

ENERGY SECTOR IN ETHIOPIA

SNAPSHOT BY: EAGATE FOREIGN TRADE AUXILIARY PLC



Country Data (2016)

Population (million inhabitants)	102,374,044
Labour force (million)	50.97
GDP (billion USD)	69.22
GDP Growth	6.50%
Exports (billion USD)	2.93
Imports (billion USD)	14.7
Exchange rate for 1 USD (2017)	23.2

Sector Data (2014-15)

Installed generation capacity (MW)	2,300
GTP-II capacity target by 2020 (MW)	17,000
Population connected to electricity	24%
Electricity consumption (kWhbn)	6.7
Electricity exports (kWhbn)	1.1

Public electricity generation, transmission and distribution in Ethiopia is the responsibility of Ethiopia Electric Power Corporation (EEP Co, www.eepco.gov.et), a 100% government owned autonomous utility company. Energy is under the Ministry of Water and Energy.

There are a few very small private and cooperative power generators in the country, but their combined capacity is less than 1% of the capacity of EEP Co. The vast majority of energy in Ethiopia comes from biomass (92.4%), 6.7% comes from oil and only 0.9% comes from hydropower. According to the World Bank only an estimated 24% of the population have access to electricity, although this is far lower in the rural areas. Given the current economic transformation and the plan for Ethiopia to become a manufacturing hub for the continent, there is a need for a vast amount of investment in the energy sector.

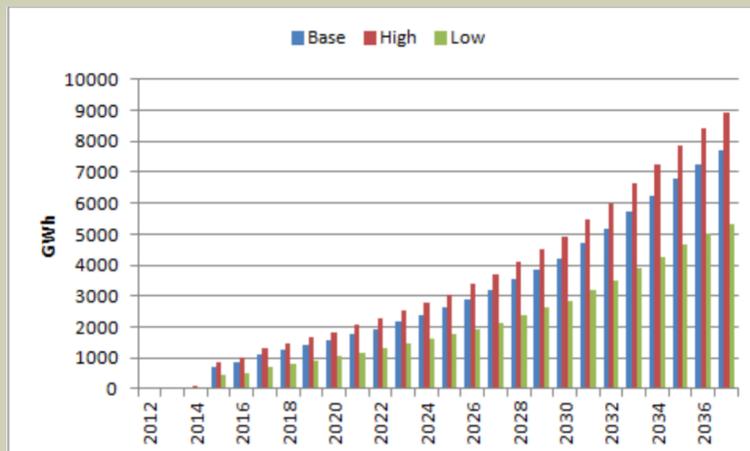
While Ethiopia, to current knowledge, does not have natural resources such as oil, it does have an abundance of resources for renewable energy, most notably the Nile river for hydroelectricity. The Ministry of Water, Irrigation and Electricity estimates that Ethiopia has a potential of 45,000 MW in hydropower. The total installed electricity capacity of electric generation was about 2360 MW for the year 2015, with 82.7% produced from hydro, 2.8% from fossil fuels and 2.7% from geothermal sources.

Given the ongoing economic transformation and the plan for Ethiopia to become a manufacturing hub for the continent, there is a need for a vast amount of investment in the energy sector. The government has recognised the need to increase energy production and is making concrete efforts to attract investors. Ethiopia currently has an installed capacity of over 2,000MW (2016) however its energy demand is growing at 25% per year. The government intends to provide 17,000 megawatts by 2020. The largest project being the 6,000MW Grand Ethiopian Renaissance Dam which is currently in construction. Given the abundance in renewable energy sources the long term intention is for Ethiopia to be the major energy producer in the wider region. The World Bank estimates that Ethiopia could earn \$1billion a year from electricity exports.

In order to facilitate the growth in energy generation, the government is encouraging public-private partnerships. As well as electricity generation, a significant opportunity exists in the construction and upgrading in resources in regards to transmission given that this has not been expanded in line with the generation facilities.

Demand for energy is growing rapidly in Ethiopia (see graph above). Electricity consumption on the national grid has grown at more than 12% annually, petroleum consumption at 11% and biomass at 6%. Access to sustainable and improved energy services are, however, still very low with only 41% of the population having access to grid electricity. Per capita electricity consumption is only 35kWh and per-capita consumption of petroleum fuels is 23kg. These figures compare unfavourably even to Sub-Saharan Africa levels.

Anticipated energy demand in Ethiopia



Source: Ethiopian electric power, 'power sector development: powering Africa

HYDROPOWER



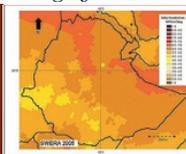
Ethiopia has an installed hydropower capacity of 3,813 (2016) and a hydropower generation of 9.67 TWh (2016). Hydropower is the major energy source for Ethiopia and more than 90% of its electrical energy production comes from different hydropower plants in the country.

Ethiopia's water resources are spread across eight major basins with an estimated exploitable hydropower potential of 45,000MW. A large proportion of this potential is located in the Abbay and Omo river basins, where the nearly-completed 6,000MW Grand Ethiopian Renaissance Dam (GERD) and the recently-completed 1,870 MW Gibe III project are located.

There are more than fifteen, small and big hydropower plants, with capacities ranging from 11.4MW (Tis Abay) up to 460MW (Beles) and some larger capacity hydropower plant projects such as Gilgel Gibe III (1800MW), Gilgel Gibe IV (2000MW) and the Grand Ethiopian Renaissance Dam (6000MW) are undergoing. Few micro hydropower plants, with a combined generating capacity of less than 10MW also exist throughout the country and are used for small-scale activities like the establishment of grinding mills and electricity generation in off-grid rural areas.

Ethiopia is aggressively developing hydropower plants, as it is cost effective, not only to fulfill domestic needs but also to export surplus electricity to surrounding countries.

SOLAR ENERGY



Ethiopia receives a yearly average daily radiation of 5000-7000 Wh/m² depending on region and season and therefore has a great potential for the use of solar energy. The average solar radiation is more or less uniform, around 5.2 kWh/m²/day.

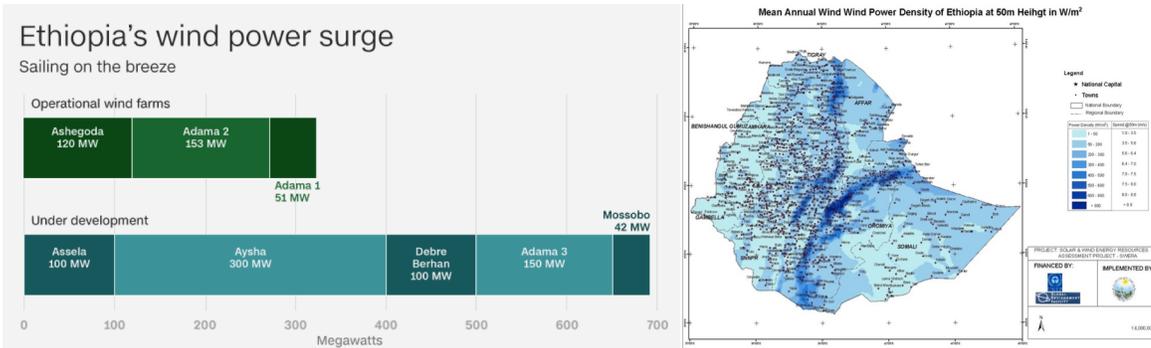
The values vary seasonally, from 4.55 to 5.55 kWh/m²/day and by location from 4.25 kWh/m²/day in the extreme western lowlands to 6.25 kWh/m²/day in Adigrat area, Northern Ethiopia. Although the growth rate is increasing (from <5% in the early 1990s to 15 – 20% in the last few years), primarily driven by the telecommunication sector, which contributes 70% to the installed capacity, the solar photovoltaic (PV) market is still at its early stage. It is estimated that Ethiopia has exploited less than 1% of its solar energy potential.

Current use of solar energy is for off-grid rural applications in homes, rural telecoms and in the social sectors (water pumping, health services, schools). Solar energy is also becoming an important alternative to water heating in the major cities. The current total installed photovoltaic power in Ethiopia is about 3.5MW, three-quarters installed in telecom stations (mostly in mobile towers but also in other stations).

The following is a list of potential sites for the development of solar PV:

1. Derbe Berhan. Capacity (MW) 10, Area (KM2) 0.39. (Amhara region)
2. Metahara. 50, 1.69. (Oramiya region)
3. Dera. 60, 1.59. (Oramiya region)

WIND ENERGY



Ethiopia has an estimated exploitable reserve of 10,000 MW for wind energy, with an average speed of 3.5-5.5 m/s, 6 hours/day. Small towns, villages, farms and other scattered loads on remote areas provide ideal situations in which electricity generation from wind is convenient compared to conventional diesel generation or grid connection. The available information identifies two basic zones with homogeneous periodicity separated by the rift valley. In the first of these, covering most of the highland plateaus, there are two well-defined wind speed maximal occurring, respectively, between March and May and between September and November, depending on location. In the second zone, covering most of the Ogaden and eastern lowlands, average wind velocity reaches maximum values between May and August.

Recently there has been a high amount of investment in wind energy. The Ashedoga (120MW) and Adama II (153MW) wind farms are two of the largest on the continent and were inaugurated in 2013 and 2015 respectively. There are plans to develop more windfarms to increase the combined capacity up to 700MW, significantly higher than the current 324MW.

BIOENERGY



Bioenergy uses in Ethiopia are generally not sustainable: according to a recent study, in more than two-thirds of districts bioenergy uses surpass sustainable yields. Bioenergy contributes to greenhouse gas emissions, due to deforestation and non-renewable use of biomass, in addition to other local environmental problems it creates. There is significant potential to diversify bioenergy sources into liquid biofuels and energy recovery from urban domestic and industrial waste. The export of biofuel could be an important source of foreign currency for Ethiopia, where there is currently no significant fossil fuel production.

The country relies primarily on biomass for thermal energy in the residential and commercial sector meaning about 200,000 ha of forest cover is lost annually because of the population's need for firewood. With it, about two billion square meters of soil is lost annually due to erosion. Farm yield potential is therefore reduced by 2% every year.

GEOHERMAL



Ethiopia has geothermal power potential recently estimated to be around 10,000 MW spread over 22 sites. One small geothermal plant (7MW) was developed in the mid-1990s but has ceased production after a few years. A number of geothermal projects are currently in the pipeline most notably the **Corbetti Geothermal project (500MW)** which hopes to be operational in 2018 and the **Aluto Langano geothermal expansion project (70MW)**.

Rich in geothermal resources, the East African Rift Zone runs through eastern Ethiopia, though the country has thus far been much less active in exploiting it than neighbouring **Kenya**. Given the vast potential, the government has plans to produce 5,000MW by 2037.

	2010				2011				2012	2013
	Ethiopia	Africa	World	Rank	Ethiopia	Africa	World	Rank	Ethiopia	Ethiopia
Total Primary Energy (Quadrillion Btu)										
Production	0.048	37	505	114	0.049	-	-	-	-	-
Consumption	0.137	16	507	112	0.146	-	-	-	-	-
Energy Intensity (Btu per 2005 U.S Dollars)	947	5,302	7,401	193	934	-	-	-	-	-
Petroleum (Thousand Barrels per Day)										
Total Oil Production	-	-	-	-	0.1	9,367	87,332	119	0.1	0.1
Crude Oil Production	-	-	-	-	0	8,571	74,144	93	0	0
Consumption	-	-	-	-	47	3,339	87,549	92	54.11	56.94
Net Export/Imports(-)	-	-	-	-	-46.9	6,028	-	66	-54.11	-56.84
Refinery Capacity	-	-	-	-	0	3,220	88,097	110	0	-
Proved Reserves(Billion Barrels)	-	-	-	-	0	124	1,474	89	0	0
Natural Gas (Billion Cubic Feet)										
Production	0	7,373	111,954	89	0	7,124	116,255	93	0	-
Consumption	0	3,558	113,321	109	0	3,909	116,395	111	0	-
Net Export/Imports (-)	0	3,813	-	64	NA	3,215	-	64	0	-
Proved Reserves (Trillion Cubic Feet)	1	495	6,637	68	0.88	515	6,846	68	-	-
Coal (Million Short Tons)										
Production	0	286	7,954	68	0	285	8,444	68	0	-
Consumption	0	223	7,770	114	0	219	8,285	115	0	-
Net Export/Imports (-)	0	64	-	85	0	66	-	87	0	-
Electricity (Billion Kilowatthours)										
Net Generation	4.93	638	20,254	119	5.11	-	-	-	-	-
Net Consumption	4.45	562	18,501	120	4.59	-	-	-	-	-
Installed Capacity (GWe)	2.06	135	5,086	102	2.13	-	-	-	-	-
Carbon Dioxide Emissions (Million Metric Tons of CO₂)										
Total from Consumption of Fossil Fuels	6.45	1,155	31,502	118	7.13	1,169	32,155	115	8.21	-

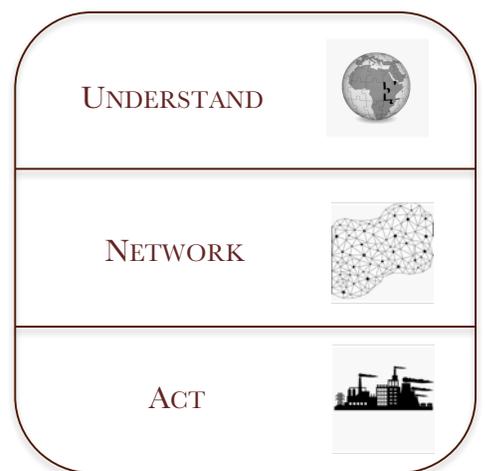
Data Source: Energy Information Administration (EIA), May 2013.

DOCUMENT SOURCES: Photo ILRI, Stevie Mann, Cattle being watered at the Ghibe River in southwestern Ethiopia / Text and figures: Ethiopian Investment Agency, Agricultural Transformation Agency, the Food and Agriculture Organization / National Bank of Ethiopia / Ministry of Agriculture of Ethiopia / Ministry of Finance and Economical Development of Ethiopia / International Monetary Fund (IMF) / 'Ethiopia economic outlook 2016-the story behind the numbers' Deloitte / International hydropower association / USAID / 'Riders on the storm: Ethiopia bids to become wind capital of Africa' CNN / Geological survey of Ethiopia / The embassy of Sweden in Ethiopia / United Nations Environment Program /



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