

Federal Democratic Republic of Ethiopia

Ministry of Water, Irrigation and Energy(MoWIE)

**PRESENTATION ON HIGHLIGHTS OF THE ETHIOPIAN
ENERGY SECTOR**

WAY OF PRESENTATION: ONLINE

ORGANIZED BY JAPAN GOVERNEMENT

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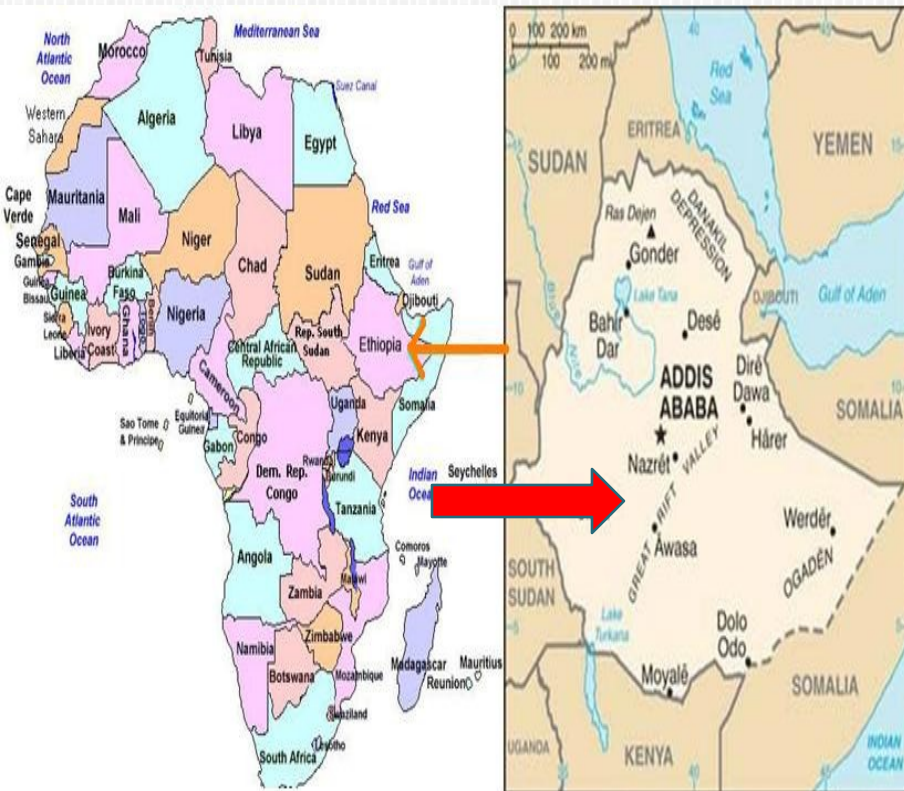
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Outline

- Country Overview
- Energy Status General Highlight
 - Resource Potential
 - Demand, Supply and Consumption
 - Institutional Arrangement
 - Policy and Regulatory Framework
 - National Electrification Program(NEP)
 - Programs (NEP I & II, GTP II and GTP III) to increase the generation
- Gaps/Challenges in the Energy Sector
- Conclusion

ETHIOPIA -COUNTRY OVERVIEW



- Country in the horn of Africa
 - Arable Land : 45%
 - Irrigable Area: 10 million hectares
 - Irrigated land: 3%
- Total area - 1.14 million square km
- Ethiopian population is **currently at 112+ million(according to 2020 population projection data)**
- Population growth rate - **2.6 % per year**

- >90% of power generation in Ethiopia is based on hydropower resources
- Per Capita energy consumption has **increased from 41kWh in 2008 to more than 90kWh in 2018**

Key economic figures of Ethiopia

Economic indicators	Values
GDP (2018)	US\$83.84 billion
GDP growth (2016, 2017, 2018)	+7.6%, +10.2%, +7.5%
Population (2018, 2019, 2020)	108 million
Inflation rate (2018 consumer prices)	12.7%
Overall access to electricity (2017)	45%
Access to electricity in urban areas	85%
Access to electricity in rural areas	29%
Power consumption per capita (2017)	77 kWh
CO₂ emissions (metric tons of CO₂ equivalent, 2018)	14
Annual per capita energy consumption (2020)	1,269 kWh
Transmission and distribution infrastructure coverage (2019)	44%
Combined transmission and distribution loss (2020)	18%
Transmission loss	3%
Distribution loss	15%
Electricity production (2015, 2018, 2019, 2020)	11.15 TWh
Electricity export (2015, 2018, 2019, 2020)	166 GWh

Energy Resource Potentials

- Hydropower potential 45,000 MW
- Geothermal potential $\sim 10,000$ MW
- Solar energy potential 5.5 kWh /sq. m/day – annual average daily irradiation
- Average wind speed > 7 meter/second at 50 m above ground level – 1,350 GW
- Wood – 1,120 million tones (annually exploitable)
- Agro-waste – 15 to 20 million tones (annually exploitable)
- Natural gas - 4 TCF (113 billion m³)
- Coal > 300 million tones.
- Oil shale – 253 million tones

Sector Snapshot

Potential

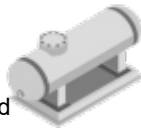
- Average irradiance 5.5 kWh/m²/day
- Solar energy reserve of more than 2 trillion MWh p.a.
- High PV potential: nationwide grid connection is about 6%.



- Exploitable hydropower reserve of 45,000 MW.
- Small scale hydropower is estimated to be 7% of the total hydropower potential (3000MW).



- Geothermal potential of 10 GW
- 2,500 MW to be developed by 2030
- All geothermal resource zones located within the Rift Valley system.



- Average wind speeds > 7 m/sec at 50 m above ground level
- Expansion of national wind power capacity to 5,200 MW by 2020 - to be developed by IPPs



Generation

4,300 MW
Total Installed Capacity

0%
Of supply is generated by IPPs

Electric power generation by source



Consumption

25% Electrification Rate

85% Urban Access

5.3% Rural Access

2491 MW Peak Demand

19% Demand Growth per Annum

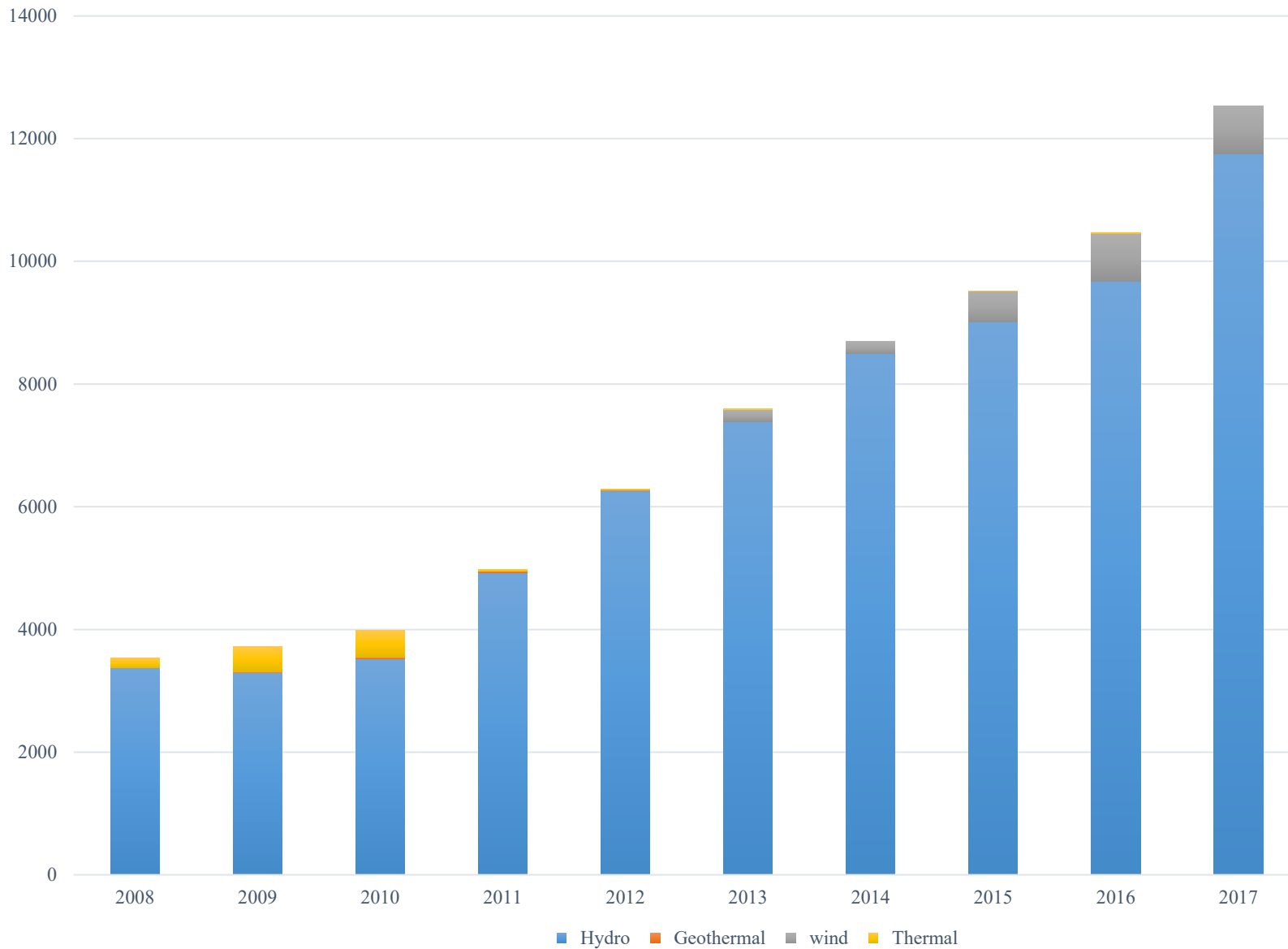
Overview of the energy sector

- Generation capacity in the grid – 4,284 MW
- Hydro – 3,810 MW ~ **88.5%**
- Wind – 324 MW ~ **7.6%**)
- Geothermal – 7 MW ~ **0.1%**)
- Diesel – 143 MW ~ **3-3%**, HV transmission line length > 12,800 km
- Power substations – 163MV & LV distribution line length > 160,000 km
- Electrified towns > 5,000, Customers more than 2 .5 million
- All energy production add up to 15,648.77GWh
- In 2016/17, 12, 535.16 GWh net energy production has been registered
- Electric Energy Consumption Tariff before the 2018/19 new tariff adjustment was 0.012USD/kwh which is 0.276 Birr/kwh.

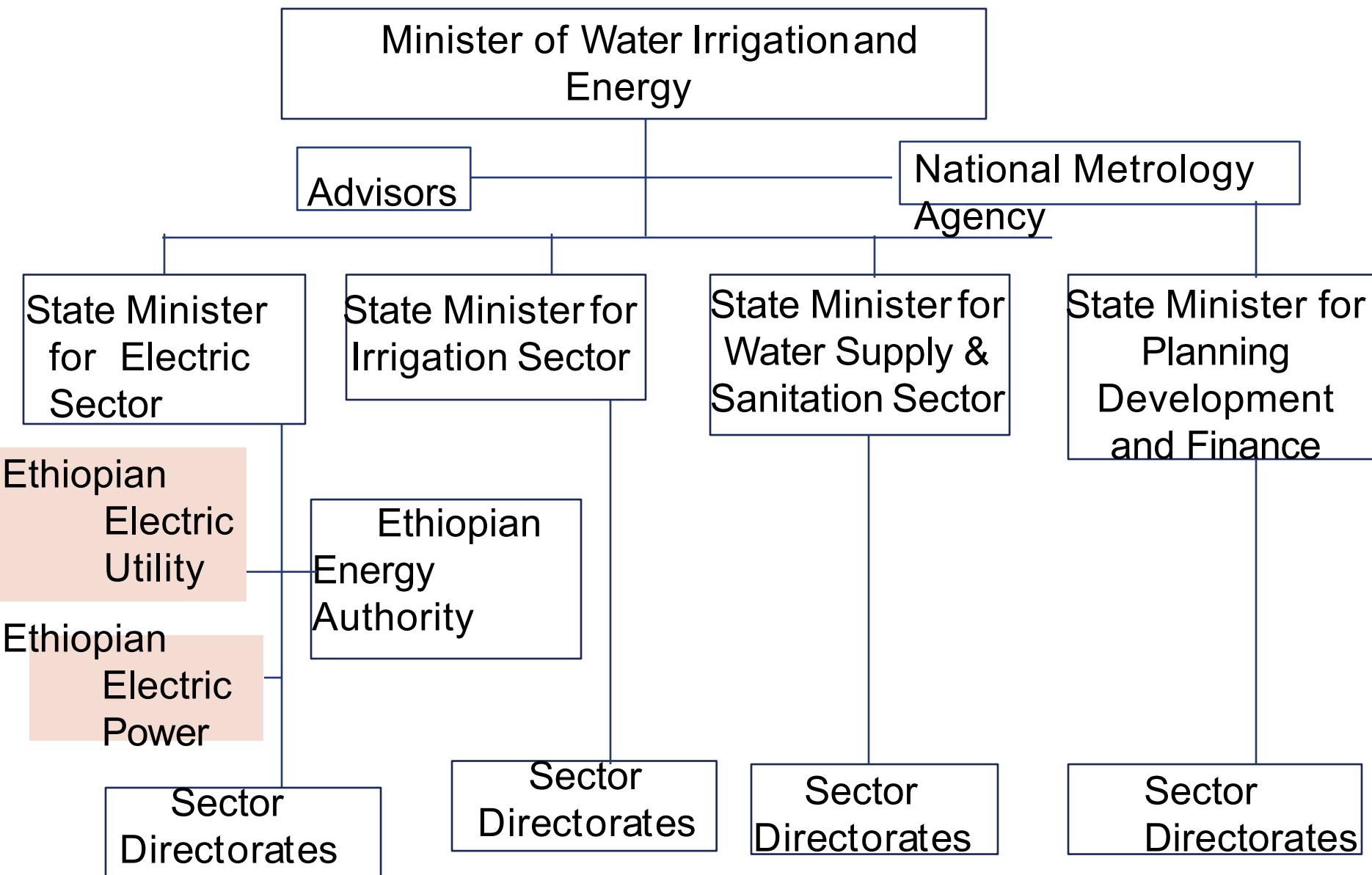
Base Case – Installed Capacity by Year and Resource Type (MW)

Plant Type	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Hydro	3779	4529	4529	6942	10478	12920	14103	14103	14103	14570	14570	14570
Diesel	46	46	46	46	0	0	0	0	0	0	0	0
Sugar	276	276	496	496	496	496	496	496	496	496	496	496
Wind	324	444	544	544	544	544	544	544	544	544	544	544
Solar	0	350	850	1950	1950	1950	1950	1950	1950	1950	1950	1950
Geothermal	10	30	80	230	400	600	850	1050	1050	1050	1050	1050
Waste-to-energy	25	25	25	25	25	25	25	25	25	25	25	25
Total Capacity	4459	5699	6569	10232	13893	16535	17968	18168	18168	18635	18635	18635

ELECTRICITY PRODUCTION(GWH)



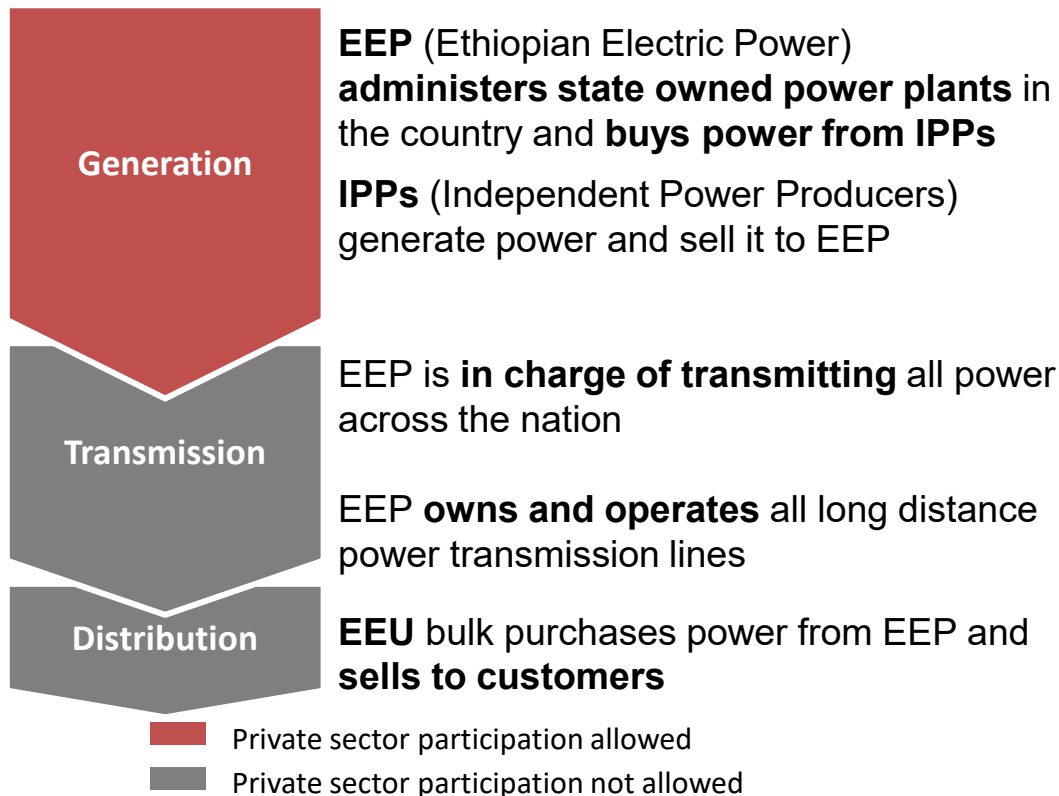
Institutional Framework...Cont'd



The Ethiopian Energy Sector at a Glance

Private sector participation is allowed for on-grid power generation

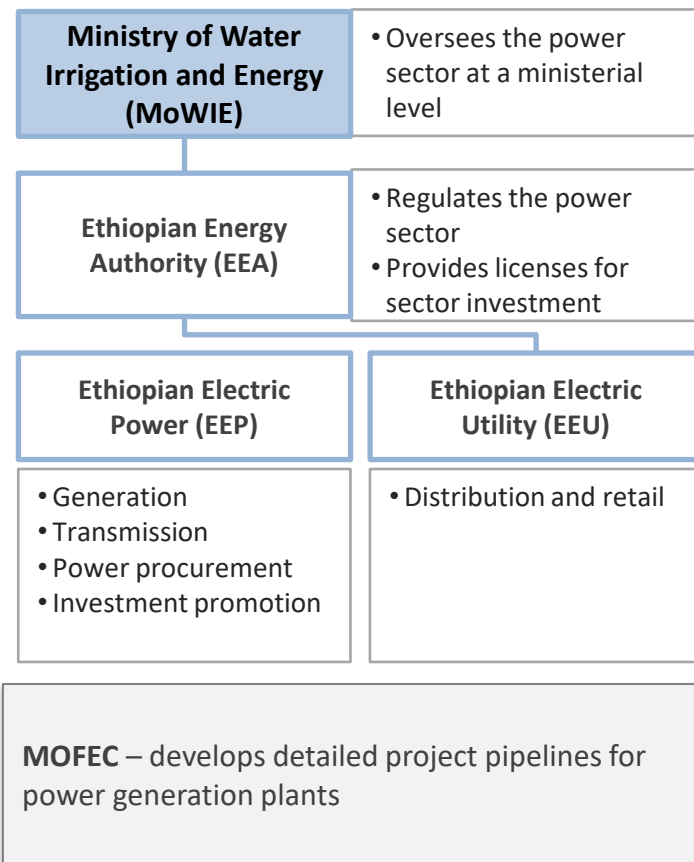
Overview of actors and respective duties along the power supply value chain in Ethiopia



Off-grid transmission and distribution are open for private investors

MOWIE oversees the power sector and EEA serves as the regulator

Institutional framework of the Ethiopian power sector



Policy, Strategy and GDP of the Energy Sector

- Energy Policy
- Climate Resilient Green Economy (CRGE) Strategy
- Growth and Transformation Plan I(GDP I)
- Growth and Transformation Plan II(GDP I)
- Universal Electricity Access program(UEAP)
 - UEAP Phase I(2005 – 2010),
 - Now also called NEP 1 and NEP 2

This Program divided in GTP I (from 2010 – 2015) and GTP II(from 2015 -2020)

- In 2021, 5 years and 10 years national draft strategic plan are already done.

ENERGY POLICY FRAMEWORK

The National Energy Policy-has the following main objectives,

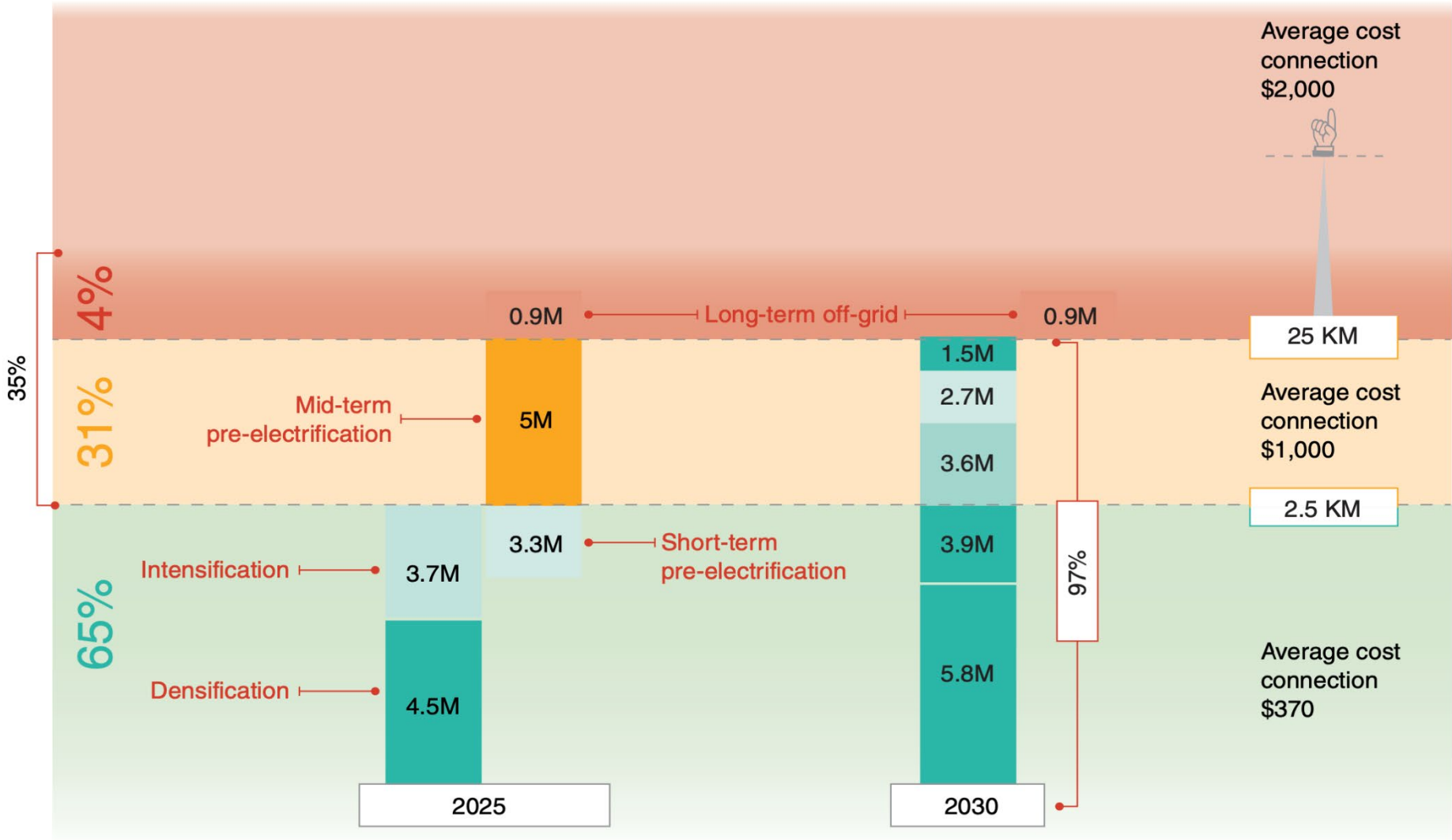
Revised now in 2018

- Giving high priority to RE Development and follows climate resilient green economy strategy
- Considers Hydropower as the backbone of the country's energy generation and maximize its utilization ;
- Promoting and enhancing other renewable energy sources development to increase RE mix there by Improving security and reliability of energy supply
- To be a hub for clean energy for regional and global cooperation
- Promoting efficient, clean, and appropriate, affordable and adequate energy technologies and conservation measures.
- Improving the energy efficiency of systems and operations.
- Exploring for natural gas and other hydrocarbon fuels
- Encourages and strengthening Public-Private Partnership in energy generation

Energy Sector Strategy and Program Highlight

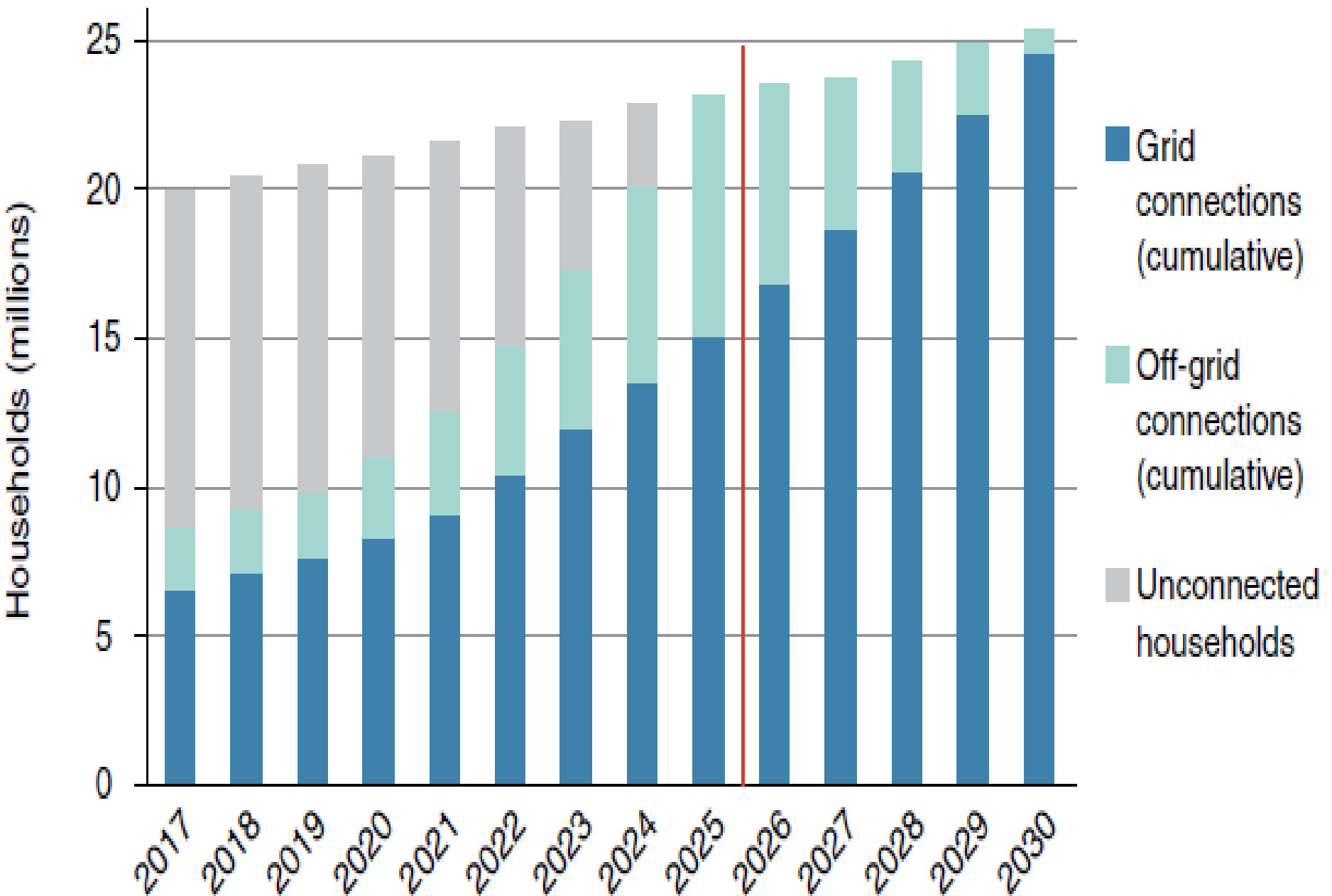
- A total of 44 percent of its population in 2020; and among this 33 percent of its population with on-grid electrification and 11 percent with off-grid electrification.
- According to National Electrification Program 2 (NEP 2), rural and urban electricity access is targeted to achieve 100 percent by 2025.
- Moreover, the NEP 2 focuses on the integrated- grid and off-grid electricity access and is implementing to achieve 65 percent of on-grid and 35 percent of off-grid access by 2025

Opportunities- The National Electrification Program 2.0

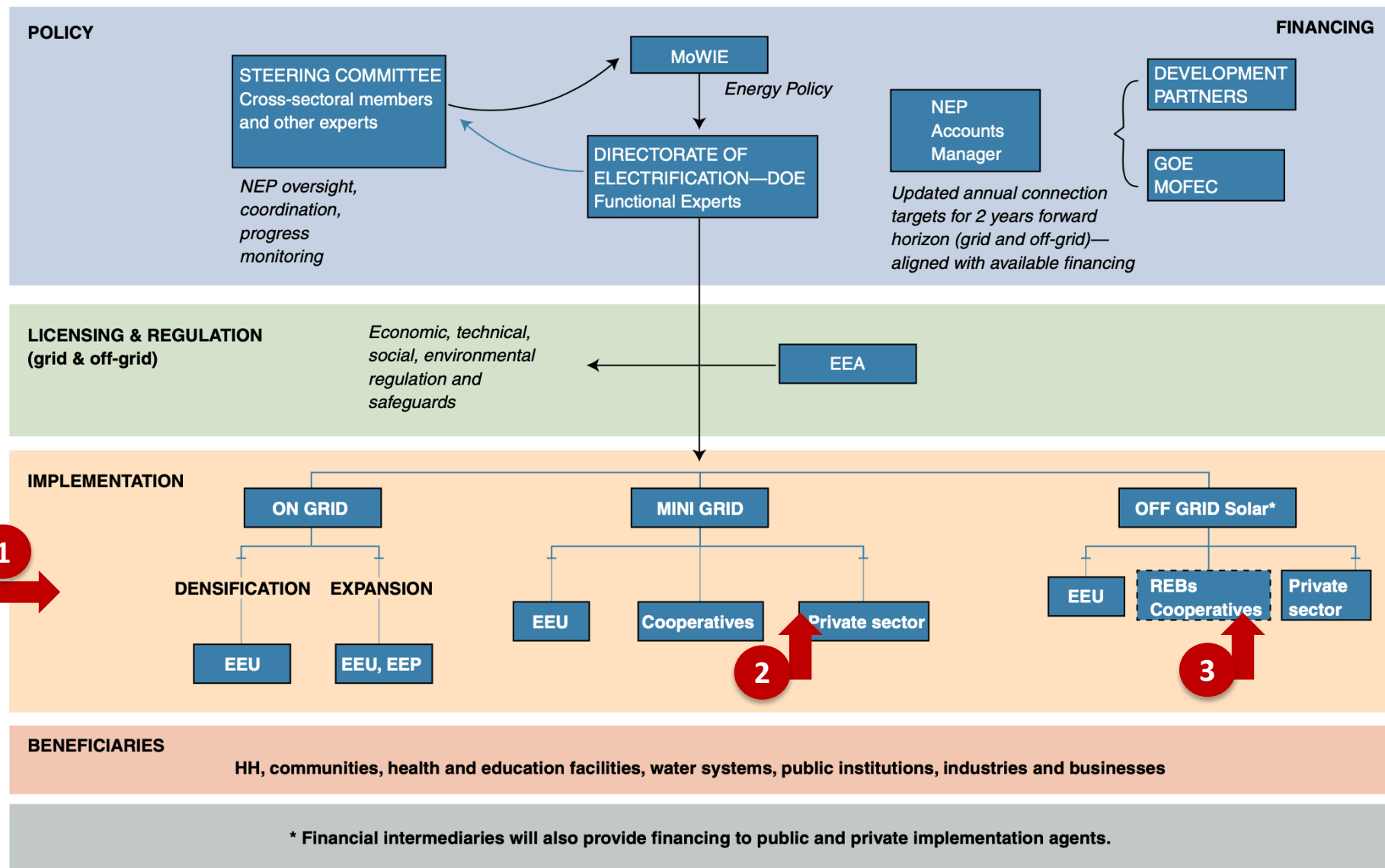


The National Electrification Program 2.0 expects around 35% **off-grid access** by 2025

NEP GRID AND OFF-GRID CONNECTIONS ROLLOUT



Opportunities – Private Sector Involvement



The Private Sector is expected to help the Energy Sector in **three main points** of entry as indicated above

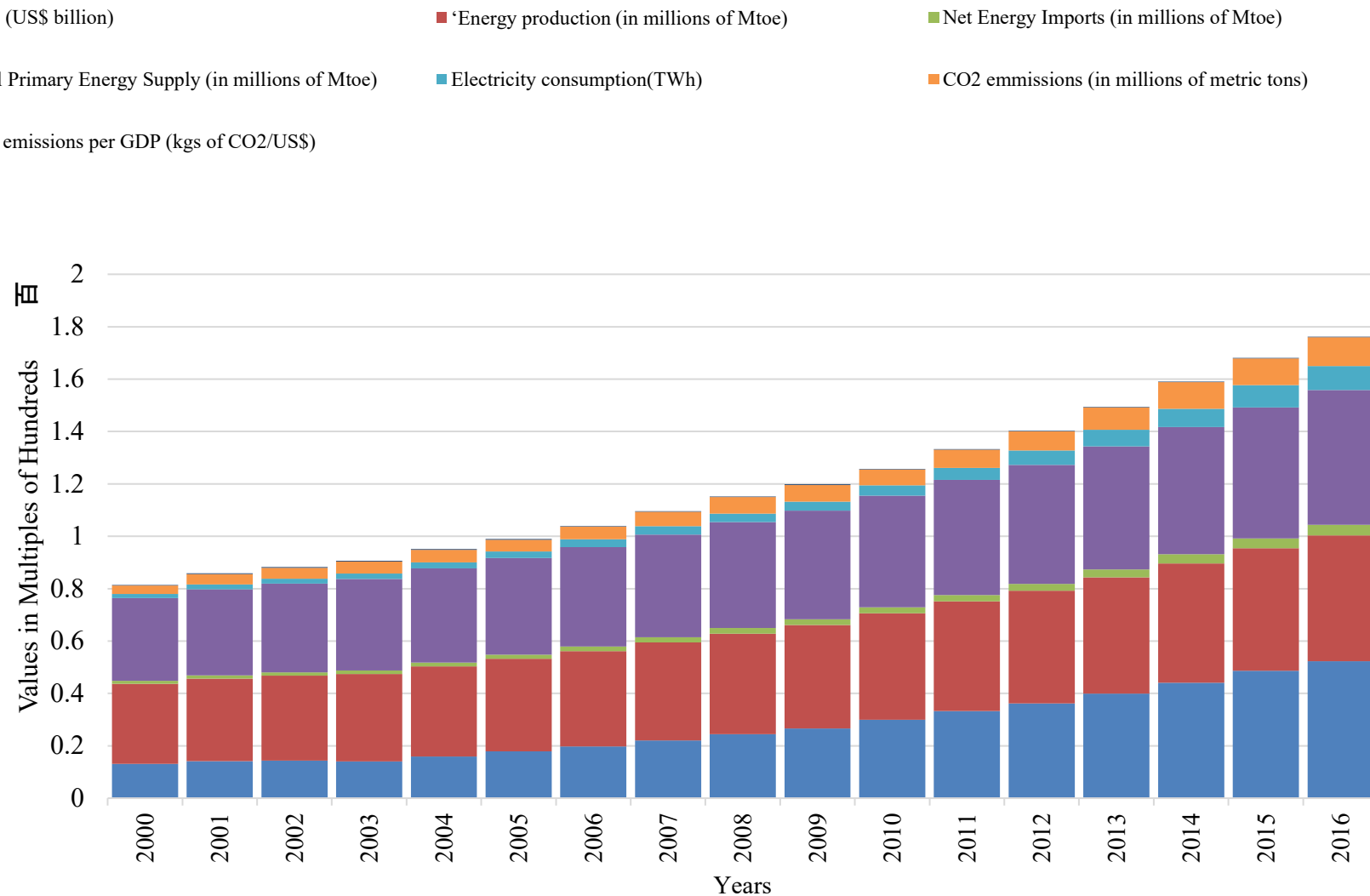
Energy, Environment, and Economic Development

- ❑ The country has undergone huge structural and economic changes even so; it has experienced high economic growth, averaging 10.9 percent a year from 2005 to 2015 (compared to the regional average of 5.4 percent)
- ❑ According to the annual report of the National Bank of Ethiopia, the Ethiopian economy showed 9 percent growth in 2018/2019; this included an increase of 12.6 percent in the industrial sector, whose share in national GDP was 28.1 percent, considerably lower than that of the service sector (40.0 percent) and agriculture (33.3 percent)
- ❑ The country has made several policy efforts to mitigate carbon emissions; these include, the Ethiopian National Energy Policy (2nd Draft) of 2018, the CRGE strategy, and the Growth and Transformation (GTP) I (2010–2015) and GTP II (2016–2020) policies
- ❑ The GoE also intends to, by 2030, curb its greenhouse gas (GHG) emissions to 145 million MtCO₂e (metric tons of CO₂ equivalent), in line with the 255 million MtCO₂e reductions that are projected for business-as-usual emissions with the integration of the CRGE strategy and GTP II.
- ❑ The GTP II aims at achieving a carbon neutral economy. At a current per capita rate of 1.8 tCO₂e, Ethiopia's GHG emissions are not high compared to the global average; however, achieving its target of 1.1 tCO₂e per capita by 2030 is a priority concern

Energy Sector Strategy and Program Highlight...Cont'd

- According to the country's new 10th years draft strategy document, GTP III (2020 – 2031),
- More than 95 percent electricity coverage will be achieved by the end of 2031 by increasing the national grid access from 34 percent in 2020 to 96 percent in 2031; and decreasing off-grid access from 11 percent in 2020 to 4 percent in 2031.
- Also, increasing the power generation capacity from 4.5 GW in 2020 to 21.2 GW in 2031; from these values the share of power generation from hydropower will be decreased from 92.6 percent in 2020 to 75.9 percent in 2031; the share of geothermal will be increased from 1 percent in 2020 to 3.8 percent in 2031.
- Further more, the strategy document stated that increasing and expanding high voltage lines from 19.6 thousand kilometers in 2020 to 24.5 thousand kilometers in 2031 will be the other target of the sector by increasing the number of substations from 180 in 2020 to 230 in 2031.
- The 10th years strategy document, GTP III (2020 – 2031) also explained that the involvement and participation of private sectors will be crucial to increase the generation capacity, national grid expansion and number of mini-grid from 14 in 2020 to 280 in 2031.

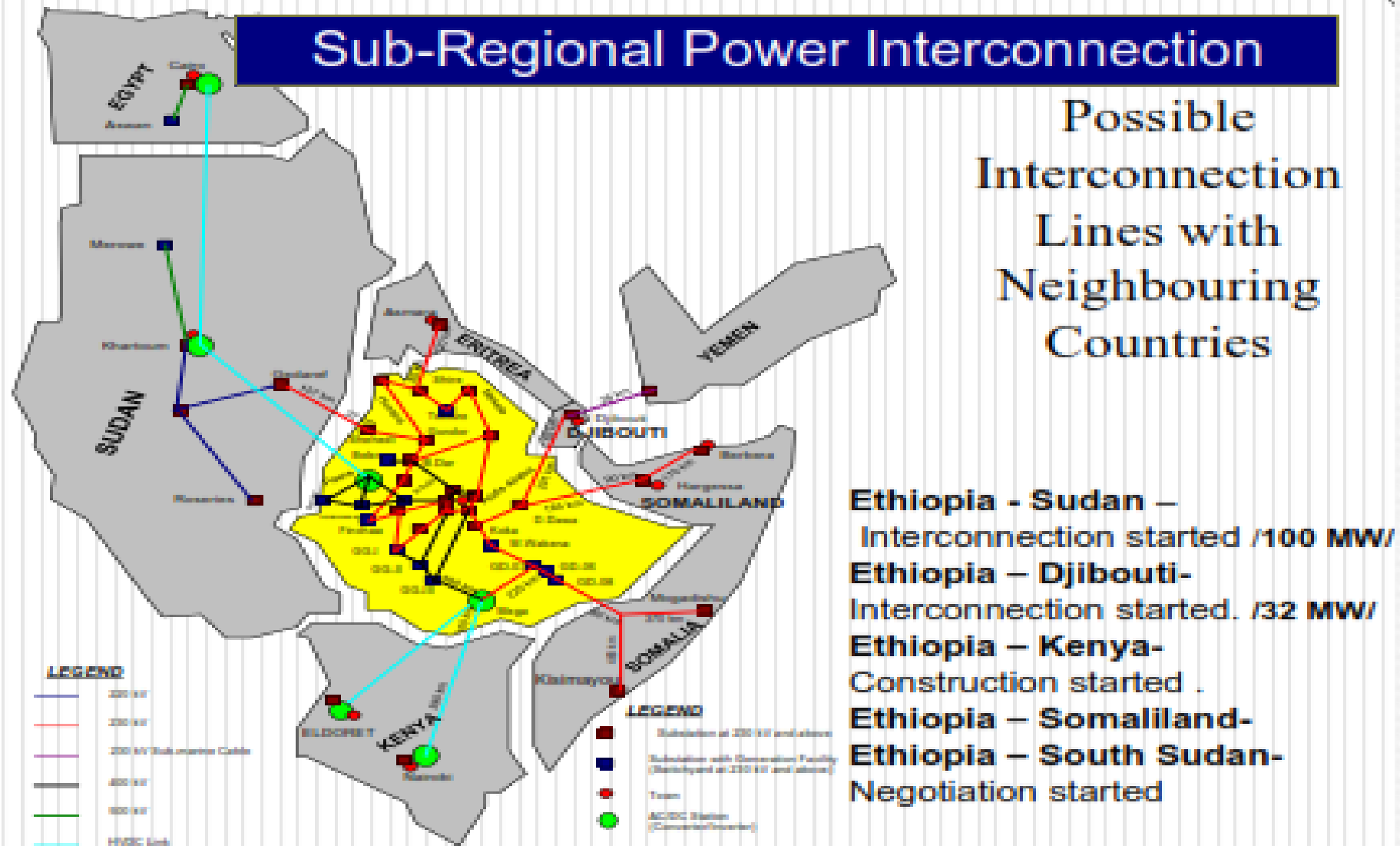
Figure 1. GDP, energy production, consumption, and CO₂ emissions in Ethiopia



Historical Data of Electricity

Year	Domestic	Commer cial	Low- voltage industrial	High voltage industrial	Total sales	Exports	Generation gross	Losses
2001	507.6	331.8	276.3	262.0	1,388	0	1,782	391
2002	568.7	383.8	301.0	330.9	1,597	0	1,976	377
2003	583.9	394.1	369.7	314.0	1,678	0	2,028	347
2004	638.0	446.8	346.9	364.4	1,817	0	2,278	456
2005	704.6	511.7	401.5	386.8	2,033	0	2,540	501
2006	759.8	562.0	494.1	468.1	2,316	0	2,845	523
2007	973.1	646.0	489.2	404.8	2,558	0	3,269	705
2008	971.4	701.1	575.6	507.0	2,795	0	3,502	700
2009	1192.7	632.5	519.5	543.0	2,906	0	3,665	751
2010	1350.3	724.6	562.9	588.7	3,247	0	3,946	692
2011	1541.7	1000.8	738.9	772.7	4,081	17	4,954	840
2012	2140.3	881.1	1057.3	560.4	4,659	332	6,277	1,252
2013	2056.7	1313.2	1263.1	876.2	5,537	563	7,576	1,434
2014	2356.1	1504.4	1447.0	1003.7	6,343	730	8,692	1,571
2015	2548.8	1627.5	1565.4	1085.9	6,862	762	9,515	1,837
2016	3050.7	1947.9	1873.6	1299.7	8,213	564	10,465	1,628
2017	3508.8	2240.4	2154.7	1494.6	9,445	1,305	12,540	1,719

The goal – to be a major exporter of electricity to the eastern Africa region



Gaps/Challenges to close

- Low Electricity Access: National Electric Access is 25% and must reach 100% by 2025..
- Poor Grid Service Quality Power interruptions are common and impair service reliability, the network must be rehabilitated with a modern Control Center.
- High Distribution Losses : distribution Losses, combining both technical and commercial losses, is nearly 20% (acceptable levels ~ 5 – 10%).
- Low Human Capacity: shortage of highly trained and skilled manpower in both technical and non-technical operations management.
- Low National Retail Tariff : the national retail tariff < \$0.03/kWh is a key hurdle to overall sector sustainability / bankability as it hinders cash generating ability of the utility
- Limited Private Sector Engagement: Private sector engagement in generation, transmission, and distribution has been limited
- Weak Research Capacity Development and institutional arrangement
- No separated Energy research Institute

Priority Areas for further study

- Ethiopian Energy Sector has many problems and bottlenecks, so it would better to study by considering each part because each problems are inter-related

Conclusion

Most of developing countries are dependent on traditional energy and transitioning is needed and needs are large, and especially in Ethiopia:

- Lack of modern energy is retarding economic growth, job creation, sustainable agriculture, health, education and constraint to 2030 Agenda for SD

- Ethiopia has large potential and investing significantly in energy generation and transmission is crucial

- Electrifying millions of households, remote communities and small-scale entrepreneurs remains challenge

- Off-grid household systems and mini-grids along side the national grid are key to create energy access

- Regional grid for regional RE, Energy Access and Integration, Federal and regional institutions, Universities, Private Sectors, Enabling Environment are essential for harnessing the huge resources and market



THANK YOU !!