Ethiopian Energy Sector Brief

Jan
2026

Energy Information Administration and Modeling Desk

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MINISTRY OF WATER AND ENERGY
የኢትዮጵያ ፌዴራላዊ ዲሞክራሲያዊ ሪፐብሊክ | Federal Democratic Republic of Ethiopia

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1. Institutional Arrangement

The Ministry of Water and Energy of Ethiopia is a federal organization established with the mission to improve the overall welfare of our society through developing and managing the water and energy resources equitably, sustainably and in an integrated manner. The Ministry is a regulatory body which involves the planning, development and management of resources, preparation and implementation of polices strategies, guidelines and sectorial laws and regulations. It also, conducts study and research activities, provides technical support to regional water and energy bureaus. The Ministry is headed by a Minister and three State Ministers. The State Minsters are managing water resource management sector, water supply and sanitation sector and energy study and development sectors. Within the energy sector, there are three main lead executive offices with responsibilities of energy sector study, electrification development, technology development, energy information administration and associated activities. Under each lead executive office there are also three desks:-

Rural Energy Technology Development Lead Executive Office

Rural energy technology development desk, rural energy technology transformation desk AND rural energy technology design and test desk

Energy Resource Study Lead Executive Office

Hydropower study and design desk, bioenergy study and technology identification desk AND small river power, solar and wind study and technology identification desk

Electrification and Energy Information Lead Executive Office

Electrification development and monitoring coordination desk, Power sector development and regional interconnection desk AND Energy information administration and modeling desk

Sectorial institutions affiliated to MoWE with their responsibilities:-

Ethiopian Electric Power

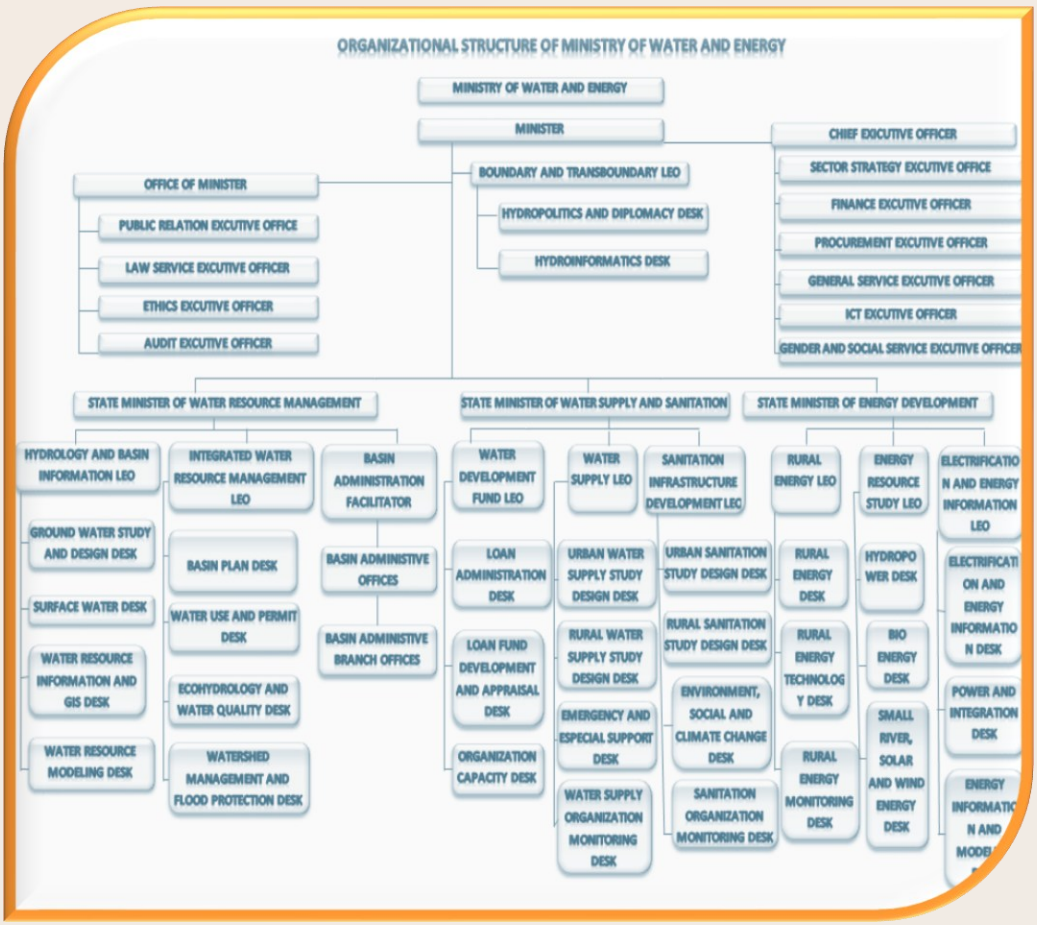
Generation, transmission and bulk sales

Ethiopian Electric Utility

Distribution and sales

Petroleum and Energy Authority

Regulatory body for electricity and energy efficiency



2. Policy and Strategy Frameworks

2.1 National Energy Policy

The broad general objective of the Ethiopian energy sector policy (1994 EC) is ensuring increased access to reliable & affordable modern energy supply using efficient & cleaner energy technologies, in environmentally sustainable way, to support sustainable social and economic development of the country

Considering the continuous economic growth and the country's vision to bring about structural transformations, which obviously & undoubtedly influence the growth of the energy demand, MoWE has been reviewing the previous 1994 EC policy and also it has been under the process of approval.

The draft policy considers the evolution and coming to the scene of different technologies like electric rail, electric cars, hybrid cars, flexi-fuel vehicles. Shifting usage to these technologies will reduce oil import dependency and also reduce the country's carbon footprint.

It also gives due emphasis to energy efficiency and conservation from both supply & demand side. It is well aligned with the new sustainable development due to the current climate change concern; it goes along with the Climate Resilient Green Economy strategy.

Unlike the policy of 1994 EC, the current draft energy policy (2017 EC) has more extensively addressed the evolution and development of electric power infrastructure interconnection not only as being a source of foreign currency but also a critical role player in the region's geopolitical stability.

2.2 National Sustainable Energy Development Strategy (N-SEDS) Of Ethiopia

The National Sustainable Energy Development Strategy (N-SEDS) 2024-2030 is a collaborative effort led by the Ministry of Water and Energy (MoWE) to address Ethiopia's energy challenges and steer the country towards a sustainable energy future. Developed with input from key stakeholders and experts, this strategy outlines a comprehensive roadmap to enhance energy access, security, efficiency, and governance while promoting economic growth and environmental sustainability.

The National Sustainable Energy Development Strategy (N-SEDS) 2024-2030 main goal is to guide actions aimed at accelerating the transition towards a sustainable energy future, integrating social, economic, environmental, and technological dimensions.

2.3 National Electrification Strategy

The principal goal of the National Electrification Strategy is to provide a roadmap for scaling up electrification in Ethiopia in a more effective and sustainable manner and ultimately contribute to raise the overall performance of the electricity sector; and its objectives include:

- Establish an institutional framework through which financial, technical and institutional resources can be allocated to achieve accelerated electrification expansion.
- Strengthen policy formulation, program coordination and performance monitoring.
- Significantly increase connection rates of households and businesses.
- Introduce and institutionalize more effective and automated planning, design, construction, and program management tools.
- Rationalize bulk supply and retail tariffs to significantly improve cost recovery and program sustainability.
- Facilitate significant increases in electrification via off-grid approaches.

The National Electrification Strategy comprises a number of strategic elements organized into three functional categories (pillars):- Institutional, Planning & Technical and Financial.

2.4 Ethiopia Climate Resilient Green Economy Strategy

Ethiopia's Climate Resilient Green Economy (CRGE) Strategy was launched in November 2011 at 4COP 17, Durban, South Africa; This Strategy re-define Ethiopia's vision of achieving middle income status by 2025 in a Climate-resilient green economy development path. It defines the country's commitment to limit its emission (from all economic activities) at 150 5Mt CO2e in 2030, by following green growth path that fosters development and sustainability.

This strategy follows a sectoral approach and has identified and prioritized more than 60 initiatives, which could help the country achieve its development goals while limiting 2030 6GHG emissions to around today's 150 Mt CO2e – around 250 Mt CO2e less than estimated under a conventional development path. The green economy plan is based on four pillars:

Improving crop and livestock production practices for higher food security and farmer income while reducing emissions
Protecting and re-establishing forests for their economic and ecosystem services, including as carbon stocks
Expanding electricity generation from renewable sources of energy for domestic and regional markets
Leapfrogging to modern and energy-efficient technologies in transport, industrial sectors, and buildings

4Conference of Parties
5 Mega ton of Carbon Dioxide Equivalent
6 Green House Gas

2.5 Energy Proclamation

The energy proclamation (810/2013) was issued in January 2014 and it is the law that defines regulations of electricity and energy efficiency & conservation. This law also defines the powers of and duties of the Ethiopian Energy Authority which has been established with Council of Ministers Regulation No.308/2014 as energy sector regulatory body. It also deals with license & certificate of competency issuance.

2.6 Energy Regulation

The Energy Regulation is endorsed by the Council of Ministers in January 2019 and deals with License and Certificate of Competency in more detail including rights and obligations. It also discusses electricity and grid access issues. It has provisions on energy efficiency and conservation issues subject to the nature of the sector and international norms and practices.

2.7 Geothermal Resource Development Proclamation

Ethiopia's Geothermal Energy Resource potential is estimated at 10GW and it is necessary to ensure the conservation and development of this resource for the social and economic benefit and growth of the country. With the intention of putting in place the legal and regulatory framework to support geothermal power generation by both public and private sectors, for a successful development and use of this resource, Geothermal Resources Development Proclamation (981/2016) was issued in September 2016 and amended on June 2020 with proclamation No. 1204/2020 to resolve tax and exploration license related issues.

2.8 Investment Proclamation and Regulation

The new investment proclamation (1180/2020) was issued in April 2020 with aim of increasing the role of private sector investment in all sectors of the economy including in productive and enabling sectors to accelerate the economic development of the country, ensure its sustainability, strengthen domestic production capacity and thereby improve the living standards of its people.

Following the new investment proclamation, the Investment Regulation (474/2020) has endorsed by the Council of Ministers in September 2020 and defines the area of investments for joint investment with the government, domestic investors, joint investment with domestic and foreign investors and foreign investors.

It also discusses investment permit, acquisition of existing enterprise and transfer of investment project under implementation, procedures for suspension and revocation of investment permit, registration of technology transfer and collaboration agreements.
By this law, the government has set a direction of engaging more private sector (in power generation) through different investment modalities, like Independent Power Producer (IPP), which is a Public Private Partnership (PPP) modalities using long–term Power Purchase

Agreement (PPA) and Implementation Agreements (IA). These new schemes of investment will follow standardize renewable energy auction process which involve series of competitions of bids and different stages of evaluation. Other than large-scale power system, the private sector can involve in off-grid solar, small hydro, wind, biomass, hybrid systems etc. investments.

2.9 Public Private Partnership (PPP) Legal and Institutional Framework

In Ethiopia, building and operating infrastructure facilities as well as the delivery of basic services have predominantly been the responsibility of the public sector as they involve huge investment and take long time for the returns on investment to be realized. And there have been inefficiencies manifested in public service deliveries in addition to the financial burden these investments have brought about.

With the overall intention of creating favorable investment environment and bringing private investment in the infrastructure sector, the government of Ethiopia has designed PPP framework; and drafted a PPP policy in 2017. In February 2018, the Public Private Partnership Proclamation has been ratified by the parliament, with proclamation number 1076/2018. Following the Ratification of this proclamation, detailed directives and guidelines have been developed. Governed by the legal framework, PPP Board has been set up and PPP directorate general (DG)- a unit (within Ministry of Finance) that looks after the operations and functions of PPP programs- has been established; and PPP Teams have been created within the Contracting Authorities to help liaise with PPP DG; these all complete the institutional framework for PPP.

2.10 Electric Vehicle Charging System (EVCS) Directive

Petroleum and Energy Authority, in accordance with the power discussed to it under article 40(2) of the Energy Proclamation No. 810/2013 and Article 82 of the Council of Ministers Energy Regulation No. 447/2019 issues this directive. EVCS directive incorporate the following major objective:

- Enable faster adoption of Electric vehicles in Ethiopia by ensuring safe, reliable, accessible and affordable charging infrastructure.
- Prescribe minimum licensing requirements for those who wish to engage in WVCS business.
- Determine approach to set reasonable electricity tariff for charging station owners and electric vehicle owners and set the tariff for off-grid systems as per directive issued by the authority.
- Generate income opportunities for entrepreneurs.
- Prescribe minimum standards and specifications in installation and operation.
- Encourage the use of alternative renewable electricity sources and to make our country Ethiopia contribute to climate change and reducing atmospheric temperature or carbon emissions.

Additionally the directive identified clearly about EV charging services modes, technical standards, license issue, electricity supply and related tariff issue and miscellaneous provision.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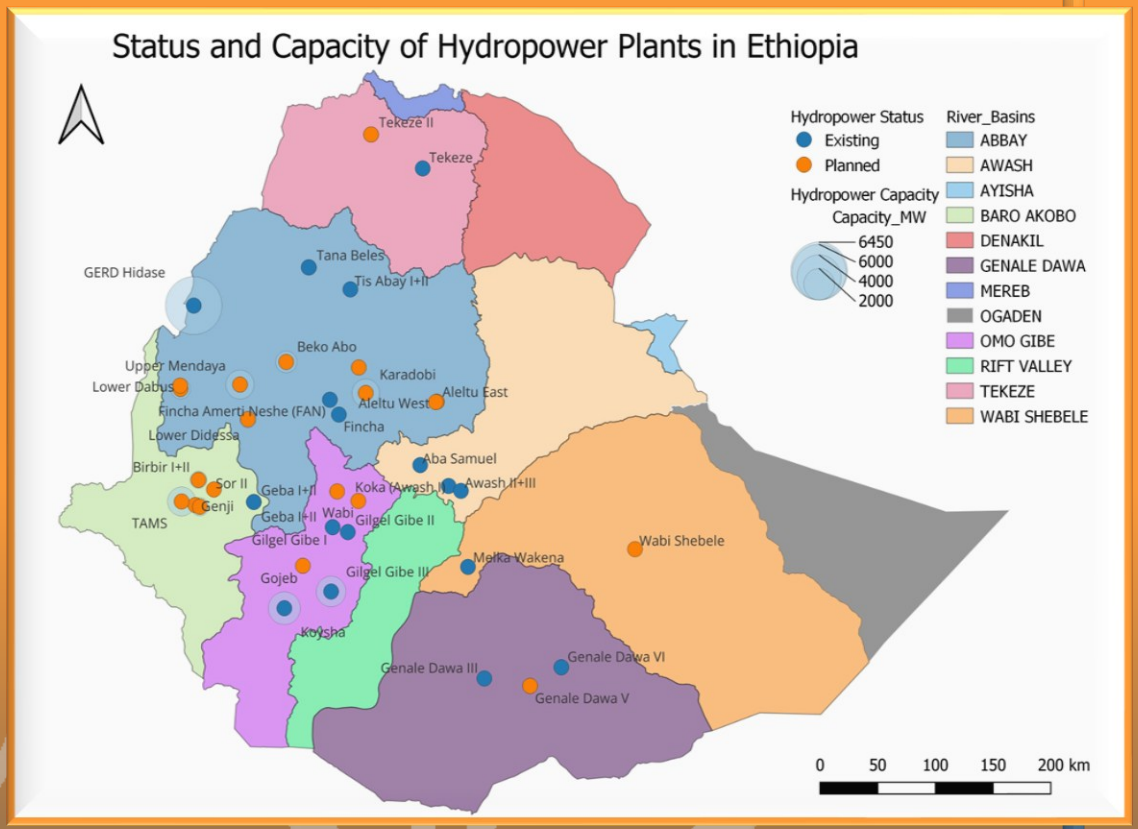
3. Energy Resources and Current Status of National Programs /Projects

3.1 Hydropower potential and current status of hydropower projects

Ethiopia has huge hydropower potential. The resources are distributed in eight major river basins and their innumerable tributaries. In accordance to the recent Hydropower Potential General Survey by Hydro China Corporation, the theoretical hydropower potential of rivers throughout Ethiopia is 366,451GWh with the technical exploitable potential of 48,030MW. However, less than 19.2% of the potential has been exploited so far. The development of hydropower resources is given highest priority in the Ethiopian energy sector policy and strategies. The existing hydropower plants are listed below.

The Existing Hydropower Plants

Power Plant	River Basin	Region	Install Capacity (MW)	Average Energy (GWh)	Commissioning date (G.C)
Koka	Awash	Oromia	42	138.2	1960
Awash II	Awash	Oromia	36	92.2	1966
Awash III	Awash	Oromia	36	172.4	1971
Finchaa	Abbay	Oromia	134	615.3	1974
MelkaWakena	Wabi Shebele	Oromia	153	603.2	1988
Tis Abay I	Abbay	Amhara			2001
Tis Abay II	Abbay	Amhara	72	206.7	2001
Gilgel Gibe-I	Omo Gibe	Oromia	184	888.7	2004
Tekeze	Tekeze	Tigray /Amhara	300	735.7	2009
Gilgel Gibe-II	Omo Gibe	Oromia /SNNP	420	1,793.7	2010
TanaBeles	Abbay	Amhara	460	2,007.5	2010
Fincha Amertinesh	Abbay	Oromia	97	281.6	2013
Gibe-III	Omo Gibe	Oromia	1870	7,026.4	2016
Genale-dawa III	Genale Dawa	Somali/Oromia	254	1,950.5	2020
Aba Samuel	Awash	Oromia			2019
GERD	Abbay	Benishabgule	5,150	15,760	2022
Total			9,208	32,272.1	



Under Construction Hydropower Plants

Power Plant	River Basin	Region	Capacity (MW)	Average Energy (GWh/yr)	Project Status
Koysha	Omo Gibe	Somali / Oromia	1,800		73.81%

Hydropower Projects Either in Construction or in Transaction Phase

Project	River Basin	Region	Install Capacity (MW)	Status
Geba 1 and Geba 2	Baro Akobo	Oromia	371	Feasibility Study
Genale-Dawa VI	Genale Dawa	Somali	246	Feasibility Study Under Review for IPP Development
Dabus	Abbay	Benshangul Gumuz	798	Feasibility Study Under Review for IPP development
Wabishebele	Genale Dawa	Somali	87	Feasibility Study
Birbir	Baro Akobo	Gambela	467	Feasibility Study
Chemoga Yeda	Abbay	Amhara	280	Feasibility Study Under Review for IPP Development
Tams	Baro Akobo	Gambela	1700	Feasibility Study
Halele Werabesa	Omo Gibe	Oromia	436	Feasibility Study Under Review for IPP Development

3.2 Geothermal Potential and Current Status of Geothermal Projects

Ethiopia is well endowed with geothermal resources, and current exploration is believed to have studied only a fraction of the ultimate potential. The best prospect areas are distributed along the Ethiopian Rift system which runs in a northeasterly direction along the entire length of Ethiopia.

A total of 22 geothermal resources areas have been identified by various studies. These resource zones are all located within the rift and are distributed as follows.

- Three areas in lake district, about 100 to 300 km south and southeast of Addis Ababa. The Aluto Volcanic Center, just north of Lake Langano, has been identified as the most attractive prospect in the Lake District.
- A total of 11 areas in the Afar region between Tullu Moye in the south and Tendaho in the north. The most promising area in the Tendaho Graben.
- Two areas in the Danakil Depression in the northwest Afar area.
- Based on the studies Ethiopia has 10,000 MW geothermal potential. However, until now less than 1% of the potential has been exploited.

To ensure the conservation and development of geothermal resources for the social and economic benefit and growth of the country and also to putting in place the legal and regulatory framework to support geothermal power generation by the public and private sectors new geothermal resources development proclamation endorsed on Sep 16, 2016 by the Proclamation No 981/2016.

Existing Geothermal Power Plant

Power Plant	Install Capacity (MW)	Emergy (GWh)	Commissioning Date
Aluto-Langano Geothermal	7.3	39.42	1998/99

Under geothermal resource exploitation, there are projects at Aluto - Langano, with expected capacity 70 MW, Tendaho with capacity of 100 MW. Furthermore, within IPP framework, two implementation contracts have been signed to develop a total of 300 MW at Tulumoye and Corbetti sites.

Status of Geothermal Projects Financed by Public and Private Sector, IPP Scheme

Project	Install Capacity (MW)	Financer	Project Status (until Sep 2016E.C)
AlutoLangano Geothermal expansion	70	Government	It was under construction but because of some reason it's stopped.
Corbetti	150	Private	Awarded to IPP and it was under construction but currently due to some reason it's stopped.
Tulu moye	150	Private	Awarded to IPP and it was under construction but currently due to some reason it's stopped.

3.3 Solar Energy Potential and Current Status of Solar Energy Projects

Distribution of solar energy resource in Ethiopia features high in the north and low in the south, especially, annual total solar radiation exceeds 2100 kW· h/(m2· a) in the central part of North Ethiopia. As for reasons for such distribution, on the one hand, Ethiopia is in tropical zone where solar radiation is strong all the year round; on the other hand, most parts of the country are plateau and mountain lands, especially the north and the central part are on high altitude where atmospheric optical path is short, solar radiation is less lost at transfer through atmospheric layer and solar shortwave radiation reaching Earth's surface is strong.

According to the Wind and Solar Master Plan study (2012) and as shown in the table below the average solar radiation power and average annual total solar energy of unit area are higher in Tigray, Amhara and Afar (all in North Ethiopia) where solar radiation power density exceeds 230W/m2. For example, solar radiation power density in Tigray exceeds 245W/m2, and average annual solar density exceeds 2.15 MW· h/(m2· a). However, to consider total solar energy in different regions, it is necessary to consider areas of different regions. For this, Oromiya, Somali and Amhara are of advantage.

Statistics of Solar Energy Resource in Different Regions of Ethiopia

Country /state	Area (1,000 km^2)	Average solar radiation flux (W/m^2)	Total regional power (TW)	Average annual solar density ($MW·h/(m^2·a)$)	Average annual total reserve (PW·h/a)
Amhara	155.0	240.34	37.26	2.105	326
Tigray	50.2	246.48	12.38	2.159	108
Afar	94.1	239.90	22.57	2.102	198
SNNP	109.9	226.65	24.91	1.986	218
Gambela	24.6	222.48	5.48	1.949	48
Oromiya	320.0	223.96	71.66	1.962	628
Benshagul	49.5	232.52	11.5	2.037	101
Somali	300.3	217.19	65.21	1.903	571
Ethiopia	1,103.6	227.42	**250.98**	**1.992**	**2199**

Based on the study, nationwide solar energy resource reserves were analyzed by virtue of GIS system. Multiyear average daily radiant quantity of Ethiopia is 3.74kWh/m2. According to estimate, the national technical exploitable potential of grid based and building Integrated PV dispersed system is about 1.1TWh/y, the national technical exploitable potentials of the off-grid application such as home, rural health centers and rural schools PV scattered systems are about 4TWh/y, 6.24GWh/y and 15.6GWh/y respectively, and the national technical exploitable potential of independent PV systems mainly for water lift operations of some households or farms is about 36GWh/y. Besides that, from existing exploitable solar energy resource less than 1% of the potential has been exploited.

The private sector can participate in electricity generation from any source and without any capacity limit in EPC scheme. Transmission and supply of Electric Energy through Integrated National Grid System, however, exclusively reserved for the government but, private investors, both foreign and domestic, are allowed to operate an off-gird applications of PV systems for Electricity.

Moreover, private investors are highly encouraged to engage in generation of Electricity in bulk and reach a power purchase agreement (PPA) with Ethiopian Electric Power (EEP), a public Enterprise, responsible for generation and transmission of Electricity through the grid system and sell bulk energy to the Ethiopian Electric Utility and to neighboring countries. Solar power has achieved impressive cost reduction since 2010.

Ethiopian Electric Utility has been developing solar mini grids in nine regions since 2012 E.C., with 8,904 families currently connected to electricity.

Solar Mini-grid Connected Customer

No	Region	Site Name	Number of minigrid	Site capacity (kw)	Total customer upto now
1	Oromia	beltu	15	750	845
		behima		200	391
		mino		225	248
		Nensebo chebe		350	365
		kofetu A		200	159
		Kofetu 2		50	47
		Hariro		600	250
		burka oda		125	94
		W/haro gurati		200	179
		Torban		125	549
		Halo oba		225	133
		Fursa		200	11
		Halo Goba		250	100
		East harogurati		250	0
		Bati		200	157
Total				3,950.00	3,528
2	Ahmara	Wasel	2	300	524
		banbaho		275	503
Total				575	1,027
3	Afar	Kursuwad	2	75	9
		Bada		153	67
Total				228	76
4	Somale	Qorele	8	325	240
		Daratole		725	321
		Higlole		600	292
		Buqulomayo		2,000	458
		Dig		350	237
		Nursadik		275	202
		Mirqan		250	300
		Misrak Gashamo		1,000	336
Total				5,525	2386
5	South	Omorate	5	375	443
		Karakorcho		250	21
		Karaduse		175	15
		Gogile		700	144
		Omorate2		350	30
Total				1,850	653
6	South west	Tum	3	550	429
		Yirini		100	52
		Mecha		300	105
Total				950	586
7	Sidama	Merera	1	625	124
8	Gambela	ungoge	2	175	106
		methar		250	192
Total				425	298
9	Benshan gule	Albasa	1	275	226
	Grand Total		39	14,403	8,904

On Progress Solar Energy Projects

Project	Install Capacity (MW)	Project Status	Financed By
Metehara solar	100	Negotiation terminated and back to feasibility study	IPP scheme
Mekele solar	125	The progress is towards feasibility study	IPP scheme
Humera solar	125	The progress is towards procurement process	IPP scheme
Dicheto Scaling Solar	125	The progress is towards feasibility study	IPP scheme
Gad1 Scaling Solar	125	The progress is towards feasibility study	Private (IPP scheme)
Wolenchiti Scaling Solar	125	The progress is towards feasibility study	Private (IPP scheme)
Weranso Scaling Solar	150	Procurement Stage	Private (IPP scheme)
Gad2 Scaling Solar	125	Procurement Stage	IPP scheme

3.4 Wind Energy Potential and Current Status of Wind Energy Projects

According to the recent wind speed measurement there are several stations with more than 6 m/s annual average wind speed – which is generally considered as a value necessary for economic operation of electricity generation. The highest wind speed is measured by the two wind measurement stations in Assella 150 km south of Addis Ababa on the edge of the Rift Valley with 8.5 m/s and 8.4 m/s at 80.5m above ground (Lahmeyer International, 2017). And also, in Mekelle region with Ashegoda, Harena and Aysha with 8 m/s. The other high wind speed sites were Adama and Gondar with 6.64 m/s and 6.07 m/s respectively. Wind speeds around 4 m/sec were recorded in Harar, DebreBirhan and, Sululta (GTZ-TERNA, 2005). The annual variation shows a minimum in July and August and two peaks in March and October.

According to the CNS Methodology of Wind Energy Resource Assessment for Wind Farm, the shows share of area suitable for grid-connected power generation and small-scale off-grid power generation in each Regional State of Ethiopia and the whole country (average of 1980~2009).

Share of Area Suitable for Grid-connected Power Generation and Small-scale Off- grid Power Generation in Each State and the Whole Country (%)

Height	10m	50m	10m	50m
Wind power utilization mode	Grid-connected power generation		Off-grid power generation	
Amhara	15.13	22.78	22.85	69.81
Tigray	39.84	43.55	25.98	58.01
Afar	15.54	30.97	23.98	73.51
SNNP	13.75	17.05	11.16	38.66
Gembela	0.00	1.99	3.59	15.14
Oromiya	18.00	23.28	19.07	52.87
Benshagul	0.00	5.36	13.49	62.50
Somali	77.75	80.85	13.66	22.19
Ethiopia	33.00	38.55	17.48	47.07

The Ethiopian Solar and Wind Master Plan document indicates wind resources, and the potential installed capacity in each region and the entire country is shown in the table below. The total potential installed capacity in the country is 1,350 GW, with Somalia having the highest capacity and Gambela and Benishangul having the lowest capacity.

Potential Installed Capacity in Each State and the Whole Country

Country/state	Area (1,000 km2)	Potential Installed capacity (GW)
Amhara	155.0	59
Tigray	50.2	78
Afar	94.1	52
SNNP	109.9	26
Gambela	24.6	0
Oromiya	320.0	75
Benishangul	49.5	0
Somali	300.3	1,060
Ethiopia	1,103.6	1,350

The values of potential installed capacity above are based on numerical simulation. There would be a certain difference to the values in future actual development.

Wind speed is high in both long and narrow zones in Central Ethiopia, the border region Djibouti and Somali Region. Wind speeds in some parts of them exceed 8m/s in height of 10m and exceed 10m/s in height of 50m.

The Existing Wind Power Plant

No	Power plant	Install Capacity (MW)	Average Energy Production(GWh/yr)	Commissioning Date
1	Ashegoda Wind Farm	120	36.9	2013
2	Adama I Wind Farm	51	126.7	2009
3	Adama II Wind Farm	153	395.6	2016
4	Aysha II	80	125.6	2017
5	Assela	82.94	100	2021
Total		486.94	784.8	

Furthermore, wind power resource potential is emerging to be more promising than it was originally thought. As a result, Adama I, Adama II, Ashegoda, Aysha II and Assela wind farms currently produce a maximum of 486.94 MW for the national grid.

On Progress Wind Energy Projects

Project	Capacity (MW)	Financed By	Project Status
Aisha II	120	Government	86.55%
Assela	100	Government	98.55%
Aisha I	300	private	Committed

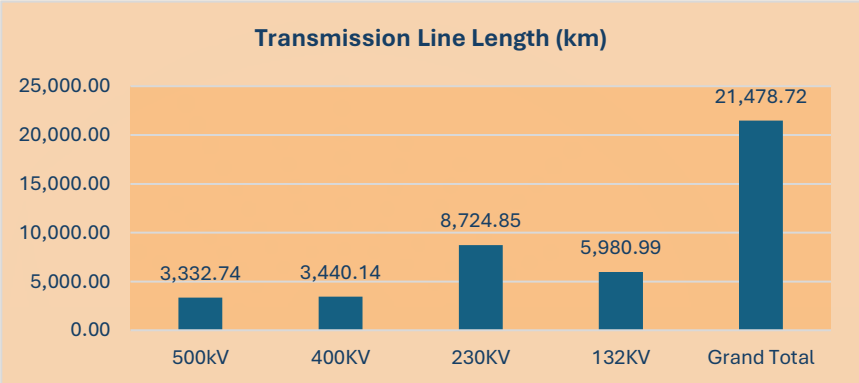
3.5 Existing Waste - to - Energy Plant

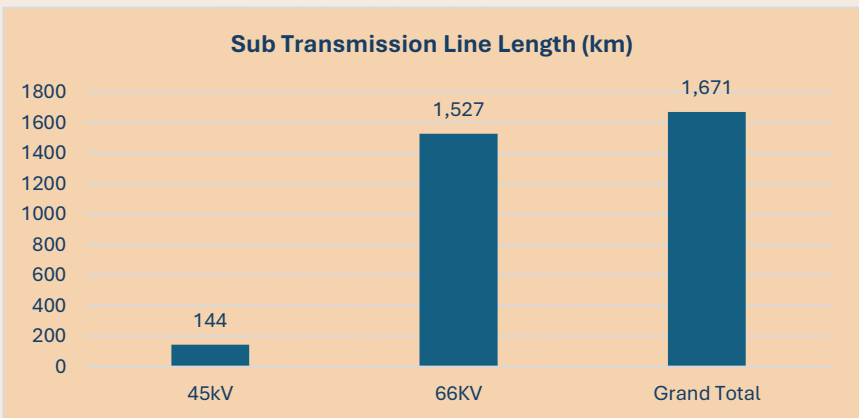
Waste - to - Energy (WtE) technology is also in the picture. Recently, the first plant with a capacity of 25 MW was built in Addis Ababa, Repi site. Other similar plants might be constructed in the major towns across the country based on the experience that will be gained from the first WtE power plant.

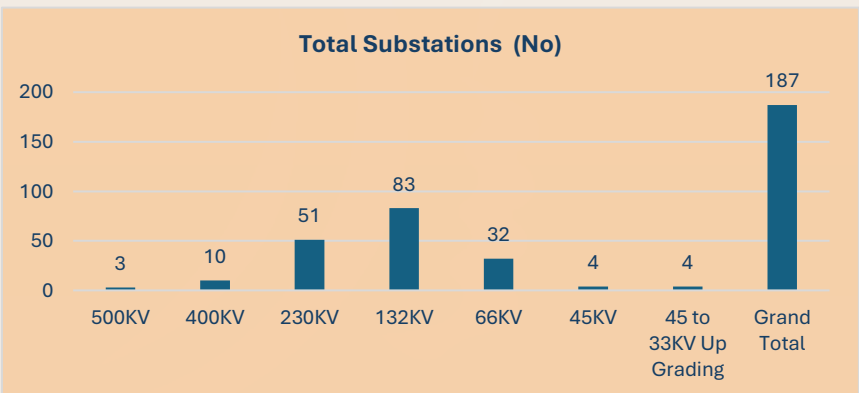
Existing Waste to Energy projects

Power Plant	Installed Capacity (MW)	Average Energy Production (GWh/yr)
Repie W-to-E	25	41

3.6 Existing Transmission, Sub Transmission Lines and Substations







3.7 Other Energy Resource Potential of Ethiopia

Waste - to - Energy (WtE) technology is also in the picture. Recently, the first plant with a capacity of 25 MW was built in Addis Ababa, Repi site. Other similar plants might be constructed in the major towns across the country based on the experience that will be gained from the first WtE power plant.

Other Energy Resources

Resource	Unit	Exploitable Reserve	Exploited Percent
Wood	Million tons	1,120	50%
Agricultural Waste	Million tons	15-20	30%
Natural gas	Billion m^3	198.2	0%
Coal	Million tons	600	<1%
Oil Shale	Billion tons	1	0%

3.8 Status of Power Generation Projects for Private Sector Investment

Power Generation Projects Open for Private Sector Investment

Solar							
No.	Name of the project	Capacity(MW)	Project Status	Planned Project Mode	Location/Region	Project Finance Status	Remark
1	Welenchiti	150	Feasibility study Completed. It is waiting for Debit restricting to secure finance	EPC	Oromia	Loan in a process	The project has been approved by the Ministry of Finance. FS and ESIA has been approved. It is waiting for Debit restricting to secure finance
2	Gad-1	125	Booked for MASDAR	PPP/IPP	Somali	Not found	
3	Gad-2	125	Procurement stage	PPP/IPP	Somali	"	
4	Humera	150	Pended	PPP/IPP	Tigray	"	
5	Dicheto	125	Booked for MASDAR	PPP/IPP	Afar	"	
6	Weranso-1 (IPP)	100	Procurement stage	PPP/IPP	Afar	"	
7	Weranso -2 (EPC)	125	Under feasibility study	EPC	Afar	AfDB	AfDB has promised to finance the project after FS
8	Awash - Amibara	150	Pre-feasibility study completed	Not defined	Afar		
9	Awash-Didub	150	Under pre-feasibility study	Not defined			
10	Shiraro	150	Screening	PPP/IPP	Tigray	"	
11	Guhala	150	Under feasibility study	PPP/IPP	Amara	"	

Wind							
1	Adigala	150	FS completed	PPP/IPP	Somali	Not found	
2	KebriBeyah	150	FS completed	PPP/IPP	Somali	“	
3	Aysha 3	125	Under FS	PPP/IPP	Somali	“	
4	Debre Derhan	125	Under FS	PPP/IPP	Amhara	“	
5	Aysha 1	300	PPA Signed with AMEA and waiting for Financial close	PPP/IPP	Somali	In a process	
6	Gode		Energy Resource Assessment Completed	Not defined yet	Oromia	Not found	
7	Tulu Guled	150	Under pre-feasibility study	“	Somalia	“	
8	Tarmaber	80	Pre-feasibility study completed	“	Amara	“	
9	Batu-Koshe	150	Pre-feasibility study completed	“	Oromia-Central Ethiopia	“	
10	Mega	150	“	“	Oromia	“	
11	Dire Dawa	125	“	“	Dire Dawa	“	It is low wind speed site
12	Deday	125	“	“	Afar	“	It is low wind speed site

Hydropower							
1	Didessa	301	Under new feasibility study	PPP/IPP	Oromia	Not found	
2	Chemoga -Yeda Stage 1and 2	280	Under feasibility study update	PPP/IPP	Amara	“	
3	Genale Dawa 5	100		PPP/IPP	Oromia	“	
4	Geba stage 1 & 2	371		PPP/IPP	Oromia	“	
5	Halele Werabesa Stage 1 & 2	422		PPP/IPP	Oromia	“	
6	Brbir	564		PPP/IPP		“	

4. Ongoing Programs and Projects in Energy Sector

4.1 National Electrification Program

In November 2017, the Government of Ethiopia launched the National Electrification Program (NEP) that represents the action plan for achieving universal electricity access nationwide by 2025, in a strategic and comprehensive as well as efficient and transparent manner, for the benefit of all its citizens. By 2025, 65 percent of access provision is targeted with grid solutions and 35 percent with off-grid technologies (solar off-grid and mini-grids). While the Ethiopian Electric Utility (EEU) will be the primary implementing agent for the grid program, off-grid scale-up will see the coordination and partnership of public and private efforts.

Tackling the access challenge with the coordinated deployment of all technology options allows the achievement of three important goals for the nation: (i) balancing efficiency and equity in access delivery, (ii) maximizing the reach of the electrification program while minimizing the time required for all Ethiopians to have access to electricity services, and (iii) supporting economic growth and human development.

The key operational action elements to reach the NEP target are:

- Fast-paced ambitious grid connections rollout program implemented by the government and designed for scaling up connectivity from 6.9 million households today to over 15 million households in customer count terms by 2025 (equivalent to about 65 percent of the population in 2025); and.
- Complementary off-grid access rollout program alongside grid connections, targeted to provide access for the remaining 6 million rural and deep rural households without grid connectivity (equivalently to about 35 percent of the population in 2025).
- Explicit cross-sectoral linkages with the productive and social services sectors and in support of vulnerable groups

NEP 2.0 is an updated version following the release of the NEP in 2017. The Government expressed its commitment to steadily update the electrification targets and timetables based on new analytics and progress on the ground. The following new analytics have become available as well as implementation progress and lessons learned over the first year of implementation:

Multi-Tier framework global energy access survey provided a more accurate baseline assessment of the access outlook in the country.
Geo-spatial analysis and map reflecting the digitized location of the existing MV network and the proximity to and density of the population, which allowed for the update of the costing of the grid program and informed the sizing, costing, and implementation
Mechanism for the off-grid program. The geo-spatial analysis also identified the location of roads, distribution channels and payment locations, which have informed the implementation framework for the off-grid program.
Implementation framework for the off-grid program based on the strategic drivers identified in the first version of the document.

According to MTF (Multi-Tier Framework) survey report a 44 percent access rate in Ethiopia, where 33 percent of access is provided through grid connections and 11 percent through off-grid solutions. The summary of other results of the survey are stated in Annex I.

The NEP adopts a sector-wide approach for the design, implementation, and syndication of financing requirements. It intends to coordinate activities and investments leveraging on public, private and development partner's support. The overall costing for the grid and off-grid programs for the achievement of universal access is estimated to be US$6 billion.

4.2 Universal Electric Access Program

Adequate, reliable and affordable electricity access connectivity nationwide is a critical enabler for realizing Ethiopia's future growth and transformation, economic prosperity and well-being of all its citizens nationwide. The Government of Federal Democratic Republic of Ethiopia has lunched the Universal Electricity Access Program (UEAP) in order to meet the demand of agricultural, industrial and commercial sectors, rural water supply installations, residential consumptions and education and health sectors. The program is designed around the principles of least cost expansion through technical and institutional innovations and rapid growth of access to electricity. It also revolves around the principle of equitable access to electricity in all regional states of the country. The number of energized towns / villages is presented in the below table.

The Number of Energized Towns/Villages in Ethiopia from 1929 to Dec 2018 E.C

No.	Region/City Administration	Before UEAP Energized Towns/Villages (1929-1997 E.C)	During UEAP Energized Towns/Villages (1998-2002 E.C)	By UEAP Number of Energized Towns/Villages From 2003 - Dec 2018 E.C																Number of Energized Towns/Villages from1929 - Dec 30/2018 E.C
				2003 E.C	2004 E.C	2005 E.C	2006 E.C	2007 E.C	2008 E.C	2009 E.C	2010 E.C	2011 E.C	2012 E.C	2013 E.C	2014 E.C	2015 E.C	2016 E.C	From July 2016 E.C - Jun 30, 2017 E.C	From July 2017 E.C - Dec 30, 2018 E.C	
1	Addis Ababa	1																		1
2	Afar	14	27	18	8	11	9	30	13	9	9	6	7	4	7	2	2	3	8	187
3	Amhara	118	1055	86	11	2	131	60	104	165	151	61	75	91	45	32	23	34	7	2271
4	Benshangul	7	72	0	0	0	6	32	17	12	8	3	5	3	5	2	2	1		175
5	Dire Dawa	1	14	2	0	0	5	0	0	2	2	0	0	1	2	0	0	1		30
6	Gambela	3	30	1	1	8	5	9	3	5	6	4	4	4	3	1	1	1	1	90
7	Harari	25	6	0	0	0	0	0	0	3	1	0	1	0	0	1	0	0	1	40
8	Oromia	313	0	0	0	1282	191	204	129	212	157	54	123	170	96	35	43	52	15	3076
9	South	120	593	34	0	0	102	178	82	146	116	45	59	48	21	31	19	26	4	1624
10	West Ethiopia															6	4	5	4	19
11	Sidama													0	5	6	4	6	2	23
12	Somale	19	98	2	0	0	7	14	10	11	30	5	19	19	10	9	8	11	4	276
13	Tigray	46	334	11	3	0	17	16	40	30	38	15	15	1	0	0	12	8	2	568
Total		667	2231	154	23	1303	473	543	398	595	518	213	306	341	194	125	118	148	48	8400

** Before 1997 E.C. Energized towns /villages number 667 includes one energized town from Addis Ababa.*

4.3 Ethiopia Electrification Program (ELEAP)

The ELEAP is a World Bank financed program to support implementation of NEP. It will support significant scale-up in electricity connections (1,080,000) through densification. It will also support pilot programs for off-grid service delivery (public sector-led programs supporting SAS (50,000) and mini-grids (5)). ELEAP will also provide strong emphasis on sector capacity and institutional reform, being an essential precondition for success of the activities under the above two. The program will finance the activities of the NEP in three results areas on a countrywide eligibility basis. Implementation of this program employ world bank's P for R financing scheme. It has been under implementation since June 2018.

4.4 National Biogas Program of Ethiopia

The National Biogas Program of Ethiopia (NBPE) started its operations in 2008 and is hosted and co-funded by the Ministry of Water, Irrigation and Energy (MoWIE) with financial support provided by the Directorate General for International Cooperation (DGIS) of the Netherlands managed by the Humanist Institute for International Development Cooperation (Hivos) and benefitting from technical support provided by the Netherlands Development Organization (SNV). The aim was to develop a commercially viable domestic biogas sector, providing access to clean energy at household level through the implementation of bio digesters while substituting the use of firewood, increasing agricultural production through the application of bio-slurry (the liquid effluent from the digesters), improving living conditions by reducing the workload and improving health and sanitation for mostly women and children, while increasing employment and income and contributing to the reduction of greenhouse gas (GHG) emissions. The programme is executed in the regional states of Amhara, Oromiya, SNNPR and Tigray.

During the first phase of the NBPE (2008 – 2013), over 8,000 bio-digesters have been installed, with growing numbers every year indicating the positive uptake by rural households, the increasingly active involvement of masons and companies and, most importantly, the establishment by the Government of Ethiopia of credit lines for bio digesters. However, with a technical potential of one million of rural households, currently only a small percentage (0.8%) of the potential households are benefitting from the direct and indirect benefits from domestic biogas.
The aim of NBPE-II is to support the market-driven dissemination of 20,000 high quality biogas installations to provide households with access to clean energy for cooking and lighting and promote the use of bio-slurry as organic fertilizer in a scientific way.

The installation of an additional number of 20,000 biodigesters during NBPE-II will be realized in the initial four regional states; Amhara, Oromiya, SNNPR, and Tigray while –funds and operational requirements permitting- expanding to the regional states of Benishangul- Gumuz And Gambela (both additional states having significant numbers of cattle-rearing households and access to water). In general, the country has focused on small-scale household digesters, with 46,000 household bio-digester plants installed to date.

4.5 Access to Distributed Electricity and Lighting in Ethiopia (ADELE) Project

The project will increase access to new and improved electricity services for households, smallholder farmers, commercial and industrial users, and social institutions in urban, peri-urban, rural and deep-rural areas through on-grid, off-grid, and mini-grid solutions by leveraging public and private delivery modalities. The project has five components:

- Network strengthening for improved reliability of supply in urban areas
- Solar-hybrid mini grids for rural economic development
- Solar home systems for households (HHs), small-holder farmers and small businesses
- Standalone solar systems for health and education facilities and
- Capacity building, technical assistance and implementation support.

These five components provide a synergetic package of investments to ensure that reliable electricity services are made available to all Ethiopians regardless of their location and economic status. Component 1 will ensure that grid-connected urban households are receiving electricity services with adequate reliability and quality, while Components 2 and 3 will ensure that remote and poor households as well as farmers and small businesses in rural areas are able to access electricity services, provided through off-grid solutions (mini-grids or stand-alone off-grid systems). Component 4 will expand the benefits of electrification in communities by supporting improved delivery of education and health care services.

4.6 Distributed Renewable Energy-Agriculture Modalities (DREAM) Project

The DREAM project is expected to have a substantial impact on the country's energy, agricultural and water supply sectors. On the energy sector, the financial viability that comes from establishing medium to large-scale Agricultural Commercial Cluster (ACC) irrigation farms will help catalyze private sector capital and accelerate the goal of achieving universal electrification by reducing the need for government subsidies. On the agriculture side, the DREAM project is estimated to make farmers 2 to 3 times more productive by availing water for irrigation throughout the years as opposed to farming once a year during the rainy season. The availability of water will also enable high value horticulture farming in some ACCS which is expected to substantially increase income for farmers. In addition to farming, renewable energy powered irrigation systems can make clean drinking water available for the rural community. Overall, the DREAM project is expected to positively impact and benefit more than 2.5 million people by delivering clean and reliable energy, large scale irrigation for farming and food security as well as clean drinking water.

5. Energy Balance and Electricity Statistics

The Energy Balance which is shown in below table describes the Supply and Final uses of Energy and different types of fuels. Total primary energy requirement also known as Total Primary Energy Supply, is obtained as the sum of indigenous production (Fuel wood, Hydro and Charcoal) and Imports of fossil fuel product (Hard coal, lignite and peat, Light, Heavy and Other petroleum products, and LPG).

The 2023/24 (2016 E.C) Energy Balance of Ethiopia in Ktoe

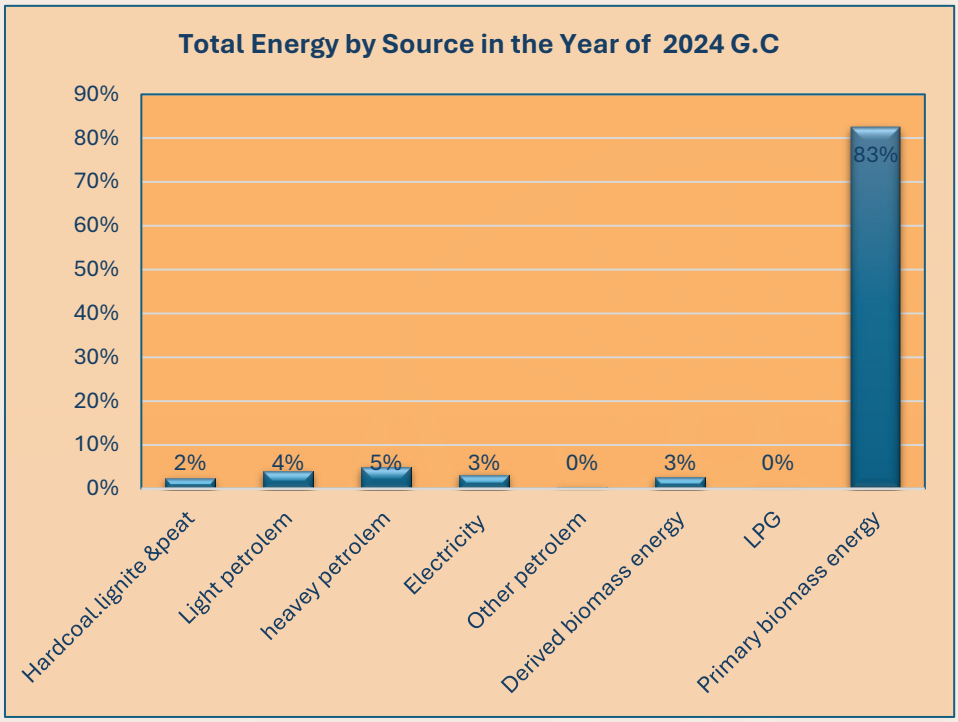
Item Unit: ktoe	Hard coal, lignite and peat	Light petroleum products	Heavy petroleum products	Other petroleum products	LPG and refinery gas	Electricity	Primary biomass energy	Derived biomass energy	Total energy
Production of primary energy	849					1767	42143		44759
Imports	328	2074	2550	230	11				5193
Exports						-144			-144
Stock changes	0	-18	-41	1	0				-58
Total energy requirements	1177	2056	2509	231	11	1623	42143		49750
Energy converted		0	0			4	-3866	1315	-2547
Electric power plants		0	0			4			4
Other conversion industries							-3866	1315	-2551
Consumption by energy sector						-5			-5
Losses in transport and distribution						-354			-354
Statistical differences	-3	22	0	0	0	-121	0	-4	-106
Final consumption	1174	2053	2565	231	11	1144	38277	1312	46767
By industry and construction	1174	66	74	231		288			1833
Other industry and construction	1174	66	74	231		288			1833
By transport		1874	2491			4	9		4378
Road		770	2491				9		3270
Rail						4			4
Air		1104							1104
By households and other consum.		113			11	852	38268	1312	40556
Households		113			11	591	37764	1246	39725
Agriculture									
Other consumers						261	504	66	831

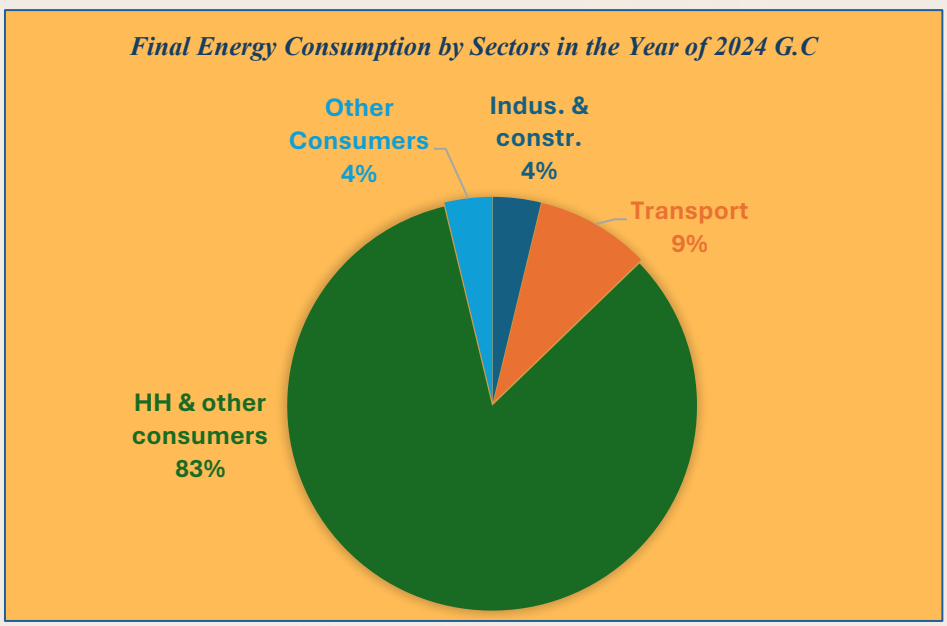
E.C = Ethiopian Calendar

Ktoe = Kilo Tone of Oil Equivalent

Ethiopian Electricity Statistics for Years 2013/14 - 2023/24 (Years 2006 - 2016 EFY)

Item	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Production, trade and consumption	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh
Total public and self-producer	8,692	9,515	10,461	12,535	13,214	14,503	15,192	15,762	15,472	17,709	20,596
Hydro	8,500	9,013	9,674	11,753	12,681	13,655	14,404	14,943	14,882	17,126	19,870
Wind	192	499	786	782	533	848	609	818	561	576	685
Thermal		3	1				179	1	29	7	41
Total public	8,692	9,515	10,461	12,535	13,214	14,503	15,192	15,762	15,472	17,709	20,596
Hydro	8,500	9,013	9,674	11,753	12,681	13,655	14,404	14,943	14,882	17,126	19,870
Wind	192	499	786	782	533	848	609	818	561	576	685
Thermal		3	1				179	1	29	7	41
Station use and station loss		10	38	50	21	41	51	58	55	60	63
Net production	8,692	9,505	10,423	12,485	13,193	14,462	15,141	15,704	15,417	17,649	20,533
Exports	740	712	166	1,303	1,432	1,000	1,000	1,637	1,671	1,725	1,671
Losses in conversion and distrib.	2,317	2,143	2,085	2,597	2,945	3,171	3,208	3,051	3,514	3,733	4,819
Consumption	5,635	6,650	8,172	8,585	8,816	10,291	10,933	11,016	10,232	12,191	14,043
By industry and construction	2,090	2,546	4,797	2,142	2,732	2,837	2,500	2,558	2,824	3,211	3,555
By transport									68	43	46
By households and other cons.	3,545	4,104	5,513	6,443	6,510	7,721	8,433	8,458	7,340	8,937	10,442
Net installed capacity	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW
Total public and self-producer	2,223	2,223	4,177	4,227	4,226	4,227	4,235	4,448	5,176	5,217	5,656
Hydro	1,940	1,940	3,813	3,816	3,815	3,816	3,816	4,070	4,820	4,821	5,220
Wind	171	171	324	324	324	324	332	338	331	371	411
Thermal	112	112	40	87	87	87	87	40	25	25	25
Total public	2,223	2,223	4,177	4,227	4,226	4,227	4,235	4,448	5,176	5,217	5,656
Hydro	1,940	1,940	3,813	3,816	3,815	3,816	3,816	4,070	4,820	4,821	5,220
Wind	171	171	324	324	324	324	332	338	331	371	411
Thermal	112	112	40	87	87	87	87	40	25	25	25
Thermal power plant input	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ
Total input		35	11	1					2	3	3
Total production		12	4	0			646		105	24	148
Estimated efficiency (% of production to input)		34	36				646		5250	800	4933


Total Energy by Source in the Year of 2024 G.C
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2%
4%
5%
3%
0%
3%
0%
83%
Hardcoal,lignite &peat
Light petrolem
heavey petrolem
Electricity
Other petrolem
Derived biomass energy
LPG
Primary biomass energy


Final Energy Consumption by Sectors in the Year of 2024 G.C
Other Consumers 4%
Indus. & constr. 4%
Transport 9%
HH & other consumers 83%

Annex I: MTF Survey Results for Access to Modern Energy Cooking Solutions

- *63.3% of households use a three-stone stove as their primary cooking solution.*
- *Only 4.1% of households use a clean stove with electricity as a fuel. The penetration of electric stoves is higher in urban areas (15.3%) than in rural areas(0.6%).*
- *51.5% of households use a three-stone stove exclusively, while only 2.4% use a clean fuel stove exclusively.*
- *Stove stacking (use of multiple stove types) occurs in 27.2% of households.*
- *Only 18.2% of households use a manufactured stove, despite high willingness to pay for such a stove: 62.2% of households are willing to pay full price upfront for manufactured stove, and 28% of households are willing to pay full price with a 6- to 24-month payment plan.*
- *Of the households that use a biomass stove, 64.3% have poor ventilation—they cook indoors with no exhaust system and two or fewer doors or windows in the cooking space.*
- *53.3% of households—including 59.1% of rural households and 32% of urban households—spend more than 7 hours a week acquiring (through collection or purchase) fuel and more than 15 minutes preparing the stove for each meal.*
- *28.4% of households use more than 5% of their monthly spending for fuel.*
- *62.2% of households are willing to pay full price upfront for an improved charcoal stove.*

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MINISTRY OF WATER AND ENERGY

የኢትዮጵያ ፌዴራላዊ ዴሞክራሲያዊ ሪፐብሊክ | Federal Democratic Republic of Ethiopia