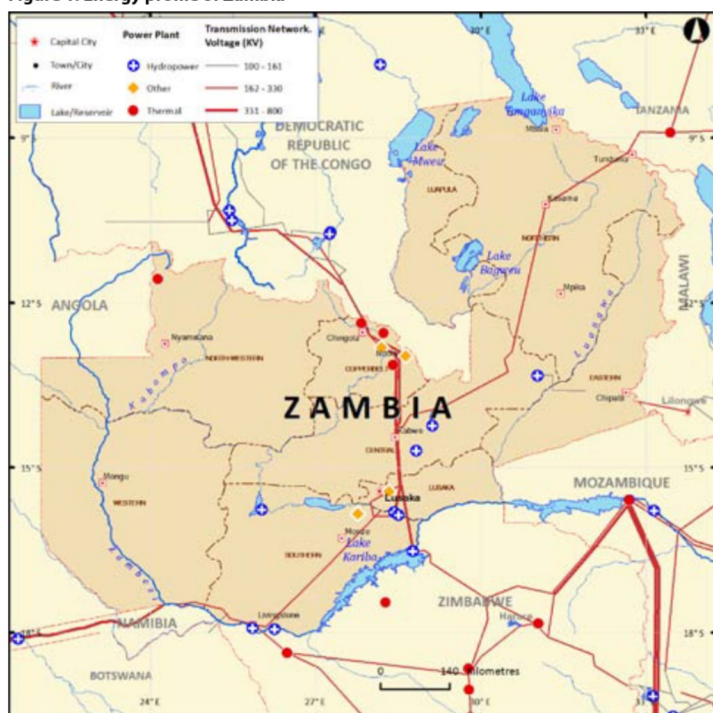




Figure 1: Energy profile of Zambia



Energy Consumption and Production

In 2013, Zambia had a population of 14.54 million (Table 1). Total electricity production in 2015 was 1,025 ktoe, with 93.3 per cent from hydro and 6.5 per cent from fossil fuels. Final electricity consumption in the same year was 97 ktoe, as shown in Table 2 (AFREC, 2015). Figures 2 and 3 show the main energy statistics.

Table 1: Zambia's key indicators

Key indicators	Amount
Population (million)	14.54
GDP (billion 2005 USD)	15.32
CO ₂ emission (Mt of CO ₂)	3.44

Source: (IEA, 2016)

Energy Resources

Biomass

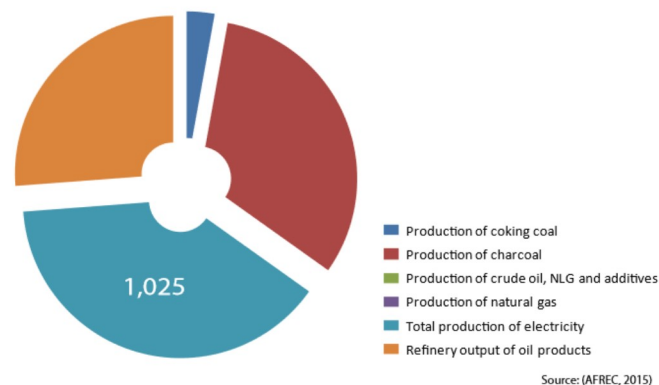
It is estimated that 95 per cent of energy used by Zambian households in the countryside is derived from woody biomass and charcoal (REEEP, 2012). Charcoal production in 2010 was 742 ktoe increasing to 842 ktoe in 2015 (AFREC, 2015). Although forest cover is vast (about 66 per cent of Zambia's total land area), it is being lost due to demand for energy from the growing population. This pressure on the forest resource is one of the drivers behind investing in alternative fuels such as biogas and biofuels. Possible feedstock for biofuels in Zambia include Jatropha, cottonseed, soy seed and sunflower.

The country has set up the legal framework for the biofuels sector including the development of standards for biodiesel and bioethanol; and a code of conduct for blending of biofuels (REEEP, 2012). The National Energy Policy is promoting gel fuel made from sugar molasses as an alternative energy to wood fuel use. Initially, ethanol is made and then it is mixed with the gel to obtain the alternative fuel, but the limitation is in accessing the ethanol.

Hydropower

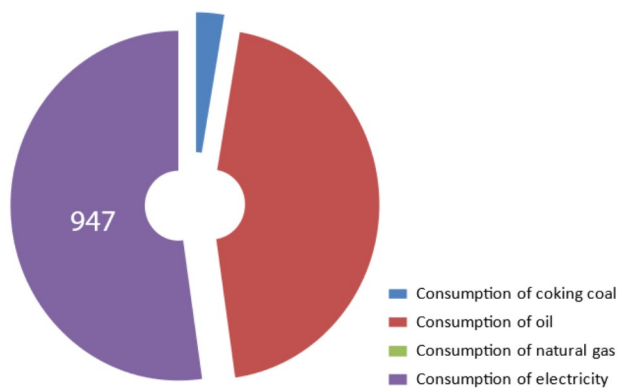
Only a third of Zambia's large hydroelectric power potential of 6,000 MW has been utilized (REEEP, 2012). In 2015, Zambia produced 957 ktoe

Figure 2: Total energy production, (ktoe)



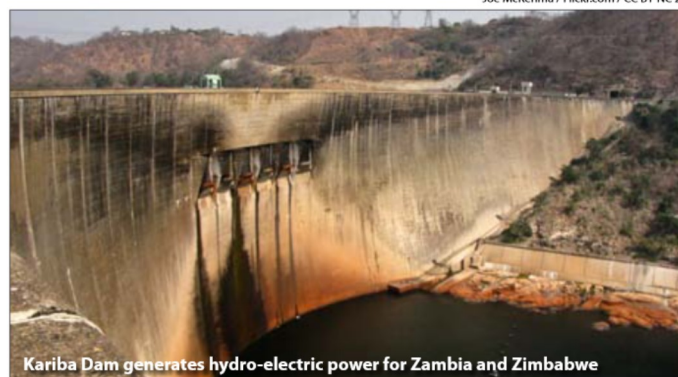
Source: (AFREC, 2015)

Figure 3: Total energy consumption, (ktoe)



Source: (AFREC, 2015)

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Kariba Dam generates hydro-electric power for Zambia and Zimbabwe

Table 2: Total energy statistics (ktoe)

Category	2000	2005	2010	2015 P
Production of coking coal	87	84	1	75
Production of charcoal	596	655	742	842
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	4	5	3	67
Production of nuclear electricity	-	-	-	-
Production of hydro electricity	669	764	969	957
Production of geothermal electricity	-	-	-	-
Production of electricity from solar, wind, Etc.	0	0	0	0
Total production of electricity	673	769	972	1,025
Refinery output of oil products	23	554	647	689
Final Consumption of coking coal	60	76	1	49
Final consumption of oil	392	608	551	816
Final consumption of natural gas	-	-	-	-
Final consumption of electricity	569	712	684	947
Consumption of oil in industry	130	199	270	383
Consumption of natural gas in industry	-	-	-	-
Consumption of electricity in industry	357	479	351	344
Consumption of coking coal in industry	56	61	1	49
Consumption of oil in transport	221	350	223	297
Consumption of electricity in transport	1	1	2	2
Net imports of coking coal	-3	-6	0	0
Net imports of crude oil, NGL, Etc.	26	544	584	710
Net imports of oil product	213	176	176	193
Net imports of natural gas	-	-	-	-
Net imports of electricity	-65	-21	-47	-48

- : Data not applicable

(AFREC, 2015)

0 : Data not available

(P): Projected

of hydroelectricity out of a total electricity production of 1,025 (AFREC, 2015). The major generating stations are Kafue Gorge Power Station with 990 MW capacity and the 720 MW Kariba North Bank plant and the Victoria Falls Power Station with 108 MW capacity (WEC 2013). Sites yet to be developed include Kafue Gorge Lower (750 MW), Itezhi Tezhi (120 MW), Kalungwishi (210 MW), Mambilima, Batoka Gorge (1,800 MW), Devil's Gorge and Kabompo, among others (REEEP, 2012).

There is great potential for mini hydro, which the Zambia Electricity Supply Corporation (ZESCO) is planning to develop.

Oil and natural gas

Zambia has a thriving downstream sector even though it has no oil or gas reserves (REEEP, 2012). The refinery at Ndola is operated by BP (REEEP,

2012). In 2000 refinery outputs of oil were 23 ktoe increasing to 554 ktoe in 2000 and 647 and 689 ktoe in 2010 and 2015 respectively (AFREC, 2015).

Peat

The area of peatland is 12,201 km² (WEC, 2013).

Coal

In 2011, there were 10 million tonnes of proved recoverable reserves of coal (bituminous, including anthracite) and coal production was estimated at 0.2 million tonnes (WEC, 2013).

Wind

Wind speeds are low only suitable for off-grid low grade activities such as generating electricity at remote sites to support domestic cooking and heating (REEEP, 2012). However, there is little growth in this area so far.

Geothermal

The Zambian Geological Survey (ZGS) has been carrying out surveys on geothermal areas since the 1950s; more recently, the Kenyan electricity generation utility, KENGEN, has been involved. The country has over 80 hot springs, with many considered promising (REEEP, 2012).

Solar

Data from AFREC (2015) indicates no production of electricity from the available solar resource by 2015. And although the mean solar insolation of 5.5 kWh/m²/day can support rural electrification, progress is really slow (REEEP, 2012).

Tracking progress towards sustainable energy for all (SE4All)

The national electrification rate is 22.1 per cent (Table 3 and Figure 4). Access to electricity in urban areas is still quite low at 47 per cent with rural electrification at only 5.8 per cent (World Bank, 2016). Zambia's Vision 2030 aims to achieve 51 per cent rural energy access and 90 per cent urban access by 2030. Access to modern fuels is low. In 2012, 42 per cent of people in urban areas and 3 per cent in rural areas were using non-solid fuels (World Bank, 2015); at the national level, the rate was 17.32 per cent (World Bank, 2016).

The Zambian economy energy intensity (the ratio of the quantity of energy consumption per unit of economic output) was 9.0 MJ per US dollar (2005 dollars at PPP) in 2012, down from 11.5 MJ per US dollar in 1990. The compound annual growth rate (CAGR) between 2010 and 2012 was -2.17 (World Bank, 2015).

The share of renewable energy in the total final energy consumption (TFEC) increased slightly from 82.9 in 1990 to 88.2 in 2012. Traditional solid biofuels form the biggest share of renewable sources at 66.4 per cent of TFEC in 2012, while modern solid biofuels contributed 11.7 per cent and hydro 10.0 per cent. Renewable sources contributed a 99.7 per cent share of electricity generation in 2012 (World Bank, 2015).

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

Zambia published its Intended Nationally Determined Contributions (INDC) in September 2015. Zambia intends to reduce its CO₂ equivalent emissions by implementing programs in various sectors, including energy, forestry, agriculture, water, Town and Country Planning, sanitation and transport. Those related to energy are listed in Table 4.

Table 3: Zambia'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	13	17	19	22.1		
	7.1.2 Per cent of population with primary reliance on non-solid fuels	4	13	17	17.32		
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	82.9	89.9	90.7	88.15		
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)			5.7	5.7 (2011)	5.74 (2013)	
	Level of primary energy intensity(MJ/\$2005 PPP)	11.5		9.4	9.0	9.20	9.03

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
22.1%	17.32%	5.93	88.15%
			

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

INDC
*Implement fuel switch (diesel/heavy fuel oil (HFO) to biodiesel)
*Implement fuel switch (coal to biomass)
*Switch from existing isolated diesel to mini-hydro; introduce and increase blending of bio-fuels with fossil fuels and where possible substitution with bio-fuels
*Expand off-grid renewable energy to non-electrified rural areas, in addition to solar photovoltaic and wind
*Expand on-grid program to support economic growth and grid extension through inter-basin water transfer
*Extend grid to non-electrified rural areas

Source: (MEM, 2015)

Table 5: Zambia'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	<ul style="list-style-type: none"> • The Ministry of Mines, Energy and Water Development • Rural Electrification Authority
Presence of a Functional Energy Regulator	
Ownership of sectoral resources and markets (Electricity/ power market; liquid fuels and gas market)	
Level of participation in regional energy infrastructure (Power Pools) and institutional arrangements	Southern Africa Power Pool
Environment for Private Sector Participation	
Whether the Power Utility(ies) is/are vertically integrated or there is unbundling (list the Companies)	ZESCO Limited is owned by the government was formerly called the Zambia Electricity Supply Corporation Limited
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)	
Extent to which Downstream services and operations are privatized or state-owned, or a mixture (extent)	Tazama Pipelines Limited, a joint venture between the Tanzanian and Zambian governments imports crude oil. It is refined at the Indeni Refinery in Ndola the Copper belt province, a 50-50 joint venture between the Zambian government and Total Outre Mer.
Presence of Functional (Feed in Tariffs) FIT systems	Renewable Energy Feed-In Tariff (REFIT) Regulatory Framework and the REFIT Pricing Methodology
Presence Functional IPPs and their contribution	<ul style="list-style-type: none"> • Lunsemfwa Hydropower Company Limited 56 MW) • Ndola Energy Company Limited (50 MW) • Zengamina Power Limited (0.75 MW).
Legal, Policy and Strategy Frameworks	
Current enabling policies (including: RE; EE; private sector participation; & PPPs facilitation) (list 5 max) most critical ones	<ul style="list-style-type: none"> • National Energy Policy 2007 • Rural Electrification Master Plan 2008-2030
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"> • Energy Regulation Act Cap 436 1995 • Electricity Act • Electricity Amendment Act • Energy Regulation Act • Petroleum Act • Petroleum Production and Exploration Act • Rural Electrification Act

This table was compiled with material from (REEEP, 2012) and (World Bank, 2013)

Institutional and Legal Framework

The Ministry of Mines, Energy and Water Development is in charge of the energy sector (Table 5). The energy regulator the is Energy Regulatory Board. ZESCO Limited is the sole

generator, transmitter and distributor of electric energy. At the regional level, Zambia is a member of the Southern Africa Power Pool. The main sector policy is the National Energy Policy 2007, while the legal framework is provided by the Energy Regulation Act Cap 436 of 1995.

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The solar panels installed in the village of Mpanta, Zambia