



Figure 1: Energy profile of Kenya

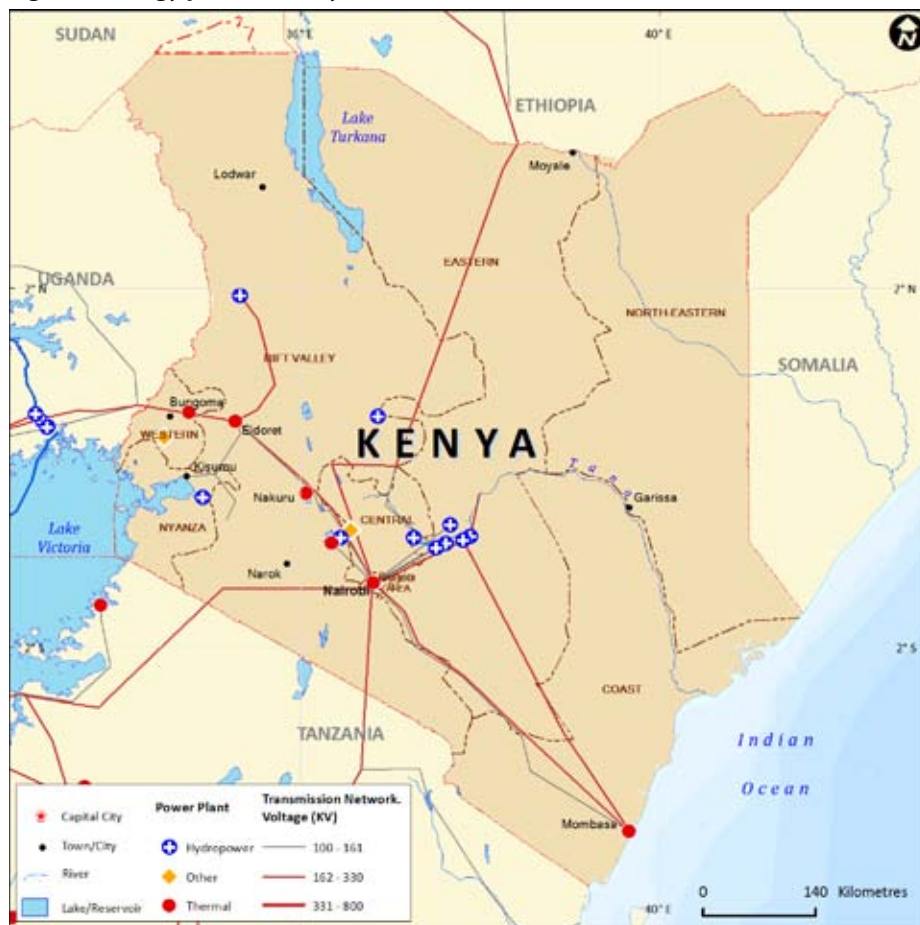


Figure 2: Total energy production, (ktoe)

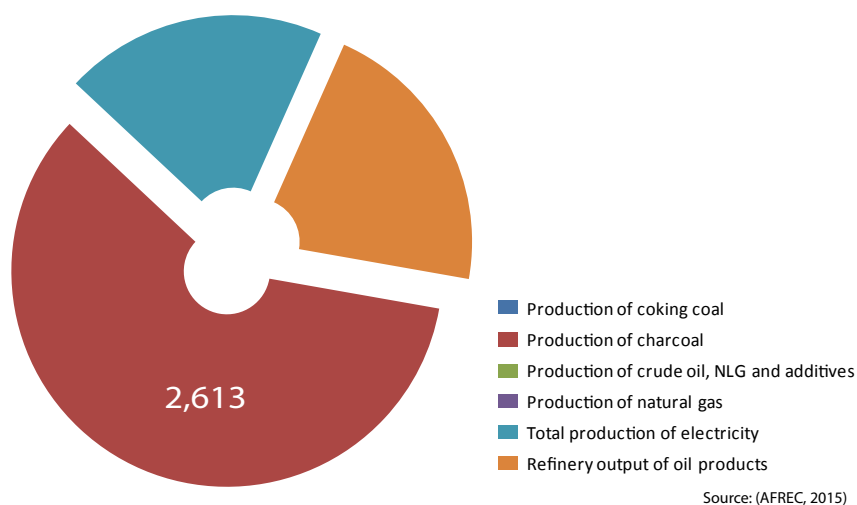
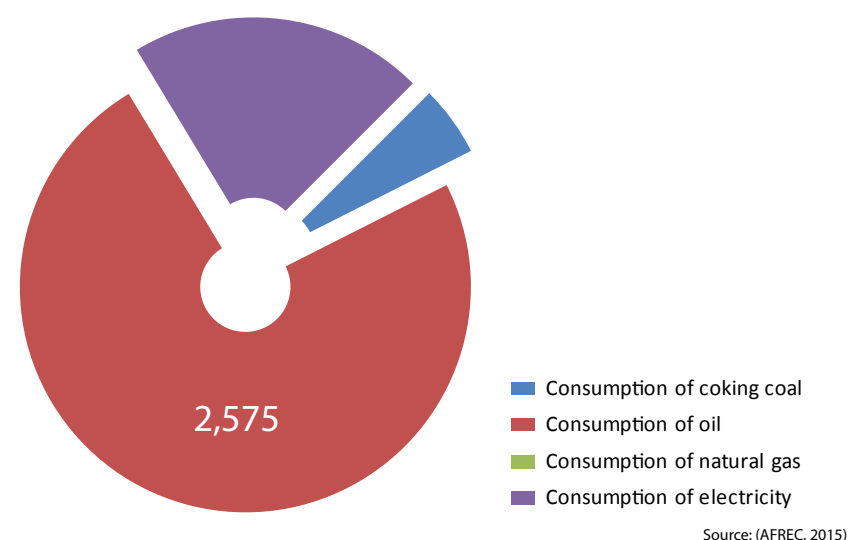


Figure 3: Total energy consumption, (ktoe)



Energy Consumption and Production

In 2013, Kenya had a population of 43.69 million (Table 1). Electricity production in 2015 was 869 ktoe with 36.4 per cent of it generated from fossil fuels, 26.6 per cent from hydro and 32.4 per cent from geothermal sources. Final consumption of electricity in the same year was 738 ktoe (AFREC, 2015). Table 2 shows the key energy statistics for the country. Key energy consumption and production statistics are shown in Figure 2 and 3.

Table 1: Kenya's key indicators

Key indicators	Amount
Population (million)	43.69
GDP (billion 2005 USD)	28.05
CO ₂ emission (Mt of CO ₂)	11.70

Source: (World Bank, 2015)

Energy Resources

Hydropower

In 2005, hydroelectricity production was 50.3 per cent of total electricity production decreasing to 26.7 per cent in 2015 (AFREC, 2015). Hydropower generation has been unstable lately due to the unpredictability of the water resource. During periods of drought, the government is forced to purchase expensive and polluting fossil fuels. For instance, the suppressed long rains in 2014 led to a 19.5 per cent decline in hydro generation. The catchment of the Mau forest complex has a potential hydropower generation capacity of about 535 MW (UNEP, 2009). Protecting forests or "water towers" has thus become a central point in ensuring a sustainable energy supply.

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Transportation in rural Kenya

Table 2: Total energy statistics (ktoe)

Category	2000	2005	2010	2015 P
Production of coking coal	-	-	-	-
Production of charcoal	1,112	2,012	2,287	2,613
Production of crude oil, NLG and additives	-	-	-	-
Production of natural gas	-	-	-	-
Production of electricity from biofuels and waste	19	28	27	20
Production of electricity from fossil fuels	183	152	197	317
Production of nuclear electricity	-	-	-	-
Production of hydro electricity	114	260	292	232
Production of geothermal electricity	37	76	125	282
Production of electricity from solar, wind, Etc.	0	0	2	17
Total production of electricity	353	516	642	869
Refinery output of oil products	1,994	1,615	1,617	932
Final Consumption of coking coal	34	55	137	176
Final consumption of oil	1,910	2,314	2,830	2,575
Final consumption of natural gas	-	-	-	-
Final consumption of electricity	276	424	544	738
Consumption of oil in industry	283	354	887	809
Consumption of natural gas in industry	-	-	-	-
Consumption of electricity in industry	169	269	312	309
Consumption of coking coal in industry	34	55	137	189
Consumption of oil in transport	1,169	1,557	1,560	1,463
Consumption of electricity in transport	0	0	0	0
Net imports of coking coal	34	55	137	179
Net imports of crude oil, NGL, Etc.	2,290	1,657	1,449	857
Net imports of oil product	763	1,484	2,316	3,190
Net imports of natural gas	-	-	-	-
Net imports of electricity	17	-1	1	1

- : Data not applicable

0 : Data not available

(P): Projected

(AFREC, 2015)

Peat

The area of land covered with peat is about 2,440 km² (WEC, 2013).

Wind

The existing highland and mountainous areas, the Rift Valley and other geographical features have combined to create ideal conditions for the high wind speeds required for commercial wind energy generation. The Kenya Renewable Energy Association indicates high wind speeds of above 9 m/s at 50 m high in the northwest while areas along the Indian Ocean average above 5 m/s at 50 m high (KEREAA, 2016). The windiest places are the edges of the Rift Valley, Marsabit and Turkana districts. In 2015, the country had 17 ktoe of solar and wind energy installed (AFREC, 2015). Existing projects include the Ngong Wind Power plant in Kajiado county with 5.1 MW, the 60 MW Kinangop Wind Park in Nyandarua county and the 300 MW Lake Turkana Wind Power Project (LTWP) in Marsabit county (KEREAA, 2016). The

LTWP project should contribute the equivalent of over 20 per cent of the current installed electricity generating capacity to the national grid (AfDB, 2014).

Geothermal

Kenya is one of the few countries in Africa that has seriously invested in its geothermal potential. As a result, electricity from geothermal sources plays an important role in the total energy mix. There is 169 MWe of installed capacity and the annual output is 1,430 GWh (WEC, 2013). Production of geothermal electricity increased from 37 ktoe in 2005 to 282 ktoe in 2015 (AFREC, 2015). Potential geothermal sites are found at Arus-Bogoria, Badlands, Barrier, Eburru, Emuruangogolak, Korosi, Lake Baringo, Lake Magadi, Longonot, Menengai, Olkaria, Suswa, PakaSilali and Namarunu. The Olkaria site is operational with Olkaria I having an installed capacity of 45 MWe, Olkaria II with 70 MWe and Olkaria III with 48 MWe (WEC, 2013). and there is another planned 2.5 MWe power station at the Eburru site (WEC, 2013).

Solar

Solar insolation rates in Kenya are over 4 kWh/m² (REEEP, 2014) suitable for solar PV commercialization. The government, through the Ministry of Energy and Petroleum, has been very supportive of solar energy development. As a result, the solar PV market is very vibrant. By the 2013/14 financial year, almost 1,000 institutions, including health centres, dispensaries and administrative units, had Solar PV systems installed at a total cost of KSh 3.2 billion. The accumulated cost of installing Solar PV systems in Arid and Semi Arid Lands (ASAL) counties of the northeastern and eastern regions was KSh 1.98 billion at the end of 2013/14 (KNBS, 2014). Solar energy facilitates lighting, drying, irrigation and solar water heating. The solar water heating sector is growing by 20 per cent per annum (KEREAA, 2016). Solar Water Heating Regulations have been in place since 2012 to guide the sector.

Tracking progress towards sustainable energy for all (SE4All)

Electricity access in Kenya is low but there are plans to address this deficit. In 2010, 31.2 million or 23 per cent of people in Kenya had no access to electricity and 32.6 million had no access to non-solid fuels. Segregating by location, 6.7 per cent of people in rural Kenya had access to electricity compared to 58.2 per cent in urban areas in 2012 (World Bank, 2015); (World Bank, 2016). Kenya's Rural Electrification Fund charges all electricity consumers 5 per cent of the value of their monthly electricity consumption towards electrification (KNBS, 2014).

Access to non-solid fuels was 16.16 per cent in 2012 with 3 per cent and 49 per cent with access to non-solid fuels in rural and urban areas, respectively (World Bank, 2015); (World Bank, 2016). The second Medium Term Plan also intends to increase installed capacity for electricity generation by 5,538 MW in 2017 (GOK, 2013). This translates into increased rural and urban access rates of 50 per cent and a reduction in the cost of electricity by 50 per cent by 2018.

Between the 1990-2000 and 2000-2010 period, energy intensity decreased from a compound annual growth rate (CAGR) of 0.14 per cent to -2.54 per cent. The energy intensity of the Kenyan economy (the ratio of the quantity of energy consumption per unit of economic output) decreased from 9.7 MJ in 2010 to 9.3 MJ per US dollar (2005 dollars at PPP) (World Bank, 2015).

The share of renewable energy in the total final energy consumption (TFEC) averaged 78.53 per cent in 2012 and 77.12 per cent between 2006 and 2011. By 2010, Kenya had 320,000 solar home systems installed (World Bank, 2015). The share of renewable energy in the electricity generated is 75.2 per cent. Vision 2030 aims to modernize the energy infrastructure network and to increase the share of energy

Table 3: Kenya'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	11	15	23	23		
	7.1.2 Per cent of population with primary reliance on non-solid fuels	19	20	17	16		
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	77.7	81.8	77.1	78.5		
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)	5.2		5.2	5.4 (2011)		5.59 (2013)
	Level of primary energy intensity(MJ/\$2005 PPP)	9.5		9.7	9.3	9.56	9.26

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
23%	16.17%	5.77	78.53%
			

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

INDC
*Expand energy production through geothermal, solar and wind sources, as well as other renewable and clean energy options.
*Enhance energy and resource efficiency across the different sectors.
*Progress towards achieving a tree cover of at least 10 per cent of the land area of Kenya.
*Adopt clean energy technologies to reduce over reliance on wood fuels.
*Develop low carbon and efficient transportation systems.

Source: (MENR, 2015)

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Table 5: Kenya'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"> • Ministry of Energy and Petroleum (MOEP) • Rural Electrification Authority (REA) • Geothermal Development Company (GDC)
Presence of a Functional Energy Regulator	Energy Regulatory Commission
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	East African Power Pool (EAPP)
Environment for Private Sector Participation	
Whether the Power Utility(ies) is/are vertically integrated or there is unbundling (list the Companies)	<ul style="list-style-type: none"> • Kenya Generating Company (KENGEN) • Kenya Power and Lighting Company (KPLC) • Kenya Transmission Company (KETRACO)
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"> • National Oil Corporation of Kenya (State owned) involved in all aspects of the petroleum supply chain – covering the upstream oil and gas exploration, midstream petroleum infrastructure development; and downstream marketing of petroleum products. • Kenya Pipeline Company (KPC) Limited
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	<ul style="list-style-type: none"> • IberAfrica Power (E.A.) Company Limited • Tsavo Power Company Limited • Mumias Sugar Company Limited • Orpower 4 Inc • Rabai Power Company Limited • Imenti Tea Factory Company Limited • Gikira Hydro • Thika Power Limited • Gulf Power Limited • IberAfrica, Tsavo, Or-power, Rabai, Imenti, and Mumias together account for about 26 per cent of the country's installed capacity from thermal, geothermal and bagasse
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"> • Sessional Paper No. 4, 2004 on Energy • Feed-in-Tariffs (FIT) Policy • Least Cost Power Development Plan (LCPDP) 2011-2030 • National Energy and Petroleum Policy 2015 • Draft Electricity Grid Code 2016 • National Petroleum Sector Master Plan
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 Act of 2006 • Energy Bill 2015 • Petroleum (Exploration, Development and Production) Bill, 2015 • Energy (Local Content) Regulations, 2014 • Energy (Energy Management) Regulations, 2012 • Petroleum Exploration, Development and Production (Local Content) Regulations, 2014

This table was compiled with information from (REEEP, 2015)

generated from renewable energy sources. The objective is to increase access to energy and ensure an affordable and reliable supply.

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

The energy-related Intended Nationally Determined Contributions (INDCs), highlighted in Table 4, aim to operationalize Kenya's climate

change, environmental and natural resources management policies through actions in clean energy development and energy efficiency, among others.

Institutional and Legal Framework

The Ministry of Energy and Petroleum is in charge of the energy sector (Table 5). The energy regulator is the Energy Regulatory Commission. The Kenya Generating Company (KENGEN), Kenya

Power and Lighting Company (KPLC) and the Kenya Transmission Company (KETRACO) are in charge of the different elements of electricity. On a regional level, the country is a member of the East African Power Pool. The legal framework is provided by the Energy Act No. 12 of 2006 and the soon-to-be approved Energy Bill 2015. The main sector policy is the Sessional Paper No. 4, 2004 on Energy (MOE, 2008) and the newly passed National Energy and Petroleum Policy 2015.