Rural electrification

Ethiopia

Ethio Resource Group (ERG)
Getnet Tesfaye

May 2019 Hannover, Germany

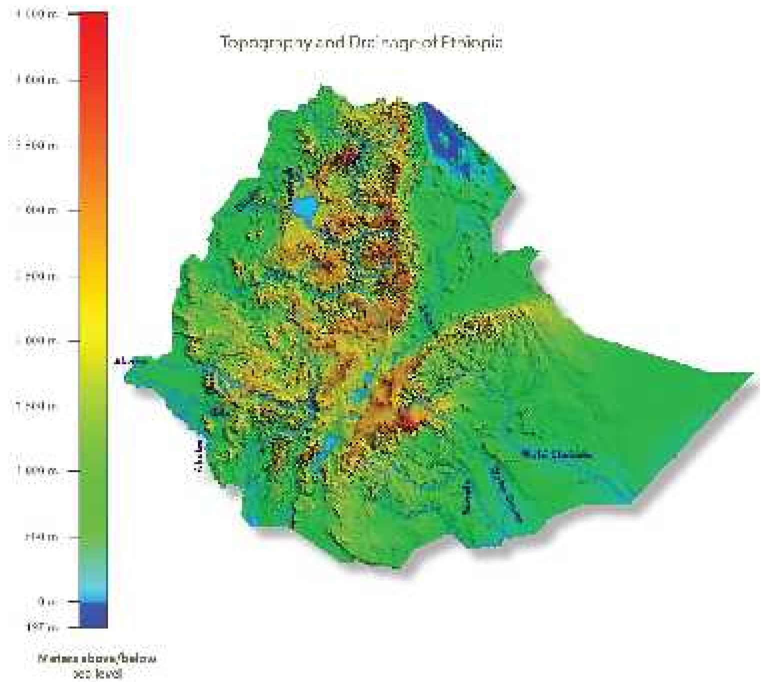
Ethiopia people, land

Population: 105 million (2.4% growth)

Surface area: 1.1 million km^2 (1/3 of area above 1500 masl)

Population density: 95/km^2 (2/3 live in 1/3 of area or highlands)

Urbanization: 20% (urb pop growth 4.7%, 80+ million live in rural areas)



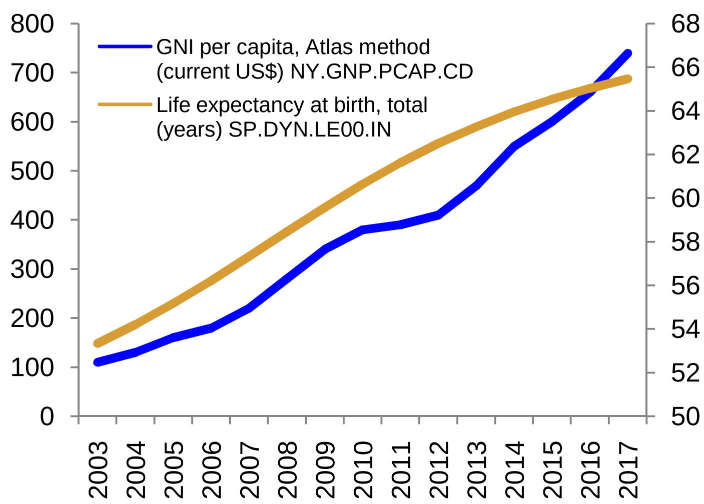
Ethiopia economy

Economy: $783/capita (35-40% agriculture, 23% industry & construction)

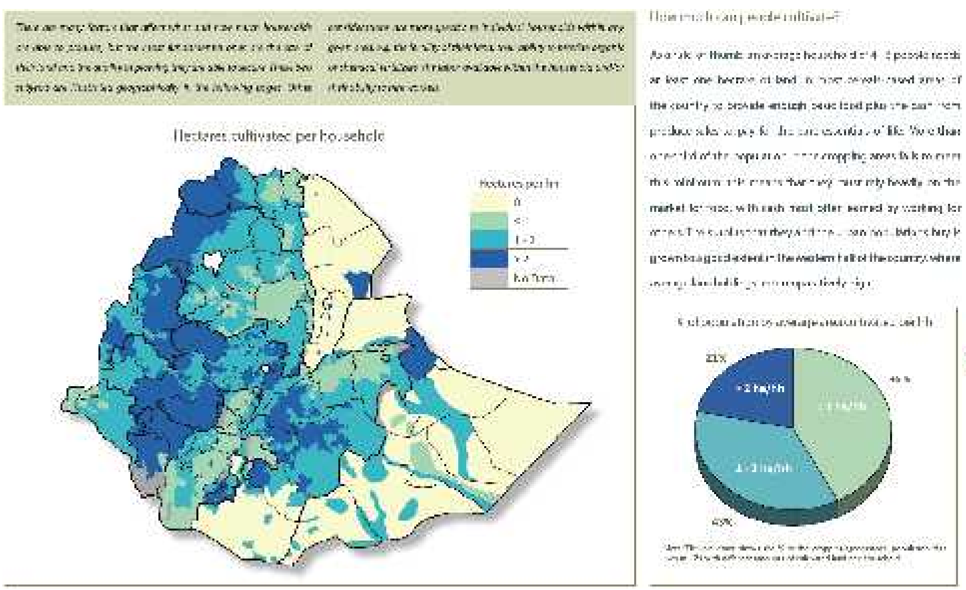
Employment: 72% of the population work in agriculture (72% of pop share in only 40% of the output)

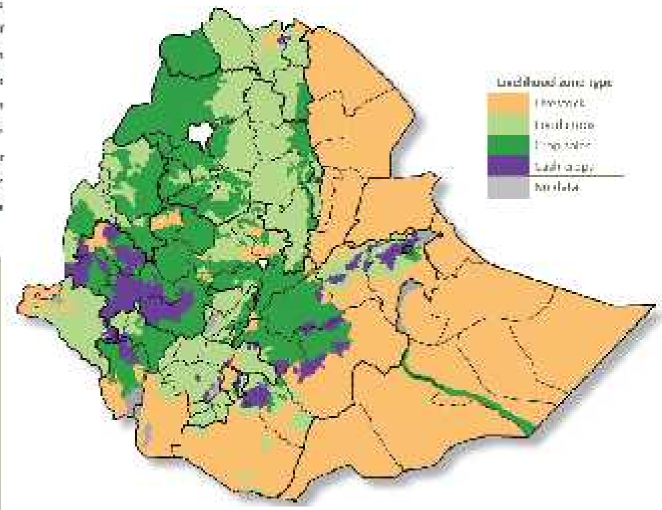
Economic growth: 10%/y (2006-2016, 7.7% in 2017)

Social indicators: rapid rise in life expectancy, health services, education



Ethiopia rural livelihoods



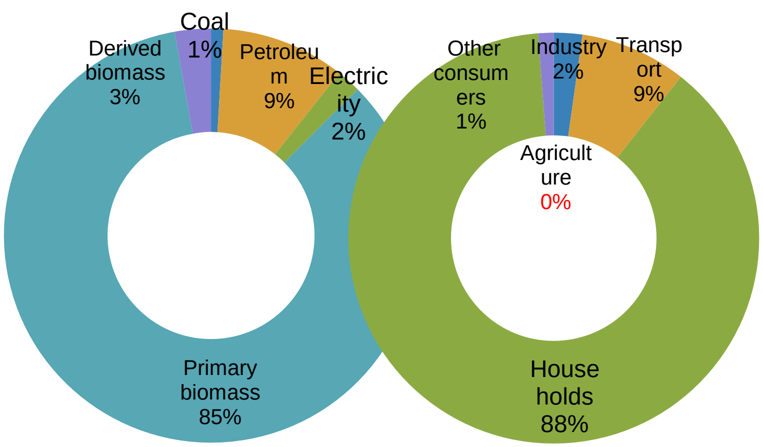


Energy supply

Energy consumed (2017): 39Mtoe

- **0.37 toe per capita**
- **85% in primary biomass** (wood, agri-residues) + **3% in derived biomass** (charcoal, ethanol)
- **9% petroleum, 1% coal**
- **2% electricity**

Biomass consumed in homes for cooking

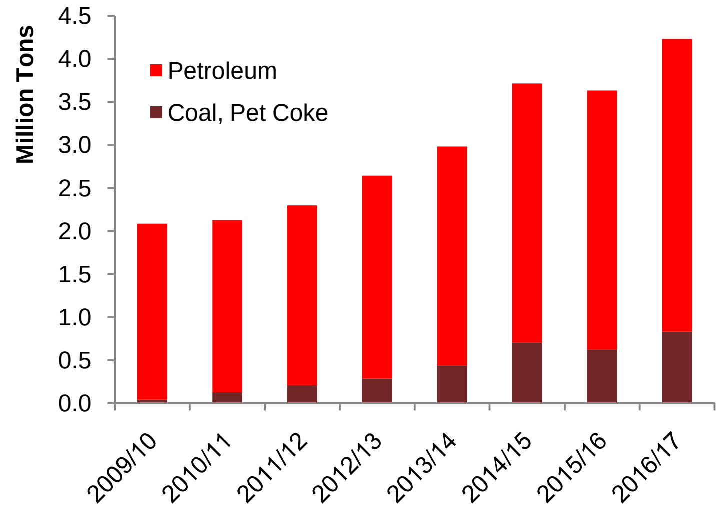


Energy use

Biomass:
- **0.9 t biomass per capita** (grows as fast as food consumption)

Hydrocarbons:
- **Consumed in transport** (liquid petroleum) **and industry** (coal, pet coke)
- 8%/y growth for petroleum, 30%+ growth for coal /pet coke

Electricity:
- **Consumed 42% by homes, 36% industry, 22% services**
- **Exported 10% of production**



Energy institutions

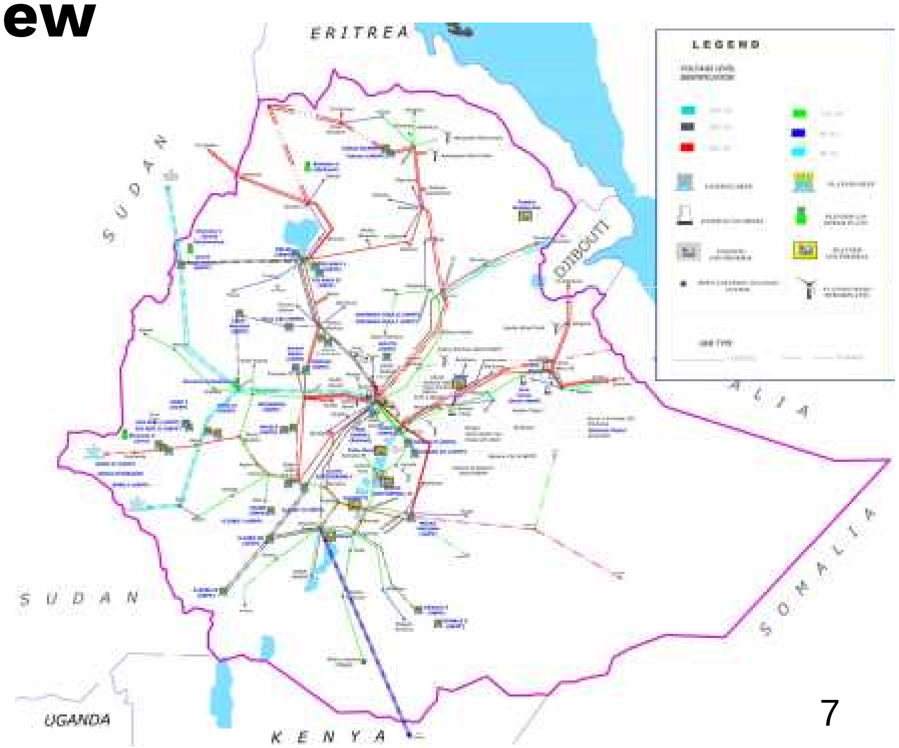
		Promotion, investment, operations	Policy	Regulation	Finance
Biomass		MOWIE, EFCCC, MOH	MOWIE, EFCCC	None	GOE, PE, bi/multilateral
Fossil fuels		Multinational Oil, MOMPNG	MOWIE, MOMPNG	MOMPNG, MOT	GOE, PE bi/multilateral
Electricity	Grid	EEP, EEU	MOWIE	EEA	GOE, bi/multi-lateral
	Mini grid	REF, EEU	MOWIE	EEA	EEU, Coop, PE
	Standalone	REF	MOWIE	EEA, ESA, MOT	GOE, PE, banks, MFIs, multilateral

Electricity overview

Power facilities in operation (2018)

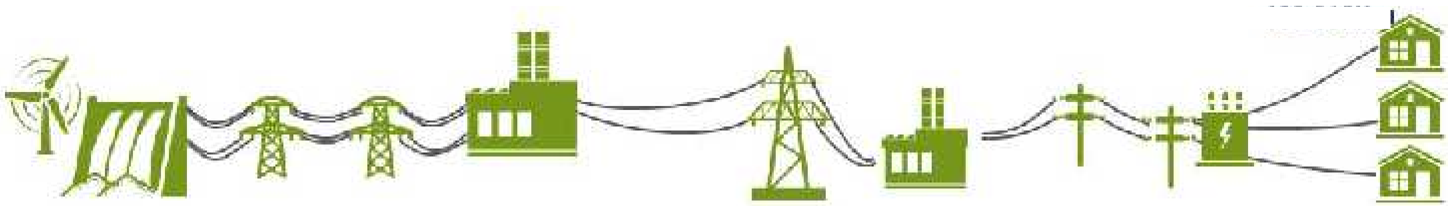
Type	Stations	Power (MW)	%
Hydro	12	3,816	90
Wind	3	324	8
Geothermal	1	7	0.2
Thermal	3	88	2
Total	**19**	**4,285**	**100%**

Peak	2.4 GW
Number of customers	2.5 millions+
Production	12.5 TWh
Consumption	8.6 TWh
Export	1.3 TWh
Tariff – residential (USc/kWh)	1.0 – 4.1
Tariff – industrial(USc/kWh)	1.8 – 2.1



Electricity facilities

Grid Layer	Generation	Transmission		Distribution			Last mile	
Step	Generation	Transmission lines	Transmission substations	Sub transmission lines	Distribution substations	Distribution lines	Transformers	Connections
Capability	3, 816 MW (Hydro) 324 MW (Wind) 7 MW (Geothermal) 88 MW (Thermal)	500 kV 400 kV 230 kV 132 kV		66 kV 45 kV		33 kV 15 kV		400 V 220 V
Status	4,285 MW	16,018 km	128	1,978 km	43	100,705 km	31,229	100,913 km 2.5 M cust



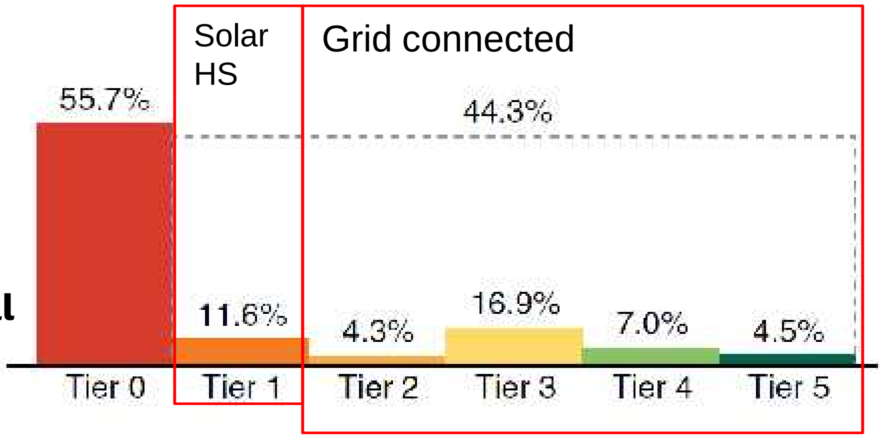
Electricity access

Access: 44% of households

- **33% connected to the grid**
- **11% served with off-grid** (mainly solar lanterns/home systems)

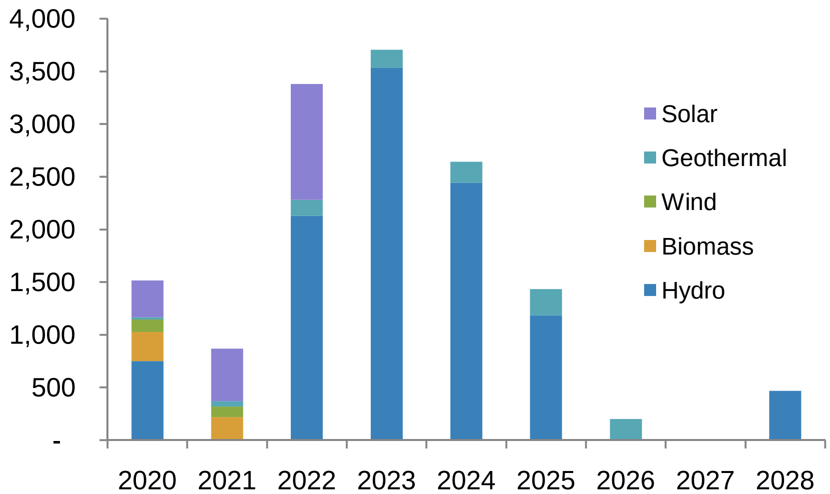
Electricity consumption level

- **86 kWh per capita (total)**
- **54 kWh per household (residential customers connected)**



Electricity plan for generation

Generation plan (MW)



COD Year	Units Added/Location	Number of Units	Total Capacity (MW)
2020	Sugar (Beles, Welkayt, Tendah Kasem)	8	275 (comm.)
	Gerd 1	2	750 (comm.)
	Ayisha wind 1	1	120 (comm.)
	Metehara solar 1	1	100 (comm.)
	Dichato solar	1	125 (comm.)
	GAD solar	1	125 (comm.)
	Corbetti geothermal 1	1	20 (comm.)
2021	Sugar (Omokuraz)	6	220 (comm.)
	Assela wind	1	100 (comm.)
	Tulu Moye geothermal 1	1	50 (comm.)
	Metehara solar 2	1	100
	Dire Dawa solar	2	200
	Jigga solar	2	200
2022	Corbetti geothermal 2	1	50 (comm.)
	Tulu Moye geothermal 2	1	100 (comm.)
	Koysha hydro	1	2,130 (comm.)
	Harar solar	2	200
	Weranfo solar	1	100
	Humera solar	2	200
	Metema solar	2	200
	Mekele solar	2	200
	Welenchiti solar	2	200
2023	Gerd 2	8	3,256 (comm.)
	Aluto Langano geothermal	1	70 (comm.)
	Yeda 1&2 hydro	1	280 (comm.)
	Tulu Moye geothermal 3	1	100 (comm.)
2024	Gerd 3	6	2,442 (comm.)
	Corbetti geothermal 3	1	200 (comm.)

Electricity plan for generation 2

- **The government is opting for IPPs for generation**
- **Created a PPP Directorate under the Minister of Finance**
- **Issued several generation tenders in the past three years** (hydro, geothermal, wind, solar)

THE Reporter

PPP approves six solar projects worthUSD 800 mil

19 January 2019

By Birhanu Fikade

A total of 16 PPP projectsslated to cost USD6.5bln

The newly formed Public Private Partnership (PPP) Board has approved six solar energy projects at a cost of USD 798 million with capacitytogenerate some 750 megawatt of electricity.

TeshomeTafesse (PhD), State Minister of Finance, told reporters on Thursdaythat the PPP Board has approved two of the six projects,and to receive term of proposal from international bidders. The remaining four will be receiving term of qualification for the foreseeable future considerations.

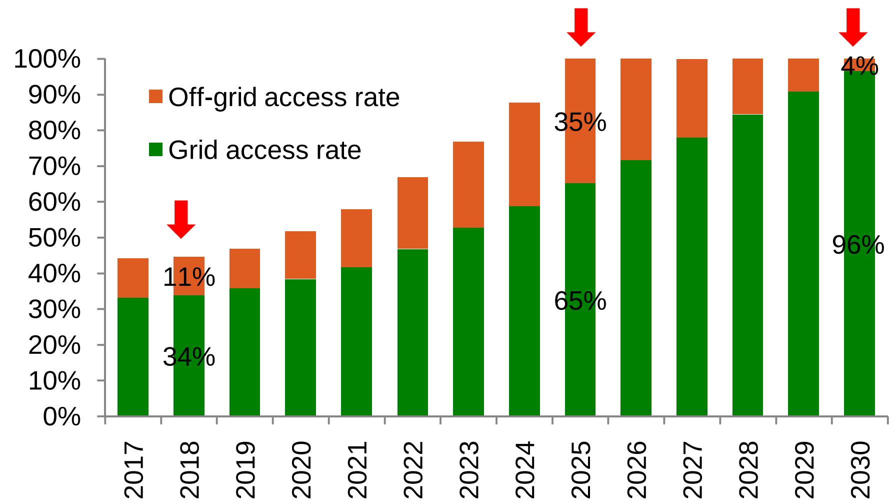
According to the state minister, the two solar projects which are about to be developed are located in the Afar and Somali Regional States. Both "Scaling Solar

Electricity plan for access

Plan for electricity access

Reach 100% access in 2025
(65% from grid, 35% off-grid)

Reach 96% grid access in 2030

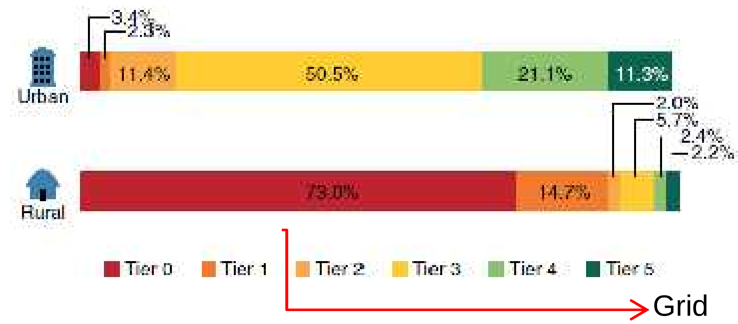


Rural electrification status

Rural households with access (2017) - 27% (12% from grid, 15% off-grid solar)

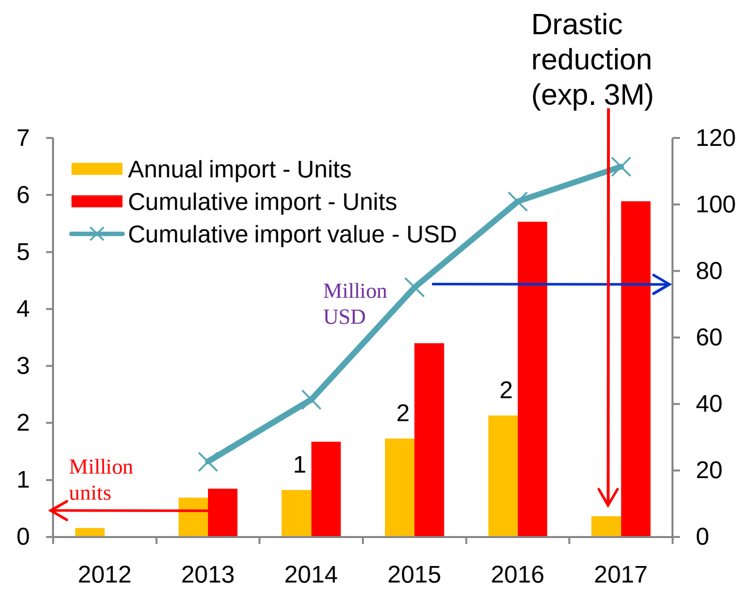
Those without access

- Households - 70M+
- MSEs - 100k+
- Social institutions (health, school) -1000s
- Smallholder agriculture



Rural electrification trends

- **Slow rate of rural customer connection** (although relatively successful area coverage; >50% of sub-district centers are connected to the grid)
- **Very fast off-grid access through solar lanterns/HS** (drastic fall in solar system sales in the past 2 years due to hard currency limitations, other factors)
- **Over the past five years, fuel based lighting has fast disappeared**



Rural electrification challenges

Grid

- Scattered settlements
- Low level of demand and paying capacity of consumers
- High distribution costs
- Investment for distribution
- Low tariffs
- Technical and management capability to build distribution as fast as desired

Off-grid – standalone

- Very limited consumer finance (cf with PAYGO East Africa)
- Finance for companies (+hard currency)
- Regulations – quality assurance, consumer warranties

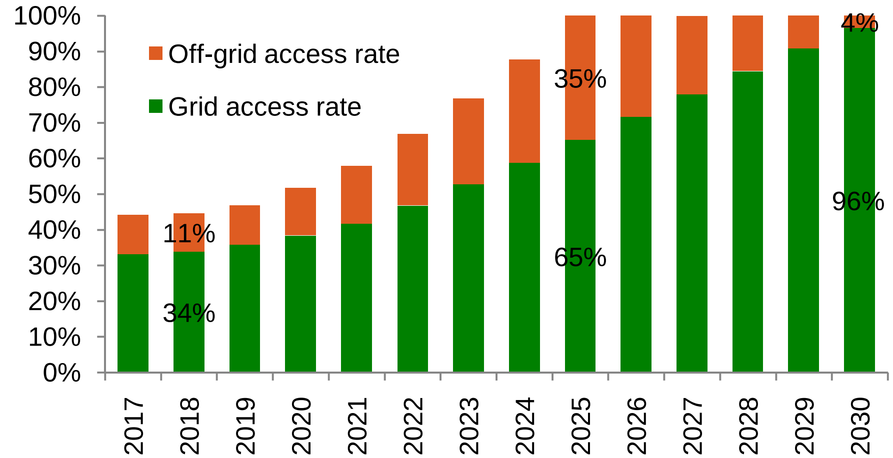
Off-grid – mini/micro-grids

- Regulations – regulations under development (no private operators)
- Low consumer concentrations, high distribution costs (sub-district centers covered by grid)

Rural electrification NEP

The new National Electrification Program (NEP2 : 2019)

- **Integrated plan for universal electrification**
- **100% access in 2025** (65% grid, 35% off-grid); 100% access for health facilities and schools
- **8.2M grid connections, 5.9M off-grid connections during 2019-2025**



Rural electrification NEP

Investment required

- USD 4.6 billion (56% on grid, 44% off-grid) during 2019-2015
- USD 3.1 billion sought from external sources

Figure ES.14 Breakdown of grid and off-grid investments and syndication scenarios for universal access, 2025

	Investment (US$ million)	GoE contribution (US$million)	Syndication (US$million)
A. Grid program			
Grid total investments* ($370/connection)	3,200		
Customer contribution (—)	(1,100)		
Total	**2,100**	**480**	**1,620**
B. Off-grid program			
Access to finance (with a revolving fund)	1,760	530	1,240
End-user subsidy	72	72	-
Social institutions	230	70	160
MST off-grid solar	133	41	92
Mini-grids (MST and EPC)[a]	300	280	20
Off-grid total investment syndication	**~2,500**	**~1,000**	**~1,500**
C. Program implementation support (grid and off-grid)	**50**	20	30
Total investment syndication (A + B + C)	**4,650**	**~1,500**	**~3,150**

MTF=Multi Tier Framework
MST=Minimum Subsidy Tender

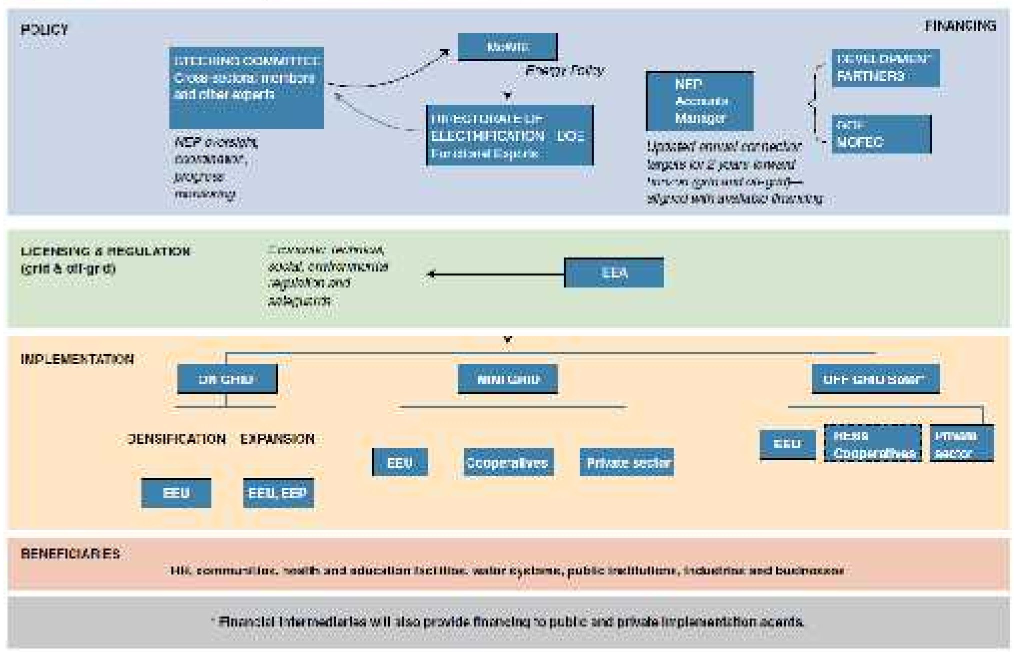
Rural electrification settlements

Amhara, East Gojam Zone, Baso ena Lisen Wereda,
Yedege Kebele [10.0869019 37.7672966]

Oromia, West Shewa Zone, Jeldu/Gojo Wereda,
Tulu Gura Kebele [9.164153 38.08337]

Rural electrification

Figure ES.12 The NEP Implementation Framework



Rural electrification challenges NEP

Finance - very high requirement (2/3 from external sources)

Capacity – 8.2M on grid, 5.9 off-grid connections in 6 years. Technical and management capacity for this low for grid connections.

Regulations (and private sector engagement) - private sector role in the grid plan? limited role for mini-grids

Thank you.