



Figure 1: Energy profile of Rwanda



Figure 2: Total energy production, (ktoe)

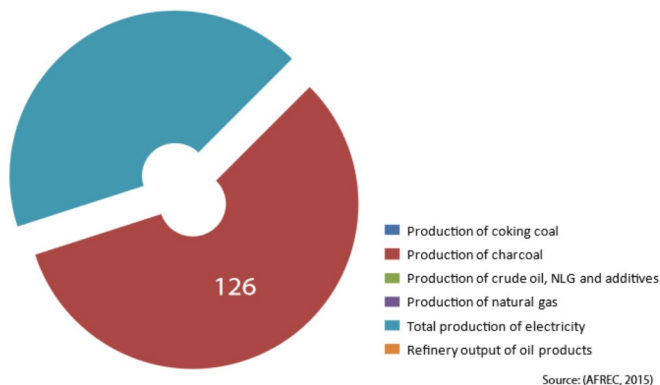
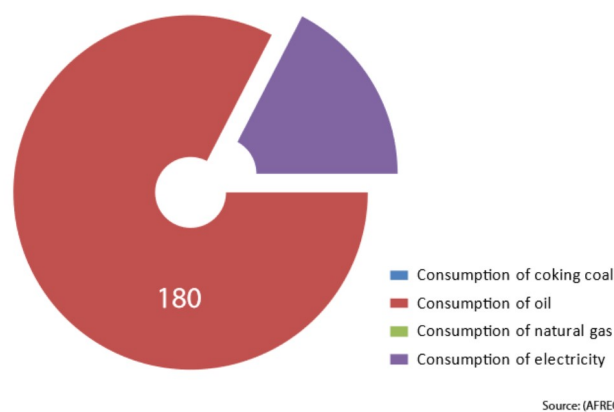


Figure 3: Total energy consumption, (ktoe)



Energy Consumption and Production

Rwanda's population in 2013 was 11.08 million (Table 1) (World Bank, 2016). In 2015, total electricity produced was 93 ktoe, of which 51.6 per cent came from fossil fuels, 19.3 per cent from hydro and 27.9 per cent from solar and wind (Table 2). Final electricity consumption in 2015 was 38 ktoe (AFREC, 2015). Figures 2 and 3 highlight key production and consumption statistics.

Table 1: Rwanda's key indicators

Key indicators	Amount
Population (million)	11.08
GDP (billion 2005 USD)	4.72
CO ₂ emission (Mt of CO ₂)	0.06

Source: (World Bank, 2015)

Energy Resources

Hydropower

There is roughly 313 MW of hydropower potential in Rwanda (AfDB, 2013). Small and medium-size hydropower projects are located in sites such as Gihira, Gisenyi, Mukungwa, Ntaruka, Nyabarongo and Rukarara, with numerous other mini- and micro-hydro sites around the country. Small and medium-size hydropower stations presently provide 39.7 MW of operational capacity and an additional 77.2 MW of potential capacity. Mini- and micro-hydro provide 4.5 MW of operational capacity, with an additional 8 MW of potential capacity. The Rusizi River (shared with DRC) and the Rusumo Falls (shared with Tanzania) are potential sources of hydropower. The various phases of Rusizi are providing 161 MW in total and the Rusumo Falls is thought to be able to provide 20.5 MW of electricity when developed (AfDB, 2013).

Geothermal and methane

There is a 700 MW potential of geothermal energy, of which 490 MW are considered an economic resource (AfDB, 2013). The main fields are Karisimbi with 160 MW, Gisenyi with 150 MW, Kinigi with 120 MW and Bugarama with 60 MW. Karisimbi has an estimated resource size of 320 MW with currently assessed potential production capacity of 160 MW. There are plans to expand the installed geothermal generation capacity to 310 MW of power by 2017 (AfDB, 2013).

The methane resource in Lake Kivu is approximately 55 bcm. Potential power production capacity is estimated at 700 MW to be shared with DRC. Rwanda's share is 350 MW (AfDB, 2013).

Table 2: Total energy statistics (ktoe)

Category	2000	2005	2010	2015 P
Production of coking coal	-	-	-	-
Production of charcoal	144	121	124	126
Production of crude oil, NLG and additives	-	-	-	-
Production of natural gas	-	-	-	-
Production of electricity from biofuels and waste	0	0	0	0
Production of electricity from fossil fuels	0	4	15	48
Production of nuclear electricity	-	-	-	-
Production of hydro electricity	9	6	9	18
Production of geothermal electricity	-	-	-	-
Production of electricity from solar, wind, Etc.	0	0	0	26
Total production of electricity	10	10	24	93
Refinery output of oil products	-	-	-	-
Final Consumption of coking coal	-	-	-	-
Final consumption of oil	260	276	265	180
Final consumption of natural gas	-	-	-	-
Final consumption of electricity	17	17	28	38
Consumption of oil in industry	0	0	0	0
Consumption of natural gas in industry	-	-	-	-
Consumption of electricity in industry	0	0	0	0
Consumption of coking coal in industry	-	-	0	0
Consumption of oil in transport	0	0	0	0
Consumption of electricity in transport	-	-	-	-
Net imports of coking coal	-	-	-	-
Net imports of crude oil, NGL, Etc.	-	-	-	-
Net imports of oil product	260	281	266	224
Net imports of natural gas	-	-	-	-
Net imports of electricity	8	8	5	7

- : Data not applicable

0 : Data not available

(P): Projected

(AFREC, 2015)

Solar and wind

Rwanda's wind potential is currently being mapped, but the resource is presently used only in small, localized instances. The country is a moderate source of solar energy with an average solar irradiation of 5.5 kWh/m²/day. The 250 kW Kigali solar project feeds into the national grid (REEEP, 2012).

Peat

Rwanda has 40,000 ha of peat bogs with an estimated power production capacity of 300

MW. Peat sites have been identified in Akanyaru, Bahimba, Bisika, Cyato, Cyabararika, Gasaka, Gihitasi, Gishoma, Kageyo, Kaguhu, Nyirabirande, Mashoza, Mashya, Murago, Nyabigongo, Rwuya, Rwabusoro, Rucahabi and Rugeramigozi (AfDB, 2013).

Geothermal

Although many geological studies have been undertaken for oil in this country, so far none has been done to assess the geothermal potential (REEEP, 2012).

Biomass

Rwanda's energy mix is dominated by biomass, which accounts for about 85 per cent of primary energy use. Although the dependency on biomass has dropped from 95 per cent to 85 per cent in the last 20 years, the ratio is still considered too high and harmful to forest resources (AfDB, 2013).

Tracking progress towards sustainable energy for all (SE4All)

Only 6 per cent of the population had access to electricity in the year 2000, increasing to 18 per cent in 2012 (Table 3). This increased access occurred even though during that period of time, Rwanda's population grew from approximately 8.4 million to 11.4 million. The electrification gap between rural and urban areas is substantial, with only 7.7 per cent of rural areas being electrified compared to 61.5 per cent of urban areas (World Bank, 2016). Access to modern fuels has remained low for several decades, with only 2 per cent of Rwandese currently having access to modern fuels (World Bank, 2015).

The energy intensity of the Rwandese economy (the ratio of the quantity of energy consumption per unit of economic output) was 7.3 MJ per US dollar (2005 dollars at PPP) in 2010, increasing to 5.6 MJ per US dollar in 2012. This has economic implications because the unit of energy required to produce a unit of GDP has increased, in essence decreasing the energy efficiency of the country. The compound annual growth rate (CAGR) between 2010 and 2012 was -12.45 (World Bank, 2015).

The proportion of renewable energy in the total final energy consumption (TFEC) was 86.3 per cent in 2012 and it generated 42.3 per cent of electricity (World Bank, 2015). Most (75.3 per cent) of the renewable energy consumed is in the form of traditional biofuels. Rwanda's energy goals stated in Vision 2020 are to reduce biomass energy from 86.3 per cent to 50 per cent by 2020, expand access to electricity to 70 per cent by 2017 and have 100 per cent of public institutions connected by 2017. The current 2012 level of electricity production from renewables is set to increase as 20 mini-hydropower projects totalling 9 MW were to

Table 3: Rwanda's progress towards achieving SDG7 – Ensure access to affordable, reliable, sustainable and modern energy for all

Target	Indicators	Year					
		1990	2000	2010	2012	2000-2010	2011-2015
7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	7.1.1 Per cent of population with access to electricity	2	6	11	18		
	7.1.2 Per cent of population with primary reliance on non-solid fuels	2	2	2	2		
7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	7.2.1 Renewable energy share in the total final energy consumption	84.4	89.4	87.9	86.3		
7.3 By 2030, Double the rate of improvement of energy efficiency	7.3.1 GDP per unit of energy use (constant 2011 PPP \$ per kg of oil equivalent)						
	Level of primary energy intensity(MJ/\$2005 PPP)	5.7		7.3	5.6	5.99	5.61

Sources: (World Bank, 2015); (World Bank, 2016)

Figure 4: SDG indicators




Percentage of population with access to electricity	Access to non-solid fuel (% of population)	GDP per unit of energy use (PPP \$ per kg of oil equivalent) 2013	Renewable energy consumption (% of total final energy consumption), 2006-2011, 2012
18% 	2.0% 	NA	86.75% 

Table 4: Rwanda's key aspects/key mitigation measures to meet its energy Intended Nationally Determined Contributions (INDCs)

INDC
*Promote a low carbon energy mix
*Establish a new grid connected to renewable electricity generation capacity in the form of large-scale hydro power plants and solar PV power plants
*Install sustainable small scale energy sources
*Install solar PV mini-grids in rural communities.
*Adopt energy efficiency and demand side management
*Increase energy efficiency through demand-side measures and grid-loss reduction
*Promote environmentally sustainable use of biomass fuels

Source: (MEM, 2015)

Table 5: Rwanda's institutional and legal framework

Basic Elements	Response
Presence of an Enabling Institutional Framework for sustainable energy development and services (Max 5 institutions) most critical ones	Ministry of Infrastructure (MINIFRA) Ministry of Forestry and Mines Rwanda Development Board (RDB)
Presence of a Functional Energy Regulator	Rwanda Utilities Regulatory Authority (RURA)
Ownership of sectoral resources and markets (Electricity/ power market; liquid fuels and gas market)	ELECTROGAZ Rwanda Energy Corporation (RECO)
Level of participation in regional energy infrastructure (Power Pools) and institutional arrangements	East African Power Pool
Environment for Private Sector Participation	
Whether the Power Utility(ies) is/are vertically integrated or there is unbundling (list the Companies)	Rwanda Energy Group (REG Limited) and subsidiaries - the Energy Utility Corporation Limited (EUCL) and the Energy Development Corporation Limited (EDCL)
Where oil and gas production exists, whether upstream services and operations are privatized or state-owned, or a mixture (extent) e.g., licensed private exploration and development companies)	<ul style="list-style-type: none"> • Controlled by the Ministry of Commerce and Consumption – which is responsible for formulating and managing the pricing policy of petroleum products – with downstream oil imports coming through Kenya and Tanzania. • Distribution and marketing of fuel products is carried out by Enterprise Rwandaise de Petrole (ERP); Societe Generale de Petrole (SGP); Rwanda Petrolgaz; Engen; and Shell.
Extent to which Downstream services and operations are privatized or state-owned, or a mixture (extent)	
Presence of Functional (Feed in Tariffs) FIT systems	Yes
Presence Functional IPPs and their contribution	Private-sector power generation is in its infancy but the GoR is keen to increase the market share of IPPs.
Legal, Policy and Strategy Frameworks	
Current enabling policies (including: RE; EE; private sector participation; & PPPs facilitation) (list 5 max) most critical ones	Economic Development and Poverty Reduction Strategy (EDPRS) Energy Policy 2008 National Energy Strategy (2008-2020) Electricity Access Roll-out Program (EARP) Biomass Energy Strategy Analysis 2009
Current enabling laws/pieces of legislation (including: RE; EE; private sector participation; & PPPs facilitation) – including electricity/grid codes & oil codes (5 max or yes/no) most critical ones	<ul style="list-style-type: none"> • Electricity Law No. 21/2011 • Law No. 39/2001 creating Rwanda Utilities Regulatory Authority and replaced by Law N° 09/2013 of 01/03/2013 • Decree No. 18/76 of April 1976 establishing ELECTROGAZ • Law of January 31, 2014 establishing Rwanda Energy Group (REG Limited) and its two subsidiaries • Draft Gas Law and Regulations for methane projects

This table was compiled with material from (REEEP, 2012), (RURA, 2012), (RURA, 2001) and (ROR, 2014)

be completed by 2014-2015, and a 12-17 MW Nyabarongo II medium hydropower as well as the 145MW Ruzizi III regional hydropower are under way (MININFRA, 2015). There are also plans to increase the number of solar projects implemented.

Intended Nationally Determined Contributions (INDC) within the framework of the Paris climate Agreement

Rwanda's high population density, over-reliance on rain-fed agriculture and increasing incidents of natural disasters such as floods and landslides

makes it very vulnerable to climate change. Rwanda's Intended Nationally Determined Contributions (INDCs) are based on its National Strategy for Climate Change and Low Carbon Development (GOR, 2015). Table 4 lists Rwanda's actions to support the energy-related INDCs.

Institutional and Legal Framework

The Ministry of Infrastructure (MININFRA) is in charge of energy infrastructure (Table 5). The energy regulator is Rwanda Utilities Regulatory Authority (RURA). Rwanda Energy Group Limited was created with two subsidiaries: the Energy

Utility Corporation Limited (EUCL) and the Energy Development Corporation Limited (EDCL). The EUCL handles generation, transmission and distribution of electricity to end-users. At the regional level, the country is a member of the East African Power Pool. The legal framework is provided by the Electricity Law No. 21/2011.

The main sector policy is the Energy Policy 2008 and the National Energy Strategy (2008-2020) facilitates implementation. A major focus is to diversify energy sources by developing available domestic sources of energy and phasing out fossil-fuels.