

Ethiopia

Geothermal Energy Market Overview

February 2021



Short Abstract:

The current electric generation of Ethiopia is mainly from renewable energy resources, namely hydro, wind, solar, geothermal, and biomass. Having the longest section of the East African Rift Valley, Ethiopia has an estimated geothermal potential capacity of 10,000 MW. To date, there is only one geothermal power plant, Aluto Langano power plant, 8 MWe, which was commissioned in 1998. The government recognizes that a partnership with the private sector via Independent Power Producers (IPPs) agreements for power generation is crucial for meeting the country's needs both on off-grid and on-grid scale. A proclamation that will regulate a Power Purchase Agreement (PPA) with IPPs was introduced in 2018. Currently, two IPPs (Tulu Moye and Corbetti Geothermal Companies) are conducting their drilling and implementation activities at Tulu Moye and Corbetti prospects, respectively. EEP and the Geological Survey of Ethiopia (GSE) are the two governmental players in Geothermal development in Ethiopia, while Ethiopian Energy Authority (EEA) is the regulatory body that monitors all kinds of energy developments performed in accordance with the proclamation. The government has a plan to achieve Universal Electric Access by 2025 to meet the target of 65% Grid connection and a 35% off-grid solution by utilising all the available sources of renewables.

Key Facts

- Installed geothermal capacity 8 MW (not operating)
- State-owned EEP developing three projects
- Geothermal resource potential estimated at around 10,000 MW
- Around 15 projects by international private players
- Projects drilling or preparing drilling: Tulu Moye, Aluto-Langano, and Corbetti



Country Overview

Ethiopia, is a landlocked country in the Horn of Africa with a total area of 1,100,000 square kilometres, and has a population of 110 million people. The economy of Ethiopia is a mixed and transition economy with a large public sector. The government is in the process of privatizing many of the state-owned businesses and moving towards a market economy.

The Gross Domestic Product (GDP) in Ethiopia was worth 96.11 billion US dollars in 2019, according to official data from the World Bank. The GDP value of Ethiopia represents 0.08 percent of the world economy.

Ethiopia is endowed with huge renewable energy resources, namely hydro, wind, solar, geothermal, and biomass. However, the majority of Ethiopians currently have no access to electricity and over 90% of the energy consumption is based solely on biomass. With the plan to reach at least 10% non-hydro renewable energy mix in the grid, a target has been set by the government for contributions from other renewable energy sources. The government is targeting to increase the electricity access from 26% (2014) to 60% by 2040.

The government of Ethiopia (GoE) recognizes that a partnership with the private sector via Independent Power Producers (IPPs) agreements for power generation is crucial to meeting the country's needs both on off-grid and on-grid scale. Ethiopian Electric Power (EEP), the governmental electric producer company, has developed procurement processes to select developers and award projects using a competitive bidding process. Currently, few IPPs are involved independently for electricity production.

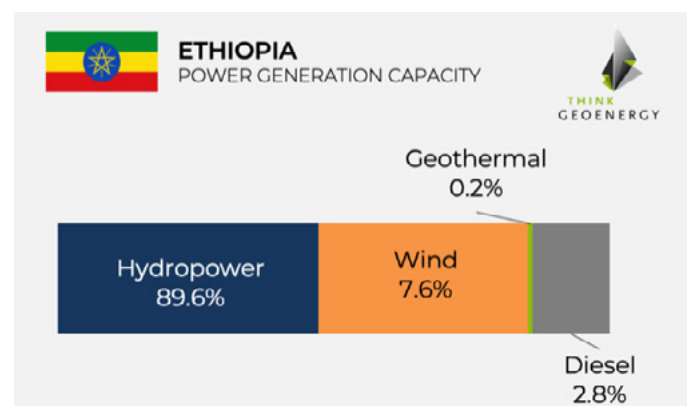
Ethiopia has an estimated geothermal potential of 10,000 MW. To date, only one geothermal power plant, Aluto Langano power plant (7.3 MWe), has been commissioned (in 1998). However, Aluto Langano power plant has not been functional since 2010 because of several challenges due to a shortage of skilled labour to monitor and maintain the plant properly.



Source: [ThinkGeoEnergy.com/map](https://thinkgeoenergy.com/map)

The Country's Energy Market

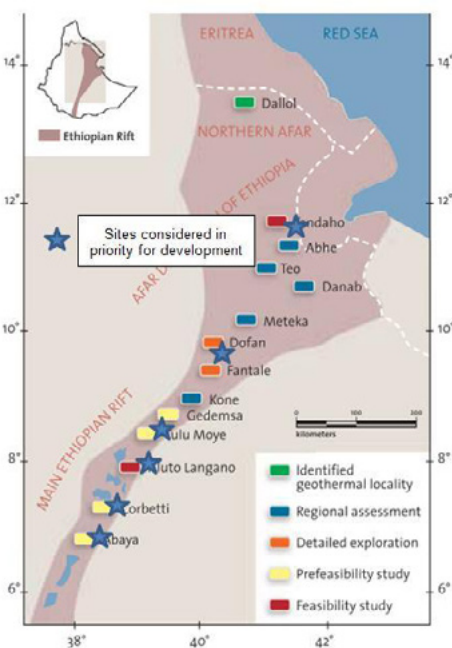
Even though Ethiopia has the potential to generate over 60,000 megawatts (MW) of electric power from all renewables, currently the country is not yet able to supply sufficient electricity to its citizens. Ethiopia currently has more than 4.3 GW of installed power generation capacity produced all from renewables, except 89 MW of diesel power generation. 3,817 MW of electricity is produced from hydro installations, 324 MW from wind, 7 MW from geothermal energy, and 25 MW from Waste to Energy. The GoE currently has created the groundwork for the participation of private sector investment in power generation. This allows and invites private sector investment in power generation without any capacity limits. One of the main prerequisites is to reach an off-take agreement (power purchase agreement) with the national grid operator, i.e. EEP.





Geothermal resources and potential

Ethiopia has the longest section of the 7,000-km East African Rift Valley, which boasts an estimated geothermal potential of 10,000 MW. The presence of the Main Ethiopian Rift (MER) in the East African Rift System (EARS) indicates the presence of heat sources, whilst the transverse faults suggest the availability of fractured reservoirs; an ideal situation for the creation of high-temperature geothermal resources. The MER is dominated by a series of diagonal rift basins and has been differentiated into the north, central and south sections. Even though 24 geothermal prospects have been identified so far along the main rift, to date only one geothermal power plant, the Aluto Langano power plant (7.3 MWe), has been developed by the government. On the other hand, many geothermal prospects have been leased to IPPs to produce power.



Regulatory framework

In February 2018, Ethiopia enacted a proclamation that will regulate Power purchase Agreement (PPA) arrangements. Ethiopian Energy Authority (EEA) is the regulatory body to monitor that all energy developments are performed in accordance with the proclamation. As a result, the private sector at present is motivated to invest in the energy sector. Based on the government's energy plan, Ethiopia has prioritized 300 MW of solar PV projects dispersed across three sites: 820 MW of wind power to be located across four sites, 570 MW of geothermal power to be developed across four sites, and an extra 3879 MW of new hydro plants will be set up across eight different sites to be developed by IPPs. Currently, two IPPs (Tulu Moye and Corbetti Geothermal Companies) are conducting their drilling and implementation activities in the prospects of Tulu Moye and Corbetti, respectively.

Geothermal Energy Utilisation today

In Ethiopia, at present geothermal is utilised through both electric generation and direct use. Aluto langano geothermal plant is the only one built to operate for electric purposes despite the fact that it's currently not functioning. Huge developmental activities are being carried out by EEP and IPPs to fill the gap in electric supply. On the other hand, Geothermal is also used for baths in a few parts of the country. "Filwuha", the well known bath in the capital Addis was constructed in 1900s for Queen Etige Taytu the wife of emperor Minilik II. Sodere, Langano, and Wendo Genet are the other hot spas located in other parts of the country which are also widely utilised. There are a lot of hot springs which people previously used as a form of natural medicine for different diseases.

Geothermal Market & Industry

EEP and the Geological Survey of Ethiopia (GSE) are the two governmental players in Geothermal development for Ethiopia. The role of EEP is to carry out the downstream activity while GSE focuses on the upstream activity (exploration phase). Currently EEP is actively working on the expansion development of the Aluto Geothermal prospect and the Tendaho field. In addition, EEP also makes PPA negotiations with private IPPs. Ethiopian Energy Authority (EEA) is the third governmental office that is involved. Their role is to issue geothermal licences as well as conduct regulatory monitoring in accordance with the geothermal framework and regulation of the country. WB, JICA, AU, IceDA and



US Power Africa, are among the key stakeholders in providing funds for the government in aid and loan forms to fully develop the sector.

Funded, in part, under the Geothermal Risk Mitigation Facility by the African Union Commission/German development KfW, there are several private entities pushing the development of further geothermal power projects in Ethiopia. Several international services companies are ready to support the development of projects in the country or are already working on the Aluto-Langano, Tulu Moye, and Corbetti projects.

Current project development

Aluto Langano – EEP drilling ongoing. This project would be for a new plant at Aluto Langano with an expected power generation capacity of 75 MW.

Tulu Moye, project by developer Tulu Moye Geothermal Operations – this is a private IPP project. Drilling is ongoing through the contractor, KenGen. It's at the planned stage of development for an initial 50 MW to 150 MW of production and beyond.

Corbetti, project by Corbetti Geothermal – drilling tender ongoing as of January 2021. This project is also planned to be developed in stages, starting with 50 MW.

ThinkGeoEnergy reports a total of 18 projects in Ethiopia, with some of those projects set up to be developed in stages. The Ethiopian state-owned utility, EEP, is delivering three projects, whilst the rest of the projects are delivered by a series of private entities.

Energy type	Low Scenario		High Scenario	
	2025	2030	2025	2030
Hydropower	14,103	14,570	14,103	15,603
Biofuel	496	496	496	495
Wind	544	544	1,244	1,244
Solar	1,950	1,950	2,750	2,750
Geothermal	850	1,050	850	1,050
Waste	25	25	25	25
Total	17,968	18,635	19,468	21,168

Outlook

The Energy Policy of the country plans to upgrade and include all of the renewable energy options in the future. It's anticipated that the hydro generation share of renewable energy production will decrease from 89.5% in 2018 to 73% in 2030, while Solar and wind variable energy are anticipated to increase from 7.6% in 2018 to 18.8% in 2030. The geothermal share of the Ethiopian renewable energy production is also anticipated to increase from 0.2% in 2018 to 5% in 2030. The government has a plan to achieve Universal Electric Access by 2025 to complete a 65% Grid connection and 35% off-grid solution by utilising all of the available sources of renewables. The future electricity (MW) generation mix with base case and high scenario forecast is tabulated in the table below.

Sources

Kebede S., (2014): Geothermal Exploration and Development in Ethiopia.
 Khan B., & Singh P., 2017: The Current and Future States of Ethiopia's Energy Sector and Potential for Green Energy.
 Mengstie G., 2019: Implementing Long Term Energy Strategy for RE Deployment in Ethiopia.

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