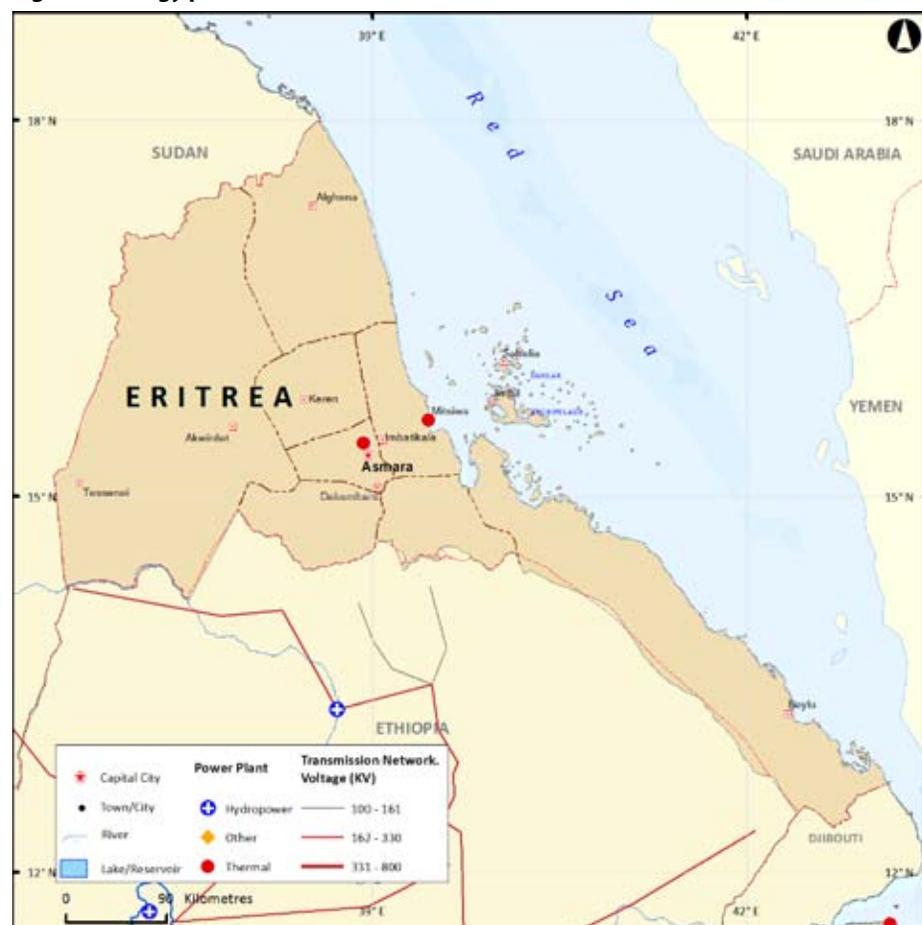




Figure 1: Energy profile of Eritrea



Energy Consumption and Production

Eritrea's population was 6.33 million in 2013 (Table 1) (IEA, 2016). Table 2 shows that total production of electricity was 38 ktoe in 2015 with 97.3 per cent generated from fossil fuels. Final consumption of electricity is 33 ktoe with 9 per cent of this consumed in industry (AFREC, 2015). Key consumption and production statistics are shown in Figures 2 and 3.

Table 1: Eritrea's key indicators

Key indicators	Amount
Population (million)	6.33
GDP (billion 2005 USD)	1.25
CO ₂ emission (Mt of CO ₂)	0.55

Source: (World Bank, 2015)

Energy Resources

Biomass

The use of combustible renewables and waste biomass (including dung, crop residues and wood) makes up about 78.25 per cent of total energy consumption. With most of the rural population (88 per cent) lacking access to electricity, biomass is an alternative energy source (World Bank, 2015). The following are the potential sources of modern biomass energy use in certain areas in Eritrea:

- The Alighider Farm Estate has the potential to supply raw materials (cotton and sorghum stalks, elephant grass and banana leaves, among others) for briquette production for at least 15 plants, each with a capacity of 4,000 tons per year. Briquettes can replace fuel wood and charcoal. Agricultural waste could generate electricity thermally;
- Biogas plants could be installed in the Elabered Agro-industry and other smaller dairy farms;
- Biogas could be generated from cacti;
- Energy recovery from municipal solid and liquid wastes is possible;
- Energy crops, such as Salicornia (being developed by SeaWater Farms, a biofuels company), could generate electricity for local uses or for the central grid (REEEP, 2012).

Figure 2: Total energy production, (ktoe)

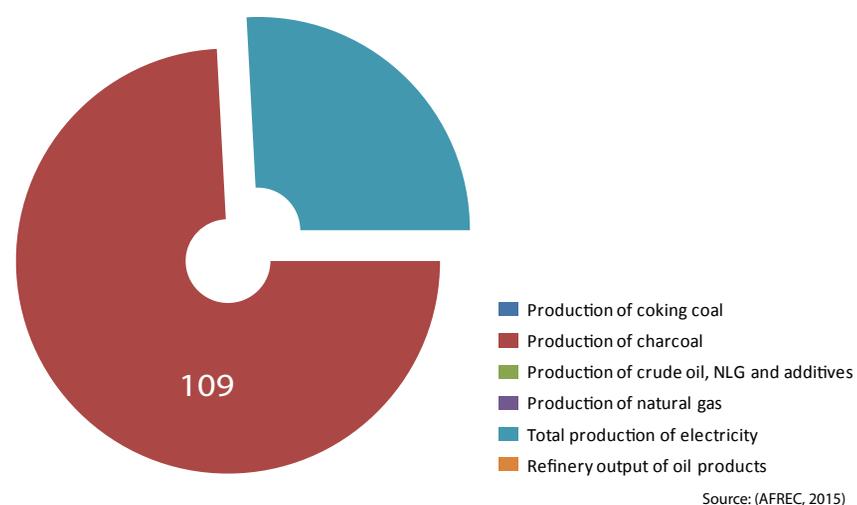


Figure 3: Total energy consumption, (ktoe)

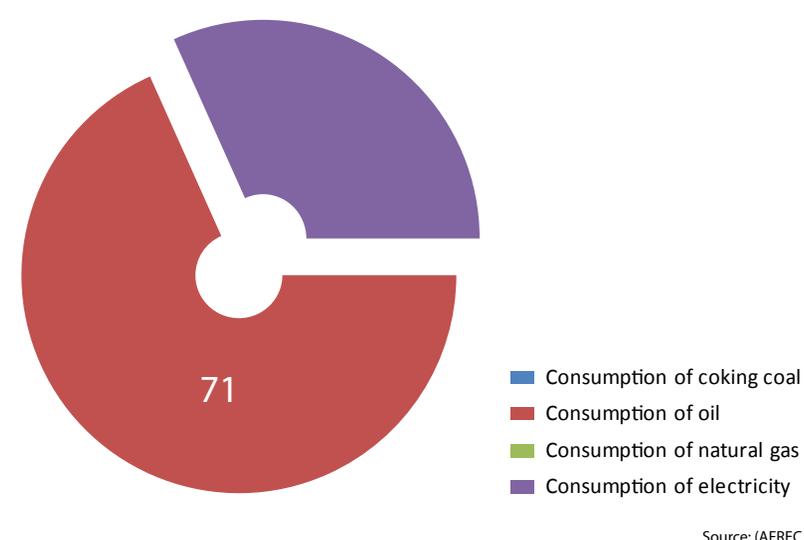


Table 2: Total energy statistics (ktoe)

Category	2000	2005	2010	2015 P
Production of coking coal	-	-	-	-
Production of charcoal	13	84	99	109
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	18	25	27	37
Production of nuclear electricity	-	-	-	-
Production of hydro electricity	-	-	-	-
Production of geothermal electricity	-	-	-	-
Production of electricity from solar, wind, Etc.	0	0	0	1
Total production of electricity	18	25	27	38
Refinery output of oil products	-	-	-	-
Final Consumption of coking coal	-	-	-	-
Final consumption of oil	161	158	39	71
Final consumption of natural gas	-	-	-	-
Final consumption of electricity	15	21	23	33
Consumption of oil in industry	17	28	8	8
Consumption of natural gas in industry	-	-	-	-
Consumption of electricity in industry	6	5	6	6
Consumption of coking coal in industry	-	-	-	-
Consumption of oil in transport	73	66	44	48
Consumption of electricity in transport	-	-	-	-
Net imports of coking coal	-	-	-	-
Net imports of crude oil, NGL, Etc.	-	-	-	-
Net imports of oil product	206	228	158	163
Net imports of natural gas	-	-	-	-
Net imports of electricity	-	-	-	-

- : Data not applicable

0 : Data not available

(P): Projected

(AFREC, 2015)

Hydropower

Ninety per cent of Eritrea receives only 450 mm of rain a year and evapotranspiration rates are very high. This has implications on river flows. Despite this, there is a small hydropower potential in the country: three river systems, the Barka, Mereb-Gash and the Setit, have hydropower potential of about 16,890 GWh altogether. Of this, about 33 per cent can be harnessed (Yohannes, 2008).

Oil and natural gas

Eritrea does not have oil resources, although oil exploration has taken place. There is a refinery that was closed down in 1997 due to high operational

costs. It has the capacity to refine 18,000 bbl/d of crude oil (REEEP, undated).

Wind

There is the potential to exploit wind energy, especially along the coastline as far as 200 km north of Aseb. For example, average wind speeds of 9.5 m/s at a height of 10 m have been measured around Aseb Airport (Rosen, Van Buskirk, & Garbesi, 1999).

Geothermal

The area south of Massawa near the Mount Alid volcanic area is thought to be viable for

geothermal resources (RECIPES, 2006), but more information is still required.

Solar

Solar energy is currently being used mainly in public buildings. However, there is the potential to extend this use to crop driers, refrigeration, water heating and tobacco curing, among others. Average insolation is between 5.0 and 6.55 kWh/m²/day (REEEP, undated).

Tracking progress towards sustainable energy for all (SE4All)

The national electrification rate in Eritrea is quite low, at 36.1 per cent in 2012 (Table 3 and Figure 4) (World Bank, 2016). All (100 per cent) urban areas have access to electricity compared to 12 per cent of rural areas. Of the rural population, only 13 per cent have access to modern fuels while the proportion is 66 per cent in urban areas (World Bank, 2015).

The energy intensity (the ratio of the quantity of energy consumption per unit of economic output) was 4.6 MJ per US dollar (2005 dollars at PPP) in 2012, down from 5.0 MJ per US dollar in 2010. The compound annual growth rate (CAGR) between 2010 and 2012 was -4.08 (World Bank, 2015).

The share of renewable energy in the total final energy consumption (TFEC) was 80.4 per cent in 2012. Traditional solid biofuels form the biggest share of renewable sources at 76.7 per cent of TFEC in 2012, while modern solid biofuels contributed only 3.8 per cent (World Bank, 2015). Renewable sources contributed 0.6 per cent share of electricity generation in 2012 (World Bank, 2015).

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

The country's energy-related Intended Nationally Determined Contributions (INDC) aim to reduce emissions by improving energy security and access and enhancing energy conservation as shown in Table 4 (SOE, 2015).

Table 3: Eritrea'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	23	32	33	36.1		
	7.1.2 Per cent of population with primary reliance on non-solid fuels	16	28	35	36.13		
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	88.3	71.2	77.2	80.42		
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)			8.4	8.82 (2011)		
	Level of primary energy intensity(MJ/\$2005 PPP)			5.0	4.6	4.75	4.61

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

Figure 4: SDG indicators

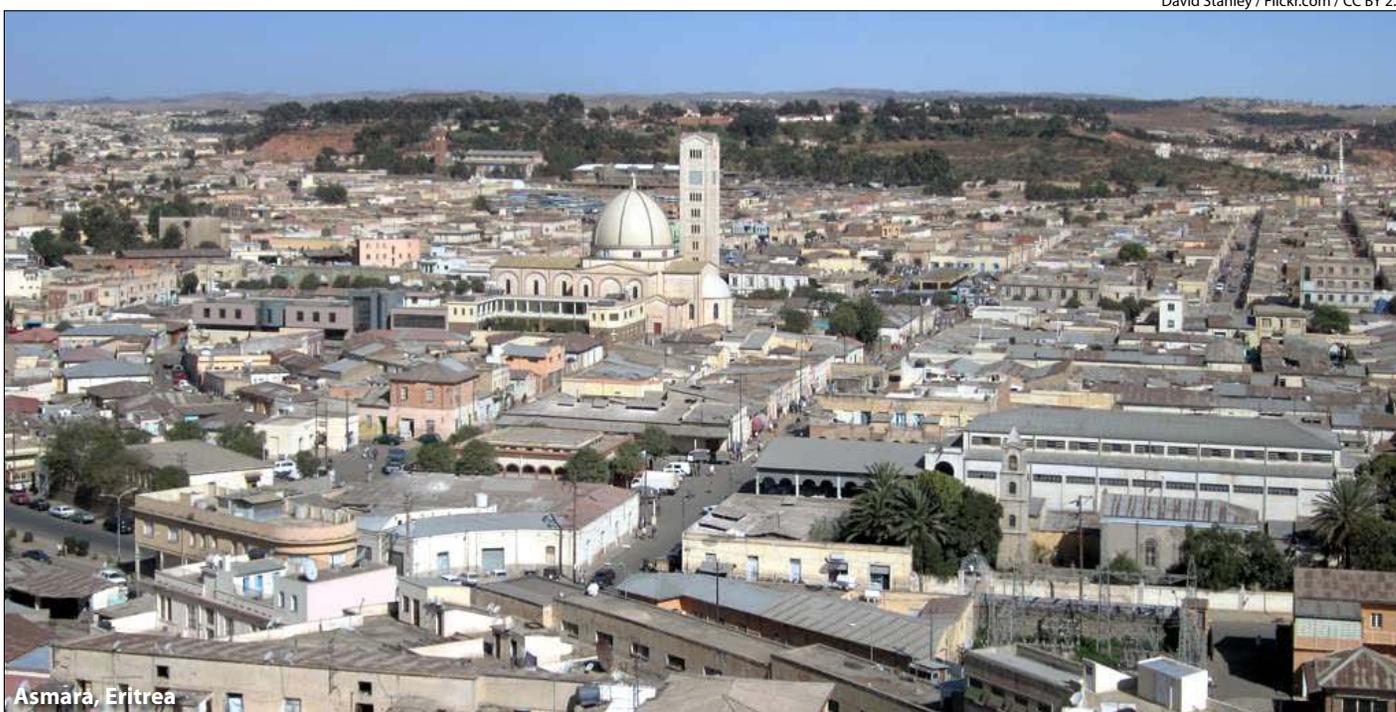
Percentage of population with access to electricity	Access to non-solid fuel (% of population)	GDP per unit of energy use (PPP \$ per kg of oil equivalent) 2013	Renewable energy consumption (% of total final energy consumption), 2006-2011, 2012
36.1%	36.13%	8.82	80.42%
			

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

INDC
*raise the share of electricity generation from renewable energy to 70% of the total electricity generation mix (wind, solar and geothermal).
*reduce transmission and distribution losses at least by 50%.
*enhance energy conservation by introducing rail transportation to cover about 400km for mass transportation of freight with estimated cost of about USD 1billion and uses of big buses for passenger transport to a long distance.

Source: SOE, 2015

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Asmara, Eritrea

Table 5: Eritrea'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 Mines • Renewable Energy Centre
Presence of a Functional Energy Regulator	Department of Energy
Ownership of sectoral resources and markets (Electricity/ power market; liquid fuels and gas market)	Eritrean Electricity Authority
Level of participation in regional energy infrastructure (Power Pools) and institutional arrangements	
Environment for Private Sector Participation	
Whether the Power Utility(ies) is/are vertically integrated or there is unbundling (list the Companies)	Electricity sector is vertically integrated
Oil market unbundled.	
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)	Eritrea Petroleum Corporation (EPC)
Presence of Functional (Feed in Tariffs) FIT systems	
Presence Functional IPPs and their contribution	
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"> • Energy Policy 2009 • Rural Electrification Programme • Energy development initiatives in its long-term program, up to 2015 • National Power Development Master Plan (under development)
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"> • Proclamation No. 141/2004 on promoting efficiency, safety, environmental protection and private sector involvement • Proclamation number 142/2004 reforming the electricity sector

This table was compiled with material from (REEEP, 2012), (Colón & Gerena, 2014) and (Lexadin, 2010)

Institutional and Legal Framework

The Ministry of Energy and Mines is in charge of the energy sector. The functions of a regulator are currently undertaken by the Department of Energy. The Eritrean Electricity Corporation (EEC) is the sole generator, transmitter and distributor

of electric energy. Eritrea is a member country of the East African Power Pool, but currently participates very little. The legal framework is provided by Proclamation number 142/2004 that reformed the electricity sector and allowed for more private sector participation.

The main sector policy is the Energy Policy 2009 (Table 5). Most of Eritrea's energy is generated from thermal yet the country has plenty of renewable energy potential. The Energy Policy aims to increase the use of renewables in its energy mix so as to reduce dependency on fossil fuels and lower greenhouse gas emissions.



Camels with firewood, Eritrea

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