World Development Indicators database, as of 2009

of Mongolia's exports go to China. The heavy dependence on climatic conditions, commodity production and trade also makes the economy highly vulnerable to natural adversities and price volatility in world commodity markets, limiting the country's long-term prospects of economic development, especially since the revenues from the key commodities are the main sources of the Government's fiscal revenues and the country's foreign exchange earnings. Mongolia has recently experienced the highest inflation rate in over a decade as consumer prices in 2007 rose 15 %, largely because of the increased costs of imported fuel and food. Although still nearly 50 % of economically active people are engaged in agriculture and stock farming, the employment sector also experiences a transition process towards an increased employment rate in the industrial and service sector.

LAND AREA:	1,564,000 km^2
POPULATION:	2.61 million (as of 2007)
DENSITY:	1.9 inhabitants/km^2
BIGGEST CITIES	Ulaanbaatar (1.00 million), Erdenet (0.09 million)
LANGUAGE:	Khalkha Mongol
CLIMATE:	Mongolia has a continental climate; the climatic conditions are tough with very cold and dry winters and short summer periods.
TEMPERATURES:	The average temperature in January is -20°C to –30°C falling well below –50°C in unfavorable areas
ALTITUDE:	518 m to 4,374 m; average altitude: 1,580 m
RIVERS:	There are about 3,800 small rivers with a total length of 65,000 km in Mongolia. The physical hydroenergy potential is currently estimated at 6,200 MW. Many rivers freeze over during the winter and cannot provide year-round electricity.
ECOSYSTEM AREAS:	Forests and woodland (9 %), permanent pasture (80 %), arable land (1 %)
GDP – PER CAPITA (PPP):	3,160 USD (as of 2007)
INFLATION RATE:	11.7 % (as of 2007)
AGRICULTURE:	Wheat, barley, vegetables, forage crops, sheep, goats, cattle, camels, horses
INDUSTRIES:	construction and construction materials, mining (coal, copper, molybdenum, fluorspar, tin, tungsten, and gold), oil, food and beverages, processing of animal products, cashmere and natural fiber manufacturing
ELECTRICITY – PRODUCTION:	4.2 billion kWh (as of 2008)
ELECTRICITY – CONSUMPTION:	3.1 billion kWh (as of 2008)
ELECTRICITY – TARIFFS:	34–114 MNT/kWh
NATIONAL ELECTRICITY CAPACITY IN OPERATION:	828 MW
ELECTRIFICATION RATE:	87.5 %
NATURAL RESOURCES:	Coal, copper, molybdenum, tungsten, phosphates, tin, nickel, zinc, fluorspar, gold, silver, iron
OIL – PRODUCTION:	3,216 barrels/day (as of 2007)
OIL – IMPORT:	17,680 barrels/day (as of 2007)
OIL – CONSUMPTION:	12,780 barrels/day (as of 2007)
OIL – PROVEN RESERVES:	0 billion barrels
NATURAL GAS – PRODUCTION:	0 billion cubic feet
NATURAL GAS – PROVEN RESERVES:	0 billion cubic feet
EXPORTS:	2.5 billion USD f.o.b. (as of 2008)
EXPORTS – COMMODITIES:	Copper, apparel, livestock, animal products, cashmere, wool, hides, fluorspar, other non-ferrous metals, coal
EXPORTS – PARTNERS:	China 71.9 %, Canada 10.7 %, US 4.8 % (as of 2007)
IMPORTS:	3.6 billion USD c.i.f. (as of 2008)
IMPORTS – COMMODITIES:	Machinery and equipment, fuel, cars, food products, industrial consumer goods, chemicals, building materials, sugar, tea
IMPORTS – PARTNERS:	China 32 %, Russia 29.4 %, South Korea 7.9 %, Japan 7.2 % (as of 2007)
EXCHANGE RATE:	1 EUR = 1,908 Mongolian Tugrik (4.2009)

Source: CIA World Fact Book, as of 2009

3 ENERGY MARKET OF MONGOLIA

The energy sector in Mongolia accounts for about 2.5 % of GDP, whereof 3.5 % are being directly employed in the sector. Currently, 12.5 % of the population lack electricity and about 40 % are not connected to any central heat grid[3]. The energy sector generated 4,200 GWh of electricity and 7.76 million Gcal of heat in 2008, an increase of 8 % and 0.5 % respectively as compared to the previous year[4]. The total energy consumption increased by 0.4 % in 2008. Mongolia has significant coal resources and production. Nonetheless Mongolia is strongly dependent on energy imports from Russia. 95 % of its petroleum products and a substantial amount of electric power are purchased from Russia. The energy sector of Mongolia is the largest contributor to Greenhouse Gas (GHG) emissions. The cold continental climate, the reliance on wood and the low energy value of Mongolian coal contribute to a high rate of CO_2 emission when measured on a per-capita basis. The estimated national CO_2 emission for 1990 was 19.1 million tons or roughly 7.9 tons per-capita. This is higher than the per-capita rates for Southeast Asia (excluding Bangladesh and Malaysia) and Africa and exceeds the world average. Using current estimates of population growth, Mongolia may experience a three-fold increase in energy demand by the year 2020[5]. At the same time, the risk of climate change or even prolonged extreme climatic events could have dramatic impacts on its economy and natural systems and – in some cases – even run danger of irreversible damage to the ecosystem[6].

Since 1990, Mongolia has been attempting to rehabilitate, upgrade and expand its energy systems because it has recognized that a sustainable economic and social development of Mongolia is strongly hampered without efficient, reliable and reasonably priced electricity and fuels. Heat is essential for survival, and the reliable supply of electricity is a key to improve economy and peoples' daily lives. In its transformation from totally subsidized non-market operations to commercialized market-based operations, the country faces a number of important and often conflicting challenges.

SHORT BUSINESS INFO

Mongolia's energy sector is the largest contributor to Greenhouse Gas (GHG) emissions. Since 1990 its Government has been rehabilitating and upgrading its energy system.

3.1 IMPORTANT PLAYERS OF THE KAZAKH ENERGY MARKET

The following key institutions are involved in regulating and managing the sector7:

As for all other national policies, the Parliament of Mongolia (Great Khural) is in charge of approving the state policy in energy sector.

The Ministry of Mineral Resources and Energy (MME) is the Ministry in charge of policy development. Its targets include the development of energy resources, energy use, import and export of energy, construction of power plants, lines and networks, energy conservation, use of RE sources and the dissemination of RE technologies. The MME is also responsible for monitoring the sector, approving rules and regulations for the sector and international cooperation projects.

The institution for regulating the energy generation, transmission, distribution, dispatching and supply of energy is the Energy Regulatory Authority of Mongolia (ERA). It was established in July 2001 as an independent regulatory organization to implement the Law of Mongolia on Energy. ERA's main duties include the issuing of licenses to energy companies and other organizations operating in the sector. ERA also reviews and approves energy tariffs throughout Mongolia. It monitors the implementation and compliance with the terms and requirements of the licenses as well as with approved prices and tariffs and is also the complaint and dispute resolving body.

Besides ERA, there is an MME implementing agency, i. e. the Energy Authority (EA). The EA is responsible for the organization of research, project and program implementation and technical monitoring for the construction of energy facilities in the country. The EA consists of an administration and management division, a projects and program implementation division, a financial and economic division, a Renewable Energy division, a research and information division, a conventional energy division and a technical inspection division. As part of the recent restructuring of the government, the former implementing agency of National Renewable Energy Center was merged into the Energy Authority. The National Renewable Energy Center has become a state-owned company and is no longer involved in policy-making.

The electricity and heat sector is controlled by 18 large-scale shareholding companies. The shares of these companies are owned by the MME, the State Property Committee and the Ministry of Finance and Economy (MoF) according to the provision of relevant legislation. Among them, Darkhan-Selenge Electricity Distribution System is a private company. Since energy sector enterprises are state-owned, major investments required for building transmission and distribution lines and networks have been implemented by the MoF. The MoF is also responsible for budget planning and budget supervision of ministries, agencies and local authorities.

A license for import or export of electricity through the main network is granted to a holder of a license for transmission through this network. The MME determines the quantity of electricity to be imported. A holder of a license for import or export of electricity shall agree with the dispatching center on time, duration and technical conditions.

Finally when it comes to the application and registration of Clean Development Mechanism (CDM) projects, the Ministry of Nature and Environment (MNE) is acting as the Designated National Authority (DNA) for Clean Energy Development Mechanism. It has formed the National Bureau of Clean Development Mechanism.

3 INFORMATION FROM THE MINISTRY OF MINERAL RESOURCES AND ENERGY, AS OF 2009

4 NATIONAL STATISTICAL OFFICE OF MONGOLIA, 2009

5 SEE GTZ/INT, 2004

6 AGRICULTURE, INCLUDING CROP AND LIVESTOCK PRODUCTION, WATER AND FOREST RESOURCES AS WELL AS BIODIVERSITY ARE CONSIDERED TO BE AMONG THE MOST VULNERABLE SYSTEMS (SEE MNE/NAPCC, 2006).

7 CONTACT DETAILS OF THE NAMED INSTITUTIONS CAN BE FOUND IN CHAPTER 7

3.2 PRIMARY ENERGY CONSUMPTION, TRANSMISSION AND PRICES

Due to its growing population, Mongolia's primary energy consumption has steadily increased over the last years while consumption intensity remained the same. In 2007, a total of about 5 million toe of primary energy was consumed in Mongolia. With approximately 2 toe, the average consumption per capita is still relatively low, yet equals one fifth of the German average. The main primary energy resource is coal with a share varying between 83 and 87 %. Mongolia is a coal exporting country, mainly to China. With a share of 13–17 %, petroleum products are the second most important primary energy resource. 95 % are imported from Russia, with strong dependency on the Russian petroleum company ROSNEFT, and the remaining 5 % originate from China. Some small but growing amounts of raw petroleum have recently been produced in Mongolia and exported to China for processing (exported raw petroleum in 2007: 850,220 barrels)[9]. Although exact figures are not available, the contribution of RE resources to the country's primary energy supply can be considered as marginal. RE (hydro power, wind and solar), however, gain steadily in importance, mainly in electricity generation for rural areas. The share of RE in total electricity generation capacities is 3 %[10]. Finally, Liquefied Petroleum Gas (LPG) plays a limited but growing role in Mongolia. Since 1998, small amounts are being imported for household consumption, transport, tourism and industry in canisters from China and trucked throughout Mongolia, which is a very expensive procedure. In 2007, approximately 30,000 customers in Aimags and Ulaanbaatar used LPG. There are 10 licensees to deliver and service LPG. The price of LPG in Ulaanbaatar is 1,100–1,300 MNT; in rural areas it is 1,500 up to 5,000 MNT per kg. In 2005, the GoM has approved a program promoting the use of Liquefied Flammable Gas (Liquefied Flammable Gas Program, Government resolution #140) and the development of an LPG network, which provides a legal basis to establish an industry delivering Compressed Natural Gas (CNG) for vehicles and Liquefied Petroleum Gas (LPG) for household consumption. This effort is aimed at diversifying energy sources as well as providing more efficient, less polluting and, in the case of LPG, possibly cheaper fuels than petrol, diesel and kerosene. The program is being implemented from 2006 to 2010. To date, four private companies have been working out the details of how to develop the market for these products, but data on their current levels of investment and future plans are not available. In 2007, the establishment of a laboratory for gas quality as well as for testing and certification of gas tanks and equipment has been started with a budget of 90 million MNT. A total investment of 360 million MNT has been planned for this project.[11]

TABLE 2

Primary Energy Consumption by Source (in ktoe)

	2001	2002	2003	2004	2005	2006	2007	2008
CONSUMPTION – TOTAL[8]	4,177.90	4,399.00	4,189.30	4,269.00	4,459.00	4,704.40	5,025.60	5,045.30
Coal and coal equivalents	3,632.30	3,874.70	3,613.20	3,632.00	3,830.80	3,983.80	4,134.30	4,090.20
Natural gas	n.a.	0.26	0.56	1.77	5.88	n.a.	7.34	11.00
Oil and petroleum products	545.60	524.00	575.60	635.30	622.40	720.60	884.00	943.70
Nuclear	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydroelectric power	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.40
Other RE	neg.	neg.	neg.	neg.	neg.	neg.	neg.	neg.

Source: author's compilation adapted from NSO, as of 2005 and 2009

Transmission and Distribution System

Besides the CES, Mongolia's electricity grid also consists of the Western (WES), the Eastern Energy System (EES) and five small independent power systems with diesel and thermal power stations, which are not connected to the three grids, and approximately 90 non-connected Soum centers. CES covers 11 Aimag centers and 102 Soum centers; the WES covers 3 Aimag centers, 8 Soum centers; isolated Aimag energy systems cover 12 Soum centers and 3 Soum centers are connected to a thermal power station. The CES and the WES are connected to Russian power grid. Several Soum centers in the southern part of Mongolia are connected to the electricity grid of China through a 35 kV transmission line (for details see tables 5 and 6). A map of Mongolia's grid and power transmission lines and substation figures can be found in annex 0.

In 2008, the electrification rate was 87.5 %. While people in urban areas have virtually all been electrified, only 43 % of the nomadic people have access to electricity and 80–85 % of villages and Soum centers were electrified. Especially in the non-interconnected villages and Soum centers, supply is limited to 3–4 hours per day during wintertime as the fuel cost for diesel generators can hardly to be afforded by people.

Although technical and non-technical losses have been substantially reduced from 39 % in 2001 to 26 % in 2009, there is still substantial space for improvement especially by replacing older facilities, by reducing power theft and by reducing the imbalance of power distribution on larger distances in rural areas.[12]

8 FIGURES DO NOT INCLUDE ELECTRICITY IMPORTS OR ENERGY GENERATED FROM RE RESOURCES.

9 MINERAL RESOURCES AND PETROLEUM AUTHORITY

10 SEE ALSO FIGURE 2 BELOW; THE 3 % OF RE SHARES HERE DERIVE FROM HPP, AS WELL AS WIND AND SOLAR

11 STATUS OF IMPLEMENTATION OF NATIONAL PROGRAMS, GOVERNMENT WEBSITE: WWW.OPEN-GOVERNMENT.MN

12 ACCORDING TO A BROCHURE OF CRETG INC., MORE THAN 50 % OF THE EQUIPMENT OF THE CES GRID IS OLDER THAN 20 YEARS, 18,9 % THEREOF IS BETWEEN 30 AND 45 YEARS OLD.

The erection of 7,000 km of new transmission lines is planned and will tie massive investments. During 2007–2008, 245 km of 110 kV, 1,807 km of 35 kV, 2,967 km of 15 kV, 342 km of 10 kV and total length of 5,361 km transmission lines were launched for construction.

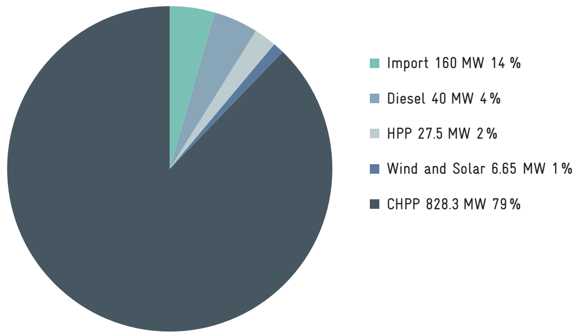
Electricity Sector and Natural Resources

Electricity

Gross generation capacities of electricity have continuously been expanded in the last years with rates of 1–4 %. In 2007, Mongolia's total installed electricity generation capacity was 1,062 MW and the total electricity generated 3,700 GWh (as opposed to 4,000 GWh in 2008). About 87 % are generated in Mongolia; the rest is being imported from Russia and partly from Kyrgyzstan. The dominant generation facilities are 7 coal fired combined heat and power plants (CHPP) with a total generation capacity of 828.8 MW equaling 79 % of the total electricity generation capacity. Furthermore, 7 % of the capacity is provided by 600 small diesel generators with individual capacities of 60–1,000 kW as well as 13 hydroelectric power plans with a total capacity of 27.5 MW, two wind power plants, two solar power plants and a solar/wind hybrid system with a capacity of 6.65 MW. The backing for the Western Energy System from Russia equals approximately a capacity of 160 MW which is supplied through interconnected Russian power plants (see Figure 1). More details on types, capacities and commissioning dates of individual generation facilities can be found in annex 0.

Electricity consumption figures in table 3 show that Mongolia's electricity demand has been growing stronger than the supply with growth rates between 3.4 and 8 % between 2001 and 2007. In 2008, the total consumption was 3,093 GWh with a peak load of 576 MW. In the biggest energy system, CES, the lowest and peak load in 2004 has reached 240 MW and 560 MW, respectively. The largest consumer groups are industry and the construction business with a share of roughly 60 %, followed by households and community services (25 %) and transport and communication (5 %).

FIGURE 2
Composition of Electricity Generating Facilities by Sources in 2007



Source: data compiled by the author from different sources

TABLE 3
Electricity Production and Consumption, Import & Exports (GWh)

YEARS	2001	2002	2003	2004	2005	2006	2007	2008
Production total	3,223.0	3,279.0	3,309.0	3,474.3	3,586.4	3,712.5	3,896.1	4,198.2
Gross generation	3,017.0	3,111.7	3,137.7	3,033.4	3,418.9	3,544.2	3,700.7	4,000.6
Import	196.0	167.3	171.3	170.8	167.5	168.3	195.4	197.6
Consumption total	1,948.0	2,031.7	2,194.6	2,357.0	2,534.0	2,619.7	2,829.1	3,093.3
Industry & Construction	1,204.0	1,260.1	1,361.1	1,458.8	1,569.1	1,627.0	1,745.6	1,918.1
Transport and Communication	87.0	84.7	91.5	98.5	105.8	109.4	117.3	128.7
Agriculture	17.0	22.0	23.8	25.6	27.5	24.3	26.1	32.6
Communal housing	476.0	487.1	526.1	567.6	609.3.	629.2	694.6	742.3
Other	164.0	177.8	192.1	206.5	222.3	229.8	245.5	271.5
Export	18.0	15.5	6.7	8.2	11.9	20.8	10.1	15.9
Technical losses	1,257.0 39 %	1,231.8 38 %	1,107.7 33 %	1,109.1 32 %	1,040.5 29 %	1,072.0 29 %	1,056.9 27 %	1,089.1 26 %

Source: author's compilation adapted from NSO, Statistical Yearbooks of Mongolia 2004–2008

Having no or only negligibly resources of gas and oil, coal is perceived as the main strategic energy resource to define long term economic development of the country.

Coal

Mongolia's total coal inferred reserves of 150 billion tons have been acknowledged. The preliminary and detailed exploration activities resulted in about 20 billion tons of coal reserves. The total reserves to be used for energy generation is 12.2 billion tons including 1 billion tons of hard and coking coal and 10.1 billion tons of B1 and B2 type brown coal. The largest coal deposits with measured resources are Baganur, Shivee-Ovoo, Ovghudag, Tevshiin Gobi and Tsaidam Nuur brown coal deposits, Nalaih, Sharyn Gol, Nuurst Hotgor and Ulaan-Ovoo hard coal deposits and Tavantolgoi coking coal deposits. About 90 % of the measured coal resources are located in the central economic region.

Currently 30 private, 3 local and 2 state-owned mines are in operation. The use of 9 million tons of coal in 2007 is the highest in the last 10 years, whereof Mongolia consumed 6 million tons and exported 3.3 million tons to the Chinese market[13]. A coal balance sheet is presented in annex 0.

Nuclear fuel and other fuels

It is noted in the Uranium Redbook that Mongolia has large uranium resources, which are total about 0.03 % of the world uranium reserves (although some sources say 5–10 %)[14]. Uranium is the main source of nuclear fuel and there is a need to determine reserves by enhancing uranium exploration and to study the possibility of producing nuclear energy.

Prices

The Energy Regulatory Authority (ERA) is responsible for providing licenses to the various new operating entities in the energy sector and approves of their proposed tariff structures. In 2004, a new tariff setting method was approved by the Regulator's Boards of the ERA. By this method, both cost covering and fair return are expected to be achieved. The new method determines the production cost on the base of the past three years' records and adopts the rate basis method for return, which determines the return by multiplying the value of employed assets by the average rate of interest (profit) according to the capital structure.

Electricity tariffs differ between the grids and user groups. In June 2008, ERA has introduced multi tariffs, progressive tariffs and base line tariffs for different consumer groups. Metered tariffs for residential customers in CES are between 58–68 MNT per kWh, in the WES and EES 34–68 MNT per kWh. Industry pays time-dependent rates between 39–114 MNT in CES and EES and 90 MNT per kWh in the WES. Transitioning from a totally subsidized electricity system, not all tariffs set by ERA can be considered as cost-covering. Cost-covering is a big problem especially in isolated Aimag diesel stations where operation costs well exceed revenues from tariffs. The Government still subsidizes a significant share of the difference between the operating costs and revenue from tariffs, adding up to 5 million USD per year. While Aimag utilities are heavily subsidized, no subsidies are provided to Soum utilities, where households are relatively poor and the cost of electricity supply is higher.

A comparable situation applies for heat tariffs. As shown in table 5, the heat prices have strongly increased since 1990 when heating was nearly supplied for free. A more detailed overview of electricity and heating tariffs for different consumers and grids are shown in the tables in the appendices 0 and 0.

The price of petroleum products is an important benchmark for RE technologies. As to be seen in table 6, the petroleum prices have increased strongly over the last four years. In December 2008, for example, the price of a liter of diesel was at 1.11 USD, for a liter of A-95 1.26 USD and for a kg of LPG 1.26 USD. Although the prices are expected to be reduced in the coming months following the world market price development, the prices of petroleum products are high and make e. g. diesel-generated electricity in rural areas quite expensive.

Import and Export of Energy

In general, Mongolia has sufficient resources of fossil fuels to cover its own demand as well as to export large amounts. Due to insufficient processing capacities and regional differences, oil and gas are also imported. Numbers on quantities can be found in the Annex.

Export of electricity to Russia amounted to 3.6 billion kWh in 2007, import from Russia 2.2 billion kWh in the same period. Import from Kyrgyzstan was 1.2 billion kWh. The dynamics of 2000–2007 generation and consumption and energy import and export are presented in the Annex.

Growth Predictions for the Energy Sector

The development of the power demand in the grid was estimated in the Asian Development Bank supported Master Plan[15]. The plan indicates that generation and demand are scheduled to increase at an annual average growth rate of 2.9 % between 2001 and 2020. Based on an improved generation and transmission efficiency, the total amount of electricity sold is assumed to grow from 2,082 GWh in 2005 to 3,276 GWh in 2020 in the medium scenario. The sales figures are assumed to be conservative as actual sales figures are already exceeding the ADB forecast by approximately 8 %. Besides the need to improve efficiency in generation and transmission, estimations also raise the need for new generation capacities.

Concerning heat, the ADB has estimated the demand for Ulaanbaatar city to increase at an annual average growth rate of 2 % during 2001–2010 and 1 % during 2010–2020 in the medium scenario. Including 15 % losses, the gross distributed heat in Ulaanbaatar city is assumed to grow from 5,570 GWh in 2005 to 7,970 GWh in 2020. Total heating power demand in 5 other urban centers with CHPPs is forecasted to increase from 1,600 GWh in 2005 to 2,620 GWh in 2020. More details are shown in table 6.

13 SEE ALSO FRANKLIN/SOMERS, 2008
14 OECD NUCLEAR ENERGY AGENCY (NEA) AND IAEA, AS OF 1995
15 SEE ASIAN DEVELOPMENT BANK, 2002

TABLE 4

Historical Heating Price for Residential Users 1990–2007, MNT

YEARS	1990	1991–1992	1993	1994–1995	1996	1997	1998–1999	2000–2001	2002–2004	2005–2007
Residential consumers (MNT/m^2)	3.0	4.5	19.0	30.0	48.0	60.0	65.0	160.0	160.0	160.0
Residential hot water (MNT/person)	0.8	1.6	6.8	42.0	67.0	100.0	109.0	400.0	520.0	620.0

Source: author's compilation adapted from ERA, as of 2007

TABLE 5

Prices of Selected Petroleum Products 2004–2008

YEAR/ PRICE[16]	A-80 (PER L)		A-92 (PER L)		A-95 (PER L)		A-98 (PER L)		DIESEL (PER L)		LPG[17] (PER KG)	
	MNT	USD	MNT	USD	MNT	USD	MNT	USD	MNT	USD	MNT	USD
2004	620	0.51	695	0.57	735	0.61	n. a.	n. a.	0.59	710	n. a.	n. a.
2005	730	0.59	790	0.64	830	0.68	n. a.	n. a.	865	0.70	n. a.	n. a.
2006	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.
2007	750–800	0.66	910–930	0.79	1030	0.88	1060	0.91	950–980	0.82	n. a.	n. a.
2008[18]	1,050	0.83	1,140	0.90	1,600	1.26	1,750	1.38	1,400	1.11	1,600	1.26

Source: Petrovis, information available on the Internet Archive www.archive.org (www.archive.org)

TABLE 6

Electricity Generation and Demand Forecast 2005–2020

YEAR	CES GENERATED	EES GENERATED	WES GENERATED	TOTAL GENERATED IN GRID	SHARE SOLD	TOTAL SOLD IN GRID
2000	2,871.0	58.7	22.7	2,952.4	60 %	1,771.4
2005	3,206.0	65.6	25.3	3,296.9	63 %	2,082.4
2006	3,275.3	67.0	25.9	3,368.2	64 %	2,149.5
2007	3,346.2	68.5	26.4	3,441.1	64 %	2,218.6
2008	3,418.5	69.9	27.0	3,515.5	65 %	2,290.0
2009	3,492.5	71.5	27.6	3,591.5	66 %	2,363.7
2010	3,568.0	73.0	28.2	3,669.2	66 %	2,439.8
2011	3,654.5	78.0	29.1	3,761.7	67 %	2,527.1
2012	3,743.1	83.4	30.1	3,856.7	68 %	2,617.7
2013	3,833.9	89.2	31.1	3,954.2	69 %	2,711.6
2014	3,926.8	95.4	32.2	4,054.3	69 %	2,809.0
2015	4,022.0	82.3	31.8	4,136.1	70 %	2,895.3
2020	4,552.0	93.1	36.0	4,681.0	70 %	3,276.7

Source: author's calculations based on Asian Development Bank, as of 2002

TABLE 7

Heat Generation and Demand Forecast of Urban Centers with CHPPs in GWh, 2005–2020

YEAR	ULAANBAATAR	DARKHAN	ERDENET	BAGANUUR	CHOIBALSAN	DALAN-ZADGAD	TOTAL
2000	4,853	579	558	258	173	28	6,449
2005	5,573	665	641	296	199	33	7,407
2010	6,495	775	747	345	232	38	8,632
2015	7,171	856	825	381	256	42	9,531
2020	7,966	950	916	423	284	47	10,586

Source: ADB, as of 2002

16 APPLIED CURRENCY CONVERSION FACTORS ARE AS FOLLOWS:
2004: 1 USD = 1,212 MNT; 2005 1 USD = 1,227 MNT; 2006 1 USD = 1,165 MNT;
2007 1 USD = 1,170 MNT; 2008 1 USD = 1,265 MNT

17 PERSONAL COMMUNICATION WITH DASHVAANJIL CO.,LTD

18 PRICE OF PETROLEUM PRODUCTS AS OF 28 DECEMBER 2008

4 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

4.1 NATIONAL STRATEGIES AND PROGRAMS TO SUPPORT RENEWABLE ENERGIES

At the beginning of the millennium, the GoM has acknowledged the benefits of RE and initiated in 2001 the 100,000 Solar Ger national program to electrify 100,000 herders in rural areas of Mongolia by subsidized SHS. In June 2005, the Parliament of Mongolia adopted the National Renewable Energy Program targeted to increase the share of RE in the total energy production by supporting the construction of RE power sources in two stages. In the first stage (2005–2010, near-term) the country is supposed to reach a 3–5 % share of RE in the total energy production and in the second stage 20–25 % (2011–2020 mid-term). In the first stage of the program, the Durgun (12 MW) and Taishir (11 MW) Hydro Power Plants were constructed, the 100,000 Solar Ger national program was launched and 12 RE systems for Soum centers with a capacity of 60–150 kW were constructed. By May of 2008, another 70,000 herder families received SHS subsidized by 50 %. Furthermore, the launching of the construction of Orkhon (100 MW) Hydro Power Plant, the conduction of feasibility studies for several hydro power sites and grid connected wind farms and research in new technologies such as fuel cell or hydrogen power sources were planned. In the long run, the program targets to introduce grid connected wind farms and large-scale PV power generating systems in the Gobi desert area. According to the decree of the Parliament of Mongolia on the approval of the National Renewable Energy Program, the GoM is charged to raise funds for implementing the program from sources such as state budget of Mongolia, involvement of domestic investors, international donors and use of CDM. Mongolia has ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1993 and the Kyoto Protocol in 1999 and is committed to its main objective of stabilizing emissions of greenhouse gas at a level that prevents dangerous interference with the climate system.

Since 2007, Mongolia has a Renewable Energy Law. The law is meant to regulate generation and supply of energy utilizing RE sources. It also includes feed-in tariffs for electricity from RE plants. The first power purchase agreement (PPA) was signed for a 50 MW grid-connected wind farm near Ulaanbaatar. The price and tariffs of RE are set for a minimum of ten years starting at the date of law's entry into force. To support the set price of RE in rural area, the law obliges the Government to form a RE fund. The fund will be formed by 50 % of the carbon credits and is intended for state-funded RE projects and other potential sources. The fund will be spent for financing the difference in feed-in tariffs and consumer tariffs for stand-alone RE systems, capacity building, research and development of RE and RE resources assessment. The RE feed-in tariff stated is not applicable to state-funded RE power sources. The tariffs are shown in table 8.

Furthermore, the European Bank for Reconstruction and Development is currently providing technical assistance to the ERA with respect to the implementation of the Renewable Energy Regulatory Development Road Map project. The project will cover assessment and improvement of a feed-in tariff regime related to electricity produced utilizing RE, assess least-cost options for developing RE and affordability of RE in Mongolia and formulate a RE regulatory development road map up to 2020.

The Promotion of Renewable Energy in Mongolia project financed by the German and Dutch Development Cooperation is implemented by the MME and the Energy Authority as Mongolian project partners and by the German Technical Cooperation Agency (GTZ) as German project partner. The third stage of the project, started in 2008, focuses on the following aspects: supporting the establishment of a RE regulatory framework, implementing projects on grid-connected RE systems, capacity building, supporting the introduction solar thermal applications and dissemination of technologies and supporting the set-up of RE professional training curriculum and training materials.

SHORT BUSINESS INFO

Since 2005 Mongolia's Parliament adopted the National Renewable Energy Program, targeted to increase the share of RE in two stages. In the first stage (from 2005–2010) it is planned to reach 3–5 % share of RE and in the second one, 20–25 % (from 2011–2020).

4.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

The transition from a centrally planned economy to a market oriented economy has brought many institutional changes. Since April 2001, when the new Energy Law came into force, fundamental changes have been occurring in the energy sector as well. By passing the new Energy Law[19], the Parliament created the legal basis for restructuring the energy sector including the use of RE technologies. Under the new law, the GoM has implemented several important steps towards creating market conditions in the energy sector, e. g. separation of ownership from regulation or separation of regulation from policy-making. A crucial part of the energy sector restructuring has been the creation of an independent regulatory mechanism by the establishment of the ERA, which enables investment and operation by new domestic and foreign economic entities. Therefore, the state owned energy entities were dismantled according to their lines of business and 18 shareholding companies and companies with limited liabilities have been established in their place.

The Ministry of Fuel and Energy (MFE) has introduced several policies to render the energy supply more independent of imports. As Mongolia has enough coal resources for the next 500 years (about 150 million tons), the exploitation of coal resources, the gasification of coal and the hydrogenation of coal have been the main focus of GoM's policy. The promotion of RE and energy efficiency improvements has been strongly fostered by foreign aid programs. In the last years, however, Mongolia has recognized the value of reducing consumption and the value of RE sources and is now also undertaking the promotion of energy conservation and RE. Another focus has been grid extension to stabilize and electrify great parts of the non-electrified Soum centers. The building of 7,000 km of new trans-

19 THE ENERGY LAW OF MONGOLIA TOOK EFFECT ON 1 JANUARY 2001.

TABLE 8

Renewable Energy Policy Landscape

Renewable Energy Targets	The National Program for Renewable Energy was adopted in 2005. The program is targeted to reach a 3–5% share of RE in the total energy production by 2010 and reach a 20–25%of share by 2020.
Renewable Energy Promotion Policies	In 2007, the Renewable Energy Law was adopted.
Feed-in tariffs	Depending on type of RE source, the followings tariffs have been set: - Grid connected wind power: 0.080–0.095 USD/kWh - Grid connected hydro power (up to 5 MW installed capacity): 0.045–0.060 USD/kWh - Grid connected solar power: 0.150–0.180 USD/kWh - Stand-alone wind power: 0.100–0.150 USD/kWh; - Stand-alone hydro power: 0.080–0.100 USD/kWh (up to 500 kW), 0.050–0.060 USD/kWh (501–2,000 kW), 0.0450–0.050 USD/kWh (2,001–5,000 kW) - Stand-alone solar power: 0.200–0.300 USD/kWh
Renewable portfolio standard	–
Capital subsidies, grants, rebates	–
Investment excise or other tax credits	–
Sales tax, energy tax, or VAT reduction	–
Tradable Renewable Energy certificates	–
Energy production payments or tax credits	–
Net metering	–
Public investment, loans or financing	–
Public competitive bidding	The GoM invested in 12 RE systems for Soum centers in 2007–2008 according to procurement law of Mongolia (direct contracting method had been used).
Municipal Level Policies	The GoM introduced RE in 4 Soum centers in 2006–2007 using public competitive bidding.
Rural Energy Policies	Targeted to electrify all Soum centers using grid extension or RE technology (about 16 Soums shall be electrified by RE according to the Integrated Energy Systems of Mongolia program adopted in 2000 and updated in 2007). In 2001, the GoM initiated the 100,000 Solar Ger national program in order to electrify rural herders by PV systems. Up to May 2008, another 70,000 SHS had been delivered to herders at a subsidized price.
CDM	Framework Convention on Climate Change ratified in 1993, Kyoto Protocol ratified in 1999

UNDP, as of 2008; State Budget Law of Mongolia, as of 2006, State Budget Law of Mongolia, as of 2007, State Development Fund Law of Mongolia, as of 2007; Renewable Energy Law of Mongolia; National Program for Renewable Energy of Mongolia

mission lines has been planned and ties massive investments.[20] The most important policies include the Government's Action Plan for the Energy Sector of Mongolia (2004–2008), the Mongolian Energy System Master Plan (2002–2020), the Governmental Program for an Integrated Energy System of Mongolia and Mongolia's Sustainable Energy Strategy (2000–2010). With the National Program of 100,000 Solar Ger and the National Program for Renewable Energy, the share of RE shall be enhanced. Since 2007, Mongolia has a Renewable Energy Law with feed-in tariffs for electricity from RE plants, which has, however, not yet really been implemented.

The major laws for RE generation and rural electrification are the Energy Law and the Renewable Energy Law. Other relevant legislations include the Environment Protection Law[21], the Law on Environmental Impact Assessment[22], the Law on Land[23], the Law on Construction[24] and the Law on Water[25]. The Energy Law regulates matters relating to energy generation, transmission, distribution, dispatching and supply activities, construction of energy facilities and energy consumption that involve utilization of energy resources. The Renewable Energy Law of Mongolia regulates relations concerning generation and supply of energy utilizing RE sources. According to the RE law, the ERA of Mongolia is obliged to approve a model for a power purchase/sales agreement based on the feed-in tariff for RE depending on the utilized type of RE.[26]

Licensing

The ERA issues licenses for the following: electricity generation, electricity transmission, heat transmission, dispatching, electricity distribution, heat distribution, regulated supply of energy, unregulated supply of energy, importation and exportation of electricity and construction of energy facilities. A license for the construction of energy facilities shall be granted upon an assessment of the environmental impact in accordance with the Law on Environmental Impact Assessment. The construction and operation of power plants (including RE systems) with a capacity of up to 1.5 MW designed for self-supply and the construction of the required transmission and distribution lines – provided that they do not have any negative impact on living conditions and environment – are not subject to license. Licenses for utilization of cross-border power lines, for construction of CHPPs and for conducting activities within the boundary of the main network are issued by the ERA.The term of a license for energy generation and transmission is 5–25 years, a license for the construction of energy facilities is valid for up to 5 years and other licenses for up to 10 years. The licenses can be extended for up to 25 years.

20 SEE MORE DETAILS ON RE REGULATION IN CHAPTER "POLICY FRAMEWORK FOR RENEWABLE ENERGIES".
21 THE ENVIRONMENT PROTECTION LAW TOOK EFFECT ON 20 MARCH 1995.
22 THE LAW ON ENVIRONMENTAL IMPACT ASSESSMENT TOOK EFFECT ON 22 JANUARY 1998.
23 THE LAW ON LAND TOOK EFFECT ON 7 JUNE 2002.
24 THE LAW ON CONSTRUCTION TOOK EFFECT ON 5 FEBRUARY 2008.
25 THE LAW ON WATER TOOK EFFECT ON 22 APRIL 2004.
26 THE RE FEED-IN TARIFF IS SHOWN IN TABLE 8.

Applicants for licenses have to provide the following documents: state registration of legal entity, technical and economic feasibility, energy resources assessment, quantitative and qualitative indicators of energy, specifications of equipment, scope of service and energy balance, environmental impact assessment, action plan for environment protection, sources of financing and financial capability and institutional capability.[27]

Clean Development Mechanism (CDM)

Currently, four projects have been registered for CDM with the DNA.[28] The Taishir HPP and Durgun HPP projects are being financed by a Japanese Carbon Fund. Furthermore, two climate change related projects have been implemented in Mongolia, namely the U. S. Country Studies Program (USCSP) and ALGAS (Asian Least Cost Greenhouse Gas Abatement Strategies) project. The goals of the USCSP project are to enhance the country's capabilities to inventory the net emissions of its GHGs, assess its proneness to climatic change and evaluate the options to mitigate and adapt to climatic change. The ALGAS Project is meant to improve the understanding and estimates of GHG emission sources, to assess more effectively the options for reducing sources and enhancing factors of GHG on the base of common and verifiable methodologies and to identify and implement cost-effective opportunities for limiting and sinking GHG emissions and for mitigating potential adverse impacts of climate change.

MONGOLIA SUSTAINABLE ENERGY SECTOR DEVELOPMENT STRATEGY PLAN

In order to ensure sustainable development of the energy sector, the Mongolia Sustainable Energy Sector Development Strategy Plan for 2002–2010 has been approved by Government Resolution #140 in July 2002. The plan includes:

- Strengthening financial independence of the sector to ensure that the energy sector provides an impetus for the country's economic and social development in order to mitigate and gradually eradicate the sector's burden for the state budget
- Implementation of structural reforms in order to commercialize the sector and increase the participation of the private sector
- Improving the structure, organization and managerial capacities in order to ensure successful transition of the sector to the market relations
- Improving the supply of energy and creating a pricing mechanism tied to the subsistence level in order to ensure that the users in rural areas and low-income clients benefit from the restructuring of the sector
- Consideration of energy efficiency measures
- Increasing the efficiency of the energy sector and accelerating economic growth so that utilization of cheap energy resources as hydro power and other RE sources will be expanded
- Introduction of a flexible energy price and tariff system in order to provide the minimum energy and heating needs of poor citizens

In order to ensure accessibility of public services to the rural population, to develop small and medium size enterprises and to meet household needs of citizens, RE resources will be used on a large scale.

INTEGRATED ENERGY SYSTEM PROGRAM

The national Integrated Energy System of Mongolia Program was approved in May 2002 by resolution #23 of the State Great Hural and amended in January 2007 by resolution #10 of the State Great Hural. The program is dealing with the near-, mid- and long-term strategy for the power sector. The program will be implemented in the following stages:

- First stage – near-term (2007–2012): Supply all the Soum and rural centers with electricity by enhancing the reliability of the existing regional electricity supply, by constructing new generating sources, transmission lines and by promoting RE sources. This includes:
- Constructing more than 100 MW CHPP in Ulaanbaatar
- Renovation of Darkhan and Erdenet CHPP
- Constructing Ulaanbaatar-Mandalgovi-Oyutolgoi 220 kV transmission line
- Constructing 300 MW CHPP at the Tavantolgoi bituminous coal mine and connect to CES
- Interconnecting Tavantolgoi and Dalanzadgad CHPP
- Conducting full-scale study on potential geothermal energy utilization
- Second stage – mid-term (2012–2022): Set up preconditions for interconnecting CES, EES and WES and the establish the Integrated Energy System by further constructing new generating sources and transmission lines. This includes:
- Constructing Erdeneburen HPP on Khovd Gol
- Constructing solar power plant and wind farm in Gobi region and connecting to CES
- Constructing 10–15 MW geothermal (possibly binary-cycle) power plant
- Third stage – long-term (2022–2040): Establish the Integrated Energy System by interconnecting CES and WES via high-voltage electricity transmission line. This includes:
- Constructing high-capacity 400 kV transit line between Ulaaanbaatar-Uliastai and establish the Integrated Energy System
- Increasing the capacity of solar power plants and wind farms and support the policy to increase share of RE

The program will be financed with state or regional budgets, domestic or international investments, international soft loan
and grant aids, private investment and other sources.

27 MORE INFORMATION AVAILABLE AT SUOZZI & REID, NEW YORK STATE COMMISSION ON PROPERTY TAX RELIEF, 2008
28 PERSONAL COMMUNICATION WITH MNE

5 POTENTIAL FOR RENEWABLE ENERGIES AND PRESENT USE

Mongolia is rich in RE resources. Solar, wind and hydro power can be used for power generation. Due to the absence of a centralized supply system and due to the low demand and lack of other energy sources, RE is the optimal and (in most areas) the only option for rural electricity supply. Despite these facts, the RE potential has remained largely unexploited. Low tariffs for conventional energy systems and abundant coal resources have constrained the development of RE systems. Earlier attempts to disseminate RE have experienced minimal success due to a lack of investments and of know-how. Recent initiatives of the Government towards the development of RE systems, however, are more promising as the legal framework for RE has improved.

RE so far plays an important role in two distinct areas: stand-alone electricity supply for nomadic households and off-grid electricity supply for rural centers. RE (hydro, solar and wind) currently represents about 3 % of country's total electricity generating capacity. The massive grid-extension and the new feed-in tariff might offer RE a new field for application.

Based on the last available information, the potentials for the individual energy sources are described in the subsequent sections.

TABLE 9

Technical Potentials for RE (MW)

TECHNOLOGY	INSTALLED CAPACITY (MW)	ECONOMIC POTENTIAL (MW)	TECHNICAL POTENTIAL (MW)	PHYSICAL POTENTIALS (MW)
Solar PV[a]	2.50+	n.a.	n.a.	2.20 * 10^{12} (MWh/year)
Solar WH[a]	0.01			
Small Hydro[a]	23.00	n.a.	1,000.00	6,200.00
Mini Hydro[a]	2.00			
Micro Hydro	2.50	n.a.	n.a.	n.a.
Geothermal	–	n.a.	n.a.	n.a.
Biogas	–	n.a.	n.a.	n.a.
Wind[b]	1.30+	n.a.	4,300,000	n.a.

Source: a – ADB, as of 2004
b – NREL, as of 2000

5.1 BIOENERGIES

Due to the climatic conditions, the use of biomass in Mongolia is strongly limited to use of wood and dung for cooking and heating. Dung is still the main energy resource for rural areas and especially for nomadic households. Utilization of biomass for energy generation, however, is limited to areas with timber resources. The two primary categories of forested land are northern coniferous forests and southern Saxaul forests. Commercial and domestic exploitation of forest resources is primarily in timber and firewood. Timber comes exclusively from the northern forests, while both northern and southern forests serve local needs for firewood, livestock forage and other timber products.

Statistics on standing volumes and forest depletion are to be read with caution as data are often confusing. Official statistics underestimate the total industrial output and fail to take the consumption of firewood or other household-use wood into account. The last national forest inventory was conducted almost 30 years ago with local inventories. According to the most realiable information available, the average standing volume of northern closed forest is estimated to 103 m³ per hectare for a total standing volume of over 1,300 million m³ (see also table in annex 0). In a study conducted in 2002, the World Bank estimated that Mongolia lost about 1.6 million hectares of forest from the 1950s to the 1980s and 660,000 hectares from 1990 to 2000. The major causes of forest loss have been unsustainable forest harvesting (both permitted and illegal) for timber and firewood, wildfires, mining, insect and disease infestations, uncontrolled grazing and long-term climatic fluctuations. Decisions are made in an ad-hoc manner and resources are allocated to the strongest lobby.

Weather and waste composition in Mongolia are not suitable to develop biogas from wastes or to install bio fuel plants. Concerning municipal solid waste (whereof approximately 900,000 m³ come from households in Ulaanbaatar), an additional problem is that it is dumped at waste dumping sites on the outskirts of the cities unsorted and is likely to partly consist of toxic and hazardous (including radioactive) wastes[29].

5.2 SOLAR ENERGY

Mongolia enjoys a favorable solar energy regime ranging from a low insulation of 4.5 kW/m² per day and less than 2,600 sunshine hours in the northern part of the country to a maximum of 5.5–6.0 kW/m² per day with a sunshine duration of 2,900–3,000 hours in the southern part of the country. The high insulation regime covers some 70 % of the territory. Intermediate insulation of 4.5–5.5 kW/m² per day with an annual sunshine duration of 2,600–2,900 hours covers 18 % of the territory of Mongolia. It is estimated that the southern part of the country receives a daily average insulation between 4.3 and 4.7 kW/m². Total annual radiation intensity equals 2.2 * 1012 MWh in Mongolia. The Gobi region with its higher solar energy resources would be suitable for large-scale solar energy applications. SHS can be used almost all over the country. Data on technical and economic potentials, however, are not available and the existing information cannot be considered as sufficiently accurate or complete for solar energy system design purposes.

Current use has mainly focused on decentralized individual SHS-electricity systems. According to statistical surveys, 103,000 nomadic households light their homes with Solar PV modules (20–200 W) and/or small wind generators (50–300 W). The biggest PV system with a capacity of 200 kW is in operation in Noyon Soum, Umnugovi Aimag. A number of PV systems (20–100 kW) and PV/wind hybrid systems (30 kW PV) are in operation all over the country. Public services in non-grid Soum centers such as telecommunication offices, TV repeater stations, border control units and hospitals use solar PV systems. Vacuum-tube solar water heaters with 120–160 l tanks were recently introduced and more

29 ADB, 2004

than 100 installations are being used in bathhouses, hospitals and tourist camps[30]. The International Energy Agency (IEA) is currently conducting a study on outstanding large-scale PV power systems in the Gobi region of Mongolia[31]. The current utilization of solar energy in Mongolia is shown in the map in annex 0.

5.3 WIND POWER

In 2000, a wind energy resource atlas of Mongolia was been developed with the assistance of the National Renewable Energy Laboratory (NREL) of the Department of Energy (DOE), USA[32]. According to this atlas, more than 160,000 km^2 of the land area in Mongolia are estimated to excellent wind potential for utility-scale applications. The amount of windy land is about 10 % of the total land area of the country. This amount of windy land, using conservative assumptions that result in about 7 megawatts (MW) of capacity per km^2, could supply over 1,100,000 MW of installed capacity and potentially deliver over 2.5 trillion kWh per year. All of the Aimags have at least 6,000 MW of wind potential. There are 13 Aimags in Mongolia with at least 20,000 MW of wind potential and 9 Aimags with more than 50,000 MW of wind potential. Umnugovi alone is estimated to have over 300,000 MW potential. If additional areas with moderate or good wind resource potential are considered, the estimated total windy land area increases to more than 620,000 km^2 or almost 40 % of the total land area of Mongolia. This amount of windy land could support over 4,300,000 MW of installed capacity and potentially deliver over 8 trillion kWh per year. There are 15 Aimags with at least 50,000 MW, 12 Aimags with at least 100,000 MW, and 9 Aimags with at least 200,000 MW of wind potential. These data show that wind could play an important role in the development of both rural areas (individual wind generators) and small urban centers (Soum or even Aimag). Utility scale wind resources at 30 m height are shown in the annex.

The current installed capacity sums up to 1,450 kW. A 100 kW wind turbine, which is currently the biggest, was installed in Erdenetsgaan Soum, Sukhbaatar Aimag. A number of wind power systems (70–150 kW) and wind-solar hybrid systems (120 kW wind) are in operation all over the country. Nomadic households use small wind turbines with a capacity of 50–400 W. A 50 MW on-grid wind park near Ulaanbaatar is underway and a PPA was installed. The license for the construction of the wind park is issued to NewCom LLC. The German KfW Bank financed the Renewable Energy II project and is making a study on the wind park in the Gobi region of Mongolia. Wind speed measurement has started in order to access the possibility of constructing a wind park in Gobi-Altai Aimag, which can work parallel to Taishir HPP. Furthermore, the Energy Research and Development Center[33] estimated in a study that large-scale wind turbine generators with a capacity of 100–150 kW could be placed in 52 provincial centers in the southern part of Mongolia.[34] The most promising sites are meant to get priority for establishing the technical and economic feasibility of operating 100–150 kW wind turbine generators parallel to existing diesel generators. A wind resource map of Mongolia and a map on the current utilization of wind energy are presented in appendices 0 and 0.

5.4 GEOTHERMAL ENERGY

From the geo-tectonic point of view, Mongolia is part of a consolidated plate and therefore not very active. An exception is an East to West stretch in the northern part of the country where the horizontal movement of two plates temporarily results in earth quakes. Along this area, a number of hot springs occur. Mongolia has about 42 small hot springs in Khangai, Khentii, Khuvsgul, the Mongolian Altai mountains, the Dornod-Darigangiin steppe and in the Orhon-Selenge region.

An overall estimation of the technical, physical and economic geothermal energy potential is not available. A geophysical survey on the crust structure, however, affirmed that accumulative thermal sources (magma lumps) are located near the surface under the Khangai and Khentii mountainous region. Heat flow in Mongolia was studied from 32 heat flow stations, which do not cover the South Mongolia and the Mongolian Altai province. The average heat flow in different tectonic regions has been estimated as follows[37]: Mongolian Altai mountainous region: 54 ± 24 MW/m^2, Khangai mountainous region: 52 ± 6 MW/m^2, Khuvsgul lake region: 80 ± 10 MW/m^2, East Mongolian steppes: 44 ± 6 MW/m^2.

Some of the hot springs are used as traditional health resorts and for small-scale greenhouse or space heating. Based on the available information, the commercial exploitation of geothermal resources in Mongolia for power generation is still considered as marginal. Further investigations will be required to verify the extent of geothermal resources and their potential of utilization for small-scale power generation possibly with binary cycle power plants.

Outlines of the main geothermal structures of Mongolia and a heat flow map of Mongolia are shown in appendices 0 and 0.

5.5 HYDRO POWER

The hydro power resources of Mongolia have not been fully investigated yet. A number of promising hydro power sites, however, have been identified to date in Mongolia. There are about 3,800 small rivers with a total length of 65,000 km in Mongolia. The average annual flow is 3.46*1010 m^3 and the physical hydroenergy potential is currently estimated at 6,200 MW. More than 1 GW of technical potential of hydro power has been identified. According to a study of NREC[35], about 70 % of all hydroenergy resources are concentrated in the Mongolian Altai ranges, in the Tagna and Khan Khukhii ranges, in the mountainous areas of Khuvsgul, Khangai, Khentii and at the Khalkh Gol River.[36]

30 PERSONAL COMMUNICATION WITH ENGEN CO.,LTD.
31 KOSUKE KUROKAWA (2007): ENERGY FROM THE DESERT – PRACTICAL PROPOSALS FOR VERY LARGE-SCALE PHOTOVOLTAIC SYSTEMS, EARTH SCAN UK & USA
32 USAID, NREL AND NREC, AS OF 2000
33 THE ENERGY RESEARCH AND DEVELOPMENT CENTER WAS ABOLISHED IN MARCH 2009 AS PART OF GOVERNMENT RESTRUCTURING.
34 NATIONAL RENEWABLE ENERGY PROGRAMME, AS OF JUNE 2005
35 NATIONAL RENEWABLE ENERGY CENTER WAS ABOLISHED IN MARCH 2009 AS PART OF GOVERNMENT RESTRUCTURING.
36 HYDRO POWER POTENTIALS AND PLANNED AND INSTALLED CAPACITIES IN MONGOLIA CAN BE FOUND IN THE ANNEX.

In recent years, there was an increasing interest in constructing large-scale HPPs in order to reduce the imported electricity from Russia. MME's current policy for hydro power is to support grid-connected HPPs to cover the peak load of CES. A cascade HPP on the Selenge River is also being discussed. Currently, there are 13 small and mini HPPs with a total capacity of 27.5 MW in operation. The small hydro plants are run-of-river designs that provide electricity to neighboring rural areas except during the winter. The construction of the Taishir HPP with a capacity of 11 MW was completed in 2008. The Govi-Altai Aimag center is connected to the HPP with a 47 km transmission line of 35 kV and the Zavkhan The Aimag Centre is connected with a 135 km transmission line of 110 kV. The project was financed with 20 million USD from a Quwait fund, 13 million USD from an Abu-Dhabi Fund and 2.7 million USD from the GoM. The construction of Durgun HPP with capacity of 12 MW was completed in 2008. The HPP will supply the Uvs, Khovd and Bayan-Ulgii Aimags with electricity. The project was financed by 26.5 million USD from soft-loans of the Shanghai Group of China.

Consideration is being given to further develop small hydro plants in order to reduce diesel imports. A number of hydro power stations with capacities ranging from 100 kW up to 220 MW (Orkhon HPP 100 MW, Egiin Gol HPP 220 MW, Chargait HPP 24 MW etc.) have been studied for feasibility during the last few years for both grid – supportive for voltage control – and off-grid supply. One complicating factor is that many rivers freeze over during the winter and cannot provide year-round electricity. In order to prioritize and to better identify the economic potentials, there is a need for developing a hydro power master plan.

6 MARKET RISK ANALYSIS AND BARRIERS FOR MARKET ENTRY

Large amounts of foreign investment have flown into Mongolia's economy, about 60 billion USD in 1991–2006, 75 % of that into the traditional fossil energy sector. There are some projects in the field of RE financed by foreign and international foundations.

6.1 COST OF RENEWABLE ENERGY APPLICATIONS

The costs of RE applications are shown in table 10. Depending on technology, application and site, the costs are generally not competitive (except HPP) with grid/retail electricity or commercial heating and energy production. Its role in grid-connected electricity supply is currently negligible, but through the new feed-in law the role of RE is expected to increase.

TABLE 6

Status of Renewable Technologies – Characteristics and Cost

TECHNOLOGY	CHARACTERISTICS	ENERGY COSTS	COST TRENDS AND POTENTIAL FOR COST REDUCTION
Power generation			
Benchmark Conventional: CHPP	7 CHPP – 828 MWa	60–90 MNT/kWhb	growing
Large hydro	–	–	–
Small hydro	Durgun HPP – 12 MW (Dam) Taishir HPP – 11MW (Dam)	Durgun – 23 MNT/kWh Taishir – 0.05–0.07 USD/kWh	n. a.
Wind	–	–	–
Biomass power	–	–	–
Geothermal power	–	–	–
Solar PV (module)	–	–	–
Rooftop solar PV	–	–	–
Solar Thermal Power (CSP)	–	–	–
Hot water/Heating			
Benchmark Conventional: CHPP	7 CHPP – 2,011 MWthd	265–400 MNT/m^2 6,144–18,241 MNT/GCale	growing
Biomass heat	–	–	–
Solar hot water/heating	Size: 120–160 l Type: vacuum tube 100 piecesf	n. a.	n. a.
Geothermal heat	n. a.	n. a.	n. a.
Biofuels	–	–	–

37 OUTLINES OF THE MAIN GEOTHERMAL STRUCTURES OF MONGOLIA AND A HEAT FLOW MAP OF MONGOLIA CAN BE FOUND IN ANNEX.

TECHNOLOGY	CHARACTERISTICS	ENERGY COSTS	COST TRENDS AND POTENTIAL FOR COST REDUCTION
Rural (off-grid) energy			
Benchmark Conventional: Diesel generators	46 MWg	540 MNT/kWhi	growing
Mini-hydro	Bogdiin HPP – 2,000 kW	50 MNT/kWhj	–
Micro-hydro	10 HPP – 100–2,500 kW	n.a.	n.a.
Pico-hydro	Borburgas – 300 W (cross flow)	–	n.a.
Biogas digester	–	–	–
Biomass gasifier	–	–	–
Small wind turbine	Size : 10–100 kW (Total 1,200 kW)k	0.22 USD/kWhf	–
Household wind turbine	250 kWk	n.a.	n.a.
Small PV	970 kWk	0.39 USD/kWhl	–
Solar home system	4,200 kWk	n.a.	n.a.

Sources:
a – ERA, 2007;
b – ERA website, www.era.energy.mn/eng/modules.php?ss=4&id=60;
c – Personal communication with the project units of Durgun and Taishir HPP;
d – ADB, 2002;
e – ERA website, www.era.energy.mn/eng/modules.php?ss=4&id=61;
f – according to feasibility study by NREC; g – Personal communication with Engen Co., LTD,
h – Estimation by NREC,
i – Rough estimates, INTEGRATION Environment & Energy, Making Access to Reliable Electricity Affordable in Rural Areas – estimation based on available information

6.2 CURRENT BUSINESS AND INVESTMENT ACTIVITIES

The RE market is still strongly Governmental and international donor-driven, whereas RE business activities remain limited. Several projects have been completed. An overview of GoM and international donor-financed projects is provided in the tables attached as Appendices 0, 0 and, 0. The new feed-in law is, however, expected to promote private sector participation.

Besides of the Government programs mentioned in chapter 3, the World Bank currently manages the Renewable Energy and Rural Electricity Access Project, which has become effective on 4 May 2007. The project aims at increasing access to energy for the country's rural population. The project consists of 3 components, i. e. herder electricity access, Soum electricity access and national capacity building. Partial funding comes from the International Development Agency, GEF, the Government of Netherlands and the GoM. The total cost of the project amounts to 13 million USD. Furthermore, KfW bank financed the Renewable Energy II project which has completed the rehabilitation of Bogdyn HPP (2 MW) in Zavkhan Aimag and the distribution network in Uliastai. A feasibility study for a grid-connected wind park in the Gobi region of Mongolia is still ongoing and with Dutch funding, the GTZ is building up mini-hydro power schemes in Zhavakan Aimag.

6.3 GENERAL SITUATION

Mongolia made good reform progress during 2006 and 2007 and, as a result, received three transition score upgrades on large-scale privatization, competition policy and banking reform from EBRD's transition progress review[38]. The liquidation of several large state-owned enterprises has encouraged privatization, while the competition authority has established a good track record for defending competition rules. The banking sector is now fully privatized and has grown substantially over the past years, with domestic credit to the private sector increasing by over 40 % in 2006 and 20 % in 2007.

One of the main macro-economic concerns is with respect to the rising inflation. Following continued rapid growth in broad money and due to increasing fuel prices, public remuneration and utility prices during the third and fourth quarter of 2007, inflation rose during the second half of 2007. End-year inflation rate reached 15.1 %.

Corruption

Corruption is still a serious issue in Mongolia at both the "subordinate" or administrative and "grand" or elite levels. According to the Corruption Perceptions Index of the Transparency International Organization, Mongolia ranks 102 with 3.0 points in 2008, 99 with 3.0 points in 2007, and in 99 with 2.8 points in 2006[39]. Opportunities for increased corruption emerged during the transition when land and companies where privatized. Areas that have been particular affected are procurement and customs, but a variety of citizen- and business-to-government transactions are also concerned. An inadequate civil service system, the lack of transparency and limited access to information in government functions, lim-

38 EBRD, 2008; PLEASE FIND A COPY OF MONGOLIA'S TRANSITION PROGRESS REVIEW IN ANNEX.
39 TRANSPARENCY INTERNATIONAL, 2009

ited political will and leadership to implement laws, complicated by conflictive and overlapping laws and weak governmental control institutions are the main factors to encourage corruption[40].

Despite the fact that few of the conditions to prevent corruption from getting worse are fulfilled, the situation has not extended to a degree that is evident in many other countries with contexts and histories similar to that of Mongolia. Furthermore, there are a number of initiating and rudimentary efforts underway to actively reduce corruption. Besides the government's commitment to apply to international anti-corruption regimes and protocols[41], an Independent Authority Program as well as a National Program against Corruption have been established in July 2006.

Availability of local Know-how

Mongolia has started to obtain the necessary local experience to design and install small hydro, PV and wind projects. There are four institutions in Mongolia instructing experts in the energy sector[42]:

- The Power Engineering School of the Mongolian University of Science and Technology is a major institution for research and instructing experts in the power sector. It recently started educating engineers in RE systems.
- The Construction College trains technicians, electricians and electrical engineers.
- The Engineering School of Mongolian State University of Agriculture prepares experts in agricultural electrification.
- The Technical College in Darkhan-Uul Aimag is training electrical engineers.

There are only few skilled employees who are able to resume both management and planning functions and to make financial analyses. Especially in rural areas, there is very limited technical know-how with respect to the operation and maintenance of RE systems. Skills, competence and economic ability of skilled employees, technicians and institutions are often insufficient with respect to project implementation[43].

Local Acceptance

In general, the local acceptance of RE systems is best in rural areas where no reliable electricity supply is available. Among them, nomadic households are highly attracted to wind and SHS as single option for their power supply. However, awareness and knowledge of rural people with regard to the potentials and limitations of the RE systems is low, often resulting in unrealistic expectations. At the same time, there is very limited technical know-how available with respect to the operation and maintenance of the RE systems, resulting in inadequate maintenance and frequent system breakdowns.

6.4 BUSINESS DEVELOPMENT

The business framework in Mongolia is liberalized to a certain degree and Mongolia is interested to attract foreign investment. According to the Word Banks Doing Business Survey 2009, doing business in Mongolia (ranking 58) is easier than in its neighboring countries, China (83), Russia (120) and easier than in other Central Asian countries such as Tajikistan (159), Kyrgyz Republic (68), Kazakhstan (70), Uzbekistan (138) and Afghanistan (162). Registering property, protecting investors and fulfilling contracts is easier, but cross-border transactions, closing business and dealing with construction permits is the most difficult part of doing business in Mongolia[44].

TABLE 7

Ease of Doing Business in Mongolia

Ease of Doing Business	58
Starting a business	59
Dealing with construction permits	103
Employing workers	71
Registering property	20
Getting credit	68
Protecting investors	24
Paying taxes	79
Trading across borders	156
Enforcing contracts	38
Closing a Business	108

Source: World Bank, Doing Business 2009

Foreign investment enjoys legal protection guaranteed by the Constitution and other legislation, which complies with those laws and as guaranteed by the international agreements to which Mongolia is a party[45]. The GoM guarantees physical property and ensures protection for intellectual property. Mongolia became a member of the World Intellectual Property Organization (WIPO) in 1979. Since 1991, Mongolia also has joined eleven International Conventions including the Paris Convention on the Protection of Industrial Property and the Madrid Agreement on International Registration of Trademarks and Agreement for Patent Cooperation. Foreigners are allowed to found companies and be their owner[46]. The registration of a business is considered to be easy. Foreign investors can get help for their registration process from the Foreign Investment and Trade Agency, where one-stop service is available. The Government authority has to issue the certificate of registration within 3 working days after receiving the requested documents or issue a refusal including the reasons for the refusal. Foreign investors with an initial investment of 80,000 USD or more receive a certificate of foreign investor. Foreign investors with an initial investment of 50 million USD or more may conclude an investment agreement with the Government. Investment agreements guarantee a stable legal environment for a period of up to 10 years for 50–100 million USD investments, up to 15 years for 100–300 million USD investments and up to 30 years for investments offer 300 million USD. Foreign investors may receive tax exemptions for

40 CASALS & ASSOCIATES, INC., 2005
41 MONGOLIA HAS SIGNED E. G. THE ANTI-CORRUPTION PLAN OF THE ASIAN DEVELOPMENT BANK/ORGANIZATION OF ECONOMIC COOPERATION AND DEVELOPMENT (ADB/OECD) AND THE UNITED NATIONS CONVENTION AGAINST CORRUPTION (UNCAC)
42 THE CONTACT DATA FOR THESE INSTITUTIONS CAN BE FOUND IN CHAPTER "RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS".
43 SEE SOME MORE DETAILS IN ADB, 2006.
44 DOING BUSINESS 2009 PROVIDES A QUANTITATIVE MEASURE OF REGULATIONS FOR DOING BUSINESS AS THEY APPLY TO DOMESTIC SMALL AND MEDIUM-SIZE ENTERPRISES; SEE WORLD BANK, 2009
45 ACCORDING TO FOREIGN INVESTMENT LAW OF MONGOLIA
46 ACCORDING TO COMPANY LAW OF MONGOLIA

up to 10 years. Business entities with foreign investments and branches of a foreign legal entity may acquire the right to use land by way of lease and subject to the conditions and procedures set out in the legislation on Mongolian land.

6.5 TAXATION

Taxation in Mongolia is regulated by the Constitution of Mongolia, the Tax Code of Mongolia and several specific laws, regulations and instructions. The authorized agency responsible for the supervision of timely payment of taxes is the General Department of National Taxation of Mongolia.

Business entities with foreign investments and branches of a foreign legal entity are liable for tax under Mongolian tax laws. Tax incentives and/or exemptions for a business entity with foreign investment, branches of a foreign legal entity and implementing entities of an investment agreement will be subject to Income Tax Law of Business entities, Real Estate Tax Law, Customs Tariff Law, Value Added Tax Law, Excise Tax Law and Land Law of Mongolia. Income Tax for business entities is 10 % for up to 3 billion MNT yearly profit and 25 % for profit that exceeds 3 billion MNT. Real Estate Tax is 0.6 %. Allocation to the Social Insurance is 29 %, with 19 % being paid by the employer and 10 % by the employee. Land Use Fee for road and transmission lines outside of urban centers is 1,500–7,500 MNT/km. Land Use Fee in urban centers is 0.1–1 % of the land rates set by the Government[47] and 0.01–0.03 % in other areas. Land Use Fee in Ulaanbaatar is 44–440 MNT/m^2. Water Use Fee for household use is 1–30 MNT/m^3, 10–20 MNT/m^3 for production use for surface water and 30–50 MNT/m^3 for ground water and 20–100 MNT/m^3 for mining industry for surface water and 50–150 MNT/m^3 for ground water[48].

6.6 IMPORT AND EXPORT

Customs Tax for imported goods is 5 % of the contract amount plus transportation costs. According to the Tax General Law of Mongolia, Value Added Tax is 10 % and is applied to all taxable goods and services produced inland, including imported goods. VAT is 0 % for exported production and services.

Transportation is an expensive service in Mongolia. Usually, there are three main types of transportation: vehicle (trucks), air and train. Local transportation by vehicle is around 250 MNT/ton/km. Local air transport cost is in 2,500–3,800 MNT/kg depending on the distance. Transportation cost for a 40 ton container is 5,000 USD between Hamburg, Germany, and TianJin, China, by sea, 2,400 USD between TianJin, China, and Zamiin Uud by train, 600 USD between Zamiin-Uud and Ulaanbaatar by train (400 USD for a 20 ton container).[49]

7 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

Below, a brief overview of government agencies, acadeMIEs and business contacts relevant to work in the RE sector is provided including contact people and details as well as a brief description of the organizations.

TRADE ORGANIZATIONSE

ORGANIZATION/CONTACT PERSON	ADDRESS/PHONE NUMBER/ E-MAIL CONTACT	DESCRIPTION OF PRODUCTS, SERVICES AND ROLE
Mongolian National Chamber of Commerce and Industry S. Demberel, Chairman & CEO	Sambuu Street 11 Ulaanbaatar 211238, Mongolia Telephone: +976-11-327176, 312501, 323974 Fax: +976-11-324620 E-mail: chamber@mongolchamber.mn, info@mongolchamber.mn Web: www.mongolchamber.mn	Established in 1960. Since the adoption of the Law of the Chamber of Commerce and Industry in 1995, the Chamber's activities have been expanding both domestically and internationally. The Chamber is the main business representative body of the Mongolian business community engaging most of the companies, enterprises and trade organizations and protecting their common interests.
Foreign Investment and Foreign Trade Agency Baasankhuu Ganzorig Chairman, WAIPA Steering Committee Member	Tel: + 976-11-326040, 320871, 321438, 320793, Fax: + 976-11-324076 E-mail: fifta@investmongolia.com Post: FIFTA Sambuu Street 11 Ulaanbaatar 211238, Mongolia Office: Suites 209, 801-805, 1202 Government Building 11 Sambuu Street 11 Ulaanbaatar, Mongolia Web: www.investmongolia.com www.exportmongolia.com	Foreign Investment and Foreign Trade Agency of Mongolia (FIFTA) is the Government agency responsible for the promotion and facilitation of foreign direct investment and foreign trade in the country. The FIFTA's vision is to promote and facilitate foreign investment and foreign trade towards meeting the national goals of industrial development and export growth, to promote Mongolia as a destination for new investment and business and to be the leading agency in Mongolia.

47 ACCORDING TO LAW ON LAND USE FEE
48 ACCORDING TO LAW ON WATER AND SPRING RESOURCES USE FEE
49 PERSONAL COMMUNICATION WITH INTERNATIONAL FREIGHT FORWARDING CENTER OF MONGOLIAN RAILWAY

FINANCING INSTITUTIONS

ORGANIZATION/CONTACT PERSON	ADDRESS/PHONE NUMBER/ E-MAIL CONTACT	DESCRIPTION OF PRODUCTS, SERVICES AND ROLE
Golomt Bank	Commercial Street 6 U B-36, Mongolia Telephone: +976-11-310639, 323844 Fax: +976-11-326865 Web: www.golomtbank.com	Golomt Bank of Mongolia declared an after tax profit of 7.96 billion MNT (6.88 million USD) for the first half of 2008. Total assets reach 724 billion MNT, (625 million USD).
Trade and Development Bank of Mongolia (TDB)	Juulchnii Street 7 Baga Toiruu 12 Chingeltei District Ulaanbaatar, Mongolia Telephone: +976-11-312362, 331133 Fax: +976-11-327028, 331155 Web: www.tdbm.mn	In June 2008, TDB's total asset reached 661.5 billion MNT and own capital reached 79 billion MNT, representing 17.2 % and 18.7 % market shares respectively. The bank has had earnings track record with 11.8 billion MNT in 2006, 16.4 billion in 2007 and 8 billion in June 2008.
Anod Bank	Zaluuchuud Avenue 1st Khoroo Ulaanbaatar, Mongolia Telephone: (976-11)-464114 Fax:(976-11)-464109 Telex: 79361 ANODBMN E-mail: anod@anodbank.com Web: www.anodbank.com	As of December 2006, Anod Bank's assets reached 202,6 billion MNT. Anod Bank now operates through its 22 branches located in the capital and eight provinces serving over 60,000 customers.
Khaan Bank	Seoul Street 25 PO. Box 192 Ulaanbaatar 44, Mongolia Telephone: 976-11-332-333 Fax: 976-7011-7023 Web: www.khanbank.com	In 2007, Khaan Bank's after-tax earnings were 19.4 billion MNT. This equated a return on assets of 3.9 % and a return on equity of 45.9 %. The bank's branch system has 466 offices.

GOVERNMENT AGENCIES

ORGANIZATION/CONTACT PERSON	ADDRESS/PHONE NUMBER/ E-MAIL CONTACT	DESCRIPTION OF PRODUCTS, SERVICES AND ROLE
Ministry of Mineral Resources and Energy Mr. Ts. Tserenpurev, State Secretary	Government Building II United Nation Street 5/2 210646 Telephone: +976-11-261511 E-mail: stsec@mme.energy.mn Web: www.mme.energy.mn	Defining, regulating, monitoring and planning of energy sector development policy, organization and implementation of Government programs and projects in the energy sector.
Ministry of Nature and Environment Mr. T. Gantulga, State Secretary	Government Building III Baga Toiruu 44 Sukhbaatar District Telephone: +976-11-265615 E-mail: mne@mongol.net	National designated Authority for CDM; policy defining, planning and monitoring in the environmental sector of Mongolia
Ministry of Finance Mr. D. Battur, State Secretary	United Nations Street 5/1 210646 Telephone: +976-11-260247 E-mail: battur_d@mof.gov.mn	Monitoring, planning and defining policy in the financial sector of the country
State Specialized Inspection Agency Mr. Ts. Shiirevdamba, Director	Government Building XII Barilgachdiin Talbai 13 211238 Telephone: +976-11-263790	Professional technical inspection, monitoring and control
Energy Regulatory Authority Mr. R. Ganjuur, Chairman	University Street 2a Sukhbaatar District 14201 Telephone: +976-11-319312 E-mail: ganjuur@are.energy.mn	Main regulatory institution in the energy sector
Energy Authority Mr. Batbayar, Head of Renewable Energy Department	Renewable Energy Department Energy Authority Peace Avenue Ulaanbaatar 36, Mongolia batbayar@ea.energy.mn Telephone: +976-11-342375	RE resources assessment, developing norms and standards for RE equipment, application and maintenance, RE research and development, technical monitoring and evaluation of RE projects

ACADEMIES

ORGANIZATION/CONTACT PERSON	ADDRESS/PHONE NUMBER/ E-MAIL CONTACT	DESCRIPTION OF PRODUCTS, SERVICES AND ROLE
State University of Mongolia Mr. Ts. Gantsog, Rector	University Street 1 Baga Toiruu 1 Sukhbaatar District Telephone: +976-11-327911, 320160, 324385, Fax: +976-11-320668, 320159 Web: www.num.edu.mn E-mail: num@num.edu.mn	Research center of RE, training of specialists in the field of RE
State University for Science Technology of Mongolia (SUST) Mr. B. Damdinsuren, Rector	Main building of SUST Sukhbaatar Duureg Ulaanbaatar, Mongolia Telephone: +976-11-324709 E-mail: ddamdinsurenb@must.edu.mn Web: www.must.edu.mn	SUST is made up of seventeen professional schools and colleges, 3 research institutes and 36 experimental and technology centers whose faculties offer educational opportunities to students ranging from first-year undergraduates through doctoral-level candidates in engineering, technology and others. 120 professors and a staff of over 1.000 are engaged in student training, educational and research activities, university administration and management. Power Engineering School is the major institution for research and training of specialists in energy field.
Ulaanbaatar University of Mongolia Dr. S. Baigalsaihan, Rector	Telephone: +976-11-458327, 456360, 453554, 458336 Fax: +976-11-458327 E-mail: UBV@magicnet.mn	Specialist preparation in field of RE and Master of Science studies in RE
Agricultural University of Mongolia Mr. B. Byambaa, Rector	Telephone: +976-11-341770, 341630, 341592 Fax: +976-11-341770 E-mail: infotech@magicnet.mn Web: www.msua.edu.mn	Research and specialist preparation in field of RE and agricultural electrification
Construction College Mr. B. Chimiddorj, N. Nyamjav	Ulaanbaatar 44 P.O. Box: 276 Peace avenue 35 Ulaanbaatar Bayangol District, Mongolia Telephone: +976-11-322797, 70122723 Fax: +976-11-322797 E-mail: cwc@magicnet.mn	Professional training in construction and electrical engineering
Technical College in Darkhan-Uul Aimag Mr. R. Lkhagvasuren	Telephone: +976-1-372-23760, +976-99379687 Fax: +976-11-327234	Professional training in electrical engineering

COMPANIES (ELECTRICITY, RENEWABLE ENERGY, CONSULTANTS ETC.)

ORGANIZATION/CONTACT PERSON	ADDRESS/PHONE NUMBER/ E-MAIL CONTACT	DESCRIPTION OF PRODUCTS, SERVICES AND ROLE
National Renewable Energy Centre Mr. N. Enebish	National Renewable Energy Center Dund Gol 2 Gurvaljin Bridge Bayangol District Telephone: +976-11-70181810, +976-11-342375 Fax: +976-11-686298 E-mail: renenergy@magicnet.mn	NREC was established in March 2009 by the resolution #58 of GoM. NREC consists of administration, research and business development, production and technology divisions. RE resources assessment, dissemination of RE technologies, RE project implementation, feasibility studies, blueprints and budget plans, developing standards, production of PV modules and RE equipment
MonMar" Co. Ltd. Mr. Ch. Batbayar	Renewable Energy Centre Building II Chingis Khan Avenue Khan Uul District Telephone: +976-11-342692 E-mail: monmar@magicnet.mn	Production of mini wind charges (50 Wp), trade of wind and solar PV systems for small users
Sobby Co. Ltd. Mr. B. Batchuluun, Director	United Nations Street 5/1 210646 Telephone: +976-11-260247 E-mail: battur_d@mof.gov.mn	Monitoring, planning and defining policy in the financial sector of the country
Narnii Zai Service Co. Ltd. Mr. D. Agchbayar	Khuch Sport Horoo Tsergiin Khothon 2-r Horoo Bayanzurkh District Telephone: +976-11-451787 E-mail: agch@magicnet.mn	Trade of PV systems for households and small users
Bayan Construction Co. Ltd. Mr. D. Byuantogtokh, Director	New Mega Power Centre 3-r Horoo Chingeltei District Ulaanbaatar, Mongolia Telephone: +976-11-319927, 319927, 91914968 Fax: +976-11-318257	Construction and trade company. In 2006–2007, the company installed PV and wind hybrid systems for four Soum centers (150 kWp installed capacity) by order of GoM. In 2007–2008, the company delivered 40,600 units of 50Wp SHS for herders by order of Government of Mongolia.

ORGANIZATION/CONTACT PERSON	ADDRESS/PHONE NUMBER/ E-MAIL CONTACT	DESCRIPTION OF PRODUCTS, SERVICES AND ROLE
Uureg Trade Co. Ltd. Mr. O. Bayar, Director	Telephone: +976-11-687883, 99112727, 99112368 Fax: +976-11-688130	Entertainment business, construction and trade company. In 2006–2007, the company installed PV and wind hybrid systems for a Soum center (150 kWp installed capacity) by order of GoM.
ABE Solar Co. Ltd. Mr. B. Baatarkhuu	Telephone: +976-11-327297, 91912224	Trade of SHS for small users and households. In 2006–2007, the company installed two wind energy systems (80 kWp installed capacity) for Soum centers by order of the GoM.
Mongol Alt Co. Ltd. Mr. J. Munkhtur	Telephone: +976-1-372-33263, 99114122, 99376169, 99081267	Mining company specializing in gold mining. In 2007, the company got a contract to build wind energy system (150kW installed capacity) for Soum center by order of GoM.
New Power Co. Ltd. Mr. Baymbatsogt, Director	Telephone: +976-11-634256, 99050662, 99094921 Fax: +976-11-635246	Construction company. In 2007, the company got a contract to build PV system (150 kWp installed capacity) for Soum center by order of GoM.
Khurd Co. Ltd. Mr. B. Enkhjargal	Telephone: +976-11-320697, 99118215, 88118215, 91912597 Fax: +976-11-325130	Civil construction company specializing in electrical and heating installations. In 2007, the company got a contract to build PV system (150 kWp installed capacity) for Soum center by order of GoM.
Prestige Engineering Co. Ltd. Mr. J. Dalai, Director	#501 Sukhbaatar Square 3 Ulaanbaatar, Mongolia Telephone: +976-11-313392 E-mail: centre@magicnet.mn	Trade and engineering company specializing in water supply business. In 2007, the company installed 80 kW wind system for Soum center by order of GoM. In 2007, the company got a Government order for feasibility study preparation of Hydro Power Plant.
Bodi Group Co. Ltd. Mr. Munkhnyam, Manager	Bodi Tower Sukhbaatar Square Ulaanbaatar 210620A Mongolia Telephone: +976-11-313261, 313007, 313285 Fax: +976-11-326535 www.bodi.mn	Trade and engineering group of companies with facility for small scale PV module assembling
MCS Engineering Co. Ltd.	MCS Plaza P.O.Box 1272 Seoul Street 4 Ulaanbaatar 13, Mongolia Telephone: 976-11-346363,346464 Fax: 976-11-326030 E-mail: mcsinter@mcs.mn www.international.mcs.mn	Engineering and consulting company specializing in energy sector including RE (hydro, geothermal, PV technology)
Mon-Energy Co. Ltd. Mr. L. Erdenedalai, Director	Energy research and Development Center Chingis Avenue Ulaanbaatar Khan-Uul District, Mongolia Telephone: +976-11-632319 E-mail: mon-epdc@mongol.net	Consulting company specializing in the energy sector
Newcom Co. Ltd. Mr. P. Gankhuayg, General manager	Naiman Zovkhis Building Seoul Street 6/3 210628 Telephone: +976-11-313183 E-mail: info@newcom.mn	Investment company holding shares for engineering, energy, communication and airway companies. In 2007, the company signed the country's first PPA contract to construct wind farm in Mongolia. The company plans to introduce grid connected wind farm (50 MW) by 2010.

8 BIBLIOGRAPHY

- Asian Development Bank – ADB (2002): Capacity Building in Energy Planning, TA 3299-MON Final Report, Ulaanbaatar
- Asian Development Bank – ADB (2004): Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement (PREGA), Ulaanbaatar
- Batsukh, N., Alei, M., Dorjderem, B. and Borchuluun, U. (1999): Geothermal Energy Sub-Program, National Program of Mongolia on Mineral Resources, Ulaanbaatar
- Casals & Associates, Inc. (2005): Mongolia Corruption Assessment (with funding from the U.S. Agency for International Development and The Asia Foundation), www.usaid.gov/mn/library/documents/Mongolia CorruptionAssessmentFinalReport.pdf
- Central Intelligence Agency (2008): CIA World Fact Book
- (www.cia.gov/library/publications/the-world-factbook/geos/mg.html)
- Central Region Electricity Transmission Grid Inc. (2008): information brochure, Ulaanbaatar
- Energy Regulatory Authority – ERA (2007): Energy Statistics 2008, Ulaanbaatar
- Energy Regulatory Authority (without year): (www.era.energy.mn/eng/)
- European Bank for Reconstruction and Development – EBRD (2008): Mongolia – Country Fact Sheet (www.ebrd.com/pubs/factsh/country/mongolia.pdf)
- European Bank for Reconstruction and Development (2008): Structural and Institutional Change Indicators 2007 (www.ebrd.com/country/sector/econo/stats/index.htm)
- Franklin/Somers (2008): Methan to Markets – Coal Mine Methane Global Overview 2008, chapter 20: Mongolia (www.methanetomarkets.org/resources/coalmines/overview.htm)
- German Technical Cooperation – GTZ/INTEGRATION Environment & Energy – INT (2004): Energiesektor der Mongolei, Ist-Situation und Perspektiven im Hinblick auf TZ Ansätze, Projektbericht, Ul2004
- German Technical Cooperation – GTZ/INTEGRATION Environment & Energy – INT (2005): Project Progress Report, Ulaanbaatar
- INTEGRATION Environment & Energy (2004): Energiesektor der Mongolei, Ist-Situation und Perspektiven im Hinblick auf TZ Ansätze, study on behalf of GTZ
- INTEGRATION Environment & Energy (2006): Making Access to Reliable Electricity Affordable in Rural Areas of Mongolia (study on behalf of GTZ), Ulaanbaatar
- International Atomic Energy Agency – IAEA (1995): Uranium 1995: Resources, Production and Demand
- Kosuke Kurokawa (2007): Energy from the Desert – Practical Proposals for Very Large-scale Photovoltaic Systems, Earth Scan UK & USA
- Methane to Markets Org (2004): Mongolia – Fact Sheet (www.methanetomarkets.org/resources/coalmines/docs/overview_ch20.pdf)
- Ministry of Nature and the Environment of Mongolia/Netherland's Climate Change Studies Assistance Programme – MNE/NAPCC (2006): Climate Change and Sustainable Livelihood of Rural People in Mongolia, Ulaanbaatar (www.nlcap.net/fileadmin/NCAP/Countries/Mongolia/032135.0508xx.MON.CON-01.Outputs-until-061202.v1.pdf)
- National Statistical Office – NSO (2005): Statistical Yearbook of Mongolia 2004, Ulaanbaatar
- National Statistical Office – NSO (2006): Statistical Yearbook of Mongolia 2005, Ulaanbaatar
- National Statistical Office – NSO (2007): Statistical Yearbook of Mongolia 2006, Ulaanbaatar
- National Statistical Office – NSO (2008): Statistical Yearbook of Mongolia 2007, Ulaanbaatar
- National Statistical Office – NSO (2009): Statistical Yearbook of Mongolia 2008, Ulaanbaatar
- Organization for Economic Cooperation and Development – OECD/Nuclear Energy Agency – NEA/International Atomic Energy Agency – IAEA (1996): Uranium 1995: Resources, Production and Demand, Paris
- Petrovis LLC. (1997): (www.petrovis.mn) and archived version of the Petrovis LLC website (http://web.archive.org/web/*/www.petrovis.mn)
- State Great Hural (1993): Foreign Investment Law of Mongolia, Ulaanbaatar
- State Great Hural (1995): Environment Protection Law, Ulaanbaatar
- State Great Hural (1998): Law on Environmental Impact Assessment, Ulaanbaatar
- State Great Hural (2001): 100,000 Solar Ger Program, Ulaanbaatar
- State Great Hural (2002): Integrated Energy System Program, Ulaanbaatar
- State Great Hural (2002): Law on Land, Ulaanbaatar
- State Great Hural (2002): Mongolia Sustainable Energy Sector Development Strategy Plan for 2002–2010, Ulaanbaatar
- State Great Hural (2004): Law on Water, Ulaanbaatar
- State Great Hural (2005): Liquefied Flammable Gas Program, Ulaanbaatar
- State Great Hural (2005): National Renewable Energy Program of Mongolia, Ulaanbaatar
- State Great Hural (2006): State Budget Law of Mongolia 2006, Ulaanbaatar
- State Great Hural (2006): State Development Fund Law of Mongolia, Ulaanbaatar
- State Great Hural (2007): Renewable Energy Law of Mongolia, Ulaanbaatar
- State Great Hural (2007): State Budget Law of Mongolia 2007, Ulaanbaatar
- State Great Hural (2008): Company Law, Ulaanbaatar
- State Great Hural (2008): Law on Construction, Ulaanbaatar
- Suozzi & Reid, New York State Commission on Property Tax Relief (2008): A Preliminary Report of Findings and Recommendations (www.era.energy.mn/eng/modules.php?ss=4&id=5)

- Transparency International (2009): Corruption Perceptions Index 2008 (www.transparency.org/news_room/in_focus/2008/cpi2008/cpi_2008_table)
- United Nation Statistics Division (2008): Indicators on Income and Economic Activity (http://unstats.un.org)
- United States Agency for International Development – USAID (2005): Mongolia Corruption Assessment (www.usaid.gov/mn/library/documents/MongoliaCorruptionAssessmentFinalReport.pdf)
- United States Agency for International Development – USAID/National Renewable Energy Laboratory – NREL/National Renewable Energy Centre of Mongolia – NREC (2000): Atlas of Wind Energy Resources in Mongolia, Ulaanbaatar
- World Bank – WB (2004): Mongolia – Forestry Sector Review (www.gateway.mn/downloads/environment/Forestry_sector_review.pdf)
- World Bank – WB (2009): Doing Business 2009 (www.doingbusiness.org/economyrankings/)
- World Bank – WB (2009): World Development Indicators database, April 2009 (http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/

Websites

- Energy Regulatory Authority – ERA: www.era.energy.mn/eng
- Government of Mongolia / status of Implementation of National Programs: www.open-government.mn

9 ANNEX

9.1 ANNEX – CHAPTER 2

GENERATION CAPACITY FOR ELECTRICITY AND HEAT BY GENERATION FACILITIES

CHP PLANTS	INSTALLED CAPACITY (MWE)	AVAILABLE CAPACITY (MWE)	BOILER CAPACITY (MWTH)	DISTRICT HEATING (MWTH)*	INDUSTRIAL STEAM (MWTH)*	YEAR OF COMMISSIONIN(G)
CHPP-2	21.5	17.6	80.0	43.0	58.0	1961–1969
CHPP-3	148.0	105.1	1,448.0	562.0	105.0	1968–1982
CHPP-4	540.0	432.0	2,450.0	918.0	29.0	1983–1991
Darkhan CHPP	48.0	38.6	477.0	210.0	49.0	1966, 1986
Erdenet CHPP	28.8	21.0	318.0	140.0	24.0	1987–1989
Subtotal of CES	786.3	614.3	4,773.0	1,873.0	265.0	–
Choibalsan CHPP (EES)	36.0	29.5	397.0	130.0	22.0	1969, 1979
Dalanzadgad CHPP	6.0	5.0	38.0	8.0	–	2000
Subtotal of CHPPs	828.3	648.9	5,208.0	2,011.0	287.0	–

OTHER GENERATING FACILITIES		INSTALLED CAPACITY (MW)	YEAR OF COMMIS-SIONING
Diesel generators in rural centers		40.00	–
Small hydro	Durgun HPP	12.00	2008
	Taishir HPP	11.00	2008
Mini hydro	Bogdiin HPP	2.00	1997
Micro hydro	10 micro HPPs	2.50	1961–2008
Wind	Small wind turbines in rural centers	1.20	1998–2008
	Household wind turbines	0.25	–
Solar	Small PV in rural centers	1.00	1998–2008
	Household PV	4.20	–
Import	Available capacity from Russian grid	160.00	–

Source: data compiled by the author based on ADB, 2002) * available in 1999 and personal inquiries at NREC and MFE

COAL BALANCE SHEET OF MONGOLIA (1,000 TONS)

YEAR	2001	2002	2003	2004	2004	2006	2007	2008
Total resources	5,337.0	5,692.5	5,823.6	7,091,8	7,860,4	8,465,1	9,555,3	10,453.7
Stock at the beginning of the year	186.0	148.0	157.2	226,5	342,9	390,8	317,3	381.3
Produced	5,141.0	5,544.4	5,666.1	6,865,0	7,517,1	8,074,1	9,237,6	10,071.9
Import	10.0	0.1	0.3	0,3	0,4	0,2	0,6	0,5
Total consumption	5,189.0	5,535.3	5,161.7	5,188.5	5,472.6	5,691.2	5,906.1	5,843.2
Consumed by thermal power plants	4,324.0	4,723.2	4,380.2	4,478.6	4,619.6	4,595.2	4,935.1	4,849.9
Distributed to economic sectors and households	865.0	812.1	781.5	709,9	853.0	1.096.0	971.0	993.3
Export	–	–	435.4	1,560.4	2,116.2	2,456.6	3,268.1	4,169.3
Stock at the end of the year	148.0	157.2	226.5	342.9	271.6	317.3	381.3	441.2

Source: NSO, 2005 & 2009

MAP OF THE MONGOLIAN ENERGY SYSTEM

Source: Energy Research and Development Center of Mongolia, Mongolia, without year

TABLE 8

Power Transmission and Distribution Lines in Mongolia

	LENGTH OF LINES (KM)						
VOLTAGE LEVEL	500 KV	220 KV	110 KV	35 KV	15 KV	6–10 KV	0.22–0.4 KV
CES	–	1,044	2,982	5,095	747	8,033	4,863
WES	–	–	472	337	–	370	387
EES	–	–	187	423	276	327	397
Total	0	1,044	3,641	5,855	1,023	8,730	5,646

Source: ERA, as of 2007

TABLE 9

Power Transmission and Distribution Sub-stations in Mongolia

	LENGTH OF LINES (KM)					
VOLTAGE LEVEL	500 KV	220 KV	110 KV	35 KV	15 KV	0.22–0.4 KV
CES	–	6	54	165	9	2,776
WES	–	–	45	6	–	166
EES	–	–	2	2	5	154
Total	0	6	61	173	14	3,096

Source: ERA, as of 2007

ERA ELECTRICITY TARIFFS IN CES, EES AND WES 2008

TYPE OF CONSUMER	TARIFF, MNT/KWH (VAT EXCL.)
CENTRAL ENERGY SYSTEM	
Central Energy System	
Flat tariff	68.00
TOU tariff	
Day (06:00–17:00)	68.00
Evening (17:00–22:00)	114.40
Night (22:00–6:00)	39.00
Trolleybus company	49.20
Flour/bread factories (4 companies)	
Flat tariff	53.20
TOU tariff	
Day (06:00–17:00)	53.20
Evening (17:00–22:00)	104.20
Night (22:00–6:00)	31.80
Residential consumers	
UB apartment dwellers	
< 150 kW/month	60.00
151–250 kW/month	64.00
> 251 kW/month	68.00
UB Ger residents	
< 150 kW/month	58.00
151–250 kW/month	62.00
> 251 kW/month	66.00
Aimags and Soums residential consumers	
< 80 kW/month	60.00
81–180 kW/month	64.00
> 181 kW/month	68.00
EASTERN ENERGY SYSTEM	
Entity and industrial consumers	68.00
TOU tariff	
Day (06:00–17:00)	68.00
Evening (17:00–22:00)	114.40
Night (22:00–6:00)	39.00
Residential consumers	68.00
TOU tariff	
Day (06:00–21:00)	68.00
Night (21:00–6:00)	34.00
WESTERN ENERGY SYSTEM	
Entity and industrial consumers	90.00
Residential consumers	60.00

Source: ERA website, as of 2009

ERA HEAT TARIFFS 2008

TARIFF CLASSES	UNIT	TARIFF (VAT EXCL.)
ULAANBAATAR		
Entity and industrial consumers		
Entity and industrial consumers	MNT/m³	282
Hot water for entities	MNT/month	3,184
Hot water for technological needs	MNT/Gcal	8,291
Metered heat	MNT/Gcal	18,241
Residential		
Apartments	MNT/m³	265
Hot water (during the heating season)	MNT/month	1,000
Hot water (during the non-heating season)	MNT/Gcal	1,500
Metered heat	MNT/Gcal	6,144
DARKHAN, ERDENET, BAGANUUR AND EASTERN ENERGY SYSTEM		
Apartments	MNT/m³	265
Hot water (during the heating season)	MNT/month	1,000
Hot water (during the non-heating season)	MNT/Gcal	1,500
Metered heat	MNT/Gcal	6,144
WESTERN ENERGY SYSTEM		
Entity and industrial consumers	MNT/m³	417
Residential consumers	MNT/Gcal	19,940

Source: ERA website, as of 2009

PROJECTS FINANCED BY THE GOVERNMENT OF MONGOLIA

NAME OF PROJECT	ORDERED AND IMPLEMENTED BY	RESULTS
Sophisticated utilization of the solar and wind energy in the state economy, construction of trial equipments and plants (1989–1990)	MFE, REC	The solar collector, biogas digester and the movable type of wind generator were invented and tested.
Wind energy (1991–1993)	MoI, REC	Wind energy measurement in Manlai Soum, Umnugovi province
Solar and wind energy (1994–1996)	Ministry of Fuel and Energy, NREC	The alternate forms to provide the herdsmen families with electricity, using RE were processed and tested in real conditions.
Assessment of solar and wind energy resources in Mongolia and technology of its utilization (1997–1999)	MFE, REC	Assessment of solar and wind energy resources in Mongolia was determined and map of resource was made. The further development plan of RE utilization in Mongolia was processed. Drawing of solar house was processed.
Small-scale electricity generating solar/wind hybrid system (1999–2000)	MFE, REC	Selection of small wind generator that can be used in Mongolian condition was made. On-site experiment of supplying rural small users with solar and wind energy
Study on possibilities to build wind farm with capacity of 25–30 MW (2002–2003)	MoI, REC	Feasibility study on wind farm with capacity of 46 MW; Wind measurement in target area

RENEWABLE ENERGY PROJECTS IMPLEMENTED AND SUPPORTED BY INTERNATIONAL DONORS

NAME OF PROJECT	ORDERED AND IMPLEMENTED BY	RESULTS
Applied research and development for rural use of RE MON 86/005 (1986–1990)	UNDP REC	Wind generator factory; Renewable Energy laboratory
Research of portable type photovoltaic power generation system for demonstration (1992–1997)	NEDO REC	On-site experiment and test of 3 types of 200 PV systems for herdsmen families in all areas of Mongolia
Study on utilization of solar and wind energy in Mongolian rural areas (1993)	DANIDO	Study and advice on electrification of Bag center and local centers using RE
PV manufacturing plant (1998)	ADB, NF PTA	PV manufacturing plant with annual production of 0,5 MWt PV panel
Rural electrification from RE sources in Mongolia (1998–2000)	TACIS REC	Assessment of solar and wind energy resources in 5 Soum centers in Gobi region; on-site experiment and test of electricity supply of hospital, school and dormitory in 3 Soum centers using solar and wind energy
Master plan study for rural power supply by Renewable Energies in Mongolia (1998–2000)	JICA REC	Master plan study of RE development in the period of 2005, 2010, 2015; 5 kW solar and wind pilot plant in 3 Soum centers
Wind energy resource assessment of Mongolia (1998–2000)	USAID, NREL REC	Wind measurement in Gobi region; Atlas of wind energy resource in Mongolia

Utilization of Renewable Energy in rural area of Mongolia (1999–2007)	BMZ/GTZ REC	On-site experiment on utilization of Renewable Energies in Zavkhan province
Demonstration research project on dispersed PV power generation systems in Mongolia (2002–2004)	NEDO MoI	PV power plant with capacity of 200 kW was built in Noyon Soum, Umnugovi province
Rehabilitation of HPP on Bogd River, Zavkhan province (2003–2004)	BMZ/KfW	Repair work of headrace channel of HPP on Bogd River
Nomadic electrification (2003)	JICA	Distribution of 11,500 PV systems with capacity of 62 W
Erdenebulgan (2003)	DANIDO	Construction of HPP with capacity of 200 kW
Development of RE utilization in local centers and rural areas (2003)	ADB	Research project
Project of HPP on Eg River (1998)	ADB	On-site study of HPP and techno-economical feasibility study; Drafts and blueprints
Taishir HPP (2000)	KF FEA	Drafts and blueprints of HPP on Zavkhan River with capacity of 12 MW were made; Tender for construction
Study on HPP on Orkhon River (2002)	JICA FEA	Techno-economical feasibility study on HPP on Orkhon River with capacity of 100 MW
Solar power systems for Soum centre hospitals and schools (1998–2000)	Bavaria	Installation of solar power system for school and hospitals and 100 herdsmen families in Zavkhan and Khuvsgul provinces
Taishir HPP (2001–2008)	Kuwait Fund Abu-Dhabi Fund GoM	Construction of Taishir HPP

ENERGY AND HEAT EFFICIENCY PROJECTS IMPLEMENTED AND SUPPORTED BY INTERNATIONAL DONORS

NAME OF PROJECT	IMPLEMENTED AND SUPPORTED BY	RESULTS
Energy conservation and monitoring, 1750 TA MON	ADB	Study and evaluation on energy systems; Study on possibilities of energy saving and improving efficiency
Energy conservation project, MON 1492	ADB FEA	Installation of flow meters in main pump stations in Ulaanbaatar and installation of thermal energy meters in main consumers; Construction of 6 km pipeline, installation of 39 valves and renewal of 2 pumps in TEPP-2; Pilot project on energy saving in residential buildings; Installation of meters and transformers on main electricity transmission lines
Improvements to energy supply in Darkhan and Choibalsan, Mongolia	TACIS Erchim Khemnelt Co. LTD.	Study on larger consumers in Darkhan, seminars; Feasibility study on rehabilitation of heating systems in Darkhan; Feasibility study and program on rehabilitation of heating systems in Choibalsan
Ulaanbaatar heat rehabilitation project	ADB	Renovation of heating system in Ulaanbaatar as automatic regulated system; Replacement of pumps on distribution network of TEPP with automatic regulated pumps; Rehabilitation of heating center; Installation of heat energy meters on consumers; Improvement of capacities of sub-distribution network; Installation of meter on hot tap water supply system; Pilot project on heating centers
Energy efficiency strategy for the district heating systems in Ulaanbaatar	WB	Study on loss in heating system; Processing of concepts for improving efficiency
Study on rehabilitation of electricity distribution network in Ulaanbaatar	WB	Processing of loss evaluation technique for bigger consumers and distribution systems, training for operating equipments of collecting system data
Study on rehabilitation of electricity distribution system in Ulaanbaatar, Dornod and 6 provincial centers	WB	Renewal of distribution transformers, transmission lines and installation of meters in suburbs of Ulaanbaatar, renovation of income collecting system; Renovation of 1 substation in Dornod, study on system loss reduction in 7 provincial centers
Implementation of energy conservation programs and rational use of energy in Mongolian industry	TACIS	Pilot project in industries such as APU, Mongol Nekhmel, Pharmaceutical factory, Eermel and Makh Impex

9.2 ANNEX – CHAPTER 4

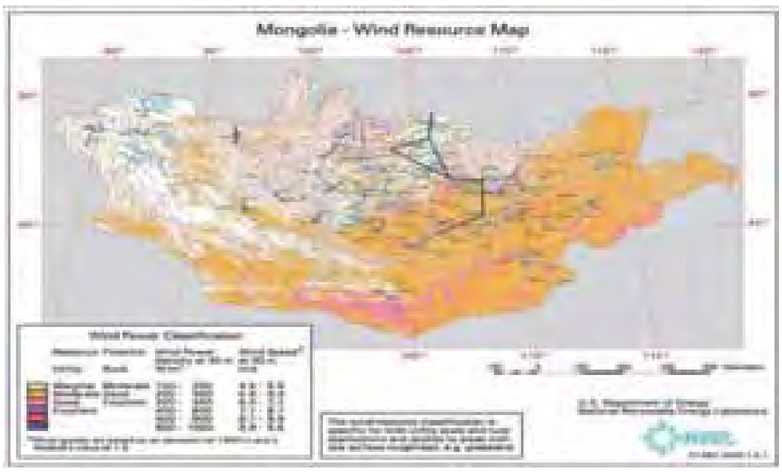
Map of Installed and Planned Hydro Power Plants in Mongolia

Source: GTZ/INTEGRATION, as of 2007

Utilization of Solar Potentials

Source: GTZ/INTEGRATION, as of 2007

Wind Resource Map of Mongolia



Source: USAID/NREL/NREC, as of 2000

Utilization of Wind Potentials

Source: GTZ/INTEGRATION, as of 2007

Outlines of the Main Geothermal Structures of Mongolia

	SYSTEM	SUBSYSTEM	BLOCKAGE	HEAT FLOW (Kcal cm[2])	GEOTHERMAL GRADIENT (°C/km)	CHEMICAL COMPOSITION	MINERALS (g/l)
Fold platform zone	Khangai	Tarvagatai-Ulastai Baidrag-Taishir Orkhon-Taats	open semi open	1.8–2.4	45–80	SO_4 HCO_3/Na CO_3 HCO_3 CO_3/Na SO_4	<0.5
	Khentii	Khoid Khentii Onon-Ulz	semi-open closed	1.0–1.2	35–50	HCO_3 CO_3/Na SO_4 SO_4 HCO_3/Na	<1.0
	Khuvsgul	Nuur Murun	semi-closed closed	0.8–1.2	25–40	SO_4 HCO_3/Na	<1.0
	Bulnai	Bulnai	open	0.7–1.0	20–25	SO_4 HCO_3/Na CO_3	<0.5
	Altai	Altai Ikh Bogd	semi-closed closed	1	20–30	SO_4 HCO_3/Na	1–5
Transitional zone	Transitional	Monol-Daur Bayankhongor Bulgan Sant Zaamar	closed	1	20–35	SO_4Cl/Na	3–10
Subsided zone	Dornod-Dariganga	Dornod Dariganga				$ClSO_4$/NaCa	5–25 (150)
	Gobi	Sainshand Gobi		1	20–35	$ClSO_4$/Na	20–80 (300)
	Ikh Nuur	Nuur				$ClSO_4$/Na	15–66 (120)
	Orkhon-Selenge	Orkhon-Selenge				$ClSO_4$/NaMg	10–20

Source: Dorjderem, as of 1998

Heat Flow Map of Mongolia

Source: Dorofeeva, Sintsov, Bat-Erdene, 1986–1987, and Dorjderem, 1992–1994

Estimate of Standing Volume of Mongolian Forests in 2000 (1.000 m^3)

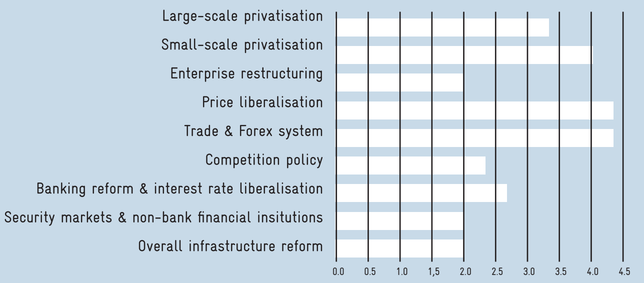
SPECIES	ESTIMATED STANDING VOLUME
Larch (Larix sibirica)	1,030.0
Pine (Pinus silvestris)	92.0
Cedar (Pinus cembra)	164.0
Birch (Betula)	86.0
Other (fir, spruce, poplar etc.)	7.0
Total	**1,379.0**

Source: Dorofeeva, Sintsov, Bat-Erdene, 1986–1987, and Dorjderem, 1992–1994

9.3 ANNEX – CHAPTER 5

EBRD Transition Indicators 2007/Transition progress

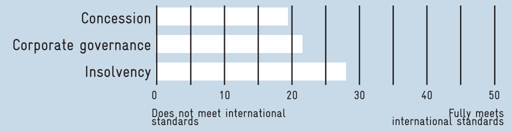
TRANSITION INDICATORS, 2007



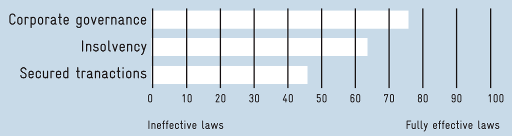
The transition indicators range from 1 to 4+, with representing little or no change from a rigid centrally planned economy and 4+ representing zhe standards of an industrialised market economy.

Source: EBRD Office of the Chief Economist , as of 2007

Quality of law `on the book´

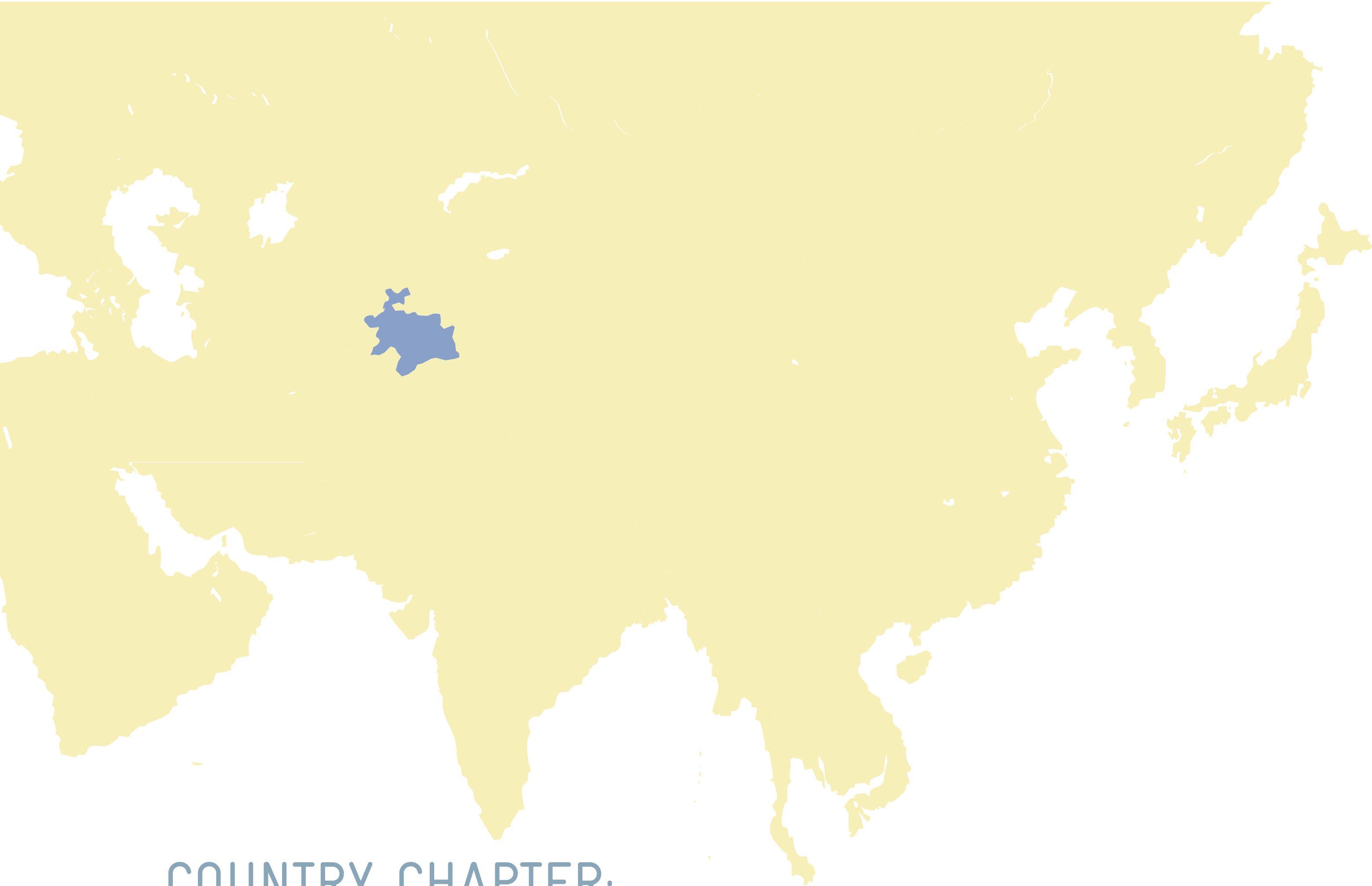


Effectiveness of the law



Measuring effectiveness of the law using specific case studies as proxies for the relevant sector

Source: EBRD Office of the General Council, country law assessments, without year



COUNTRY CHAPTER: REPUBLIC OF TAJIKISTAN

Authors and Coordination of Country Chapter
Dr. Ing. Klaus Jorde
Entec Consulting & Engineering AG
St. Gallen, Switzerland
www.entec.ch

Axel Biegert (Dipl. Economist & Pol.)
INTEGRATION UMWelt & Energie GmbH
Graefenberg, Germany
www.integration.org

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS

ACRONYMS AND ABBREVIATIONS
REPUBLIC OF TAJIKISTAN

ADB	Asian Development Bank
AKFED	Aga Khan Foundation for Economic Development
AS	Academy of Science
BT	Barki Tojik, Tajikistan's national power company
CAPS	Central Asian Power Systems
CDM	Clean Development Mechanism
CIS	Commonwealth of Independent States
FDI	Foreign Direct Investment
FEC	Fuel and Energy Complex
GAA	German Agro Action
GBAO	Gorno-Badakhshan Autonomous Oblast (Tajikistan)
GDP	Gross Domestic Product
GoT	Government of Tajikistan
HVDC	High Voltage Direct Current
HPP	Hydro Power Plant
IDB	Islamic Development Bank
IFC	International Finance Corporation
IPP	Independent Power Producer
MHPPs	Mini/Micro Hydro Power Plants
MoEI	Ministry of Energy and Industry
MSc	Master of Science (Degree)
PE	Pamir Energy
RT	Republic of Tajikistan
SECO	Swiss State Secretariat for Economic Affairs
SHPPs	Smaller Hydro Power Plants
SME	Small and Medium Enterprise
TALCO	Tajik Aluminium Company
TDS	total dissolved solid
UNDP	United Nations Development Program
USD	US Dollar (Exchange rate 1 USD = 3.45 Somoni (345 Diram)
USSR	Union of Soviet Socialist Republics
WB	World Bank

MEASUREMENTS

°C	degree Celsius
GWh	gigawatt hour (1GWh = 1,000,000 kWh)
kJ	kilojoule (1kJ = 1,000 joules)
km	kilometer
km^2	square meter
ktoe	kilotons of oil equivalent (1 ktoe = 11.63 GWh)
kV	kilovolt
kWh	kilowatt hour
m	meter
m/s	meter per second
m^3	cubic meter
mm	millimeter
MW	megawatt (1 MW = 1,000 kW)
TDS	total dissolved solid
TWh	terawatt hour (1 TWh = 1,000,000,000 kWh)
W	watt

1 SUMMARY

Tajikistan has an enormous hydro power potential which is presently only used at a small fraction. 94 % of the electricity is generated in large Hydro Power Plants. The Government focuses on the development of new and refurbishing/upgrading of existing large Hydro Power Plants (HPPs) and negotiates directly with foreign investors. But there are also plenty of opportunities for small hydro power development including isolated grids and to support decentralized power generation.

Electricity prices for consumers are extremely low as a result of the extremely low prime costs for large hydro power in Tajikistan. As a result, alternative ways of generating electricity have not been developed so far.

Sharp fuel shortage exists in rural mountainous areas where firewood is scarce and power from the grid is not available. In those areas, however, the poverty level is significant and the population is unable to pay for high-cost power generating devices. There is a significant potential for small hydro power development and also for solar energy. Potentials for wind and geothermal energy are small. In remote areas without grid connection, those may, however, be the only option.

The Government of Tajikistan invites foreign direct investment especially in the energy sector. Enterprises can be 100 % foreign owned or jointly owned with Tajik partners. Nevertheless, the general conditions for small foreign investments in Tajikistan are difficult. Although the process of obtaining a business license has become much easier, there are still critical issues. The license obtaining and license renewal process is lengthy and complicated. The issuance of permits and licenses is altogether not clearly regulated.

Frequent inspections by government officials related to permission and license issues often result in unofficial payments. There are no official power purchase tariffs, and a general regulatory framework for private investments in the Renewable Energy (RE) sector is not existent.

2 COUNTRY INTRODUCTION

Tajikistan is the smallest nation in Central Asia by area. After gaining its independence in 1991, it was afflicted by a civil war. The majority of the 400,000 ethnic Russians mostly employed in the industry fled the county. By 1997, the war had cooled down and a central government began to take form resulting in peaceful elections in 1999. Since then, the newly established political stability and foreign aid have allowed the country's economy to grow. Tajikistan has on of the lowest per capita Gross Domestic Products (GDP) of the former Soviet republics and the economic situation remains fragile due to uneven implementation of structural reforms, corruption, weak governance, widespread unemployment, seasonal power shortages and the external debt burden.

The majority (72 %) of the population lives in rural areas and the agricultural production is mostly based on irrigation farming. The rivers of Tajikistan provide 55 % of the flow to the Aral Sea.

Tajikistan is the poorest country in Central Asia yet has enormous hydro power potential, which remains to be developed. The national transmission system of Tajikistan is an integral part of the Central Asian Power Systems (CAPS). Based on its hydro power potential, Tajikistan could provide enormous amounts of electricity to Central Asian countries as well as to Pakistan, India and China. Currently, the Tajik power system is connected to energy systems of Uzbekistan and Kyrgyzstan by 220 and 500 kV transmission lines. A new transmission line from Afghanistan is under construction and several more lines connecting Tajikistan with potential customer countries have been identified as being critical for the export of electricity. The most significant obstacle for the development and export of hydro power generated electricity is the lack of available funding.

2.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Tajikistan is a landlocked country in the South East of Central Asia. It extends over 700 km from West to East and 350 km from North to South. Characterized by a complex borderline, it is located approximately at he same latitude as southern Italy.

FIGURE 1

Map of Tajikistan

Tajikistan is a mountainous country with half of its territory above 3,000 m and mountains covering about 93 % of its area. One third of the country is occupied by foothills and prairies. Lowland areas are situated in river valleys. Tajikistan is situated in an active seismic zone characterized by frequent earthquakes.

The climate in Tajikistan is continental, with considerable seasonal and daily variations of temperature and air humidity. The rugged relief with large amplitudes of high mountains accounts for the diversity of climates and temperatures. The average annual amount of precipitation in Tajikistan is 760 mm with a highly uneven distribution. In the hot deserts of Southern Tajikistan and cold high mountain deserts of the eastern Pamirs, precipitation varies from 7 to 160 mm/year and in some areas of the southern slope of the Gissar Range the amount of precipitation can rise to 2,000 mm.

2.2 POLITICAL AND ECONOMIC ENVIRONMENT

Since the end of the civil war in 1997, peace and stability have been a crucial challenge for increasing international support. This has allowed a remarkable economic development in the recent years, with annual growth rates of 8–10 %. The Economic Development Program of Tajikistan envisages an average annual real GDP growth of 13 % until 2015, increasing the scale of the economy by 4.4.

The drawback of this development is an increasingly self-centered government with considerable and augmenting elements of authoritarian arbitrariness, endemic corruption, exploitation of profitable economic assets by a minority of the society and a general neglect of the peoples' basic development needs in the overall policy. More than 40 % of the people lived below the poverty line of 2 USD/day in 2001. Poverty also contributes to large-scale labor migration aggravating the current shortage of qualified labor resources.

The economy of Tajikistan is based on the production of hydro power, cotton and aluminium. A lack of investment prevents further development of the country's hydro power capacity. Tajikistan currently depends on natural gas imports from Uzbekistan and oil imports from Russia, Turkmenistan and Kazakhstan.

In the former USSR, Tajikistan was the third largest cotton producer with one million tons per year and 11 % of the total production. In the past years, cotton production has not exceeded 60 % of the former amount. Around 80 % of the total export revenues come from aluminium and cotton, making Tajikistan highly dependent on price fluctuations in the world primary market. The cotton sector is heavily indebted and continues to make losses

LAND AREA:	143,100 km²
POPULATION:	6.4 million (28 % urban, 72 % rural)
DENSITY:	44.9 inhabitants/km²
BIGGEST CITIES AND INHABITANTS:	Dushanbe (0.68 million), Khujand (0.15 million)
LANGUAGE:	Tajik
CLIMATE:	The climate in Tajikistan is continental with considerable seasonal and daily variations of temperature and air humidity. The average annual number of sunshine hours varies from 2,097 to 3,166 hours. The average annual amount of the solar radiation varies from 151.1 to 176.1 kcal/cm² and reaches 182.9 to 223.9 kcal/cm² on a clear day.
TEMPERATURES:	The average annual air temperature in the foothills and valleys varies from +6° to +17 °C and is close to 0 °C in the high mountains of the Pamirs. The absolute minimum was registered in the Bulunkul in the Eastern Pamirs (–63 °C) and the absolute maximum of +48 °C in the Shaartuz in the southern Khatlon Region. In southern valleys, the average temperature in the hottest month of July is +31 °C. The rugged relief with large amplitudes of high mountains accounts for the diversity of the climates and temperatures.
ALTITUDE:	330 m to 7,495 m, about half of the country's territory is located above 3,000 m
RIVERS:	Syr Darya, Piani River, Zerayshan River, Kafirnigan
ECOSYSTEM AREAS:	Forests (1 %), shrubland, savannah, grassland (48 %), cropland and crop/natural vegetation mosaic (24 %), urban and built-up areas (0.3 %), sparse or barren vegetation, snow and ice (25 %), wetland and water bodies (2 %)
GDP – PER CAPITA (PPP):	514 USD (as of 2007)
INFLATION RATE:	11.8 % (as of 2008)
AGRICULTURE – PRODUCTS:	Cotton, grain, fruit, grapes, vegetables, cattle, sheep, goats
INDUSTRIES:	Aluminium, zinc, lead, chemicals and fertilizers, cement, vegetable oil, metal-cutting machine tools, refrigerators and freezers
ELECTRICITY – PRODUCTION:	17.27 billion kWh (as of 2007)
ELECTRICITY – CONSUMPTION:	17.34 billion kWh (as of 2007)
ELECTRICITY – TARIFFS:	0.5 US Cent/kWh (among the world's lowest rate)
NATIONAL ELECTRICITY CAPACITY IN OPERATION:	4,400 MW
NATURAL RESOURCES:	The world's largest reserves of barite, lead, tungsten and uranium; the second largest of chromite, silver and zinc; the third largest of manganese, significant deposits of copper, gold and iron ore
ELECTRIFICATION RATE:	n.a.
OIL – PRODUCTION:	0.28 thousand barrels/day (as of 2007)
OIL – IMPORT:	33.72 thousand barrels/day (as of 2007)
OIL – CONSUMPTION:	34 thousand barrels/day (as of 2007)
OIL – PROVEN RESERVES:	0.012 billion barrels
NATURAL GAS – PRODUCTION:	1 billion cubic feet/year
NATURAL GAS – PROVEN RESERVES:	200 billion cubic feet
EXPORTS:	1.4 billion USD (as of 2008)
EXPORTS – COMMODITIES:	Aluminium, electricity, cotton, fruit, vegetable oil, textiles
EXPORTS – PARTNERS:	Netherlands (38.9 %), Turkey (32.5 %), Russia (6.6 %), Uzbekistan (5.9 %), Iran (5.1 %) (as of 2007)
IMPORTS:	3.2 billion USD (as of 2008)
IMPORTS – COMMODITIES:	Electricity, petroleum products, aluminium oxide, machinery and equipment, food
IMPORTS – PARTNERS:	Russia (32.1 %), Kazakhstan (13.1 %), China (10.8 %), Uzbekistan (8.4 %)
EXCHANGE RATE:	1 € = 4.97149 TJS Tajik Somoni (as of 2009)

Source: CIA World Fact Book, as of 2009; IEA, as of 2006

3 ENERGY MARKET IN THE REPUBLIC OF UZBEKISTAN

Tajikistan possesses rich hydro power resources (4 % of the world's resources) and coal, whereas it has only poor natural gas and oil deposits. These resources are not sufficiently developed and the country suffers from an annual energy deficit of 3.0 to 3.5 GWh, resulting in reduced electrical power availability and regular blackouts from October to April. Whereas the electricity sector alone currently accounts for about 5 % of the GDP, electricity is the most important input for the two most exported commodities – aluminium and cotton. In addition, this sector has the confirmed potential to contribute to export-led growth by electricity exports to countries within Central Asia and outside.

To secure the overall situation and the provision of fuel and energy in particular, the Government of Tajikistan (GoT) is making a two-track approach on the development of the energy sector.

The first track focuses on the domestic energy sector, making a sector-wide approach by covering the electricity, gas and heating components. In order to achieve the approach's main goal, i. e. the recovery of the domestic energy sector, the GoT is intending to take a series of policy and investment measures. The second track of the development strategy is oriented towards export markets. This strategy wants to activate the sector's significant potential to contribute to the country's economic growth through electricity exports. At present, there are electricity surpluses in the summer, which are already being exported to Afghanistan, Kazakhstan, Uzbekistan and Russia. It is intended to intensify these exports and secure more long-term contracts for existing surpluses.

In order to support these strategies, a number of policy measures are being considered by the GoT to further the implementation of the energy sector. These include:

- The increase of the energy supply, particularly during the winter months, by rehabilitating and upgrading some of the existing large HPPs
- The revision of the energy pricing policy and tariff increases to achieve cost recovery
- The reduction of transmission and distribution losses under a program sponsored by the World Bank (WB) and the Swiss State Secretariat for Economic Affairs (SECO)
- The improvement of revenue collection from consumers
- The management of the demand side at the Tajik Aluminium Company (TALCO) including efficiency enhancement

It is also intended to separate the transmission and distribution of electricity from generation by creating new entities responsible for each of the components.

Tajikistan aims to provide a stable supply of energy carriers and to achieve maximal energy independence of the republican Fuel and Energy Complex (FEC). FEC is a combination of interrelated economic stakeholders including governmental and non-governmental organizations, which are engaged in coal, oil, gas, heat and electricity supply as well as consumption systems and territorial subsystems.

3.1 IMPORTANT PLAYERS OF THE TAJIK ENERGY MARKET

Policy and Regulatory Level

The Fuel and Energy Department in the Office of the President has overall responsibility for the energy sector. The Ministry of Energy and Industry, re-established in December 2006, is responsible for implementation of the Government's energy policy. The Agency on Anti-Monopoly Policy and Entrepreneurship acts according to the provisions of the Law on Natural Monopolies and regulates the tariffs of electricity. It reports directly to the Office of the President.

Operational Level

The major electrical utility is the joint-stock holding company of Barki Tojik (BT). BT is a 100 % state-owned electrical energy utility that controls electricity generation, transmission and distribution within the Republic except in the Gorno-Badakhshan Autonomous Oblast (GBAO). Moreover, BT is engaged in substantial trade relationships with neighboring states. BT also owns the Tajik State and Scientific Research Institute named Hydro Energy Project, which is a general design organization for hydro power projects. Major investments into the sector are handled by a Project Implementation Unit for a Power Rehabilitation Project that is under the control of the President's office.

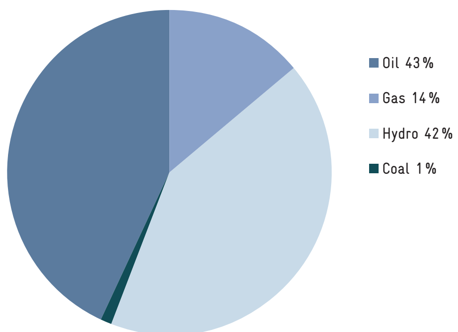
Private Companies

In GBAO, the private company of Pamir Energy (PE) was established with the support of the Aga Khan Foundation for Economic Development (AKFED) and the International Finance Corporation (IFC). PE took over the GBAO electric network from Barki Tojik on 1 December 2002 by a 25-year concession agreement. This is the first public-private partnership project in the energy sector implemented in Central Asia.

3.2 PRIMARY ENERGY CONSUMPTION, TRANSMISSION AND PRICES

In 2005, the total primary energy consumption in Tajikistan was 3,458 ktoe as estimated by the International Energy Agency. Figures 2 and 3 show the resources used and consumer groups.

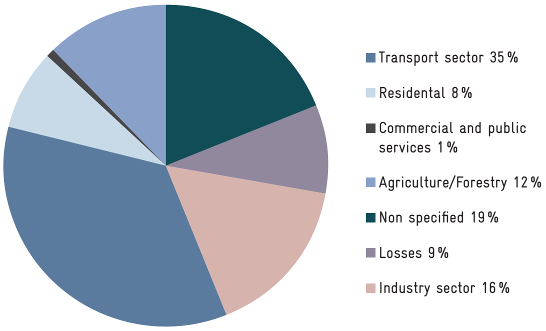
FIGURE 2
Share of Total Primary Energy Supply



Source: International Energy Agency – IEA, as of 2005

FIGURE 3

Major Consumer Groups for Primary Energy



Source: International Energy Agency – IEA, as of 2005

38,6 % of the total primary energy supply is domestic produced and 61,4 % is imported. More detailed information on the share of domestic production, import and export can be found in the annex. Hydro power is a major resource in the Tajik power system whereas other RE resources play no role.

Electricity Sector

Hydroelectric power plants generate over 94 % or approximately 17,000 GWh of BT electricity production, with the remainder produced by the Dushanbe Thermal Station during the winter period (November–March). During wintertime, BT meets 85 % of the total electricity demand of the country. The remainder is to be met by imports from Uzbekistan, but power shortages or scheduled cuts regularly occur. A significant portion of Tajikistan's power sector infrastructure is in poor condition, which has contributed to increased commercial and technical losses of nearly 15,7 % of the generating capacity.

TABLE 1

Total Electricity Consumption in GWh

GAS	401
HYDRO	16,685
TOTAL PRODUCTION	17,086
IMPORTS	4,508
EXPORTS	4,257
DOMESTIC SUPPLY	17,337
ELECTRICITY USED BY PLANT AND FOR PUMPED STORAGE	169
DISTRIBUTION LOSSES	2,489
TOTAL FINAL CONSUMPTION	14,679

Source: International Energy Agency – IEA, as of 2005

The large HPPs produce less energy during the winter than during the summer. Combined with a higher energy demand in winter, this fact leads to power shortages with electricity only available for 1–3 hours in the morning and 1–3 hours in the evening.

TALKO is the largest consumer in Tajikistan and consumes about 50 % of the total electricity consumption.

Natural Resources

The Republic of Tajikistan has abundant fuel and energy resources. Hydroenergy resources are estimated to 527 TWh equaling 53 % of the total Central Asian region. More specific investigations of 511 rivers resulted in 300 TWh of hydro power potential. This quantity would be sufficient to provide electricity to all Central Asian countries. Increased exploitation of oil and gas resources are hindered by high expenses resulting from difficult mining and geological conditions and deposits deeper than 5–7 km. At present, potential reserves of coal are assessed at 4–5 billion tons (only 25 thousand tons were extracted in 2001). Stocks of coal fuel have been found in practically all districts of the Republic but most of the deposits are located in regions with difficult access. Other hydrocarbon deposits in Tajikistan are oil (117 million tons), gas (857 billion m^3) and condensate (26 million tons). Despite of these domestic resources, oil and gas have to be imported.

The extreme shortage of organic fuel, the difficulty of its delivery to the mountain areas of Tajikistan and the absence of electric power in remote settlements forces the inhabitants of mountain areas to use wood as fuel. Forests of the first category and fruit trees are cut down for fuel. This results in a reduction of the area and density of large forests, the uncovering of hillsides and an increased risk of mud flows and soil erosion. The deforestation supports desertification and reduces the potential of land and biomass to absorb carbon dioxide from the atmosphere. It also leads to water supply and health problems. For the inhabitants of the mountain regions, deprived of other means of subsistence, the environment has become a serious challenge for survival. Ploughing up of slopes, cutting down of the forests and the uncontrollable use of pastoral land result in the degradation of the landscape in the catchment of the Amu Darya river basin.

Transmission and Distribution System

Tajikistan's power grid consists of three separate systems: the northern, the southern, and the Gorno-Badakshan electrical systems. While the northern system has a shortage of electricity and requires imports from Uzbekistan, the southern part has a surplus and exports electricity during the summer. There is an ongoing project of the construction of a 500 kV transmission line between the South and the North of the country to be completed in 2009. Basically all towns and villages are connected to the power grid. Many components of the transmission and distribution system and the switchgear are generally in bad condition. Most of the equipment is very old and needs to be replaced. Network losses combined with high commercial losses result in total losses of up to 17 %.

The rural population of Tajikistan experiences more difficulties to access electric power than the urban population. This is caused by the unsatisfactory conditions of the system of electricity supply in Tajikistan, such as instability of voltage and faults of supply of electric power, weak capacity of the distribution and communication systems, a low payment level and high losses.

Import and Export of Energy

Tajikistan imports electricity during autumn and winter from Turkmenistan (1,000 GWh), Uzbekistan (600 GWh) and Kyrgyzstan (400 GWh), but actually succeeded only to import 1,050 GWh in total (as of 2006/2007).

Electricity export from Tajikistan is limited to repay for supplied electricity during the winter seasons by neighboring countries. The project CASA 1000, however, is to boost the export of electricity from Tajikistan and Kyrgyzstan to South Asia, especially Afghanistan and Pakistan. The High Voltage Direct Current (HVDC) transmission lines from Tajikistan via Afghanistan to Pakistan are under construction.

Prices

The Agency on Anti-Monopoly Policy and Entrepreneurship acts according to the provisions of the Law on Natural Monopolies and regulates the tariffs of electricity. Tariffs vary greatly but local residents pay approximately 1.5 US Cents/kWh. It is not clear what prices would have to be paid to an Independent Power Producer (IPP) as there are presently no IPPs from whom BT is buying electricity.

Growth Predictions for the Energy Sector

Hydro power is a foundation of the energy sector in Tajikistan and its development could multiply the energy production of the overall Central and South Asia Region. Tajikistan has a power deficit of 3,000–3,500 GWh/year and in the winter, power consumption must be rationed. Nevertheless, during the summer, Tajikistan has a stable abundance of hydro power that exceeds both internal and external demand given restrictions on economic exchange between former Soviet republics.

In 2007, Tajikistan has managed to attract several oil and gas exploration companies including Russian GazProm, which started exploration activities for oil and gas deposits in Tajikistan.

Besides domestic consumption, there is a growing demand for electricity from South Asian countries such as Afghanistan, Pakistan, China and India.

4 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

4.1 NATIONAL STRATEGIES AND PROGRAMS TO SUPPORT RENEWABLE ENERGIES

The Government of Tajikistan and the National Parliament have created legal, normative-technical, industrial and financial regulations for a successful implementation of a hydro power development program. They include:

- Law on Foreign investments in the Republic of Tajikistan adopted in 1992 with additions in 1996 and 1997. A new Law on Investments was adopted in 2007.
- Order of the Presidium of the Supreme Body of the Republic of Tajikistan No. 1,350 on Redemption of Tax Payment for Small Hydro Power Plants, Objects of Non-conventional Power Sources for small Enterprises on Mining and Coal Conversion adopted in 1992
- Order No. 267 on Development of Small Power Engineering in Tajikistan adopted in 1997
- Concept of Development of Branches of the Fuel and Energy Complex of Tajikistan for the Period of 2003–2015 adopted in 2002
- Law on Power Engineering adopted in 2004
- Complex Program on Wide Use of Alternative Energy Sources such as Energy of Small Rivers, Sun, Wind, Biomass, Geothermal Energy for the Period of 2007–2015 adopted in 2007

The primary energy law, the Law on Power Engineering, defines key terms and indicates the fundamental state policy objectives in the sector including security and reliability of supply, environmental protection and efficiency and investment gains through moving to a market-based system. The Law on Power Engineering authorizes the GoT to develop Tajikistan's energy policy. The Ministry for Power Engineering is responsible for the implementation of that policy including licensing.

The Tajik electric power industry is attractive for big investors. This is due to the fact that prime costs of electric hydro power energy in Tajikistan are among the worlds lowest. To attract foreign capital, the Government adopted special terms for major investors. A large part of the hydro power potential, however, remains unexploited, primarily because of an uncertain private investment environment and a protracted structural reform process. Nevertheless, over the last couple of years, GoT has managed to attract foreign investment from Russia, Iran and China to the electricity sector. Secured investments channeled in the construction of two important hydroelectric plants – Sangtuda 1 HPP (Russia) and Sangtuda 2 HPP (Iran) – and the construction of South-North transmission lines (China). After bringing into operation the two HPPs, the electricity deficiency of the country will be almost solved.

In 1997, the Government of Tajikistan issued an order for Development of Small Power Engineering, which approved the establishment of an association to support small and non-traditional energy. The term usually refers to small powerplants with less than 25 MW, often operating in isolated mode. The project was initiated by the Russian Association of Non-traditional Energy and Barki Tojik.

In 2007, the Complex Program on Wide Use of Alternative Energy was initiated by the Government of Tajikistan. The Academy of Science was assigned to establish a special Center and Design Office for Research and Development for technological solutions for the generation of alternative energies. The overall program is divided in the following phases:

- **Phase 1** (timeframe: 2007–2009; state financing: 87,000 USD)
  Research in the area of compiling cadastre for alternative energy sources; review of effectiveness taking into account geo-climatic conditions; development of new devices, materials and technologies for energy generation. It is also envisaged to establish a data bank of alternative energy sources and international cooperations on alternative energy.

- **Phase 2** (timeframe: 2010–2012; state financing: 290,000 USD)
  Continue research; production of samples of high efficiency devices for energy generation; establishment of an industrial base for production lines; focus on capacity building of human and technical potential.
- **Phase 3** (timeframe: 2013–2015; state financing 1,450,000 USD)
  Continue research; industrial production of high efficiency devices for alternative energy generation

The program is financed from the state budget by 25.4%. The rest of the financing is to be acquired from international partners and the private sector. The program is supervised by the Academy of Science. Main program coordinator is the Umarov Physical-Technical Institute under the Academy of Science of Tajikistan. After a delay in 2007, the program started in 2008 with an allocation of 22,000 USD. An open tender was announced to relevant institutions to participate in the research program. Three proposals have been submitted to the Academy of Science:

1. Creation of photo elements – Khujand University
2. Production of bio-gas – Agrarian University of Dushanbe
3. Creation of a cadastre for alternative energy sources – Umarov Physical-Technical Institute

Energy Saving Program

In 2008, the Norwegian Society for the Conservation of Nature launched a Peace Core Project on simple energy saving measures in households in Tajikistan. The project's goal is to transfer Nepalese know-how to Tajikistan by implementing efficient stoves. The project has gradually been extended with practical objectives on energy saving and alternative energy sources since 2005. Since Tajikistan has severe energy shortages mostly in rural regions, sustainable and productive development represents a great challenge. The country has scarce forest areas, and local people spend most part of the day collecting firewood. The project has focused on energy saving and efficiency in educational buildings, window insulation improvement, solar water heating, efficient greenhouses, lighting, cooking and household heating. The project is co-financed by the Norwegian Ministry of Foreign Affairs.

Education Project of Tempus

The education project on RE called Tempus is assisted by the Tajik Technical University to establish a good quality research laboratory in partnership with international universities such as the Technological University of Hamburg (Germany) and Universities from Greece, Sweden and Kazakhstan. The project support and partnerships have allowed setting up an MSc program in RE at the Tajik Technical University that is going to accept first students in October 2008.

Energy for Rural Communities

Apart from the above-mentioned future exploitation of the hydro power potential, a special emphasis lies on energy carriers used in small remote villages with a population of up to 100 persons. An average family in such settlements consists of 5 persons. One family uses 10–15 kg of dry wood per day for the preparation of food, hot water and heating as well as 0,3–0,5 l of petroleum for lighting. In order to increase living standards of inhabitants in the mountain regions, it is necessary to increase the quantity of available energy and at the same time change the structure of energy consumption and methods of obtaining energy and reduce the quantity of the by-products negatively influencing inhabitancy and health of the people. It is estimated that for a reliable power supply of an average family the following set of devices is necessary:

- Electric power of 500 W for illumination and appliances
- Solar kitchen, high efficiency wood furnace
- Biogas installation (with volume of digesters of around 10 m^3)
- Solar water heater with capacity of 300–500 W
- The cumulated capacity of consumed energy will reach up to 4 kWh per family per day. The cost of the necessary equipment to provide this RE will be 2000 –4000 USD.

The State Complex Program on Wide Use of Alternative Energy outlines the following technological directions for the development of alternative energies:

- PV panels
- Mini and small hydroelectro stations
- Sun collectors for water heating and greenhouses
- Construction of dryers for fruit processing
- Wind energy generators
- Biogas and geothermal energy
- Construction and installation of hydro ram-pumps for irrigation and drinking water in rural villages

4.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

The development of alternative energy is allowed in accordance with several Laws (e.g. Energy Efficiency Law), but many issues such as special tariffs for RE, ownership matters, licensing, financial incentives and others aspects are not sufficiently covered by the current legislation. Within the Complex Program, the Government of Tajikistan has acknowledged that there is a need to develop a separate Law on Alternative Energy Sources, which will provide a sufficient legal and normative base for the development of the alternative energy sector.

SHORT BUSINESS INFO

While Tajikistan generally acknowledges the need for developing RE, there is only a very general legal commitment and no regulatory framework to attract private investors into the Renewable Energy market.

Clean Development Mechanism (CDM)

In Tajikistan, Clean Development Mechanism (CDM) projects have not been pursued yet because the country has only recently ratified the Kyoto Protocol in 2009. Nevertheless, the National Action Plan of Tajikistan on the abatement of consequences of climate change specifies the necessity and expediency of an acceptance of the Kyoto Protocol.

5 POTENTIAL FOR RENEWABLE ENERGIES AND PRESENT USE

Tajikistan has an abundant potential of hydro power resources and possesses fairly developed studies on how to utilize some of this potential, especially at the large capacity sites, at relatively low prime costs. Compared to that, all other RE appear very minor. The use of solar energy, however, has good prospects, especially in the Tajik Pamir, where irradiation is nearly 2,000 kW/m^2 annually. Wind energy has not yet been investigated, but there are promising areas in this mountainous country. Geothermal resources are small and poorly studied in Tajikistan. Concerning bioenergy, there are some small-scale community projects, implemented under the guidance of the Academy of Science and international organizations.

5.1 BIOENERGIES

Since forest coverage is very small, Tajikistan primarily possesses bioenergy potential from agricultural wastes. It is estimated that Tajikistan has the potential to produce around 2 billion kWh/year of electricity from biomass sources (Kabutov, as of 2007). An overview of available biomass resources can be found in the appendix.

Solid Biomass

Tajikistan has a range of solid biomass sources such as wood, sawdust, grass cuttings, domestic refuse, charcoal, agricultural waste, dried manure and cotton stalks. The last two are the most important raw biomass in a suitable form. These biofuels are frequently burned for domestic purposes directly in a stove or furnace to provide heat, and it is estimated that three quarters of the population depend on this type of heat source. A major source of solid biomass are the cotton stalks left over after harvesting the cotton fiber. In 2008, Tajik farmers have planted 253,000 hectares of cotton. There are few enterprises in the Sughd region of Tajikistan that accept solid biomass in a convenient form (such as sawdust, coal chips, grass, agricultural wastes) and pelletize the biomass in a pellet mill. The resulting fuel pellets are easier to burn in a pellet stove.

Liquid (Bioethanol or Biodiesel)

Tajikistan does not focus on the production of liquid biofuels. Only a small private processing factory located near the Dushanbe city produces 60,000 liters of ethanol per month. The selling of the produced biofuel is officially allowed by the authorities. The ethanol fuel is produced by fermentation of sugars derived from corn.

TABLE 2

Annual Solar Radiation

RADIAL ANNUAL SOLAR RADIATION INCIDENTS	ON HORIZONTAL SURFACE (KWH/YEAR)	ON NORMAL SURFACE TO SUNLIGHT BEAMS (KWH/YEAR)
Dushanbe (west)	1,675	1,646
Gorbunov (pamir)	1,953	1,859

Source: EBRD/Renewable Development Initiative, as of 2009

Biogas

The most promising option of biomass utilization is the generation of biogas produced by anaerobic fermentation of manure. In Tajikistan, there are 35 complexes and farms with more than 400 dairy cattle where the manure could be used for biogas generation. In 2008, the production of biogas started in several districts of Tajikistan as part of the Community Agriculture and Watershed Managemen in the Zarafshan Valley Project implemented by Welthungerhilfe/German Agro Action (GAA) with financial support of the World Bank and the Government of Tajikistan. According to experts, wide introduction of biogas technology using the waste products of animal industries or agricultural and household waste products could reduce methane emissions by 5–8 thousand tons/year.

5.2 SOLAR ENERGY

Solar Photovoltaic

Tajikistan has a good potential for the use of solar energy with up to 280–330 days of sunshine per year and annual sunshine hours between 2,100 and 3,000 depending on the location. The intensity of the direct solar radiation ranges from 0.9 kW/m^2 to 1.18 kW/m^2. On a clear day, the daily isolation reaches 7.5 to 8 kW/m^2.

Solar radiation is higher in the mountain territories, especially in the East Pamir where the population has no opportunity to utilize hydro power. Nevertheless, the shortest sunshine duration is observed in the mountain areas where the weather over the year is often overcast and which have a closed relief (Dehavaz: 2,097 hours; Fedchenko Glacier: 2,116 hours). The greatest sunshine duration (more than 3,000 hours per year) is observed in the South of the republic (Pianj: 3,029 hours) and on the East Pamir (Lake Karakul: 3,166 hours) where overcast is minimal and the terrain is wide open.

While photovoltaic (PV) electricity cannot yet compete with electricity from large HPs, there are good prospects for the use of solar lanterns, independent radio-transmitters, meteorological stations etc. Tourism and international organizations are also interested in use of PV devices for independent electricity supply. For an introduction of PV technology in Tajikistan, the necessary raw materials as well as the industrial (ELTO factory) and scientific (Physico-Technical Institute of AS RT) facilities are present. The republic also has its own experience in designing such devices but there is a lack of professional skills of experts and missing availability of modern technologies.

Solar Thermal Energy

Thermal use of solar energy is more common in Tajikistan than the use of PV. Local manufacturing of such devices is possible due to local materials (aluminium). Local manufacturers are available with ELTO factory and IE Tajikspecavtomatika. Solar devices for providing hot water and heat are commonly applied in apartment houses, hotels, rest houses, shower-baths in rural summer residences and hothouse facilities.

Research and Development

Research and development of non-conventional RE sources are carried out in the Physical/Technical Institute of the Academy of Sciences (AS) of the Republic of Tajikistan (RT). Financing, however, is very limited as well as access to new technologies. In the Physical/Technical Institute of AS of RT, experiments on PV cells are carried out on the basis of silicon and arsenide of gallium connections. Experience in designing and manufacturing of solar water-heating devices is also available, solar kitchens are developed, constructed and installed in mountain villages.

5.3 WIND POWER

The potential of wind power in Tajikistan has not been investigated, yet. There is no systematic network of meteorological stations, and measurements of the wind speed at a level of 30 meters and above are not available. Available measurements (see appendix N.) were presumably taken at elevations around 10 m above ground.

The strongest wind is observed in open high-mountainous areas (glaciers, mountain passes) and in those areas where topographical factors result in strengthening of the wind speed (Khujand, Faizabad). Average annual wind speed in these areas reaches 4–5 m/s. According to experts, wind energy installations could compete with other energy sources only in some areas of the Republic. In Tajikistan, the most suitable territories for use of a wind power on the basis of wind power stations are the Faizabad mountain region, Fergana valley, Murgab hollow and some mountain passes as Haburobad, Shahristan and Anzob.

5.4 GEOTHERMAL ENERGY

Geothermal resources are small and poorly studied in Tajikistan. Data about using thermal waters are generally absent, though it is planned to use the thermal water in the vicinity of Khodja-Obi-Garm. Geothermal resources are concentrated in the convective hydrothermal systems of the Tien Shan foothills. Evaluation of the resources of one thermal water field was carried out at Khodja-Obi-Garm. The result states a temperature of 90 °C, a TDS of 0.5 g/l and a total flow rate of 280 l/s. The total thermal water resources in Tajikistan have not been estimated and resources for electricity production have not been identified. But Kabutov estimates that Tajikistan could produce 45 billion kWh annually using geothermal energy sources (as of 2007). It is not clear how this potential was assessed.

5.5 HYDRO POWER

The potential of hydro power in Tajikistan is approximately 500 TWh/year with more than 300 TWh/year identified as technically viable. From this, only 5–7 % have been developed so far. The construction and operation of more HPPs – especially large ones – is a clear objective of Tajik policy. The Tajik electric power industry is attractive for investors due to the fact that the prime costs of electricity generated by hydro power in Tajikistan are among the worlds lowest (around 0.4 cents/kWh). In order to attract foreign capital to the economy of Tajikistan, the Government adopted special terms for the major investors. A big part of the hydro power potential, however, remains unexploited, primarily because of an uncertain private investment environment and a protracted structural reform process.

On a regional base, Tajikistan is working with partners to optimize the mutual use of water energy resources of border-rivers flowing towards the Aral Sea and continues the work on building a common electricity market.

Small Hydro Power

In the former Soviet Union and the Central Asian Region, the definition of small Hydro Power Plant is anything with a capacity below 10 MW. Small Hydro Power Plants (SHPPs) are referred to Mini or Micro Hydro Power Plants (MHPPs), referring to less than 1 MW or 100 kW, respectively.

While the GoT's strongest focus lies on the development of large HPPs, there are also activities directed to small HPP development. Extending transmission facilities and transferring energy from large HPPs to small settlements scattered in mountain territories would not be profitable. For such remote locations located near small rivers and streams it is more profitable to use small HPPs with capacities from 10kW up to a few MW. Such small HPPs can be constructed with the use of local manpower. Local specialists conducted an extensive research that covered 530 big and small rivers of Tajikistan with a total length of 14,316 km. The rivers with a length of 10–25 km are attributed as small rivers. The results shown in the following table are based on HPPs with capacities between 10 and 1,000 kW.

TABLE 3

Potential Capacity of Rivers

POTENTIAL CAPACITY OF RIVERS [MWH/YEAR]	QUANTITY OF RIVERS	CAPACITY [GWH/YEAR]	%
More than 500	7	20.0	62.1
100-500	28	6.0	18.7
50-100	44	3.0	9.2
25-50	135	2.1	6.7
5-10	137	0.626	2.0
<5	190	0.439	1.3
Total	541	32.2	100.0

Source: Power Resources of Tajik SSR, Bowels of Earth, Leningrad[1]

The development of only 10 % of the small rivers' energy potential in moderate and high-mountain zones will allow the power supply of approximately 70 % of the settlements and agricultural entities. In the Rasht area of Tajikistan alone there is an opportunity for constructing more than 100 small HPPs.

1 THESE NUMBERS APPEAR INCORRECT. 32 GWH/YEAR WOULD BE EQUIVALENT TO 6.4 MW INSTALLED CAPACITY. THAT IS TOO LOW. THE FOLLOWING LISTS OF SMALL HPPS PLANNED OR UNDER CONSTRUCTION IS ALREADY MORE THAN THAT. IT IS ASSUMED THAT THE NUMBERS SHOULD BE TWH/YEAR INSTEAD OF GWH/YEAR.

There is a large list of programs for the construction of small hydro stations in Tajikistan. One of them, developed by the Asian Development Bank (ADB) and started in 2007, has put into operation two plants in the Rasht Valley:

- The Dushokhzamin plant in the Nurobod district
- The Kalandak plant in the Rasht district
- The construction of two more plants is ongoing.

The Islamic Development Bank (IDB) funded the construction of eight small power plants in rural areas of Tajikistan. The loan of 9.3 Mio USD provided by the IDB will support the construction of five small hydro power stations in the rural area of Tajikistan:

- The 2,750 kW Marzich station (Ayni district in Sughd)
- The 667 kW Sangikor station in the Rasht district (North East of Tajikistan)
- The 600 kW Fathobod station in Tojikobod (North East of Tajikistan);
- The 850 kW Pitavkul station in Jirgatol (North East of Tajikistan)
- The 100 kW Shahboloi station in Nourobod (eastern Tajikistan)

The United Nations Development Program (UNDP) and German Agro Action have also funded the construction of several small hydro power stations in Tajikistan. The Government of Tajikistan represented by the Barqi Tojik company provided 2.4 Mio USD to be spent on the construction of three other small Hydro Power Plants:

- The 360 kW Khorma station in Baljuvon (Khatlon)
- The 500 kW Toj station in Shahrinav (central Tajikistan)
- The 700 kW Shirkent station in Tursunzoda (central Tajikistan)

A number of bilateral donors (Switzerland, Germany and Japan) supported the construction of MHPs in Tajikistan. About 26 small Hydro Power Plants are supposed to be put into operation in Tajikistan from 2007–2012.

SHORT BUSINESS INFO

The Tajik Embassy in Germany has published a list of 14 mini HPPs provided by the GoT. International investors are invited to tender for these HPPs.

The Ministry of Energy and Industries (MoEI) reported that there were 55 feasibility studies for the construction of small power plants in the country to be done. 18 of them have already been approved by energy specialists.

6 MARKET RISK ANALYSIS AND BARRIERS FOR MARKET ENTRY

6.1 GENERAL SITUATION

There are investment opportunities in the field of power generation (big and small hydro, PV, geothermal, wind) as well as for heating (solar, biomass, geothermal). The development of RE has been traditionally limited by the high upfront costs and their weak competitive position in centralized energy systems. Decreasing capital investment costs and system decentralization may make these technologies more competitive in the future, particularly in mountain regions with isolated communities where access to traditional energy supply is limited.

Foreign individuals and companies can start a business in Tajikistan with or without Tajik partners. Thus, an enterprise with foreign investment may either be with 100 % of foreign capital or as a joint venture with a local partner.

According to the Law on Investments, the investments can be implemented in any form:

- Traditional, i. e. direct investment defined as capital investment with a goal of considerable or complete control over the activity of the investment object
- Portfolio investment, where an investor is holding a certain percentage of the total amount of the issued shares of a national enterprise
- Vested interests, i. e. the right to use land and other natural resources as well as other vested interests
- The right to conclude any treaties providing for other forms of foreign investment

Corruption

The Worldwide Corruption Perceptions Index published by Transparency International ranks Tajikistan at 51 out of 180 countries.

Availability of Local Know-how

Tajikistan maintains a skilled industrial labor force that is widely recognized by established foreign investors. Being well educated, the average monthly salary of the local workforce remains at competitive levels.

Local Acceptance of Foreign Activities

The GoT's policy strongly favors Foreign Direct Investment (FDI) realizing that it plays a vital role in the development of the country's economy. In this regard, the GoT puts emphasis on foreign investment as a means to develop new industrial activities as well as to modernize existing ones. Unfortunately, the country's weak institutions and poor governance do not provide an favorable environment for domestic and foreign private investment or efficient public service delivery. A weak public administration and the undeveloped financial sector hamper the nurturing of an investment climate needed for private sector development and for attracting foreign direct investments.

Recognizing these constraints for private sector development – particularly on the development of small and medium enterprises – and the need to address these issues as part of its poverty reduction strategy, the Government has expressed the intention to develop a comprehensive strategy for private sector development. To sustain medium- and long-term economic growth, Tajikistan needs to attract foreign investment. In order to do so, significant improvements are required, not only the continued modernization of the legal and regulatory framework, but also the institutional capacity to implement the reforms.

6.2 INTELLECTUAL PROPERTY RIGHTS

In 1994, Tajikistan joined the World Intellectual Property Organization in the field of industrial property protection. Since then, the departments of copyright at the Ministry of Culture and Information and the National Center for Patents and Information have been charged with the administration of intellectual property rights within the country.

6.3 BUSINESS DEVELOPMENT

In 2006, the International Finance Corporation completed its second Small and Medium Enterprises (SME) survey in Tajikistan. The following is a summary of the market risk analysis for Tajikistan.

Registration

Registering a new business in Tajikistan has become easier, particularly for small businesses. The registration procedure was reformed in 2003, and now individual entrepreneurs can register a business in less than a week at limited costs. The average registration time of legal entities is over a month. It is a complex and time-consuming process and involves more than five governmental agencies. As a result, unofficial payments are a common solution and expenditures can be quite significant.

Licensing for Business Activities

According the new Licensing Law, obtaining a license has become easier. The duration of licenses remains a critical issue. Although the legislation establishes a minimum duration of three years, the de facto average duration of a license in Tajikistan is less than one year. The process of a license renewal is even more complicated and more prone to corruption than an initial issuance.

Permits for Business Activities

More than half of SMEs need to obtain permits prior to launching business activities. The permit system in Tajikistan is the result of two complementary forces: technical regulations of the Soviet era and new market oriented regulations. The permit issuance process is not properly regulated. In addition, some permits also contradict the requirements of a market economy (i. e. the permit to use energy). The valid time of a permit is another critical issue. Some existing businesses need to receive permits almost as frequently as do start-ups.

Access to Finance

Tajikistan's financial sector is still in a developing stage. The relationship between financial intermediaries and SMEs is still extremely limited: only one out of six businesses has a bank account. This partly reflects the limited trust in the financial sector, but also points out a lack of effort on the supply side to develop products and services to attract new customers.

Inspections

Once established, a Tajik business is likely to face Government interference in the form of inspections at least once a month. Only one out of five inspections results in an official sanction. On the one hand this testifies a limited use of risk management principles in selecting inspection targets and highlights inefficiency. On the other hand, it points out a high likelihood of unofficial payments to resolve inspection-related issues. After the start-up of a new Inspection Law in 2007, the overall inspection situation has considerably improved.

6.4 TAXATION

SME taxation, although not particularly heavy in terms of tax rates, represents a serious obstacle for the sector's development due to complicated tax administration procedures. Tax administration is cumbersome, requiring multiple reports and payments over the year. Tax compliance is mostly pursued through repeated tax audits.

According to the Tax Code of the Republic of Tajikistan (Article 343, paragraph 2), all investors and enterprises are granted exemption from Value Added Tax and Customs Duties on materials and equipment required for the construction of hydro power stations.

In addition, in accordance with (Article 343, paragraph 3), individuals and legal entities that are not the citizens of the Republic of Tajikistan yet working at the construction of the hydro power stations receive exemption from Value Added Tax, Road Users' Tax and Social Tax.

In the appendix there is a table listing financial incentives and tax benefits for investors in the energy sector that is promoted by the GoT.

Export/Import:

Complicated foreign trade procedures as well as high transportation costs represent two critical constraints for import/export activities, resulting in lower competitiveness of exports as well as in price increases for imports. Standardization and certification requirements represent a major barrier to international trade for the Tajik economy. Goods imported into Tajikistan need to be tested and meet separate local quality requirements as set by the national agency responsible for standardization and certification.

7 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

Asian Development Bank (ADB)
Ruslan Sadykov, Project Implementation Officer
107, Nozim Khikmat Str., 734001, Dushanbe, Tajikistan
Phone: (992 37) 2210558
E-Mail: rsadykov@adb.org
Co-financing small hydro power

Academy of Sciences of Tajikistan
Akhmedov Khakim Munavarovich, Chief scientific secretary, Academician AS RT
33, Rudaki Ave., 734025, Dushanbe, Tajikistan
Phone: (992 37) 2215017
E-Mail: Khakim48@mail.ru
Cooperation in research related to alternative energy development

Commercial Company Fon-Dario,
Abdulloeva Sadafmo
Settlement Komsomol, Dushanbe
Phone: (992 37) 2247795, (992 91) 9442242, (992 907)704501
E-Mail: fondario@mail.ru
Production of biofuel

Tajik Branch of Open Society Institute
Tolib Tokhiri, Program Coordinator
37/1 Bokhtar Str., Business Center "Vefa", 4th floor, 734002, Dushanbe, Tajikistan
Phone: (992 47) 4410728
E-Mail: tolib@osi.tajik.net
Cooperation in biogas

Tajik Technical University
Alphia Akhrorova, Head of Department,
Project Director for Renewable Energies
10 Akademik Rajabova Str., Building 1, Energy Department
Phone: (992 37) 2213984
Fax: (992 37) 2217135
E-Mail: aalphia@mail.ru
Education, research, project implementation

United Nations Development Program (UNDP)
Brian Donaldson, Early Recovery Advisor
39 Ayni Street, 734024, Dushanbe, Tajikistan
Phone: (992 47) 4410641
E-Mail: brian.donaldson@undp.org
Policy dialog, project implementation

Machine Factory IE Vostokredmet
Chkalovsk City, Sughd Oblast
Phone: (992 34) 2265319
Manufacturing capacities for equipment for small HPPs

RENEWABLE ENERGY: RELEVANT INSTITUTIONS

Ministry of Energy and Industry (MoEI) of the Republic of Tajikistan
734012, RT, Dushanbe, 22 Rudaki Ave.
Phone: (992 37) 2216997
Fax: (992 37) 2218281
E-Mail: minprom@netrt.org

Open Joint Stock Holding Company "Barki Tojik", (BT)State electricity company
734026, RT, Dushanbe, 64, Ismoili Somoni Str.
Phone: (992 37) 2358668
Fax: (992 37) 2358692
E-Mail: barkitojik@tajnet.com

Academy of Sciences of Tajikistan
Akhmedov Khakim Munavarovich, Chief scientific secretary, Academician AS RT
33, Rudaki Ave., 734025, Dushanbe, Tajikistan
Phone: (992 37) 2215017
E-Mail: Khakim48@mail.ru

Umarov Physicotechnical Institute
Academy of Sciences of the Republic of Tajikistan
299/1 Aini. Str., Dushanbe, 743063, Republic of Tajikistan

Holding Company Nourfazo for Construction of Power Plants under the Government of RT
734011, RT, Dushanbe, 39 a, Kakharov Str.
Phone: (992 37) 2217112, 2215225

Design and Exploration Institute TAJIKGIDROENERGOPROEKT
734011, RT, Dushanbe, 39, Kakharov Str.
Phone: (992 37) 2217340, 2213507
Hydro plants, transmission lines, switching substations

Agency for Land, Geodesy and Cartography under the Government of the Republic of Tajikistan
734033, RT, Dushanbe, 4/1Abaya Str.
Phone: (992 37) 2217321, 2212848, 2314602
Fax: (992 37) 2311487

Agency for Standardization, Metrology, Certification and Trade Inspection under the Government of the Republic of Tajikistan.
734018, RT, Dushanbe, 42/2 N. Karabaeva Str.
Phone: (992 37) 2336467, 2346365
Fax: (992 37) 2341933
E-Mail: stndart@tajik.net

Ministry of Agriculture and Nature Protection of the Republic of Tajikistan
734025, RT, Dushanbe, 44 Rudaki Ave.
Phone: (992 37) 2211596, 2211094
Fax: (992 37) 2215794

8 BIBLIOGRAPHY

- ADB (2005): Country Strategy and Program Update for Tajikistan (2006–2008)
- Barki Tojik (2006): Energy Loss Reduction Report
- Barki Tojik (2008): Operating Results Report for January–April 2008
- Dushanbe (2005): Individual Restructuring Plan of OJSHC Barki Tajik for Period 2005-2015, commission report
- Economist Intelligence Unit (2008): Country Report
- European Bank for Reconstruction and Development – EBRD/ Renewable Development Initiative (2009): Country Profile. Tajikistan (http://ebrdrenewables.com/sites/renew/countries/tajikistan/profile.aspx)
- International Energy Agency – IEA, (2005): Beyond the OECD – Tajikistan (www.iea.org/country/n_country.asp?COUNTRY_CODE=TJ)
- International Finance Corporation (2006): Business Environment in Tajikistan
- International Monetary Fund (2007): Report for the 2006 Article IV Consultation
- Kabutov, K. (2007): Tajikistan – Priority Directions and Status of Research in the Field of Renewable Energy Sources (in Russian), published in Geliotekhnika, 2007, No. 4, pp. 91–96
- N. N. (2004): Tajikistan Energy Utility Reform Review – a Strategic Approach to the Sector Development
- N. N. (2006): Water Sector Development strategy of Tajikistan
- N. N. (without year): World Hydro-Electrical Engineering Atlas – Hydro Power & Dams
- Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement – PREGA (2006): Country Report Tajikistan
- Renewable Development Initiative (without year): Country Report Tajikistan (www.ebrdrenewables.com/sites/renew/countries/Tajikistan/default.aspx)
- World Bank (2006): Strategic Framework for the Energy Sector in CAREC Countries
- World Bank (2007): Private Sector Development Strategy Paper

Websites

- Goskomstat, Statistical Committee of Tajikistan (www.stat.tj)
- Ministry of Energy of Tajikistan (www.minenergo.tj)
- Environment and Security (ENVSEC) Initiative (www.envsec.org)

9 ANNEX

FIGURE 4

Energy Sector Overview

Source: Environment and Security (ENVSEC) Initiative (www.envsec.org), without year

LIST OF GOVERNMENT INITIATIVES

GUARANTEES AND BENEFITS	BENEFICIARIES	CONTENT OF GUARANTEES AND BENEFITS	LEGISLATIVE DOCUMENTS
Exemption from customs duty and VAT	All enterprises	Import of production technological equipment and its components (forming unified set that is without these components the work of the production technological equipment is impossible), to form or replenish the chartered capital of the enterprise or technical re-equipment of the current production under the condition that this property is used exactly for production of goods and rendering services in accordance with the constituent documents and do not belong to category of excise goods and also personal property imported to the Republic of Tajikistan by foreign employees of enterprises with foreign investments for personal use	Customs Code of the Republic of Tajikistan (Article 345, § 4) Tax Code of the Republic of Tajikistan (Article 211, § 4, part 4)
Exemption from VAT and customs duty	All enterprises	Import of goods for implementation of the targeted projects approved by the Government of the Republic of Tajikistan at the expense (within the limits) of grants and/or credits/oans provided to legal entities and individuals, foreign states, governments of the foreign states or international organizations	Tax Code of the Republic of Tajikistan (Article 211, clause 4, subparagraph 6) Customs Code of the Republic of Tajikistan (Article 345, § 6)
Exemption from VAT and customs duty	All enterprises	Supply of goods, execution of work and rendering of services as a humanitarian aid	Tax Code of the Republic of Tajikistan (Article 211, § 2, subparagraph 7) Customs Code of the Republic of Tajikistan (Article 345, § 3)
Operations taxable at zero rate	All enterprises	Export of goods except for raw cotton, ginned cotton and raw aluminum are taxable by VAT at zero rate	Tax Code of the Republic of Tajikistan (Article 214, § 1)
Exemption from income tax	All enterprises	New enterprises created for production of goods at the year of their state registration and starting from the year following the year of the initial registration if their founders' deposit investments into the chartered fund of these enterprises taking into account the minimal investments established by the legislation for the period of: – 2 years if the investments are equivalent to 500,000 USD; – 3 years if the investments are equivalent more than 500,000 to 2 million USD; – 4 years if the investments are equivalent to more than 2–5 million USD; – 5 years if the investments exceed 5 million USD	Tax Code of the Republic of Tajikistan (Article 145, § 6)
Exemption from VAT from the road users, profit tax from the legal entities, minimal income tax from enterprises, land tax, vehicle users' tax, real estate tax, social tax from those people that are working at the construction of hydro-power stations and that are not the citizens of the Republic of Tajikistan	Building owners and general contractor of the construction	For the period of the hydro power station's construction on the territory of the Republic of Tajikistan	Tax Code of the Republic of Tajikistan (Article 343, § 1)
Exemption from VAT and customs duties	All enterprises	Import of goods for the construction of the hydro power stations that are highly important objects of the Republic of Tajikistan	Tax Code of the Republic of Tajikistan (Article 343, § 2)
Exemption from VAT and road users' tax, social tax	Suppliers, subcontractors and staff for the construction of hydro power stations	Individuals and legal entities who are working at the construction of the hydro-power stations, persons that are not the citizens of the Republic of Tajikistan	Tax Code of the Republic of Tajikistan (Article 343, § 3)
Exemption from customs duty and VAT	All enterprises	Import of goods necessary for personal use of the newly created enterprises operating the full cycle of cotton processing up to the finished product (from cotton yarn to cotton ready-made garments)	Tax Code of the Republic of Tajikistan (Article 344, § 1)
Exemption from VAT	All enterprises	Export of goods produced by newly created enterprises operating the full cycle of cotton processing up to the finished product	Tax Code of the Republic of Tajikistan (Article 344, § 2)
Exemption from income tax of legal entities, minimal income tax, real estate tax and land tax	All enterprises	Newly created enterprises operating the full cycle of cotton processing up to the finished product	Tax Code of the Republic of Tajikistan (Article 344, § 3)

Source: Tax Code and Custom Codes of the Republic of Tajikistan, without year

TABLE 4

GDP Development in Tajikistan*

YEARS	NATIONAL GDP IN MIO TAJIK SOMONI	NATIONAL GDP IN MIO USD	GDP GROWTH IN %	PER CAPITA	
				TAJIK	USD
2000	1,806.00	820.00	8.30	289.00	131.00
2001	2,512.00	1,069.00	10.20	396.00	168.00
2002	3,344.00	1,115.00	10.90	527.00	175.00
2003	4,757.00	1,612.00	10.20	732.00	248.00
2004	6,157.00	2,032.00	10.60	927.00	306.00
2005	7,201.00	2,250.00	6.70	1,040.00	325.00
2006	9,272.00	2,711.00	7.00	1,319.00	386.00
2007	12,779.00	3,693.00	7.80	1,780.00	514.00

TABLE 5

Primary Energy Consumption in ktoe*

	COAL	CRUDE OIL	PETROLEUM PRODUCTS	GAS	HYDRO	ELECTRICITY	TOTAL
Domestic production	43	22	0	24	1,435	0	1,524
Imports	3	0	1,468	459	0	388	2,318
Exports	0	-5	-12	0	0	-366	-383
TPES	46	17	1,456	483	1,435	22	3,458

TABLE 6

Electricity Consumer Groups*

CONSUMER GROUP	2005	2006	2007
ÒÀLKO (Aluminium plant)	6,282.00	7,108.00	7,228.00
Industry excluding ÒÀLKO	905.00	1,005.00	795.00
Pumping irritation	1,546.00	1,677.0	1,648.00
Agriculture excluding pumping irrigation	572.00	563.00	31.00
Government	426.00	410.00	478.00
Residential customers	3,941.00	3,352.00	3,044.00
Other	438.00	423.00	1,179.00
Total billed sales	14,110.00	4,538.00	14,405.00

TABLE 7

HPPs Operated by "Barki Tajik" Electric Utility Company*

NAME OF HPP	TOTAL CAPACITY MWt
Nurek	2,700
Baipaza	600
Sarband	240
Sharshara	29.95
Centralnaya	15.1
Kairakkum	126
Varzob 1	7.44
Varzob 2	14.4
Varzob 3	3.52

TABLE 8

Thermoelectric Plants Operated by "Barki Tajik" Electric Utility Company*

NAME OF TPS	TOTAL CAPACITY MWt
Dushanbe	230
Yavan	180

TABLE 9

HPP Operated by "Pamir Energy" Electric Utility Company*

NAME OF HPP	TOTAL CAPACITY MWt
Pamir 1	28
Lenin	0.936
Horog	8.7
Kalai Humb	0.208
Vanj	1.2
Teharv	0.36
Shyjand	0.832
Savnob	0.08
Sponj	0.16
Namadgyt	2.5
Aksu	0.64

TABLE 10

Electricity Production in Tajikistan (in GWh)*

GENERATION	2005	2006	2007
Hydro generation	16,839.0	16,528.0	16,960.6
Thermal generation	119.0	228.0	379.7
Total generation	16,958.0	16,756.0	17,340.3
Total stations own use	45.0	56.0	68.5
Total stations output	16,913.4	16,700.3	17,271.8
Total export	798.2	948.5	696.3
Total import	1,042.0	1,556.8	1,057.1
Manufacture needs	–	–	18.7
Total delivered to domenstic market	17,157.4	17,308.6	17,340.8

* Sources Tables 4–16: data compiled by the authors from different sources

TABLE 11

Consumption of Electricity in Tajikistan by Customer Groups (in GWh)*

BILLED SALES BY CONSUMERS CATEGORIES	2005	2006	2007
ÒÀLKO (Aluminium plant)	6,282.0	7,108.0	7,222.8
Industry excluding ÒÀLKO	905.0	1,005.0	795.6
Pumping irritation	1,546.0	1,677.0	1,648.7
Agriculture excluding pumping irritation	572.0	563.0	31.4
Goverment	426.0	410.0	478.2
Residential customers	3,941.0	3,352.0	3,044.6
Other	438.0	423.0	1,179.4
Total billed sales	14,109	14,539.2	14,400.7

TABLE 12

Electricity Losses in Tajikistan*

LOSSES	UNIT	2005	2006	2007
Technical losses	GWh	1,552.0	2,728.0	2,940.1
	%	9 %	15.8 %	17.0 %
Commercial losses	GWh	1,496.0	40.9	0
	%	9 %	0.2 %	0 %
Total technical and unbilled losses	GWh	3,048.0	2,769.0	2,940.1
	%	18 %	16.0 %	17.0 %

TABLE 13

National Tariffs in Tajikistan (approved 2 May 2008)*

ELECTRICITY ENERGY	DIRAM PER KWh
Industrial and non industrial users	10.95
Tajik Aluminium company	5.15 (1,5 US Cent)
State buget organizations, communal sector and electric transport	4.35
Pumped irrigation	2.91
Residential customers (VAT included)	4.8
HEAT ENERGY	**SOMONI PER 1 Gcal**
For state budget organizations	19.5
For wholesale consumers that supply heat energy to population	2.55
For all other users	75.0
RENEWABLE ENERGY TARIFFS	
As per order "Development of Small Energy" Barki Tojik was tasked to purchase excess electricity from private small scale providers are per an average national tariff	

TABLE 14

Major Electricity Sector Projects in Tajikistan*

FUNDING AGENCY	PROJECT TITLE	AMOUNT (USD MILLION)
PROJECTS UNDER IMPLEMENTATION		
Asian Development Bank	Power rehabilitation Project I phase Power rehabilitation Project II phase	34.0 50.0
	Small Hydro Power Plants Emergency Baipaza	11.6 5.3
Islamic Development Bank	Rehabilitation of two substations, Construction of small HPS in rural areas	13.0 9.3
Kuwait F und for Arabic Economic Development World Bank	Rehabilitation of Dushanbe City Distribution network Pamir Private Power Projekt	13.0 10.0
	Energy Loss Reduction Project	18.0
Goverment of Switzerland	Power Rehabilitation Project Pamir Private Power Project	8.1 5.0
International Financial Corporation (IFC) and Aga Khan Foundation (AKFED)	Energy Loss Reduction Project Pamir Private Power	8.0 26.0
Government of Russia	Completion of the Sangtuda 1 Hydro Power Plant	570.0
Government of Iran	Construction of Sangtuda 2 Hydro Power Plant	180.0
Government of China	"South-North" & "Lolazo" transmission Lines	340.0
Government of India	Rehabilitation of Varzob-1 HPP	13.0
Government of Tajikistan via "Barki Tojik" company	Small Hydro Power Plants	5.0
United Nations Development Program	Small Hydro Power Plants	0.4
PROJECTS UNDER NEGOTIATIONS		

* Sources Tables 4–16: data compiled by the authors from different sources

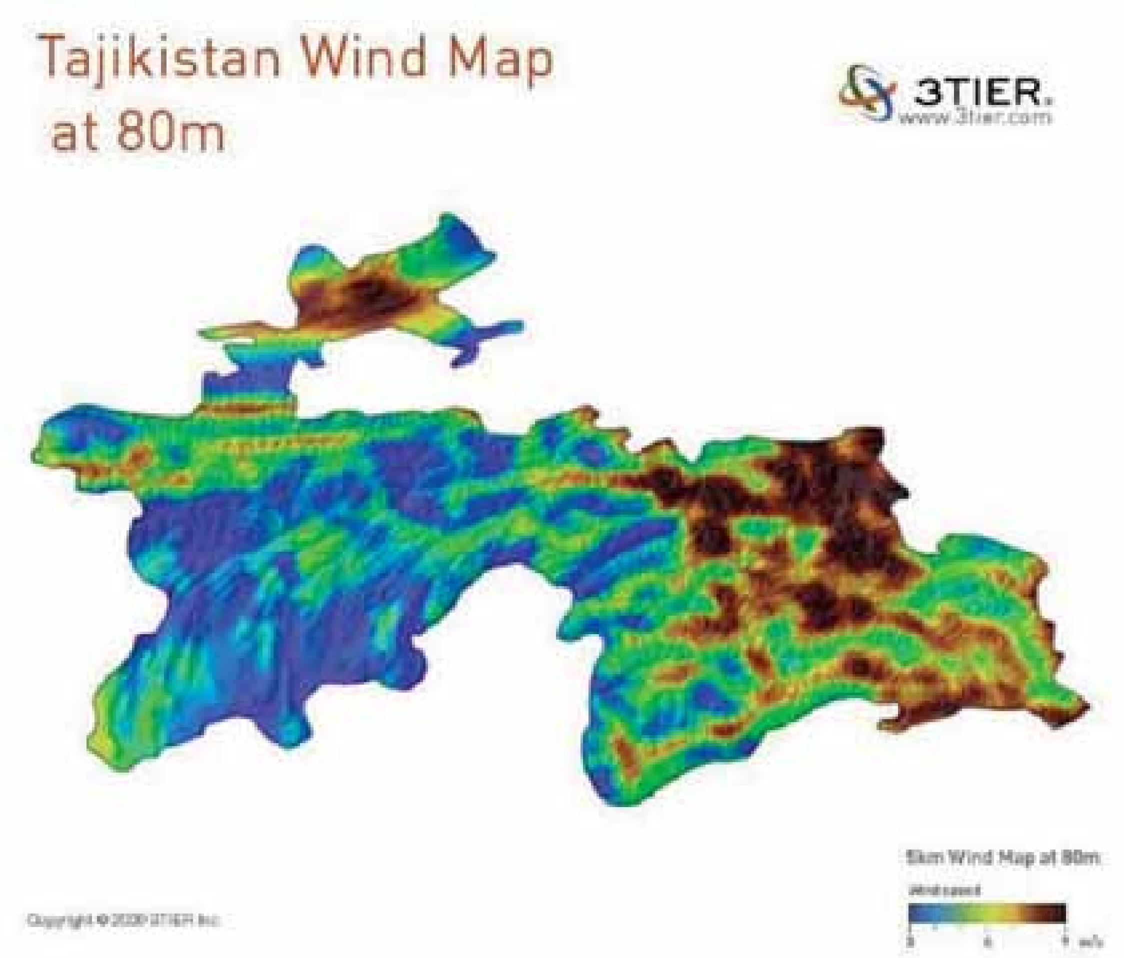
TABLE 16

Average Wind Speeds in Tajikistan*

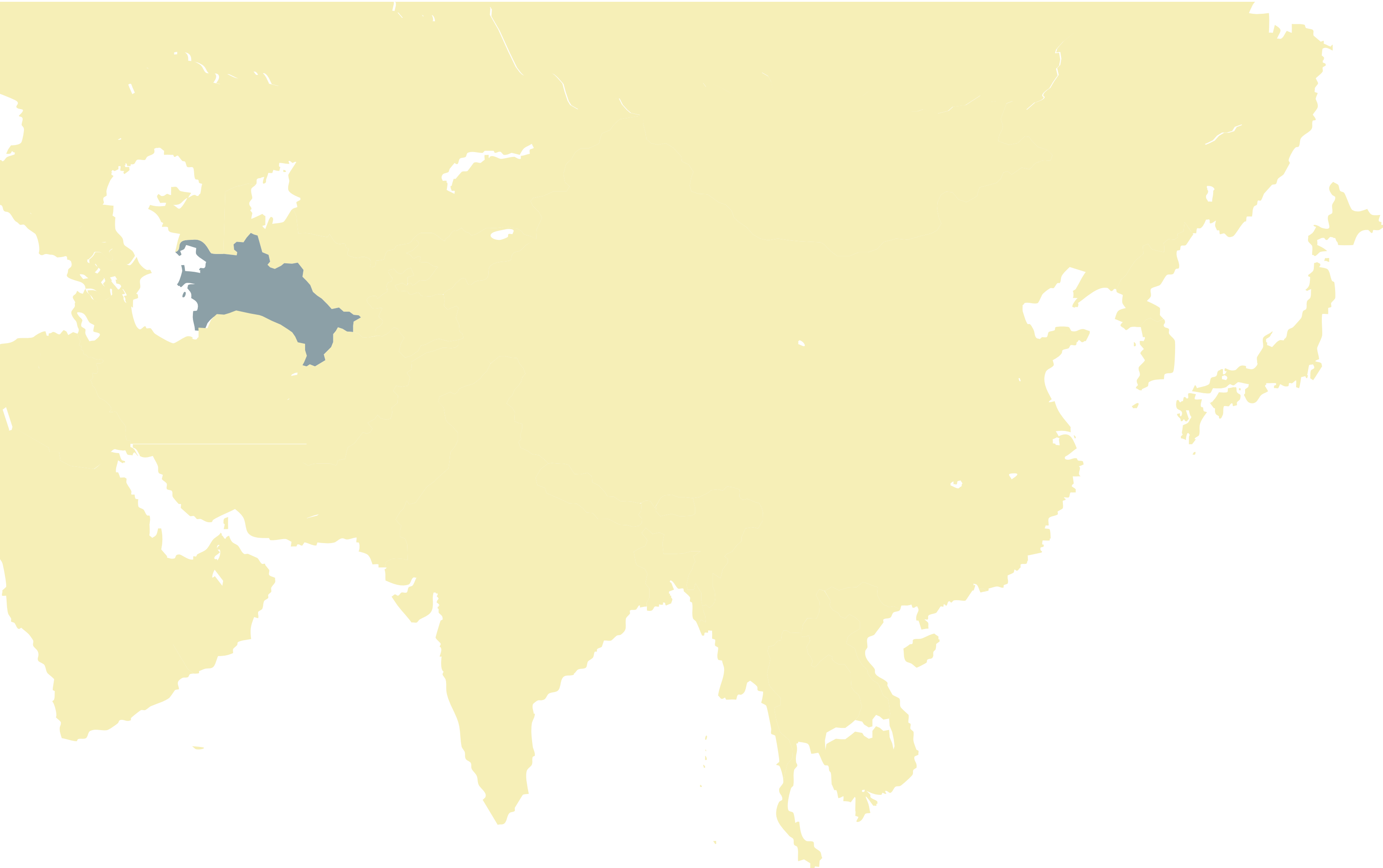
STATION	HEIGHT ASL (m)	SPEED OF WIND (m/s)
DISTRICTS AN CITITES		
Dushanbe	788	1.1
Asht	698	1.4
Khujand	425	4.6
Isfara	863	1.8
Yra-tube	1,004	1.6
Penjekent	1,014	2.0
Garm	1,316	2.5
Komsomolobad	1,258	1.4
Obi garm	1,900	1.4
Tavildara	1,616	1.7
Shahrinay	852	2.3
Faizabad	1,215	4.1
Orshenikinzabad	866	2.3
Pahktaabad	641	2.8
Khovaling	1,468	4.3
Yavan	663	2.3
Dangara	660	1.3
Kuliab	359	1.5
Sharabad	1,900	3.0
Kurgan tube	427	1.2
Kolhozabad	473	0.8
Shaartuz	378	1.8
Parhar	447	1.6
Vaksh	445	2.1
Djilikul	349	2.1
SERPERATE VILLAGES		
Dehays	2,564	3.7
Madrushkent	2,254	2.9
Sangistion	1,502	2,7
Khoja obi garm	1,900	1,4
Gushari	1,361	1,2
Bustonabad	1,964	4,7
Sanglok	2,239	3,0
Kangurt	948	1,4
Isanbai	563	1,9
Liayr	2,254	1,9
Aivadj	318	3,6
Nijnii Pianj	329	1,8
Maihura	1,921	1,4
Liayash	1,998	1,8
Chormahzak	1,726	3,9
Kharamkul	2,826	0,9
Iskanderkul	2,204	1,6
Shahristan	3,143	4,7
Anzob	3,373	4,6
PAMIR REGION		
Kalai humb	1,288	1,3
Murgab	3,576	2,3
Rushan	1,981	2,1
Ishkashim	2,524	2,0
Khorog	2,075	2,3
Khumgari	1,736	2,7
Jashayangos	3,410	2,3
Bulunkul	3,744	1,5
Lake Karakul	3,930	3,0
Galcier Fendchenko	4,169	6,0
Khaburabad	3,347	4,8

* Sources Tables 4–16: data compiled by the authors from different sources

FGURE 5
Tajikistan Wind Map



Source: 3Tier (www.3tier.com), as of 2009



COUNTRY CHAPTER: REPUBLIC OF TURKMENISTAN

Authors and Coordination of Country Chapter

Kurban Balliyev (Eng. Water Management & Dipl.)

Dr. Ing. Klaus Jorde
Entec Consulting & Engineering AG
St. Gallen, Switzerland
www.entec.ch

Axel Biegert (Dipl. Economist & Pol.)
INTEGRATION UMWelt & Energie GmbH
Graefenberg, Germany
www.integration.org

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS TURKMENISTAN

ACRONYMS AND ABBREVIATIONS

TURKMENISTAN

ADB	Asian Development Bank
BISNIS	Business Information Service for the Newly Independent States
CAR	Central Asian Region
CCA	Common Country Assessment
CDM	Clean Development Mechanism
CHP	Combined Heat and Power Plant
CIS	Commonwealth of Independent States
GDP	Gross Domestic Product
GEF	Global Environmental Facility
DNA	Designated National Authority
DDP	Distribution Demonstration Project
EBRD	European Bank for Reconstruction and Development
EIA	Energy Information Administration
EPC	JSC Electric Power Plants (GenCo)
FSU	Former Soviet Union
GDP	Gross Domestic Product
GHG	Greenhouse Gas Emissions
HPP	Hydro Power Plant
HV	High Voltage
HVL	High Voltage Lines
HVN	High Voltage Network
IBRD	International Bank for Reconstruction and Development
ICWC	Interstate Commission for Water Coordination
IDA	International Development Association
IGES	Institute for Global Environmental Strategies
JSC	Joint Stock Company
KNG	JSC KyrgyzNefteGas (Oil and Gas)
KPC	Kyrgyz Petroleum Company
MB&C	Metering, Billing and Collection
MDG	Millennium Development Goals
NEAP	National Environmental Action Plan
NEG	National Electric Grid
O&M	Operation and Maintenance
PCCAR	Power Council of Central Asia Republics
PREGA	Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement
RE	Renewable Energy
SJSC	State Joint Stock Company
UDC	Unified Dispatch Center
UAE	United Arab Emirates
UNDP	United Nations Development Program
UNDAF	United Nations Development Assistance Framework
UNFCCC	United Nations Framework Convention on Climate Change
UPSCAR	United Power System of Central Asia Republics
USD	United States Dollars
TFC	Total Final Consumption
TPP	Thermal Power Plant
VAT	Value Added Tax
WB	World Bank

MEASUREMENTS

kV	kilovolt (1kv = 1,000 V)
MW	megawatt (1MW = 1,000 kW)
GWh	gigawatt hour (1 GWh = 1,000,000 kWh)
TWh	terawatt hour (1 TWh = 1,000,000,000 kWh)
kJ	kilojoule (1 kJ = 1,000 Joule)
ktoe	kilotons of oil equivalent (1ktoe = 11,630,000 kWh)
km^2	square kilometer
GW	gigawatt
km	kilometer
mm	millimeter
m^3	cubic meter
C	degree Celsius
m	meter
m/s	meters per second

1 SUMMARY

Turkmenistan has a tremendous wind power potential and a high solar potential as well, but these are overshadowed by the well-known wealth of oil and gas. The reserves of natural gas mean that the country can meet the domestic electricity demand with currently existing facilities and without the need for new development.

Currently, large sections of the population do not pay for their use of electricity due to state subsidies. These conditions are not favorable for Renewable Energy (RE) projects entering the market. There are programs in place aimed at reducing the environmental impact of oil and gas extraction and refinery and energy saving/water conservation measures by the public. This, rather than renewable development, has been Turkmenistan's primary response to greenhouse gas emissions.

The poor environment for RE development is particularly unfortunate as the wind potential is high on more than 40 % of Turkmenistan's territory, with a mid-term estimate of up to 10,000 MW potentially developable. This is only a fraction of the available wind resources, which have the potential to even rival the republic's natural gas reserves. Besides that, Turkmenistan also has a high solar energy potential almost everywhere in the Republic.

The Turkmen Government is supporting the development of innovative technologies including RE. It would, however, require more pushing from the Government or consumers to really initiate the development and application of RE in the country.

2 COUNTRY INTRODUCTION

2.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Turkmenistan is located in the South of Central Asia and is bordered by Afghanistan to the South East, by Iran to the South and South West, Uzbekistan to the East and North East, Kazakhstan to the North and North West and the Caspian Sea to the West. The country covers a total of 488,100 km².

The central part of the country is dominated by the Turan Depression and the Karakum Desert, which cover almost 80 % of the country. Turkmenistan is a mostly flat country. The only significant elevations are along the border to Iran and Afghanistan. Rivers include the Amu Darya, the Murghab and the Tejen. Surface waters are very sparsely distributed and water resources are limited in most parts of the country. The Karakum Canal brings water from the Amu Darya River to the Kope Dag Mountains and allows the irrigation of 1 million hectares of land, thus providing the basis for agricultural production but also causing environmental problems due to leaking canals and the shrinking of the Aral Sea[1].

FIGURE 1

Map of Turkmenistan

The climate is mostly arid subtropical desert with little rainfall. The Karakum Desert is one of the driest deserts in the world; some places have an average annual precipitation of only 12 mm. Winters are mild and dry, with most precipitation falling between January and May. Summer temperatures can reach up to 48 °C.

The Republic is divided into five provinces and one capital city district. Other large cities are Turkmenabat, Mary, Turkmenbashy (Krasnovodsk), Dashoguz and Balkanabat. Most of Turkmenistan's citizens are ethnic Turkmens, sizeable minorities include Uzbeks and Russians.

Turkmenistan is part of two main seismic zones of the world. The Ashgabat earthquake of 1948 killed over 110,000 people (2/3 of the city's population)[2].

2.2 POLITICAL AND ECONOMIC DEVELOPMENT

The territory of Turkmenistan has a history of several centuries as arMIEs from numerous empires decamped there on their way to more prosperous territories. In 1884, Russia gained control over the territory, which later became part of the Soviet Union. In 1991, Turkmenistan declared its independence. Until recently, it was a single-party system that was considered to meet not even the most basic standards of democracy. Turkmenistan was ruled by President for Life Saparmurat Niyazov who wielded virtually absolute power until his sudden death in 2006. Gurbanguly Berdimuhamedow was elected the new president on 11 February 2007[3].

Prior to independence, Turkmenistan's economy was entirely geared to providing raw materials for the other Soviet Republics, most prominently natural gas but also crude oil and cotton. In turn, it was dependent on importing staple foods to a large extent.

After gaining independence, natural gas supplies had to be discontinued step by step with extreme consequences on the country's economy. Since the export of natural gas was the main income source, the country suffered from negative Gross Domestic Product (GDP) growth and hyperinflation for six consecutive years. In 1999, a turn-around point in the economic development was reached, and there has been a considerable economic growth ever since. GDP per capita has only recently re-achieved the level it held before independence.

Taking the enormous natural gas deposits, Turkmenistan can be considered as a "gas republic". But Turkmenistan is heavily dependent on export routes established during the Soviet area, namely the Russian Gazprom pipelines, which weaken Turkmenistan's bargaining position in price negotiations. This seeming disadvantage, however, may turn out to be good for the country's long-term development. The Government realized that the only way out of this dependency situation is by diversifying the industrial production and to substitute imported staple foods and consumer goods. Instead of relying on Russian pipelines, the option of refining and processing crude oil is increasingly realized as well as the option to generate electrical power by using natural gas and then exporting electricity. The agricultural sector, which still employs 50 % of the entire working population, has also profited. Today, over 80 % of staple foods are produced within the country[4].

1 SEE LAKENET, AS OF 2009
2 PUBLICATIONS INTERNATIONAL, AS OF 2006, AND KING ET. AL., AS OF 1996
3 FREEDOM HOUSE, AS OF 2009
4 SCHMID & LANGBEIN, AS OF 2004

LAND AREA:	448,100 km^2
POPULATION:	4.9 million (as of 2009)
DENSITY:	10.9 inhabitants/km^2
BIGGEST CITIES AND POPULATION:	Ashgabat (1.0 million), Turkmenabad (0.2 million), Mary (0.12 million)
LANGUAGE:	Turkmen 72 %, Russian 12 %, Uzbek 9 %, other 7 %
CLIMATE:	Subtropical desert, hot summers (up to 48 °C), mild winters
ALTITUDE:	–81 m (Vpadina Akchanaya) to 3,139 m (Gora Ayribaba))
RIVERS:	Large river system of Amudarya and smaller systems of Murgab and Tejen rivers in the South
ECOSYSTEM AREAS:	Arid (80 %), rest: river valleys, oasis and mountainous ecosystems; forest coverage less than 1 %
GDP – PER CAPITA (PPP):	6,500 USD (as of 2008)
INFLATION RATE:	13 % (as of 2008)
AGRICULTURAL PRODUCTS	Cotton, grain, livestock
INDUSTRIES:	Natural gas, oil, petroleum products, textiles, food processing
ELECTRICITY – PRODUCTION:	13,650 GWh (as of 2006)
ELECTRICITY – CONSUMPTION:	Consumers 7,940 GWh, energy sector 2,460 GWh (as of 2006)
ELECTRICITY – TARIFFS:	0–0.3 US Cent/kWh
NATIONAL ELECTRICITY CAPACITY IN OPERATION:	3.3 GW (as of 2007)
ELECTRIFICATION RATE:	99.6 %
NATURAL RESOURCES:	Natural gas, petroleum, sulphur, salt
OIL – PRODUCTION:	189,400 barrels/day (as of 2008)
OIL – EXPORT:	84,770 barrels/day (as of 2007)
OIL – CONSUMPTION:	112,000 barrels/day (as of 2006)
OIL – PROVEN RESERVES:	0.6 billion barrels (as of 2009)
NATURAL GAS – PRODUCTION:	70.5 billion m^3/year (as of 2008)
NATURAL GAS – PROVEN RESERVES:	2,662 trillion m^3 (as of 2009)
EXPORTS:	11.92 billion USD (as of 200)
EXPORTS:	Gas, crude oil, petrochemicals, electricity, textiles, cotton fiber
EXPORTS – PARTNERS:	Ukraine 51.7 %, Poland 10 %, Hungary 8.1 % (as of 2008)
EXPORTS – PARTNERS:	5.65 billion USD (as of 2008)
IMPORTS – COMMODITIES:	Machinery and equipment, foodstuffs, chemicals
IMPORTS – PARTNERS:	China 16.9 %, Russia 15.9 %, Turkey 14 %, UAE 10.3 %, Ukraine 7.9 %, Germany 5.6 %, Iran 5.1 % (as of 2008)
EXCHANGE RATE:	1 € = 7,780 Turkmen Manat (as of 2009)

Source: CIA, as of 2009, and IEA, as of 2006

3 ENERGY MARKET IN TURKMENISTAN

3.1 IMPORTANT PLAYERS OF THE TURKMEN ENERGY MARKET

Turkmenistan's energy market is dominated and controlled by the State. The participation of foreign players remains insignificant. In addition, the following main actors play an important role in the local energy market:

- The Ministry of Energy and Industry regulates and manages electric power.
- Turkmenenergo is the State Energy Corporation, which owns most power plants in the country and manages and monitors the power grid.
- The state-owned energy-engineering corporation is called Kuvvat and belongs to the Ministry of Energy and Industry. It provides electric power generation and transport. Kuvvat comprises all necessary subdivisions for design, construction, repair and operation of energy projects.
- Türkmengas is the national gas company of Turkmenistan and controls gas extraction in the country. It is operating under the Ministry of Oil and Gas. Türkmennebit, also known as Turkmenoil or Turkmenneft, is the national oil company of Turkmenistan. The company is extracting most of Turkmenistan's oil.

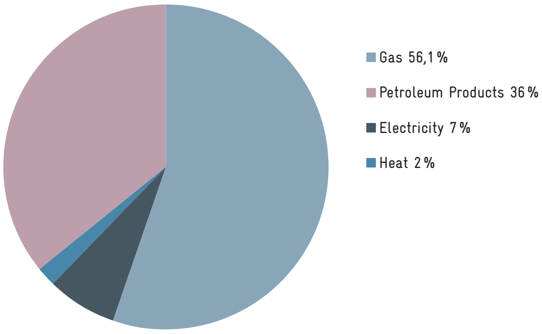
3.2 PRIMARY ENERGY CONSUMPTION, TRANSMISSION AND PRICES

In 2006, the total primary energy production in the Republic of Turkmenistan was 61,611 ktoe (716,535 GWh), consisting of 84 % natural gas and 16 % crude oil. Of this amount, 44,431 ktoe (516,732 GWh) were exported. The Total Final Consumption of energy (TFC) was 10,370 ktoe (120,603 GWh) in 2006[5]. The figure below shows in which forms energy resources were consumed:

5 IEA, AS OF 2006

FIGURE 2

Composition of Total Final Consumption



Source: IEA, as of 2006

Transmission and Distribution System

The transmission and distribution of electric power is realized by electrical networks with a voltage of 0.4–500 kV. The total length of the electrical grid is over 54,000 km. Despite efforts in refurbishment, Turkmenistan's distribution system still suffers from tremendous power loss due to ageing and inadequate maintenance.

Due to the potential of power export, international assistance funding in the early 2000s was offered from several sources to improve the efficiency of the power distribution grid in order to reduce the transmission costs of the exported power. The primary beneficiaries of the power exports, Iran and Turkey, were at the forefront of the refurbishment funding. A 270 km power transmission line connecting Turkmenistan to northern Iran was completed in August 2002, allowing for Turkmen exports to Iran and Armenia as Armenia's and Iran's electricity grids are connected. Another 220 kilovolt transmission line to north-eastern Iran was completed in August 2004, and there are other grid expansion projects under way.

Turkmenistan withdrew form the Central Asian Power Grid in 2003. There are, however, reports that it has reconnected again, supplying Tajikistan with electricity during the winter months (which is only possible by transiting the grid of Uzbekistan).

Prices

During the economically difficult years after gaining independence, the politics of Turkmenistan were focusing on maintaining stability in the country. To lower the population's burden, staple foods were subsidized and free-of-charge electricity, natural gas and water supplies introduced in 1993. According to the decree of the Peoples' Council of 14 August 2003, electricity, natural gas, water and salt will be subsidized for citizens up to 2030.

SHORT BUSINESS INFO

The electricity tariff for non-private consumers was increased by 10 % at the end of 2008 and stands currently at around 0.3 US Cent/kWh.

Electricity Sector

Electricity is mainly produced in eight power plants with a total installed capacity of 3.3 GW, 99 % of which is from thermal power plants (see appendix 1). Turkmenistan has sufficient generating potential to power its own cities, unlike much of Central Asia. In 2006, Turkmenistan's power sector generated 13,650 GWh while Turkmen consumers used 7,940 GWh and the energy sector itself 2,460 GWh, giving the country 3,247 GWh of surplus electricity. But owing to the country's inefficient power infrastructure from the Soviet era which needs to be repaired, power line losses wasted a significant portion of the electricity generated in 2006, resulting in exports of only 1,340 GWh[6]. The surplus increased in recent years as the transmission network has been partly modernized and the sector's efficiency has been improved. Figure 3 below shows the domestic electricity consumption by sector.

SHORT BUSINESS INFO

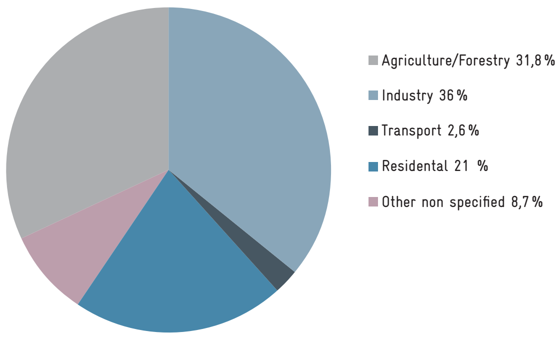
Turkmenistan has sufficient generating potential to power its own cities, resulting also in a surplus of electricity. But due to the country's inefficient power infrastructure, power line losses used to waste a significant portion of the generated electricity. Since 2006, the energy sector's efficiency has been improving.

The energy and electricity market is largely operated by the Government. Abundant natural gas reserves have steered the Turkmen electricity sector towards using it as the primary generating fuel. Save for minute quantities of hydroelectric generation, natural gas turbine plants produce all of the country's electricity. Its ease of acquisition has driven large-scale increases in the overall generating capacity. As a result, Turkmenistan is a large net exporter of electricity.

A key feature of Turkmenistan's energy sector is the low energy tariffs, which were introduced after gaining independence. The population receives natural gas and electricity free-of-charge, and other users who have to pay for energy consumption still enjoy the world's lowest energy prices. Inefficient and wasteful use of energy is the result of that policy which severely undermines the competitiveness of RE technologies.

FIGURE 3

Electricity Consumption by Sector



Source: IEA, as of 2006

6 IEA, AS OF 2006

SHORT BUSINESS INFO
The population receives natural gas and electricity free-of-charge, and paying users still enjoy the world's lowest energy prices. Inefficient and wasteful use of energy is the result of this policy, which still severely undermines the competitiveness of RE technologies.

Natural Resources

Oil and Gas

Turkmenistan is estimated to possess the world's fifth-largest natural gas reserves. Schmid & Langbein mention proven reserves of up to 4,400 billion m^3 of natural gas and additional possible reserves of 4,500 billion m^3.[7] Turkmenistan's Government has published even higher estimates of natural gas reserves with 25,000 billion m^3 onshore and 5,000 billion m^3 offshore reserves[8].

SHORT BUSINESS INFO:
Turkmenistan is estimated to possess the world's fifth-largest natural gas reserves. That is the main reason why Turkmenistan's demand for RE sources is practically inexistent up to now.

The Turkmenistan Natural Gas Company (Türkmengaz), being under the governance of the Ministry of Oil and Gas, controls gas extraction in the country. Domestic consumers have been receiving natural gas for free since 1993. Not surprisingly, Turkmenistan has had the fastest consumption growth in the region, averaging 16.1 % annually from 2000 to 2006, as compared with 6.3 %per year for the rest of Central Asia[9].

While the Turkmen natural gas sector remains under control of the Government, the oil sector is open for foreign investors. Foreign companies, however, are only involved in about 5 % of the total oil production. Most of Turkmenistan's oil is still extracted by the State Company Türkmennebit from fields near the Caspian Sea. Following an initial euphoria, foreign companies have started to pull out of the Turkmen market due to strong governmental control and structural difficulties. Proven oil reserves are estimated at 0.6 billion barrels[10].

Oil production reached a peak of more than 15 million tons in 1974, as compared to 5.4 million tons in 1991. Today, some 10 million tons of oil are produced annually by Turkmennebit and five foreign oil companies operating under production sharing agreements. A large part of the oil produced in Turkmenistan is refined in the Turkmenbashy and Seidi refineries.

Import and Export of Energy

Turkmenistan is fully self-sufficient in energy resources due to its large hydrocarbon reserves. Energy imports into the country are negligible.

SHORT BUSINESS INFO:
Turkmenistan is fully self-sufficient in energy resources due to its large hydrocarbon reserves.

In 2006, more than 70 % of Turkmenistan's primary energy production was exported, mainly in the form of natural gas. Major export countries are Ukraine and Iran. The natural gas export, however, is constrained by Turkmenistan's continental location. The country is largely dependent on the pipelines of the Russian monopolist Gazprom. The construction of new pipelines is a politically sensitive issue and very expensive. Turkmenistan is, therefore, promoting alternative energy exports, e. g. in the form of electricity.

Export of Turkmen electric power currently makes up over 10 % of the total production. Power export has annually increased by over 15 % in 2005–2007. The bulk of the electricity exports go to Afghanistan, Iran, Turkey and Tajikistan. Once the ongoing grid extension projects are completed, Turkmenistan will be able to export nearly 2,400 GWh per year to Iran alone. The Iranian electricity company of Tavanir pays 2 US Cent/kWh for this power.

Growth Predictions for the Energy Sector

The Government of Turkmenistan has ambitious plans to increase the capacity of the power sector by building new thermal power plants and modernizing existing plants[11]. Foreign investors are invited to help realize these plants.

SHORT BUSINESS INFO:
The Government of Turkmenistan has ambitious plans to increase the capacity of the power sector by building new thermal power plants and modernizing existing plants. Foreign investors are invited to contribute to the realization of these plants.

A number of new gas turbine plants are under construction with the goal of increasing the installed capacity to 4,300 MW and the total production to 25,500 GWh by 2010, a substantial increase of current capabilities. It is planned that the total generation capacity shall further increase by 1,250 GWh per year.

While these investment projects aim to substantially increase the production capacity, domestic consumption is not projected to increase at anywhere near the same rate. As a result, when these projects are completed by 2010 and 2011, up to 40 % of electricity production will be exported for external consumption.

7 SCHMID & LANGBEIN, AS OF 2004
8 TURKMENISTAN OIL, AS OF 2007
9 EIA, AS OF 2009
10 EIA, AS OF 2009
11 ACCORDING TO THE PROGRAM OF THE TURKMENISTAN MINISTRY OF POWER ENGINEERING & INDUSTRY UP TO 2020, APPROVED BY THE TURKMENISTAN PRESIDENT DECREE NO.8068 OF 22 AUGUST 2006

4 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

4.1 NATIONAL STRATEGIES AND PROGRAMS TO SUPPORT RENEWABLE ENERGIES TO SUPPORT RENEWABLE ENERGIES

After gaining independence, the Government of Turkmenistan was concerned with environmental issues and established a Ministry of Environmental Protection[12]. There exists, however, no specific policy or program for the promotion of RE solutions so far. But the Government seems to have realized that the heavily subsidized provision of electricity and gas has resulted in a wasteful handling of valuable energy resources. This situation is reflected in the Law of Turkmenistan on Energy Saving, which is at the stage of preparation. This law declaratively covers all the aspects of energy saving in both the energy production and consumption sector. The law defines the framework for governing the energy saving policies at national level. High priority is also given to measures for reducing Greenhouse Gas (GHG) emissions in the energy production and consumption. The implementation of such measures is intended to be entailed by the law. Ultimately, RE will also get more attention through the law. The following priority measures have been determined[13]:

- Increase of fuel efficiency at power plants by means of modernization of combustion systems
- Increase of natural gas share in the energy balance
- Increase of renewable sources in the energy balance
- Increase of energy efficiency in municipal services and in industry as well as modernization of heating systems
- Implementation of measures on energy saving in the residential sector and industry

SHORT BUSINESS INFO

There exists no specific policy or program for the promotion of RE solutions so far. However, a Law on Energy Saving in energy production and consumption is under development, which also pays attention to reduction measures for GHG emissions and partly also to RE solutions.

Other programs addressing aspects of climate change, conservation of nature and environmental protection are:

- The national Basic Directions of Social and Economic Development of Turkmenistan for the Period until 2010 Program
- The national Strategy of Economic, Political and Cultural Development of Turkmenistan for the Period until 2020
- The National Environmental Action Plan (NEAP)

4.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

In October 2007, Turkmenistan enacted a revised Foreign Investment Law aimed at encouraging foreign investment. The law envisages quick issuing of multi-entry visa to foreign investors and also waives a number of taxes and other fees for foreign investment projects. Critics, however, say that the law would not mean much and that doing business in Turkmenistan still depends on personal agreements with the authorities. Furthermore, the types of enterprises a foreigner can operate with have not been specified[14].

The petroleum sector is regulated through the Petroleum Law of Turkmenistan of 1996. The law allows the issuance of operation licenses for registered foreign persons or companies[15].

In September 2008, a revised Law on Hydrocarbon Resources was approved. The revised law spells out fiscal and customs policies, defines benefits to be enjoyed by national and foreign investors and companies and reinforces their ecologic accountability for exploration of hydrocarbon resources. The law allows foreign investors to buy property in Turkmenistan. Under the law passed in 1992, foreign investors were only allowed to set up joint ventures with state-owned companies.

As already hinted at under section 4.1, RE may get more attention through the Law of Turkmenistan on Energy Saving which is at the stage of preparation at present. Due to the absence of a specific program for the promotion of RE, there are neither any regulations regarding licensing nor other legal and regulatory issues related to RE in place. The Ministry of Economy and Finance is responsible for general licensing issues.

The rural electrification ratio of Turkmenistan is 99.6 %[16]. Thus, there is no specific legislation required for rural electrification of the country. There are only a few remote islands in the Caspian Sea, which are not yet electrified. RE solutions would be the ideal option for the electrification of these places.

SHORT BUSINESS INFO

There is no specific legislation required for rural electrification in Turkmenistan. There are only a few remote un-electrified islands in the Caspian Sea for which RE solutions would be the ideal electrification option.

Clean Development Mechanism (CDM)

Turkmenistan ratified the fundamental UN conventions in the fields of environmental protection and conservation of nature, including the UN Framework Convention on Climate Change (UNFCCC) in 1995 and the Kyoto Protocol in 1998.

Like other Central Asian nations, Turkmenistan has a potential for large-scale Clean Development Mechanism (CDM) projects. This is specially the case in the field of natural gas and oil exploration and transport as well as in the thermal power sector. However, if the CDM Executive Board does not simplify the baseline methodology acceptance procedure, it is unrealistic to expect that this potential will be realized.

Turkmenistan has established a Designated National Authorities (DNA) for the assessment of CDM projects at the Office of Climate Change within Ministry of Nature Protection. Until October 2009, however, no CDM project has been registered[17].

12 SEE ALSO THE MINISTRY'S WEBSITE AT WWW.NATUREPROTECTION.GOV.TM
13 SEE ALSO EBRD, AS OF 2009
14 SEE ALSO PRESS ARTICLE KOMMERSANT, AS OF 2007
15 PRESIDENT OF TURKMENISTAN, AS OF 1996
16 WORLD BANK, AS OF 2008
17 IGES, AS OF 2009

5 POTENTIAL FOR RENEWABLE ENERGIES AND PRESENT USE

Apart from the Russian Federation, Turkmenistan has the largest proven gas reserves of any of the former Soviet republics. That is the main reason why demand for RE sources was practically inexistent, yet. Nevertheless, Turkmenistan is interested in developing its abundant RE potential (wind and solar) and would like to explore the use of carbon financing for the implementation of projects in this area.

5.1 BIOENERGIES

Turkmenistan has a very low potential for bioenergies (solid biomass, liquid, biogas) as alternative energy sources. Waste from livestock is used exclusively as fertilizer, and no infrastructure for utilizing waste fuels exists. Other forms of biomass, such as forest waste, are also minimal since forest covers less than one percent of the country and the Government forbids deforestation[18].

5.2 SOLAR ENERGY

The southern and southeastern part of Turkmenistan yields tremendous solar power opportunities. Three separate areas in three different regions receive comparably high amounts of sunlight: Gasan-Kuli, Ashkabat and Chardzhou. These regions receive the most usable sunlight of any Commonwealth of Independent States (CIS) territory[19]. There are nearly 300 clear days per year in the country where the average solar radiation amounts up to 2,000 kW/m^2/year (see also appendix 2).

Despite having a high solar energy resource potential, Turkmenistan does not utilize solar power technologies. There are just a few experimentation centers where solar energy is used for food drying and water desalination purposes.

TABLE 4

Annual Solar Irradiation

Baku	30,400 tons	42.8 million m^3
Ganja	5,100 tons	7.2 million m^3
Sumqayit	4,900 tons	6.9 million m^3
Mingachevir	1,600 tons	2.3 million m^3
Shirvan	1,200 tons	1.7 million m^3
Nakhchivan	1,200 tons	1.7 million m^3

Source: EBRD, as of 2009

SHORT BUSINESS INFO

Three separate areas in three different regions – Gasan-Kuli, Ashkabat, and Chardzhou – receive the most usable sunlight of any Commonwealth of Independent States (CIS) territory.

5.3 WIND POWER

Turkmenistan has a very large wind power potential, which is estimated to equal the country's fossil fuel potential. The long Caspian coastline and the large central desert area provide strong and reliable winds, both in the 4–5 m/s category and in the 5–6 m/s category. Some areas near the coastal town of Turkmenbashi have reliable speeds even higher than 6 m/s. The theoretical wind energy potential is estimated at 500,000 MW of which 10,000 MW are technically feasible to be developed in the mid-term[20].

The most promising areas for wind energy development are located in the Kara Bogaz Gol Bay coastal zone: the Krasnovodsk (Turkmenbashi) plateau, a strip of the Caspian Sea coast near the boundary to Iran, the region of the Kara Kum desert and headwaters of the Murghab river on the Kara Bil Hills near the Afghanistan border. A wind energy map is shown in appendix 3.

SHORT BUSINESS INFO

The most promising areas for wind energy development are located in the Kara Bogaz Gol Bay coastal zone.

5.4 GEOTHERMAL ENERGY

Turkmenistan has a moderate potential of geothermal energy. If not for the exploratory ventures for oil and gas reserves, the geothermal water temperature would have not been explored in any way. Nevertheless, a modest potential for geothermal power, particularly in the Darvaza Region, the Caspian Coast Region, and the Kopet-Dag Foothills was uncovered. Temperatures ranging from 70–100 °C have been located, and if developed, could yield approximately 6,600 thermal MW of heat[21]. The geothermal potential remains untapped as of today.

5.5 HYDRO POWER

The Turkmen hydro power industry's year of birth is considered to be 1913, when the construction of Indigush Hydroelectric Power Plant was completed on the Murghab River with an installed capacity of 1.2 MW. Despite its age, the power plant is still operational and remains the only Hydro Power Plant (HPP) in the country.

The hydro power potential is estimated to be rather small in Turkmenistan. Amu Darya is the biggest river flowing through Turkmenistan. But due to the flatness of the country, it may be difficult to develop its potential. Other rivers (Tejen and Atrek) are not attractive due to unpromising water resources.

The most remarkable small hydro power potentials are concentrated in the southern part of the Republic on the Murgab and Tejen rivers and Karakum Canal.

18 WORLD ENERGY COUNCIL, AS OF 2007
19 WORLD ENERGY COUNCIL, AS OF 2007
20 WORLD ENERGY COUNCIL, 2007
21 WORLD ENERGY COUNCIL, 2007

6 MARKET RISKS AND BARRIERS FOR MARKET ENTRY

A continuing Soviet-style economy and widespread corruption diminish equality of opportunity, although some changes are taking place. The new constitution establishes the right to have private property, but it remains unclear how this can be implemented.

Freedom of speech and freedom of the press are severely restricted by the Government, which controls all broadcast and print media. The Government also places significant restrictions on academic freedom, and the Ruhnama[22] is still used throughout the school system. Reforms in 2007 undid some of the damage Niyazov had inflicted on education, but the concerted effort needed to really change the situation has not yet been made. The constitution guarantees peaceful assembly and association, but these rights are severely restricted in practice. While not technically illegal, non-governmental organizations are tightly controlled, and Turkmenistan has no civil society sector to speak of.

Turkmenistan's regulations do not exclude foreigners from doing business in the country. Without personal relations to government officials, however, it can be hard and cumbersome.

6.1 GENERAL SITUATION

Corruption

Corruption is widespread and officials are often obliged to bribe their way into their positions. Turkmenistan was ranked 166 out of 180 countries surveyed in Transparency International's 2008 Corruption Perceptions Index[23].

Turkmenistan is a smuggling corridor for drugs from neighboring Afghanistan, with reports from the Niyazov era suggesting the involvement of high-level officials in the narcotics trade as well as a growing problem of drug addiction within Turkmenistan.

The judicial system is subservient to the President, who appoints and removes judges without legislative review. The authorities frequently deny rights of due process, including public trials and access to defense attorneys. The new constitution bars judges and prosecutors from membership in political parties.

Availability of Local Know-how

There are only three domestic organizations known to be involved in RE technology development[24], most notably the Sun Scientific Production Association affiliated with the Supreme Council for Science and Technology under the President of Turkmenistan. The organization carries out research on the use of RE sources and is responsible for virtually all experimental projects implemented in the country so far. Projects include wind power, solar drying technology for farms, integrated wind and solar power complexes both for generating electricity and pumping water, the development of solar "photaic" bioreactors for breeding microscopic algae and solar furnaces for high-temperature studies.

Further know-how is located at the state ministries and state-owned companies.

Local Acceptance

There is no information available regarding the acceptance of RE technologies in Turkmenistan. It is reported, however, that people living in the tiny 0.4 % of the country which are not electrified yet would very much welcome RE solutions as a source of electricity and for other purposes.

6.2 BUSINESS DEVELOPMENT

The Government controls most of the economy and restricts foreign participation in some sectors. The Government chooses its investment partners selectively, and personal contact with high political officials is the best guarantee for approval. Other investors – foreign and domestic alike – face significant discrimination. The bureaucracy is non-transparent and politicized, and bureaucratic procedures are confusing and cumbersome. Inconsistent rule of law and high levels of corruption are strong disincentives to investment. Foreign exchange accounts require the Government's approval as do all payments and transfers. Capital transactions face restrictions and Central Bank approval in some cases. All land is owned by the state.

The overall freedom to conduct a business is very limited by Turkmenistan's regulatory environment. The system is non-transparent, enforcement is inconsistent and businesses have difficulties in getting copies of laws and regulations. Personal relations with Government officials often help to determine how and when regulations are applied.

SHORT BUSINESS INFO

The overall freedom to conduct a business is very limited by Turkmenistan's regulatory environment.

6.3 INTELLECTUAL PROPERTY RIGHTS

The legal system does not deal with contracts and property rights effectively. Laws are poorly developed and judicial employees and judges are poorly trained and open to bribery. Laws designed to protect intellectual property rights are implemented arbitrarily or not at all. Pirated copies of copyrighted and trademarked materials like videos, cassette tapes and literature are widely available.

6.4 TAXATION

Turkmenistan has low tax rates. In the past year, overall tax revenues as a percentage of GDP equaled 20.2 percent. The top Income Tax rate is 10 %, and the top Corporate Tax rate is 25 %[25]. Foreign companies, their branches or representative offices and foreign individuals doing business in Turkmenistan must pay a Value Added Tax (VAT) of 20 %. Tax administration is weak and widespread exemptions for state enterprises reduce the Government's revenue.

22 RUHNAMA IS A BOOK WRITTEN BY SAPARMURAT NIYAZOV, LATE PRESIDENT FOR LIFE OF TURKMENISTAN, COMBINING SPIRITUAL/MORAL GUIDANCE, AUTOBIOGRAPHY AND REVISIONIST HISTORY, MUCH OF IT OF DUBIOUS OR DISPUTED FACTUALITY AND ACCURACY.

23 SEE TI, AS OF 2008

24 SEE CONTACT INFORMATION IN CHAPTER

6.5 IMPORT/EXPORT

Turkmenistan's weighted average tariff rate was 2.9% in 2002. Import and export bans and restrictions, some prohibitive duty rates for agricultural and food products, high import taxes and fees, services market access restrictions, cumbersome import and export registration requirements, subsidies and customs procedures that are bureaucratic, slow and subject to corruption add to the cost of trade.

7 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

The following organizations may to some extent provide information regarding the investments in the energy sector of Turkmenistan.

NAME OF ORGANIZATION	ADDRESS AND CONTACT	CONTACT PERSON
Ministry of Nature Protection of Turkmenistan	Ashgabat, Kemine Str., 102	+(99 312) 35 43 17/39 31 84
Ministry of Power Engineering and Industry of Turkmenistan	Ashgabat, 2022 Str., 55	+(99 312) 37 92 59/37 93 77
Ministry of Economy and Finances	Ashgabat, N. Pomma Str., 4	+(99 312) 51 05 03/51 05 63
Ministry of Oil and Gas Industry and Mineral Resources	Ashgabat, Archabil Ave., 23	+(99 312) 40 30 48/40 31 37
State Power Corporation – Turkmenenergo	Ashgabat, 2022 Str., 55	+(99 312) 37 93 51/ 37 93 77
State Concern of Oil – Turkmennebit	745100 Balkanabat Sity, 148 Kvartal	+(99 300222) 49 584
State Concern of Gas – Turkmengas	Ashgabat, Mollanepes Str., 1	+(99 312) 40 32 01/ 40 32 60
State Commodity and Raw Materials Exchange	Ashgabat, Mahtumkuli Ave., 111	+(99 312) 35 43 21
State Tax Inspection	Ashgabat, Pushkin Str., 11	+(99 312) 35 43 55
State Custom House	Ashgabat, S. Muradova Str.,7	+(99 312) 27 33 36/27 32 25
High Council for Science and Technique under the President of Turkmenistan	Ashgabat, Bitarap Turkmenistan,15	+(99 312) 35 38 42
National Institute of Deserts, Flora and Fauna	Ashgabat, Bitarap Turkmenistan,15	+(99 312) 39 54 27/39 20 39
National Institute of State Statistics and Information of Turkmenmilli-hasabat	Ashgabat, Mahtumkuli Ave., 72	+(99 312) 39 42 65/39 47 08
Institute of Oil and Gas	Ashgabat, Archabil Ave., 23	+(99 312) 40 30 48
Turkmen State University	Ashgabat, Turkmenbashy Ave., 33	+(99 312) 35 44 55
Turkmen Polytechnic Institute	Ashgabat, 1916 Str., 136	+(99 312) 41 18 02
Turkmen State Institute of Energy	Mary, Bayram Han Str., 62	+(99 522) 6 04 12/3 12 52, 3 90 18

25 BISNIS, AS OF 1998

In Turkmenistan, there are three organizations engaged in the field of RE. Their projects are mainly dependent on donor support.

Sun Scientific Production Association
General Director: Dr. M. A. Rakhmanov
60, Bekrova Str.
Ashgabat
Turkmenistan
Phone: +(993 12) 370348
E-Mail: nazarkorpeyev@mail.ru

Governmental organization involved in scientific research and development of pilot projects in the field of Renewable Energy technology

Tebigy Kuwwat /Natural Energy
Chairman: Dr. Pr. N. P.Korpeyev
Institute of Deserts
15, Bitarap Turkmenistan Str.
Ashgabat 744000
Turkmenistan
Phone/Fax: +(993 12) 398584
E-Mail: tebigykuwwat@rambler.ru
nazarkorpeyev@mail.ru

Non-governmental organization involved in RE development, CDM and projects in the field of environmental protection

Economic Entity – ADVIS
General Director: A. Gladishyev
PO Box 157
Ashgabat-11, 744011
Turkmenistan
Phone: +(993 12) 432092
Fax: +(993 12 350481
E-Mail: advis@online.tm

Private sector company involved in projects on automation, communication, computer, network technologies, contract deliveries of equipment & materials, construction projects

8 BIBLIOGRAPHY

- AllBusiness (2004): Turkmenistan – The Power Sector, APS Review Downstream Trends (www.allbusiness.com/mining/oil-gas-extraction-crude-petroleum-natural/220274-1.html)
- Central Intelligence Agency – CIA (2009): The World Fact Book – Uzbekistan
- Business Information Service for the Newly Independent States – BISNIS (1998): Turkmenistan's Tax System (http://permanent.access.gpo.gov/lps3997/9806turk.htm)
- European Bank for Reconstruction and Development – EBRD (2009): Renewable Development Imitative. Turkmenistan, Country Profile 2009 (http://ebrdrenewables.com/sites/renew/countries/turkmenistan/profile.aspx)
- Energy Information Administrations – EIA, U.S. Dept. of Energy (2009): International Energy Outlook 2009 (www.eia.doe.gov)
- Freedom House (2009): Freedom in the World, Country Report on Turkmenistan
- Heritage Foundation (2009): Index of Economic Freedom – Uzbekistan
- International Energy Agency – IEA (2006): Electricity/Heat in Uzbekistan in 2006
- Institute for Global Environmental Strategies – IGES (2009): CDM Project Database (www.iges.or.jp/en/cdm/report_cdm.html)
- International Crisis Group (2006): Uzbekistan – In for the Long Haul
- Kakharo, Jahangir (2008): Uzbekistan Power Generation Sector Overview, U.S. & Foreign Commercial Service and U.S. Department Of State
- King S. A., Khalturin, V. I., Tucker E. (1996): Seismic Hazard and Building Vulnerability in Post-Soviet Central Asian Republics
- Kommersant (2007): Turkmenistan Passes New Foreign Investment Law (www.kommersant.com/p814971/economic_legislation)
- LakeNet (2009): Lake Profile Aral Sea (www.worldlakes.org/lakedetails.asp?lakeid=9219)
- President of Turkmenistan (1996): Petroleum Law of Turkmenistan (http://turkmeniya.tripod.com/turkmenistanlaws/id6.html)
- Publications International (2009): 12 of the Most Destructive Earthquakes
- Schmid, H., Langbein, J. (2004): Turkmenistan – Nation Building and Economic Development since Independence
- Toderich, K., Massino, I., Shoab, I., et al. (2008): Utilization of Agriculture Residues and Livestock Waste in Uzbekistan, IDEAS
- Transparency International (2008): Corruption Perceptions Index (www.transparency.de/Corruption-Perceptions-Index-2.1234.0.html)
- Turkmen Government (2009): Turkmenistan, The Golden Age (www.turkmenistan.gov.tm)
- Turkmenistan Oil (2007): Investor's Guide to Oil and Gas of Turkmenistan (http://turkmenistanoil.tripod.com)
- World Bank (2008): The Welfare Impact of Rural Electrification: A Reassessment of the Costs and Benefits – an IEG Impact Evaluation
- World Energy Council (2007): Electricity in Central Asia, Market and Investment Opportunity Report
- 3TIER Inc. (2009): Renewable Energy + Information Services (www.3tier.com/en/)
- Ministry of Environmental Protection (without year): Various publications (www.natureprotection.gov.tm)

9 ANNEX

TABLE 5

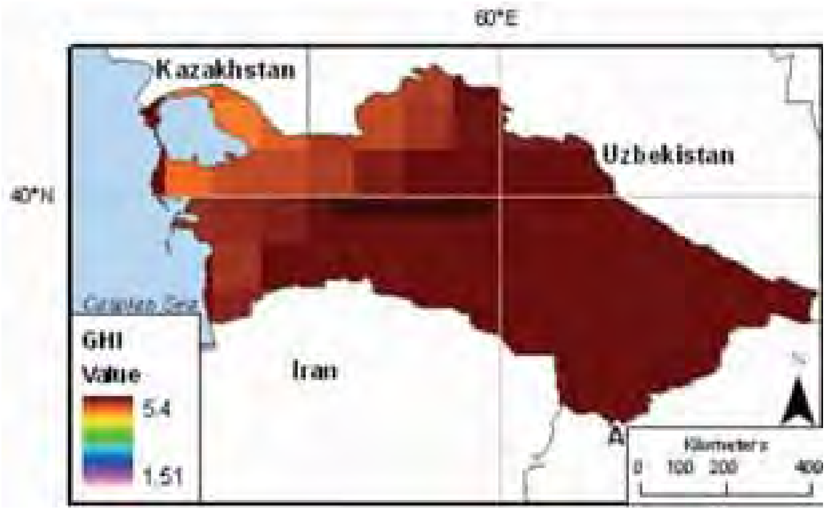
Installed Capacity in Operational Power Plants

GENERATION FACILITY	INSTALLED CAPACITY (MW)	COMMISSIONING DATE
Mary TPP	1,685.0	1973
Turkmenbashy TPP	540.0	1965
Abadan TPP	321.0	1962
Ashkhabad TPP	254.2	2006
Dashoguz TPP	254.2	2007
Balkanabat TPP	126.0	1979
Seidi TPP	160.0	1992
Gindukush HPP	1.2	1913
Total	3,341.6	

Source: data compiled by the author from different sources, as of 2007

FIGURE 4

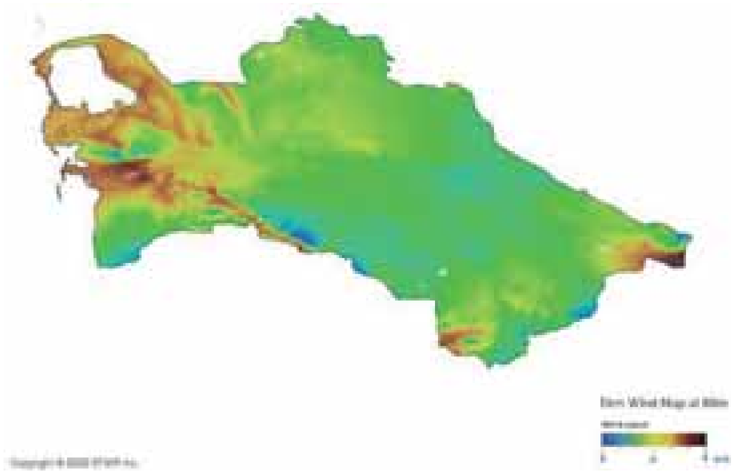
Turkmenistan Solar Global Horizontal Irradiance



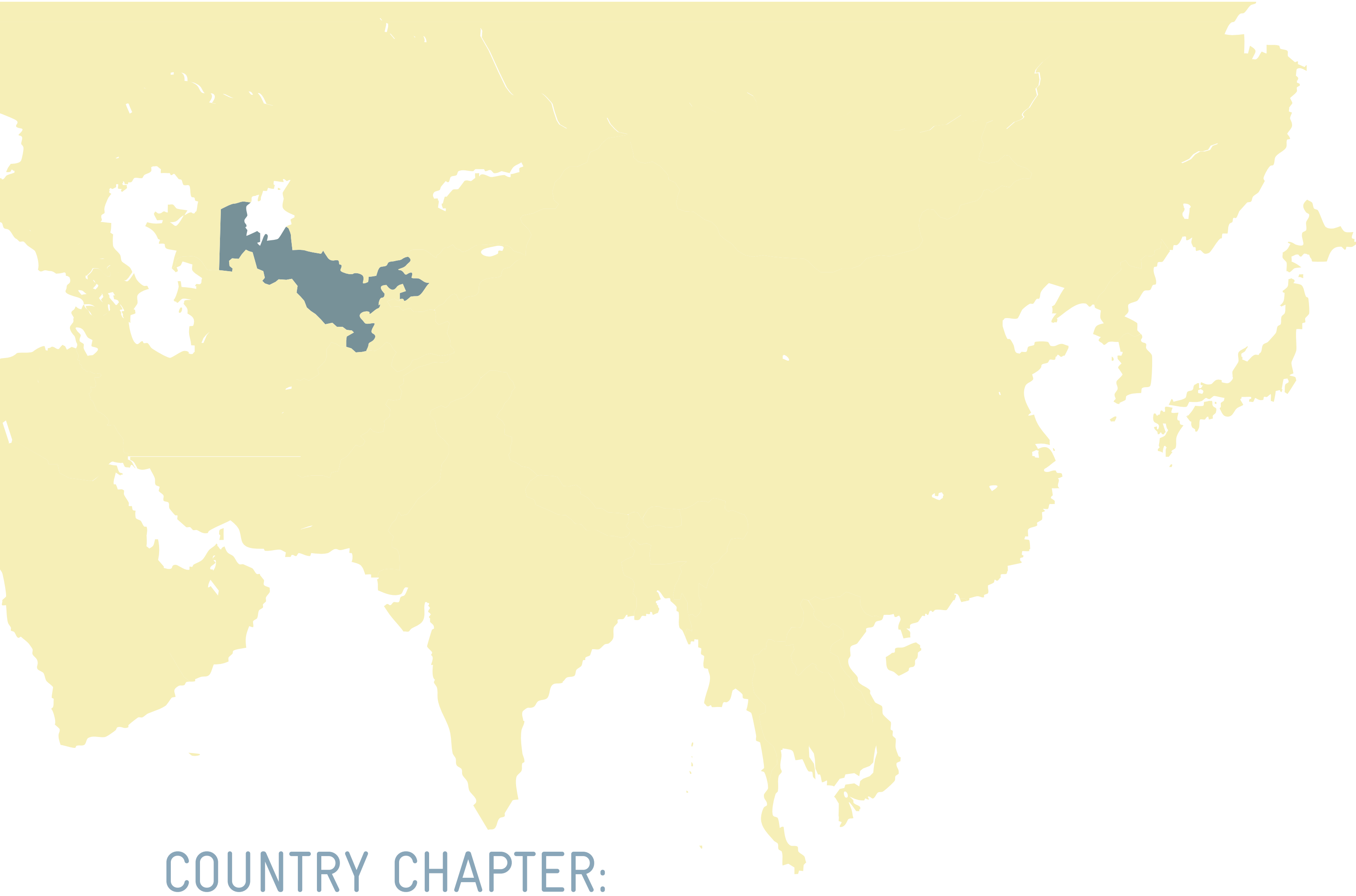
Source: NASA/EBRD, as of 2009

FIGURE 5

Wind Map of Turkmenistan



Source: 3TIER Inc., as of 2009



COUNTRY CHAPTER: REPUBLIC OF UZBEKISTAN

Authors and Coordination of Country Chapter
Dr. Ing. Klaus Jorde
Entec Consulting & Engineering AG
St. Gallen, Switzerland
www.entec.ch

Axel Biegert (Dipl. Economist & Pol.)
INTEGRATION UMWelt & Energie GmbH
Graefenberg, Germany
www.integration.org

Editor
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Department Water, Energy, Transport
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
www.gtz.de

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)

Editorial staff
Diana Kraft
Tel: +49 (0)6196 79 4101
Fax: +49 (0)6196 79 80 4101
Email: diana.kraft@gtz.de

CONTENTS

ACRONYMS AND ABBREVIATIONS

REPUBLIC OF TAJIKISTAN

ADB	Asian Development Bank
CAR	Central Asian Region
CAPS	Central Asian Power System
CCA	Common Country Assessment
CDM	Clean Development Mechanism
CHP	Combined Heat and Power Plant
CIS	Commonwealth of Independent States
CO_2	Carbon Dioxide
GDP	Gross Domestic Product
GEF	Global Environmental Facility
DDP	Distribution Demonstration Project
EBRD	European Bank for Reconstruction and Development
EPC	JSC Electric Power Plants (GenCo)
FSU	Former Soviet Union
GHG	Greenhouse Gas Emissions
HDR	Hot Dry Rock
HPP	Hydro Power Plant
HV	High Voltage
HVL	High Voltage Lines
HVN	High Voltage Network
IBRD	International Bank for Reconstruction and Development
ICWC	Interstate Commission for Water Coordination
IDA	International Development Association
JSC	Joint Stock Company
KNG	JSC KyrgyzNefteGas (Oil and Gas)
KPC	Kyrgyz Petroleum Company
MB&C	Metering, Billing and Collection
MDG	Millennium Development Goals
NEG	National Electric Grid
O&M	Operation and Maintenance
PCCAR	Power Council of Central Asia Republics
PPP	Purchasing Power Parity
PREGA	Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement
SJSC	State Joint Stock Company
TPP	Thermal Power Plants
UDC	Unified Dispatch Center
UNDP	United Nations Development Program
UNDAF	United Nations Development Assistance Framework
UNFCCC	UN Framework Convention on Climate Change
UPSCAR	United Power System of Central Asia Republics
USD	US Dollar
VAT	Value Added Tax
WB	World Bank
WPI	Wind Power Installations

MEASUREMENTS

°C	degree Celsius
GW	gigawatt
GWh	gigawatt hour (1 GWh = 1,000,000 kWh)
kJ	kilojoule (1 kJ = 1,000 Joules)
km^2	square meter
ktoe	kilotons of oil equivalent (1ktoe = 11,630,000 kWh)
kV	kilovolt (1kV = 1,000 V)
kWh	kilowatt hour
m	meter
m^3	cubic meter
mm	millimeter
MW	megawatt (1 MW = 1,000 kW)
t.c.f.	trillion cubic feet
TWh	terawatt hour (1 TWh = 1,000,000,000 kWh)

1 SUMMARY

The Republic of Uzbekistan is one of the few countries, which are fully self-sufficient in energy resources. Substantial reserves of conventional energy sources ensure the country's current energy independence and also allow for energy exports. Due to this rich endowment with energy, the development of Renewable Energy (RE) does not enjoy high priority on the Government's agenda with the exception of hydro power. Still, a growing interest in the development of RE sources can be observed. There are plans to further develop the power industry by building small-scale Hydro Power Plants as well as to develop the vast solar power potential of the country. Below, please find an overview of the technically feasible potentials of RE in Uzbekistan[1]:

TABLE 1

Renewable Energy Resources in Uzbekistan

SOURCE	TECHNICALLY FEASIBLE POTENTIAL
Solar energy	2,000,000 GWh
Bioethanol form cotton stalks	2,000 GWh
Small Hydro Power	8,000 GWh
Thermal water	2,000 GWh
Wind energy	800 GWh
Biogas	55 GWh
Total energy consumption	423,762 GWh

Source: Data compiled by the author from different sources, data as of 2006

Besides small hydro power, which is already developed by approximately 30 %, the other potentials remain virtually untapped and open a large field for a possible development of new RE solutions. Climatic conditions of Uzbekistan are especially favorable for utilizing solar energy.

The reasons for the marginal utilization of RE sources is seen in the relatively high start-up costs, the low gas and electricity prices and the neglect of existing regulations to promote RE, which have not yet been translated into a favorable feed-in tariff for RE installations. One of the greatest challenges Uzbekistan faces in restructuring the power sector is the problem of cross-subsidies and direct governmental subsidies.

The difficult business environment does not encourage investments in RE projects. Extensive state controls over the economy continue to hinder the functioning of markets and the development of the private sector. Corruption permeates the society and grows more rampant over time. The economic policies have discouraged foreign investment, which is the lowest per capita in the Commonwealth of Independent States (CIS).

1 LARGE HYDRO POWER IS NOT SHOWN IN THE TABLE AS ITS POTENTIAL IS ALREADY 80 % DEVELOPED.

2 COUNTRY INTRODUCTION

2.1 GEOGRAPHY AND CLIMATIC CONDITIONS

The Republic of Uzbekistan is located in the very heart of Central Asia, between the rivers Amu Darya and Syr Darya. It shares borders with Kazakhstan to the North and to the NorthEast, to the East and to the South East with Kyrgyzstan, to the West and to the South West with Turkmenistan and to the South with Afghanistan. The physical environment of Uzbekistan is diverse, ranging from the flat desert topography comprising almost 80 % of the country's territory to mountain peaks in the East reaching 4,500 m above sea level. The country has an area of 447,000 km^2 with a population of 27.6 million inhabitants, of which 63 % live in rural areas and 37 % in cities[2]. According to official statistics, Uzbeks form the majority of the population with 80 %. Other sources estimate that the majority are in fact Tajiks constituting 50 % followed by Uzbeks with 31 %[3]. Other ethnic groups include Russians, Kazakhs, Karakalpaks, Tatars and Turkmens.
Uzbekistan is divided into 14 administrative units comprising 12 regions, the Republic of Karakalpakstan and Tashkent city, which is not a part of the Tashkent region.

The climate of Uzbekistan is mainly continental with average summer temperatures of 28 °C in the North and 32 °C in the South of the country and moderate winter temperatures of –6 °C in the North to +2 °C in the South respectively. Occasionally, summer peak temperatures can reach 50 °C, but, due to low moisture, such temperature is tolerant. About 250 days of the year are sunny days. The total annual precipitation varies from 80 to 200 mm in the plain, from 300 to 400 mm in foothills and to 600 to 900 mm in the mountains.

The two most important feeder rivers of the Aral Sea flow partly through Uzbekistan, namely the Amu Darya river and the Syr Daria river.

FIGURE 1

Map of Uzbekistan

1 CIA, AS OF 2009

2 FOR A VARIETY OF REASONS THE DESIGNERS OF THE SOVIET NATIONAL DELIMITATION IN CENTRAL ASIA DISCRIMINATED AGAINST THE TAJIKS. THEY WERE ASSUMED TO HAVE DEPRIVED THE NEWLY FORMED REPUBLIC OF TAJIKISTAN OF THE TWO MOST IMPORTANT CENTERS OF TAJIK URBAN CULTURE, I.E. BUKHARA AND SAMARKAND, AS WELL AS OF THE REGIONS OF FERGANA, SURHANDARYA AND KHWRAZM WHICH WERE AWARDED TO UZBEKISTAN. THE MAJORITY OF TAJIKS LIVING IN UZBEKISTAN WERE FORCED TO BE REGISTERED AS UZBEKS (LIBRARY OF CONGRESS COUNTRY STUDIES, AS OF 1996).

2.2 POLITICAL AND ECONOMIC ENVIRONMENT

Uzbekistan was incorporated into the Russian Empire in the 19th century and later became a constituent republic of the Soviet Union. It has been an independent republic since December 1991.

Since gaining independence, the Government of Uzbekistan has been implementing its energy policy as part of its social-economic policy, focusing it on maintaining Uzbekistan's energy security and using energy resources to achieve further social aims.

Oil and natural gas are very important for the industry of Uzbekistan as they have a 97 % share of the country's energy balance. Uzbekistan has the second largest oil reserves in Central Asia after Kazakhstan and the third largest reserves of natural gas after Turkmenistan and Kazakhstan. There are also considerable brown coal deposits at the head of the Angren Valley, in the South East of Tashkent.

There are eighteen large hydroelectric stations on the Syr Darya, Chirchiq and Naryn rivers, which largely depend on Kyrgyzstan and Tajikistan for their power.

Currently, Uzbekistan is the largest electricity producer among the Central Asian republics and a net exporter of electricity. About 50 % of the power generating capacity of the United Central Asia Power System is located in Uzbekistan. This power grid also incorporates the power systems of Tajikistan, Kyrgyzstan and southern Kazakhstan. The Government gives high priority to the energy sector. Strategic objectives include:

- Achievement of fuel independence by increasing petroleum and natural gas condensate output
- Creation of a reliable raw material base for the energy sector, including the use of RE resources
- Maximization of the public's access to natural and liquefied gas, electricity and modern fuels
- Promotion of the financial stability of investments and attraction of more investments in the energy sector
- Development of the energy sector's legal framework and improvement of its financial-taxation system, taking into account the peculiarities of price formation and interaction of the energy sector with closely allied sectors
- Use of energy resources in a more efficient way
- Promotion of competition in the energy sector by consistently establishing entities and constantly building a genuine market economy infrastructure

Uzbekistan's economy relies mainly on commodity production and natural gas. It is the sixth largest exporter of cotton in the world, has the fourth largest reserves of gold and significant reserves of uranium, copper and other non-ferrous and rare earth metals. Uzbekistan has an abundance of natural gas, used both for domestic consumption and export. Inefficiency in energy use is generally high because the low controlled prices do not stimulate consumers to save energy.

Manufacture of agricultural production in Uzbekistan essentially depends on irrigation. Today's irrigated agricultural ground occupies 4.2 million hectares and provides more than 95 % of all agricultural production. 54 large-scale water reservoirs with a total volume of 20,840.95 million m^3, 60 supply channels with total length of 24.300 km and a capacity of 900 m^3/sec and 35 big electrical stations operate for irrigating the land.

Uzbekistan is Central Asia's most populous country. Its 27.6 million people (as of 2009) provide nearly half of the region's total population. With an average age of 24 years, the country has a huge labor potential. Despite a generally good education system and a large number of highly educated specialists, about 45 % of the population live on less than 1.25 USD per day. Uzbekistan ranks 170 of 209 countries by Gross Domestic Product (GDP) per capita in PPP equivalents totaling 2,600 USD per capita/year (as of 2008). Real GDP growth remained at high levels from 7 to 9 % in recent years[4].

Facing a multitude of economic challenges after gaining independence, the Government adopted an evolutionary reform strategy with emphasis on state control, reduction of imports and self-sufficiency in energy. Despite the declared objective of transition to a market economy, Uzbekistan continues to maintain rigid economic control, which often repels foreign investors. Uzbekistan's domestic policy of human rights and individual freedoms are often criticized by international organizations[5].

LAND AREA:	447,400 km^2
POPULATION:	27.6 million (as of 2009)
DENSITY:	61.4 inhabitants/km^2
BIGGEST CITIES AND INHABITANTS:	Tashkent (2.18 million), Samarkand (0.6 million), Namangan (0.42 million)
LANGUAGE:	Uzbek (language for inter-ethnic communication is Russian)
CLIMATE:	Mostly mid-latitude desert, long, hot summers (28 to 32 °C), mild winters (–6 to +2 °C); semiarid grassland in the East
TEMPERATURES:	The average annual air temperature in the foothills and valleys varies from +6° to +17 °C and is close to 0 °C in the high mountains of the Pamirs. The absolute minimum was registered in the Bulunkul in the Eastern Pamirs (–63 °C) and the absolute maximum of +48 °C in the Shaartuz in the southern Khatlon Region. In southern valleys, the average temperature in the hottest month of July is +31 °C. The rugged relief with large amplitudes of high mountains accounts for the diversity of the climates and temperatures.
ALTITUDE:	30 m (Aral Sea) to 4,643 m (Khazret Sultan)
RIVERS:	Two large river systems (Amudarya and Syrdarya) and 600 small rivers
ECOSYSTEM AREAS:	Shrubland, savannah, grassland (47 %), cropland and crop/natural vegetation mosaic (27 %), urban and built-up areas (0.5 %), sparse or barren vegetation, snow and ice (18 %), wetland and water bodies (7.5 %), no forests
GDP – PER CAPITA (PPP):	2,600 USD (as of 2008)
INFLATION RATE:	14 % (as of 2008)
AGRICULTURE – PRODUCTS:	Cotton, ambary, jute, tobacco, wheat, rice, sheep
INDUSTRIES:	Cotton cleaning, machine building, textile, gas, precious metals, electronics, instrument manufacturing, aviation, oil processing, car manufacturing, agricultural processing
ELECTRICITY – PRODUCTION:	46.33 billion kWh (as of 2007)
ELECTRICITY – CONSUMPTION:	41.94 billion kWh (as of 2007)
ELECTRICITY – TARIFFS:	3.5 US Cent/kWh
NATIONAL ELECTRICITY CAPACITY IN OPERATION:	12.6 GW (as of 2007)
NATURAL RESOURCES:	Natural gas, petroleum, coal, gold, uranium, silver, copper, lead and zinc, tungsten, molybdenum
OIL – PRODUCTION:	83,820 barrels/day (as of 2008)
OIL – EXPORT:	6,104 barrels/day (as of 2007)
OIL – CONSUMPTION:	148,000 barrels/day (as of 2008)
OIL – PROVEN RESERVES:	0.6 billion barrels
NATURAL GAS – PRODUCTION:	2,303 billion cubic feet/year (65.2 billion m^3/y) (as of 2007)
NATURAL GAS – PROVEN RESERVES:	65,014 billion cubic feet (1,841 billion m^3)
EXPORTS:	0.37 billion USD (as of 2008)
EXPORTS – COMMODITIES:	Exports – commodities: Cotton, gold, energy products, mineral fertilizers, ferrous and non-ferrous metals, textiles, food products, machinery, cars
EXPORTS – PARTNERS:	Russia (25.3 %), Turkey (9.7 %), Kazakhstan (7.6 %), Bangladesh (6.5 %), China (6.1 %), Ukraine (6 %), Japan (5.3 %), US (4.9 %), Tajikistan (4.1 %) (as of 2008)
IMPORTS:	7.07 billion USD (as of 2008)
IMPORTS – COMMODITIES:	Machinery and equipment, food, chemicals, ferrous and non-ferrous metals
IMPORTS – PARTNERS:	Russia (27.6 %), China (16.3 %), South Korea (11.5 %), Germany (6.1 %), Kazakhstan (5.4 %), Turkey (4.5 %), US (4 %) (2008)
EXCHANGE RATE:	1 € = 2,250 Uzbekistan Som (2009)

Source: CIA World Fact Book, as of 2009, and International Energy Agency, as of 2006

4 CIA, AS OF 2009
5 AMNESTY INTERNATIONAL, AS OF 2009

3 ENERGY MARKET IN THE REPUBLIC OF UZBEKISTAN

3.1 IMPORTANT PLAYERS OF THE UZBEK ENERGY MARKET

The governmental company of Uzbekneftegas holds almost the entire hydrocarbon production in Uzbekistan, 99.6 % of gas, 100 % of oil, and 99.7 % of condensate (as of 2006). The company was established in 1992 in form of a national corporation. Since 1998, the Company has been operating as the National Holding Company of Uzbekneftegas. This major industrial facility controls the entire national oil and gas business. Its subsidiaries conduct geological exploration, oil and gas production, hydrocarbon processing, transportation and export through its own pipeline systems.

As mentioned above, the dominant player in the electricity sector is Uzbekenergo.

3.2 PRIMARY ENERGY CONSUMPTION, TRANSMISSION AND PRICES

Uzbekistan is one of the few countries fully self-sufficient in energy resources. Substantial reserves of conventional energy sources ensure the country's current energy independence at the same time allowing for exports of energy carriers.

In 2006, the total primary energy supply in the Republic of Uzbekistan was 48,454 ktoe (563,520 GWh) excluding exports of primary energy which totaled 11,579 ktoe (134,663 GWh). The total final consumption was 36,437 ktoe (423,762 GWh).

The need for sustainable economic growth and growing international competition is the reason for the definition of new requirements concerning the development of the country's fuel and energy complex. The attraction of investments and new technologies into the oil, gas and electric power sectors is the primary goal of the sector development for the medium-term outlook.

Uzbekistan is a partner country of the EU INOGATE energy program, which has four key topics: enhancing energy security, convergence of member state energy markets on the basis of EU-internal energy market principles, supporting sustainable energy development and attracting investment for energy projects of common and regional interest.

Transmission and Distribution System

The Uzbek power system is located in the central part of the United Central Asian Power System (CAPS), which includes the power systems of Kazakhstan, Kyrgyzstan and Tajikistan (the Turkmen system that has previously worked with the CAPS is now working with the Iranian Power System). As noted above, Uzbekistan accounts for over 50 % of the electricity generated within the system. The power system is connected to the infrastructure of the neighboring countries, mostly by 500 kV and 220 kV lines.

The transmission and distribution of electric power to the consumers in Uzbekistan is realized by electrical networks with voltage of 0.4–500 kV. The total length of the electrical grid is over 236,000 km. Appendix 2 shows Uzbekistan's main 220–500 kV electricity grids with possible extensions until 2010.

Electrical power supply to rural areas is not reliable and of low quality. There are often power blackouts lasting for several hours. The capacity of existing distribution networks in the 0,4–10,0 kV range including rural transformers are not suitable for the current electricity demand and need to be upgraded and modernized.

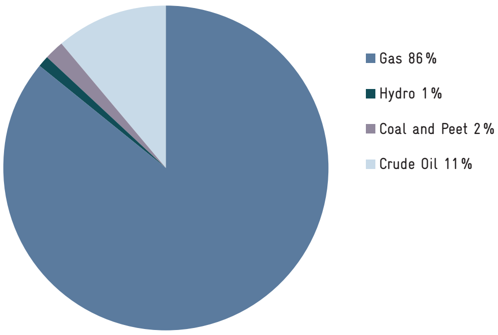
Reconstruction and further development of the power transmission networks is one of the most important directives of the energy sector improvement plans. Its implementation would reduce Uzbekistan's dependence on energy systems of neighboring countries and increase the efficiency, reliability and flexibility of the electric energy transmission networks.

Uzbekistan also operates a powerful distribution system for natural gas not only within the Republic, but also to foreign customers. The total length of the gas mains is 13,000 km (see appendix 1).

Electricity Sector

The electricity sector in Uzbekistan is dominated by the State Joint Stock Company (SJSC) of Uzbekenergo established in 2001. The company comprises 39 power generation plants and a number of power distribution companies. The company is the monopolist on the market with a total installed capacity of over 12.0 GW producing 97 % of total electrical energy in Uzbekistan. The total national electricity capacity in operation is 12.6 GW (as of 2007), of which 88.5 % is provided by Thermal Power Plants (THH) and 11.5% by Hydro Power Plants (HPP).

FIGURE 2
Total Primary Energy Supply



Source: IEA, as of 2006

FIGURE 3
Total Final Consumption

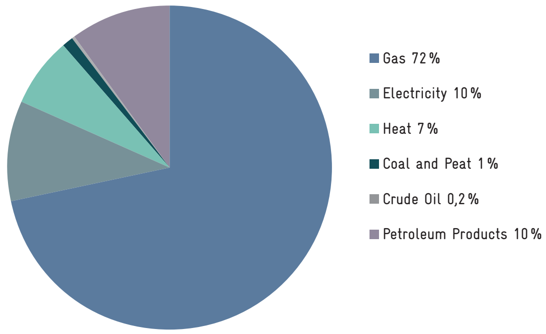
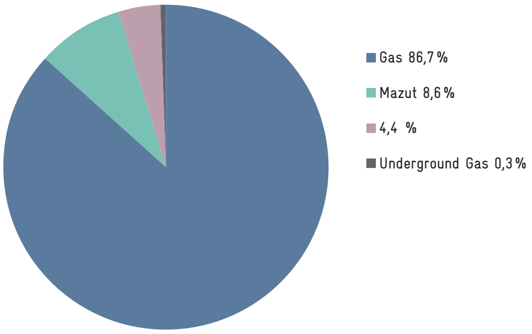
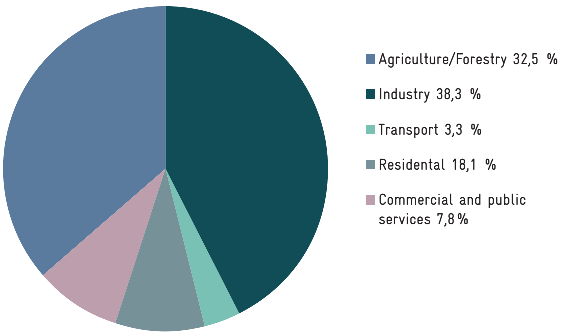


FIGURE 4
Fuel Consumption in Thermal Power Plants



Source: Uzbekenergo, as of 2006

FIGURE 5
Electricity Consumption by Sector



Source: IEA, as of 2006

Electricity production totaled 49,299 GWh in 2006 and electricity consumption 40,661 GWh. The figure below shows the consumption by sector.

Uzbekistans's maintenance of its power systems has deteriorated over the past years. Much of the equipment in generation, transmission and distribution systems is outdated and extremely inefficient. At present it needs serious renovation and upgrading to meet the growing demand of the economy. The facilities require rehabilitation by introducing more efficient and environment friendly equipment, so that they can operate at their designed capacities. There are currently no manufacturing facilities in the country for the production of equipment used in power generation and transmission.

Renovation of the energy sector is a priority for the Government of Uzbekistan. The growing demand for electricity and the wear and tear of the existing power generating facilities has motivated the Government to develop a long-term program for the reconstruction and development of the sector during 2001–2010. In December 2001, the Government of Uzbekistan approved a Generating Capacity Development and Rehabilitation Program for the Energy Sector envisaging an increase in the installed capacity of national power stations by 15 % by 2010. In 2008–2010, Uzbekistan plans to implement 4 projects worth more than 300 million USD. This program is likely to be extended beyond 2010 and presents good opportunities for international contractors and suppliers of energy equipment and services.

The need for renovation is also expressed in Uzbekenergo's three priority directions for the further development of the electricity sector:

1. Technical re-equipment and modernization of power facilities:
   Modernization of power plants, introduction of advanced technologies, reduction of fuel consumption for electric power generation, implementation of measures for maintenance and replacement of process equipment, renovation of turbines, boilers, fuel supply systems and other works at thermal power plants
2. Reconstruction and further development of the electrical network:
   Provision of flexible power transmission schemes, reduction of power losses, optimization of arrangements between main and distributive power networks
3. Construction of new generating capacities:
   Replacement of worn-out generating capacities to meet the projected growth of power consumption, implementation of modern technologies to counteract adverse environmental impacts of power facilities

Natural Resources

Oil and Gas

Uzbekistan is one of the ten largest producers of natural gas in the world. In 2007, production totaled 65.2 billion m^3 and the proven reserves in 12 major deposits amounted to as much as 1,900 billion m^3 and were located mainly in the western Qizilkum Desert. Natural gas is the main source of electricity production in Uzbekistan (86.7 %).
At the beginning of 2002, Uzbekistan's proven oil reserves were estimated at 594 million barrels. Oil production in 2007 amounted to 99,260 barrels per day, mostly from the wells in the Fergana Valley. Since 1991, Uzbekistan has more than doubled its oil production to become essentially self-sufficient in petroleum and, since 1996, a net exporter of petroleum as well.

Coal

Uzbekistan's coal reserves were estimated at 1,900 million tons (1,853 million tons of brown coal and 47 million tons of black coal). About 3.2 million tons of coal were produced in 2000 of which 85 % were used for electricity production. OJSC Uzbekugol (SJSC Uzbekenergo), OJSC Shargunkumir and OJSC Apartak are the largest players in the coal mining sector.

Uzbekistan has not yet introduced environmentally friendly coal burning technologies.

Import and Export of Energy

Electricity exports are mainly directed at the neighboring countries (Tajikistan and Kyrgyzstan during the winter period and Afghanistan throughout the year). Uzbekistan is therefore extending its electricity network in the direction of these countries. In contrast to the Kyrgyz Republic and Tajikistan, however, the potential to export electrical energy is not significant in Uzbekistan. Currently, imports and exports of electricity are more or less balanced (11,400 GWh in each direction). Extending the grid of the United Central Asian Power System will particularly benefit the Kyrgyz Republic and Tajikistan. Uzbekistan can possibly benefit in its role as a prospective transit country and as potential power trader.

Natural gas of Uzbekistan is exported to neighboring countries – Kazakhstan, Kyrgyzstan and Tajikistan and to the Russian Federation. Exports totaled 15 billion m^3 in 2008.

Oil imports are increasing as Uzbekistan's oil production has been shrinking during the past three years. For 2008, it was estimated that the Republic import 35,810 barrels per day and export 6,104 barrels per day.

Uzbekistan has the potential to export thermal power to its neighboring countries during the winter months.

Prices

Since Uzbekenergo has virtually a monopoly in the production, transmission and sale of power, the Government of Uzbekistan regulates all tariffs for energy. Price and tariff regulatory functions are distributed among several state bodies. One of them is the Department of Price Settlement under the Ministry of Finance of the Republic of Uzbekistan dealing with economic regulation. The Department is, in fact, setting the tariffs for all forms of energy. Another one is UzEnergoNadzor, which is responsible for technical regulation in the electricity sector. The Ministry of Finance has price setting functions regarding electricity and energy products. These functions are further distributed to two subdivisions with one of them dealing with all prices and tariffs for electricity and energy products for industry residential consumers and the other dealing with prices for coal and oil products for retail customers. Uzbekenergo elaborates the draft electricity tariffs and submits them to the Ministry of Finance for approval. Draft tariffs developed by Uzbekenergo for electricity and heat take into account the forecasted annual costs in the power sector and the profits needed to assure the development of the sector. Depending on changes in the cost of power production, the tariffs can be revised and adjusted. All electricity end-users are differentiated by categories of tariff groups, depending on their activities, but irrespectively of the form of ownership.

The average price for power in Uzbekistan in 2007 was about 3.5 US Cents/kWh – lower than in many other countries of the CIS. Nevertheless, this represents a significant increase compared to the average weighted tariff as of July 2003 with 1.26 US Cents/ kWh.

As the Energy Charter Secretariat notes, one of the greatest challenges Uzbekistan faces in restructuring the power sector is the problem of cross-subsidies and direct governmental subsidies. Both subsidies and cross-subsidies lead to negative consequences such as inefficiency, insolvency etc. The officially stated purpose of cross-subsidies is to keep the prices of electricity and other energy products low for consumers and businesses that cannot afford to pay the real price or enjoy special supply rights. As a result, the consumers and businesses that do not have such privileges pay a higher price for electricity, which results in higher cost of their products and often renders them uncompetitive. Eventually, such businesses fail or just stop paying the bills. As a consequence, Uzbekenergo has to face the problem that its revenue does not cover the cost of fuel and other expenses. As there are no bankruptcy procedures and enforcements, this leads to a situation where everyone owes to everyone else, with the only distinction being that some owe more than the others. In an environment like this, businesses cannot be properly run, as managerial decisions cannot be made on economic grounds[6].

Growth Predictions for the Energy Sector

The total volume of the maximal possible production of fuel-energy resources is projected to increase from 79,7 million tons of conventional fuel (t.c.f.) in 2004 to 87,6 million t.c.f. in 2010 and to 88,9 million t.c.f. in 2020 (equaling a 11,5 % increase for the period 2004–2020). This projection is based on a favorable scenario of energy base development.

The increase of production volumes of this prediction broken down in different energy sources reads as follows: oil and condensate from 7.2 million t.c.f. to 8,0 million t.c.f., gas from 58,4 billion m^3 to 60,0 billion m^3, coal from 2,7 million of tons to 9–11,0 million tons and hydroenergy and Renewable Energy sources from 0,9 million t.c.f. to 3,26 million t.c.f.

In the prediction period of 2015–2030, however, even under assumption of rapid development of new deposits of oil and gas, Uzbekistan will only be able to cover its energy needs by 88–95 % from domestic sources. From 2010, the republic will have to import energy in the range of 0,4 million t.c.f. to 11,1 million t.c.f.

Some energy experts in Uzbekistan doubt the above projections and say that the country may fall short of the projected production growth due to the high capital requirements and a lack of interest by large investors.

4 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

4.1 NATIONAL STRATEGIES AND PROGRAMS TO SUPPORT RENEWABLE ENERGIES

Uzbekistan has extensive oil and gas resources, which result in low tariffs and a limited attention paid by the Government to develop RE resources with the exception of hydro power. There are plans in place to further develop the power industry by building natural gas TPPs and HPPs. Hydro power accounts for 11.5 % of the total generating capacity and enjoys priority for further development.

RE technologies are competing against fossil fuel technologies with little though increasing governmental support. Worth mentioning efforts are the Government's program for the construction of small-scale Hydro Power Plants and its activities to develop the country's vast solar power potential (see chapter 5).

An important barrier to the realization of grid-connected RE projects is the extremely low feed-in tariff of 1.2 US Cents/kWh.

6 KAKHAROV, AS OF 2008

4.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

The Law of the Republic of Uzbekistan on the Rational Use of Energy (as of 1997) serves as the cornerstone for the development and functioning of the entire energy sector including RE. It sets the general legal framework for conserving the nation's energy resources and for making efficient use of its existing production potential of fuel and energy.

The provisions of the law apply to legal and physical persons associated with the extraction, production, refining, storage, transport, distribution and consumption of fuel and energy.

The scope of the law was designed to achieve the following aims:

- To provide for the efficient and environmentally safe use of energy in producing and consuming energy
- To foster the development and adoption of energy saving and lower cost technologies for extracting petroleum, natural gas, coal and other types of fuel and for producing petroleum products
- To ensure the trustworthiness and uniformity of measurements used in accounting for the quantity and quality of energy produced and consumed
- To exercise governmental control and oversight for the efficient production and consumption of energy, energy quality and over the technical maintenance of energy equipment as well as energy supply and consumption systems
- The law was the first to lay down in summary outline form the main directions of the Government's policy encouraging the sound use of energy. The English translation of the law can be downloaded from the Internet[7].

Article 11 of the law requires the Government to promote the implementation of projects that are aimed at the practical application of technologies employing secondary energy resources and waste as well as solar, wind and hydroenergy.

Article 20 obliges distribution companies "to take the energy from non-utility developers in their grids at a transaction rate charged in accordance with established procedures". The article further sets forth that "prices of heat and electricity should serve to expedite as much as agreed upon with the Government of the Republic of Uzbekistan the pay-back of investments into those facilities".

The law also makes provisions for granting subsidies from the Intersectoral Energy Conservation Fund to projects aiming at reducing energy consumption and to use secondary energy and RE resources.

Despite this positive legal framework, the process of creating an environment conducive to the development of RE in Uzbekistan is being held back because basic documents stipulated in the law have been waiting for many years to be enacted, namely documents regulating procedures, conditions and size of subsidies, conditions for gaining access to energy grids and procedures for fixing RE prices.

Another legal document aiming directly at the regulation of the use of RE sources is Resolution No. 476 on the Development of Small hydro power in the Republic of Uzbekistan. The Resolution was approved by Cabinet of Ministers of the Republic of Uzbekistan on 28 December 1995. What is important about the resolution is that it is the first document to make provisions for the regulation of certain issues associated with independent power producers using RE technologies.

The resolution, however, applies only to Hydro Power Plants belonging to the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan and does not apply to other RE technologies. But the Resolution could serve as the basis for drafting a more comprehensive normative act.

Other matters associated with independent power producers are also governed by the Civil Code of the Republic of Uzbekistan, the Law of the Republic of Uzbekistan on the Contractual-Legal Basis for Business Activities and by the rules and regulations for the use of electricity. The laws serve as the basis for business agreements, which establish specific obligations and responsibilities of the business partners, amounts and costs of electricity to be provided, billing and payment procedures and other conditions for business relations.

Clean Development Mechanism (CDM)

The reduction of greenhouse emissions under the Clean Development Mechanism (CDM) projects in developing countries like Kyrgyzstan could be used by developed countries to fulfill their obligations to the Kyoto Protocol. The developed countries are allowed to purchase a part of other countries' reduced greenhouse emissions as expenses on such reduction in the developed countries are much higher than in developing ones.

Thus the CDM Projects are aimed to attract investments, to stimulate the transfer of new technologies to the developing countries and at the same time to solve the environmental problem – particularly the climate change. The implementation of projects opens new opportunities for organizations within the country – independent of their form of property and institutional subordination – to modernize manufactures that reduce greenhouses emissions.

As a signatory to both the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, Uzbekistan has supported the Road to Copenhagen Initiative and is actively involved in the UN negotiations on a new international climate change deal. The portfolio of CDM projects in Uzbekistan includes 79 project proposals at present. Of these, 59 have already received approval by the Ministerial Council on the CDM and are at various stages of preparation.

7 LEXADIN, AS OF 2009

5 POTENTIAL FOR RENEWABLE ENERGIES AND PRESENT USE

Uzbekistan possesses large potential resources of RE. With 250 sunny days per year, the republic has a particularly large potential of solar energy which, if utilized with state-of-the-art technology, could provide three times more energy than currently provided through fossil energy carriers. In many remote rural areas, decentralized generation through RE sources, mainly through small Hydro Power Plants, would offer a competitive and environmentally friendly option for addressing electricity shortages. While the potential to use wind energy is limited to some areas of the country, the potential of biofuel production from agricultural waste is considered as significant, particularly from waste from the vast cotton plantations throughout the country.

Despite their huge potential, RE solutions still have difficulties to compete with the abundantly available fossil fuels due to market distortions through energy subsidies and a lack of powerful lobby organizations. Despite such rather unfavorable conditions, there are signs that RE solutions have attracted more interest in the recent past. A widely felt wake up call was certainly the high commodity prices for fossil fuels in 2008. The Government is now more seriously promoting the development of the potentials of small hydro power and solar energy.

5.1 BIOENERGIES

Solid Biomass

Uzbekistan has no significant forest coverage. In the existing small forest territories, commercial deforestation is forbidden. Thus, fuel wood is not a prospective option for energy production.

Livestock and poultry farming wastes are preferably used for fertilizers. Therefore, the prospects of direct energy conversion of livestock wastes are problematic. There is, however, a potential for indirect energy conversion of livestock wastes through biogas production (see chapter 5.1.3).

Liquid Biofuels (Bioethanol or Biodiesel)

Uzbekistan has a high potential for biomass energy generation as the fourth largest producer of cotton in the world. 15 % of world production of cotton is manufactured annually in the republic. There is a strong interest in the thermo-chemical conversion of cotton stalks to produce energy. The biomass potential is more than 3 million tons of cotton stalks per year, which can be used as raw material base to produce glucose and reducing sugars or bioethanol. The gross potential is estimated at 27 billion kWh/year (27,000 GWh) and its technical potential at 2 billion kWh/year (2,000 GWh).

There is also an increasing interest in the cultivation and processing of sorghum, a traditional crop in Uzbekistan, which is suitable to be grown under harsh climatic conditions and poor soil fertility. The crop is said to have a large potential for the production of bioethanol, however, implementation remains in the research stage .

Biogas

There is a considerable potential to implement biogas technologies in Uzbekistan. The main sources of raw materials in the country are manure from livestock breeding and poultry farming, municipal sewage and residues of crops. The most feasible source is manure from the livestock breeding industry comprising about 9,500 large- and medium-scale farms in Uzbekistan. Biogas technologies, however, are not yet widely adopted in the country. The Government of Uzbekistan and UNDP had launched the joint Assisting the Development in Biogas Technology in Uzbekistan Project in 2005. The annual technical potential for biogas production form livestock breeding and poultry farming, municipal sewage and other organic wastes is estimated at 8.9 million m^3 equivalent to approximately 55.2 GWh per year (at an average 6,2 kW/m^3).

A pilot demonstration biogas plant was set up at a cattle farm in the Tashkent region as well as a Training Centre of Biogas Technologies. The production of biogas is also relevant with regards to project in the field of Clean Development Mechanism. If the full technical potential would be developed, 46,000 thousand tons of CO_2 emissions could be saved.

A demonstration biogas plant was placed into operation at the stock breeding farm Milk-Agro in Zangiota, Tashkent. The plant produces of 300 m^3 of biogas and 10 tons of liquid fertilizer per day[9].

5.2 SOLAR ENERGY

The climatic conditions of Uzbekistan are especially favorable for utilizing solar energy. The gross potential of solar energy is 51 billion toe (593 million GWh). The technically feasible potential is 177 million toe (2 million GWh), which is several times higher than the country's annual energy consumption[10]. Unfortunately, this powerful energy source remains largely untapped. The problem for Uzbekistan, as with many alternative energy sources, is the relatively high start-up costs. The marginal utilization of solar energy in Uzbekistan is also caused by low gas and electricity prices and the neglect of the existing regulations to promote RE, which were not yet translated into a favorable feed-in tariff for solar installations.

TABLE 7

Potential for Small Hydro Power Projects

REGIONAL ANNUAL SOLAR RADIATION INCIDENTS	ON HORIZONTAL SURFACE KWH/YEAR	ON NORMAL SURFACE TO SUNLIGHT BEAMS KWH/YEAR
Taskent	1,687	1,943
Samarkand	1,776	1,909
Termez	1,786	1,957

Source: estimation of Dukenbaev, 1996

8 TODERICH, K. ET AL., AS OF 2008
9 TODERICH, K. ET AL., AS OF 2008
10 ABDULLAEV, D.A. AND ISAEV, R.I., AS OF 2005

Solar Thermal Energy

At present, solar energy is mainly used for hot water supply. Several manufactures in Uzbekistan, namely Uzgeliokurilish, Encom and Photon, produce flat solar water heaters. The total area of installed solar collectors in the country is estimated at 40,000 m^2. The installed capacity consists of 12 MW of solar hot water supply plants with one high temperature solar plant (large solar furnace) with a 1 MW thermal capacity.

5.3 WIND POWER

Uzbekistan is characterized by weak winds. Average annual wind velocities are less than 3m/s. There are, however, small territories with average annual velocities 5m/s and more. These territories are the Aral Sea coast, Plato Ustyurt, some areas of steppe zone of Kyzylkums, a zone of winds near Bekabad alternately in eastern and western direction and a number of areas of mountain and foothill valleys such as Pskem, Ahangaran, Boysun etc.[11]

The wind energy potential of Uzbekistan is fair with a potential generating capacity of around 100 MW. Although this is small compared to the generating capacity of existing power plants, environmental concerns and needs of remote locations may drive the development of this potential. To develop the whole technical potential of wind power in Uzbekistan, more than 70,000 wind power installations (WPI) in the capacity range of 60 to 250 kW would be required.

The most promising sites would be the Aral Sea region, Karakalpakiya and the central region of the country. A more in-depth study of the eastern coast of the Aral Sea would be worth performing.

5.4 GEOTHERMAL ENERGY

Geothermal resources of Uzbekistan consist of thermal waters with temperatures in the range of 60–120 °C and Hot Dry Rock (HDR)[12] energy with temperatures up to 300 °C. The gross potential of explored reserves of thermal waters is estimated at 2,000 GWh/year. The technically feasible potential has not been established yet. Main thermal water areas are:

- Amu Darya Basin, geothermal gradient 38 °C/km, reservoir depth 12,950 m, temperature 122 °C
- Surkhan Darya Basin where an aquifer produces 830 l/s of thermal water, temperature 65 °C
- Taskent Basin where the Lower Cretaceous reservoirs contain thermal water, depth 2,000–2,500 m, temperature 75–80 °C, TDS 1 g/l, total flow rate 500 l/s
- Fergana Valley where aquifers in Neogene sediments produce thermal water, temperature 70–90 °C, flow rates ranging from 30–500 l/s

The total thermal water resources are estimated as 135 MW (free flow operation) or 1,150 MW (pumping operation).

Despite the good degree of examination of geothermal reservoirs, the use of thermal water is still in the initial stage. The mastering of geothermal resources is foreseen by the National Energy Program. Presently, however, there is no generating capacity in the country.

The gross potential of hot dry rock (HDR) geothermal energy is estimated much higher than that of hydrothermal waters. However, no systematic studies were conducted on the use of such petro-thermal energy as of today.

5.5 HYDRO POWER

In 2007, total installed electrical capacity in Uzbekistan was 12.6 GW. Total electricity production in 2006 came to 49,299 GWh, of which 87 % was from fossil fuels and 13 % from hydro power (6,333 GWh)[13]. The technically feasible potential of hydro power sources is estimated at 27,400 GWh and the economically feasible potential at 11,000 GWh per year[14].

Uzbekistan maintains a significant hydroelectric generation capacity with 18 facilities in operation and another 20 facilities in various stages of planning and construction that will constitute another 1,100 MW of capacity and another annual hydro power generation of 2,900 GWh. Appendix 3 provides an overview over the ongoing projects.

The main problems interfering with the development of hydroenergy potentials include:

- The necessity of core hydro power equipment acquisition abroad (water turbines, hydro generators, controllers)
- The absence of a legislative base in the field of hydro power engineering regulating interrelations such as access rights to power resources with various patterns of ownership including the rights and guarantees of investors
- The difficult access to electric networks of the SJSC Uzbekenergo by independent producers of electric power on HPP
- The status and power of regional and local authorities on use of water and energy sources
- Legislatively fixed specific privileges and guarantees

The challenge in the development of hydro power resources of Uzbekistan – and other countries of Central Asia region including Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and bordering Afghanistan – is the absence of interstate agreements on (i) the use of water and power sources, (ii) transboundary water flows both large and average, (iii) small water flows on the territories of these countries which are of strategic interest for each country in solving problems of water supply and irrigation and (iv) power supply and export of power resources.

Large Hydro Power

Uzbekistan is covered by two large river systems – Amu Darya and Syr Darya. Most of the large HPPs are located at the Syr Darya river and its branches. At present, 30 HPPs with a total capacity of 1,684 MW per year generate up to 6,400 GWh

11 EBRD/RENEWABLE ENERGY INITIATIVE, AS OF 2009

12 HDR ENERGY IS HARVESTED FROM THE PRESSURIZED CIRCULATION OF WATER THROUGH MAN-MADE (ENGINEERED) RESERVOIRS CREATED IN HOT CRYSTALLINE BASEMENT ROCK WHICH HAS BEEN HEATED BY CONDUCTION FROM THE EARTH'S MANTLE AND BY THE DECAY OF RADIOACTIVE ELEMENTS IN THE CRUST.

14 IEA, AS OF 2006

15 ACCORDING TO ERBD (AS OF 2002), THIS POTENTIAL DOES NOT INCLUDE THE POTENTIAL FOR SMALL HYDRO POWER.

of energy. The biggest HPPs are located in the upper part of Chirchik River – namely Charvak, Khodjikent and Gazalkent – and have water storage basins, which allow running the plants in capacity control mode.

The potential for large-scale Hydro Power Plants is already developed by 80 %. This is due to the fact that only 30 % of the existing water energy resources are large rivers.

Small Hydro Power

There is still a largely untapped hydro power potential of 600 small rivers, irrigation canals and water reservoirs. This total potential for small hydro power is estimated at 1,760 MW with a possible annual energy production of 8,000 GWh. Only 3.2 % of this potential has been developed so far.

As mentioned earlier, the Government of Uzbekistan approved a resolution on the Development of small hydro power in the Republic of Uzbekistan in 1995. The resolution makes provisions for the regulation of issues associated with independent power producers using RE technologies.

The quantitative objective of this resolution is to develop 15 plants with a total capacity of 423 MW and generate 1.36 billion kWh of electricity per year by 2010. No information was available regarding the implementation status of this project.

6 MARKET RISK ANALYSIS AND BARRIERS FOR MARKET ENTRY

Since its independence, the Uzbek Government has continually stated its commitment to a gradual transition to a free market economy. It has been extremely reserved, however, in doing so. The Government succeeded in narrowing the gap between the black market and the official exchange rate, but its restrictive trade regime has hindered efforts. Moreover, a substantial structural reform is needed in order to improve the investment climate for foreign investors.

Extensive state controls over the economy continue to hinder the functioning of markets and the development of the private sector. Privatization, particularly large-scale, has been limited, with annual privatization revenues averaging just 0.5 % of the GDP over the past 10 years.

6.1 GENERAL SITUATION

Corruption

Uzbekistan's gradualist reform strategy in the years after achieving independence has involved the postponing of significant macroeconomic and structural reforms. State-ruled bureaucracy has remained a dominant influence on the economy. Corruption permeates the society and grows more rampant over time: Uzbekistan's 2005 Corruption Perception Index was 137 out of 159, whereas in 2007, Uzbekistan was at the very bottom of the ranking, 175 out of 179[15]. A February 2006 report on the country by the International Crisis Group suggests that revenues earned from key exports, especially cotton, gold, corn and increasingly gas, are distributed among a very small circle of the ruling elite with little or no benefit for the population at large.[16]

Availability of Local Know-how

Uzbekistan has a huge labor potential. It possesses 40 % of the labor forces in Central Asia. Uzbekistan has a 99.3 % literacy rate among adults older than 15, which is attributable to the free and universal education system introduced by the Soviet Union . The peculiarity of the republic's labor potential is its high educational level. There is a large number of scientists, engineers, doctors, teachers and professionals in the fields of energy, geology, mining, nuclear physics, agricultural chemistry and cotton-growing.

The high educational levels are also reflected in the powerful industrial enterprises operating in Uzbekistan, presenting actually all fields of industry from heavy to light industry and industrial processing of agricultural products as well as high-technology productions.

As shown in chapter 8, there are plenty of companies and organization active in the field of RE. Therefore, the required human resources for the implementation of national RE projects are available within the country.

Local Acceptance

in 1996, the Government of Uzbekistan founded the Technology Transfer Agency, which has the task to promote and disseminate technologies in the country. A special focus is on RE solutions. The agency has already gained experience with various RE solutions and reports high levels of acceptance particularly in remote areas beyond the reach of national distribution networks.

6.2 BUSINESS DEVELOPMENT

Officially, foreign and domestic investments face equal treatment under the law. Numerous sectors, however, are either reserved for the state or subject to limited ownership restrictions. In practice, investors face barriers as cumbersome procedures, the threat of expropriation, inconsistent and arbitrary regulation, corruption and political unrest and violence. Residents and non-residents may hold foreign exchange accounts, these are, however, subject to some restrictions. Payments and transfers face quantitative limits. Some capital transactions including credit operations and real estate transactions are subject to controls.[17]

According to the Economist Intelligence Unit, the Government is hostile to allowing the development of an independent private sector, over which it would have no control. Thus, the national bourgeoisie in general and the middle class in particular are economically and politically marginalized.
Accordingly, state interventions in business operations are widespread. The economic policies have discouraged foreign investment, which is the lowest per capita in the CIS.

15 TRANSPARENCY INTERNATIONAL, 2005–2007
16 INTERNATIONAL CRISIS GROUP, AS OF 2006
17 CIA, AS OF 2009

6.3 INTELLECTUAL PROPERTY RIGHTS

The Government influences Uzbekistan's judiciary. Judicial procedures fall short of international standards, corruption is extensive and expropriation is possible. There is no general system for the registration of liens or chattel property. Pirated audiotapes, compact discs, videotapes and other optical media are sold without restrictions .

6.4 TAXATION

The top Income Tax rate is 25 % and the top Corporate Tax rate is 10 % (17 % for commercial banks). Other taxes include a Value Added Tax (VAT) and a Property Tax. In the past year, the overall tax revenue as a percentage of GDP was 21 %.[18]

The Government of Uzbekistan restricts foreign imports in many ways including high import duties. Excise taxes are applied in a highly discriminatory manner to protect locally produced goods. Official tariffs are combined with unofficial, discriminatory charges resulting in total charges amounting to as much as 100 to 150 % of the actual value of the product, making imported products virtually unaffordable. Import substitution is an officially declared policy and the Government proudly reports reductions in the volume of consumer goods imported. A number of CIS countries are officially exempt from Uzbekistan import duties.

Some taxation aspects related to the development of RE are included in the Tax Code of Republic of Uzbekistan of 2007.

The tax for using water resources is regulated in paragraph 10. Article 261 defines privileged calculation of the tax for water resources used for the operation of hydraulic turbines of Hydro Power Plants: The taxable base decreases by the volume of water used.

The taxation of land is regulated in paragraph 12. Article 282 defines land areas not subject to taxation including land areas occupied with water reservoirs (the rivers, lakes, water basins etc.) and hydro-technical and other water-economic constructions.

18 HERITAGE FOUNDATION, AS OF 2009

7 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

In Uzbekistan the following ministries, departments, companies, and organizations are interested in cooperation on development and use of RE sources:

State Joint Stock Company of Uzbekenergo
6, Khoremskaya Str.
Tashkent 100000
Uzbekistan
Phone: (99871) 2339889
Fax: (99871) 2332700
E-Mail: sjsc@uzpak.uz
Modernization, reconstruction, construction of large, medium and small hydroelectric power stations; development, designing, construction of solar power stations with thermodynamic and photoelectric transformation of solar radiation are future directions pursued

Ministry of Agriculture and Water Resources Republic of Uzbekistan
4, Navoi Str.
Tashkent 100004
Uzbekistan
Phone: (99871) 2421353; 2420042
Fax: (99871) 2423292; 2440920
E-Mail: msvh_uz@yandex.ru
Building, exploitation of average small hydroelectric stations, building water basins and irrigational channels, small run-of-river schemes, electric power supply of water-elevating, soil-reclamation large, average, small pumping stations with use of solar power stations, small hydroelectric power stations, wind electric installations, improvement of power and water supply in rural areas

Specialized Association of Uzsuvenergo
of the Ministry of Agriculture and Water Resources Republic of Uzbekistan
1, Shayhantahur Str.
Tashkent 100128
Uzbekistan
Phone: (99871) 2414552; 2413711
Fax: (99871) 2394768
E-Mail: Uzsuvenergo@maul.ru
Building, exploitation of average small hydroelectric stations on water basins, irrigational channels, small rivers

Joint Stock Company of O'Ztransgas
31a Yusuf Khos Khojib Str.
Tashkent 100031
Uzbekistan
Phone: (99871) 2398965
Fax: (99871) 2394768
E-mail: ak_uztg@mail.ru
Development, building and exploitation of solar thermal boilers, development and use of solar photoelectric and wind electric installations

State Joint Stock Company of O'Zbekgidroenergoqurilish
22, Navoi Str.
Tashkent 100011
Uzbekistan
Phone: (99871) 2413295
Fax: (99871) 2336496
E-Mail: uzges@mail.ru
Building of Hydro Power Plants

Producing Association of Toshissiqquvat
1, Furqat Str.
Tashkent 100027
Uzbekistan
Phone: (99871) 2270834
Fax: (99871) 2270864
E-Mail: teploenergo@sarkor.uz
Building and exploitation of systems of heat supply in Tashkent city, development, building and exploitation of combined solar heating boilers

RENEWABLE ENERGY: RELEVANT INSTITUTIONS

Joint Stock Company of Hydroproject
Bobur Str.
Tashkent
Uzbekistan
Phone: (99871) 2531465
Fax: (99871) 2546709
E-Mail: gidep@tps.uz
Design of unique large, middle and small Hydro Power Plants in Central Asia and other countries

Uzbekchimmash OJSC
8, Mendeleev Str.
Chirchik 111708
Uzbekistan
Phone: (99837071) 6-57-96, 5-34-26
Fax: (99837071) 64473, 65893
E-Mail: ompr@bk.ru
Manufacturing of high quality oilfield equipment, equipment for thermal power station and water supply, manufacturing of the equipment for Hydro Power Plants is also possible

Foton JSC
13, Movaraunnahr Str.
Tashkent 100047
Uzbekistan
Phone: (99871) 2334230; 2337556
Fax: (99871) 2361454; 2360933
E-Mail: foton@globalnet.uz
PV stations with capacity of 100 and 500 W, future development of PV stations with capacities from 500 to 5,000 W

ENCOM SCIENTIFIC – PRODUCING ENTERPRISE
40, Navoi Str.
Tashkent, 100011
Uzbekistan
Phone: (99871) 2205832; 2922728;
Fax: (99871) 2922728
E-Mail: encom@buzton.com
Boilers with heating capacities from 125 to 6,000 kW for heat supply, block module boiler rooms for autonomous heat supply in apartments, offices, hospitals etc., solar collector production for heat supply of apartments, offices, hotels etc.

Qurilishgelioservis Ltd.
2, Bg. Mavlyanov Str.
Tashkent 100084
Uzbekistan
Phone: (99871) 2354160
Fax: (99871) 2354160
E-Mail: qgs@uzsci.net
Design, production, installation and operation control of solar water heating systems

Toshkent – Zenner JV CJSC
122, Gavkhar Str.
Toshkent 100081
Uzbekistan
Phone: (99871) 2798860
Fax: (99871) 2205190
E-Mail: zenner@buston.com
Manufacturing of solar water heating systems

MIR – SOLAR LTD
176, Akhsikat Str.
Tashkent 100076
Uzbekistan
Phone: (99871) 2913346
Fax: (99871) 2915721
E-Mail: mirsolar@mail.ru
Development of manufacturing technologies of solar installations, portable combined PV stations with water-cooling intended for the reception of electrical energy and heating of water

Technology Transfer Agency
13, Movarounnahr Str.
Tashkent 100047
Uzbekistan
Phone: (99871) 2361071
Fax: (99871) 2394917
E-Mail: attgknt@mail.ru
Assistance in technology transfer for industrial production, international scientific and technical cooperation in the field of commercialization of research and design results

Institute of Power Engineering and Automation of the Academy of Science of the Republic of Uzbekistan
29, F. Khodjaev Str.
Tashkent
100125 Uzbekistan
Phone: (99871) 2620522
Fax: (99871) 2620919
E-Mail: power@energy.uzsci.net
Research and applied development in the field of hydro, solar, wind and geothermal energies

Physical–Technical Institute of the Academy of Sciences of the Republic of Uzbekistan.
2B, Mavlyanov Str.
Tashkent 100084
Uzbekistan
Phone: (99871) 2331271
Fax: (99871) 2354291
E-Mail: lutp@uzsci.net
Research and applied development of different aspects of solar energy such as thermodynamic converters, PV and solar thermal devices and systems

Institute of Electronics of the Academy of Science of the Republic Uzbekistan.
33 F, Khodjaev Str.
Tashkent 100125
Uzbekistan
Phone: (99871) 2627940
Fax: (99871) 2628767
E-Mail: electronics@uziel.uz
Research and applied development of technologies, production of solar PV cells

Tashkent State Technical University
2, Universitet Str.
Tashkent 100095
Uzbekistan
Phone: (99871) 2464600
Fax: (99871) 2271032
E-Mail: tstu-info@edu.uz
Research and applied development of hydro power and solar energy such as PV and solar thermal systems, education of students in the sphere of energy

8 BIBLIOGRAPHY

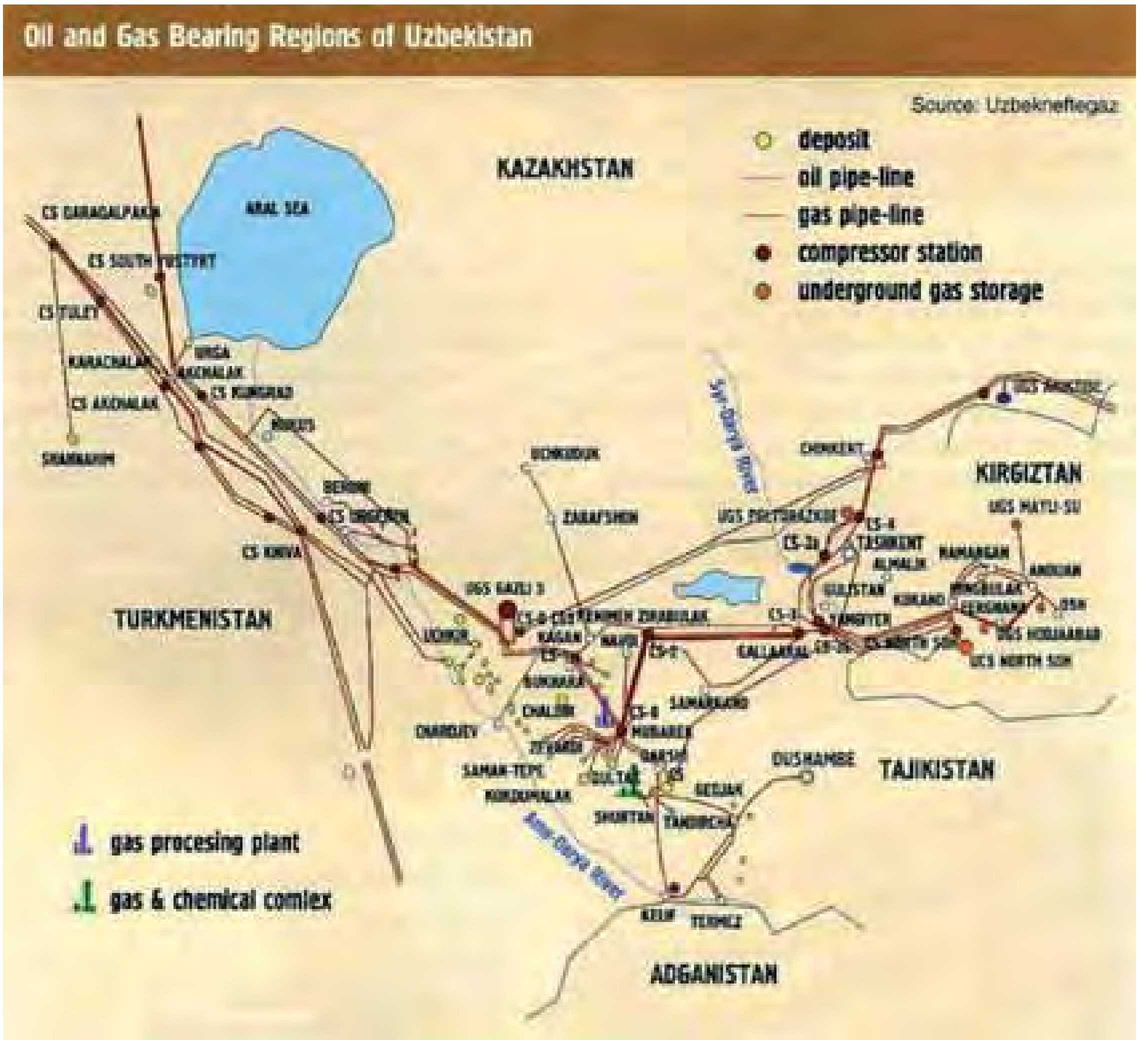
- Amnesty International (2009): Amnesty Report. Usbekistan (www.amnesty.de/jahresbericht/2009/usbekistan?destination=node%2F3037)
- Abdullaev, D.A. and Isaev, R.I. (2005): Resources of Solar Radiation and Wind Energies in Uzbekistan and System of Their Combined Utilization, ISESCO
- Central Intelligence Agency – CIA (2009): The World Fact Book – Uzbekistan
- European Bank for Reconstruction and Development – EBRD (2002): Overview of Electricity Supply, Uzbekistan, Renewable Energy Country Profile
- European Bank for Reconstruction and Development – EBRD/ Renewable Energy Initiative (2009): Country Profile. Uzbekistan (http://ebrdrenewables.com/sites/renew/countries/uzbekistan/profile.aspx)
- Heritage Foundation (2009): Index of Economic Freedom – Uzbekistan
- International Energy Agency – IEA (2006): Electricity/Heat in Uzbekistan in 2006
- International Crisis Group (2006): Uzbekistan: In for the Long Haul
- Kakharo, J. (2008): Uzbekistan Power Generation Sector Overview, U.S. & Foreign Commercial Service and U.S. Department of State
- Lexadin (2009): Legislation Uzbekistan (www.lexadin.nl/wlg/legis/nofr/oeur/lxweuzb.htm, updated in November 2009)
- Toderich, K., Massino, I., Shoab, I., et al. (2008): Utilization of Agriculture Residues and Livestock Waste in Uzbekistan, IDEAS
- Transparency International (2005–2007): Corruption Perceptions Index
- Uzbekenergo (2006): Uzbekenergo. State Joint Stock Company (www.uzbekenergo.uz/eng/technical_and_economic_indices)

9 ANNEX

ANNEX 9.1

FIGURE 1

Gas and Oil Carrying Regions and Transporting Systems of Uzbekistan



Source: unknown

ANNEX 9.2

FIGURE 2

Map of Uzbekistan's Exisitng and Planned Main Electricity Grids

Source: unknown

ANNEX 9.3

TABLE 1:20

Ongoing HPP Projects of Uzbekistan's Programm of Hydro Power Development

PROJECT TITLE	CAPACITY (MW)	PRODUCTION/YEAR (BILLION KWH)
Pskem	400	0.9200
Mullalaskaya	270	0.5060
Tupolang water storage basin	175	0.5140
Gossaral water stprage basom	45	0.0809
Akhangaran water storage basin	21	0.0360
Andijan water storage basin	50	0.1000
Shaarikhan – 0	30	0.1100
Shaarikhan – 1	15	0.0500
South Fergana channel – 2	7.9000	0.0420
Karkidon water storage basin	10	0.0260
Gavasay water storage basin	9.5	0.0320
Sokh water storage basin	14	0.0700
Uygin – 1	20.3000	0.0700
Uygin – 1	38.6000	0.1400
Bagishamal – 2	17.7000	0.0740
Shaudar	6	0.0270
Gulba	6	0.0288
Pioner	8	0.0350
Lower Bozsu – 5	4.5	0.0230
Lower Bozsu – 5A	4.5	0.0230

Source: unknown