Ethiopia's Renewable Energy Power Potential and Development Opportunities.

Ministry of Water and Energy

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Brief Facts about Ethiopia

- Ethiopia - landlocked country in the Horn of Africa.
- Total area - 1.13 million square km.
- Population - 85 million (2.57% growth per annum).
- GDP at market value ~ 30 Billion USD (11% growth per annum)

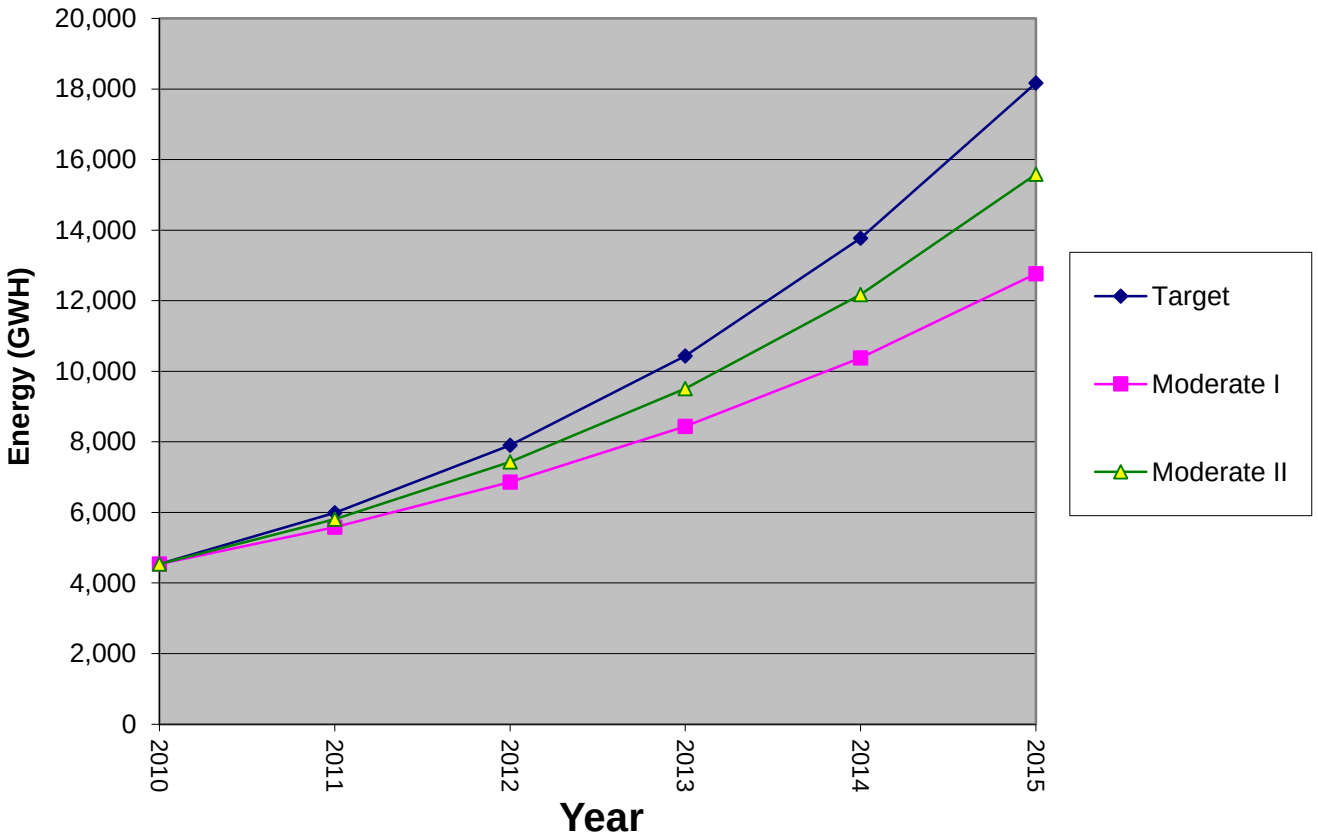
The Energy Situation

- ~ 90 % use traditional biomass for cooking
- 70 % use kerosene for lighting
- All hydrocarbon products are imported
- Grid accessible to 52 % of the population
- 2 million households connected to electricity
- Per capita electricity consumption 77 kWh/year
- System installed capacity ~ 2167 MW
  - Hydropower (94%)
  - Wind and Geothermal (4%)
  - Diesel stand by (2%)
- 6,210 GWh generated in 2011/2012 f.y.

The Energy Resource Potential

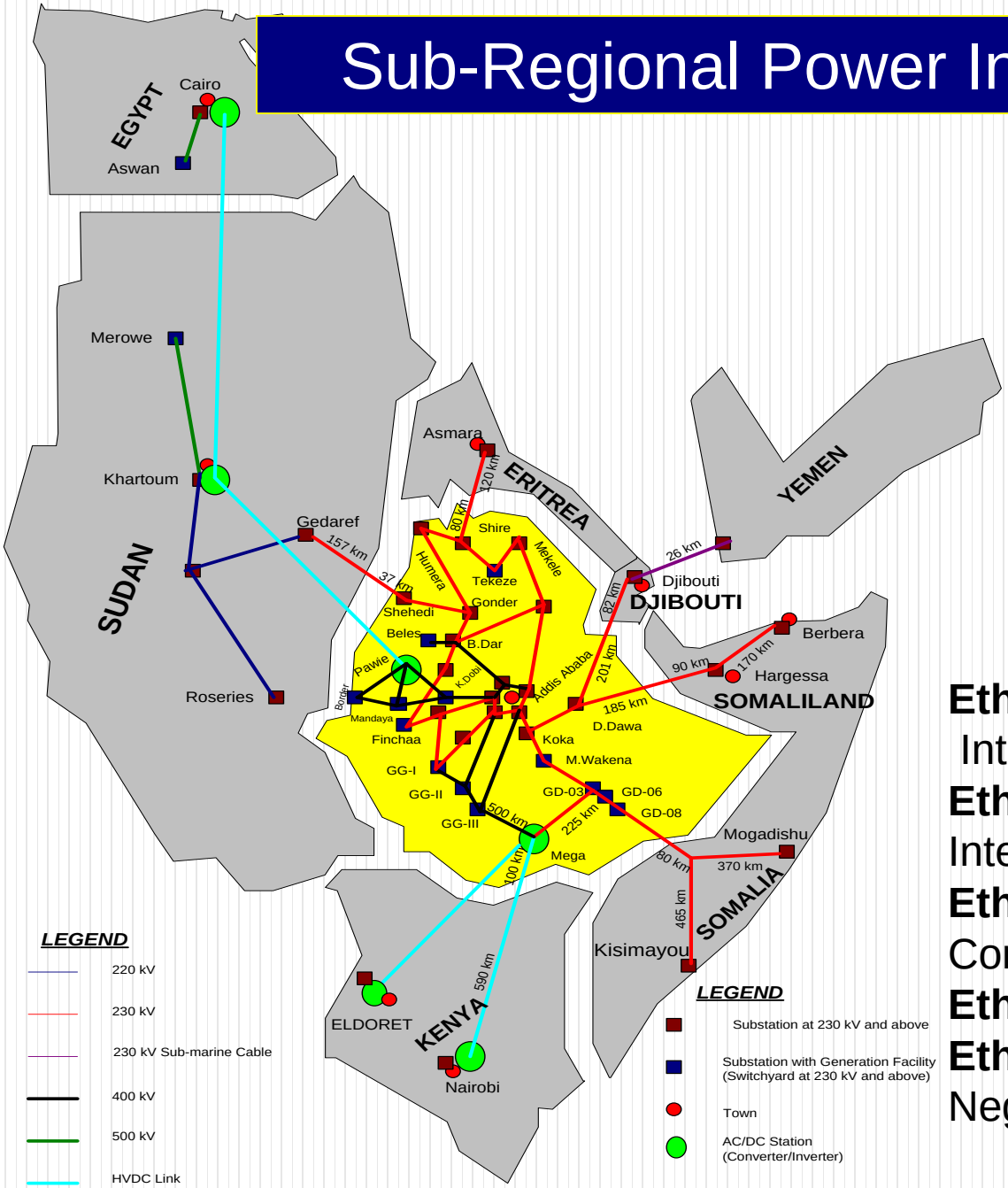
Resource	Unit	Exploitable Reserve	Exploited	
			Amount	Percent
Hydropower	MW	45,000	~2100	<5%
Solar/day	kWh/m^2	4 – 6		<1%
Wind: Power Speed	GW m/s	1350 > 7	171MW Under construction	<1%
Geothermal	MW	7000	7.3 MW	<1%
Wood	Million tons	1120	560	50%
Agricultural waste	Million tons	15-20	~6	30%
Natural gas	Billion m^3	113	-	0%
Coal	Million tons	>300	-	0%
Oil Shale	Million tons	253	-	0%

Power Demand Forecast
Target and Moderate forecast



According to the Target scenario electricity demand will be expected to grow by **32%** for the period 2011-2015.

Sub-Regional Power Interconnection



Possible Interconnection Lines with Neighbouring Countries

Ethiopia - Sudan –
Interconnection started /**100 MW/**

Ethiopia – Djibouti-
Interconnection started. **/32 MW/**

Ethiopia – Kenya-
Construction started .

Ethiopia – Somaliland-

Ethiopia – South Sudan-
Negotiation started

The National Energy Policy

- Ensure a gradual shift from traditional energy to modern energy
- Ensure reliable supply of energy at affordable prices
- Streamline the development and utilization of energy resources
- Give priority to indigenous energy resources to attain self-sufficiency
- Increase energy efficiency
- Ensure environmental sustainability

How to develop the energy sector

- Electric Power Generation Construction Programme
- Electricity transmission lines construction Programme
- Power Distribution and Expansion Programme
  - Universal Electrification Access Programme (grid-based)
  - Off-grid Rural Electrification
- National energy regulatory system for electricity and energy efficiency
- Alternative energy development and promotion
- Capacity building

Some of the major energy goals of the GTP:

- Increase power generation capacity from 2,000 MW to 10,000 MW
- Increase grid access from 41 % to 75% of the population
- Double grid connections from 2 m to 4 m households
- Increase households supplied with at least one kind of modern, efficient and renewable energy source/technology from 16 % to 80 %
- More than 1,500 towns and villages electrify/yr.
- To disseminate more than 3 million solar lanterns and SHS 9 million efficient cook stove with the assistance of Development partners (AfDB, WB ..etc)

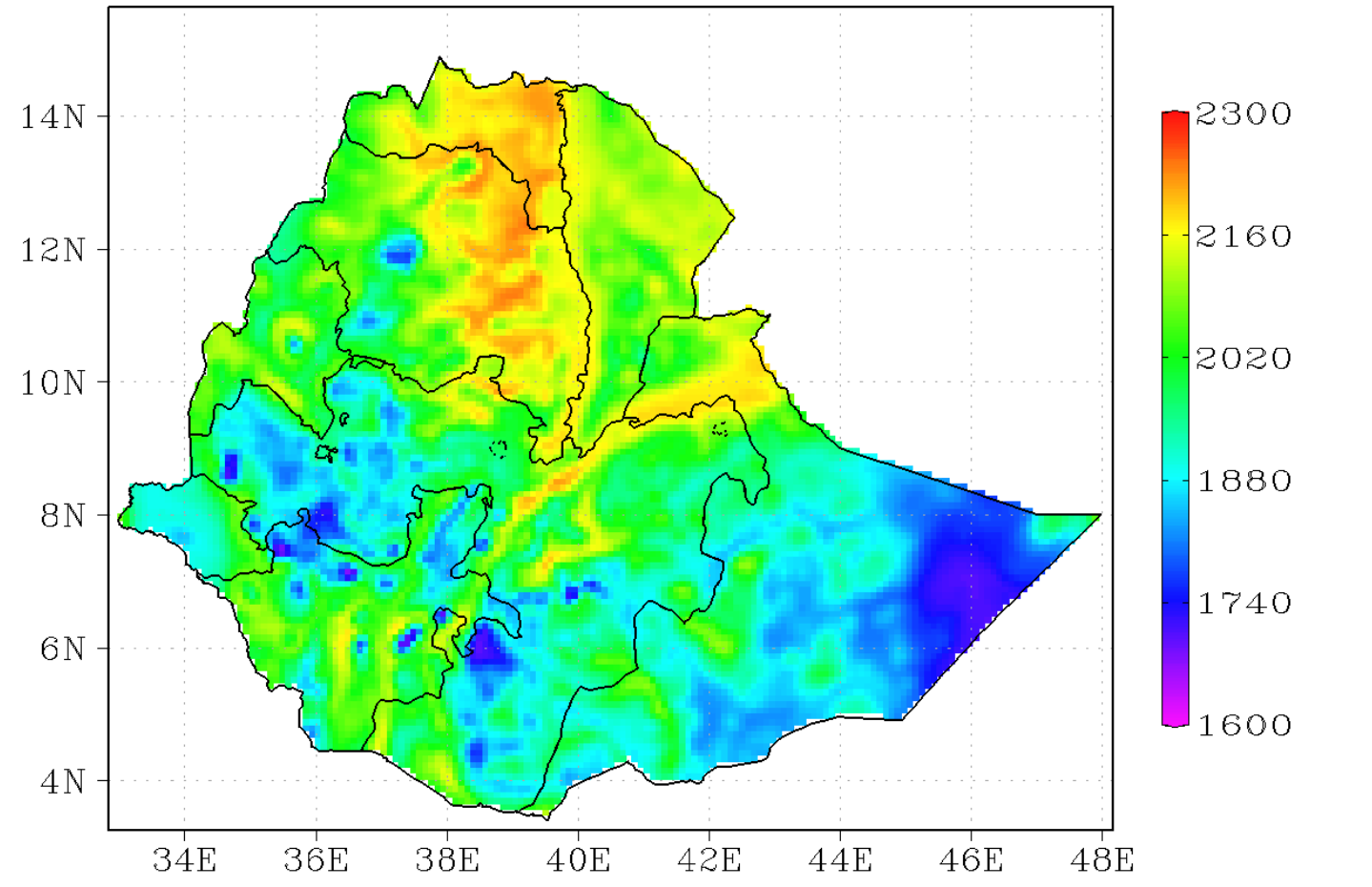
Solar and Wind Resource assessment.

The government of Ethiopia with the collaboration of Chinese government prepared solar and wind master plan for the whole country, which can be very useful to identify the gross amount and distribution condition of wind and solar energy resources, construction conditions, cost and other limiting factors of wind and solar power generation projects.

Based on the analysis of this master plan:

- Ethiopia has a capacity of **1,350 GW** of energy from wind.
- Ethiopia has annual total solar energy reserve of **2.199 million TWh/annum.**

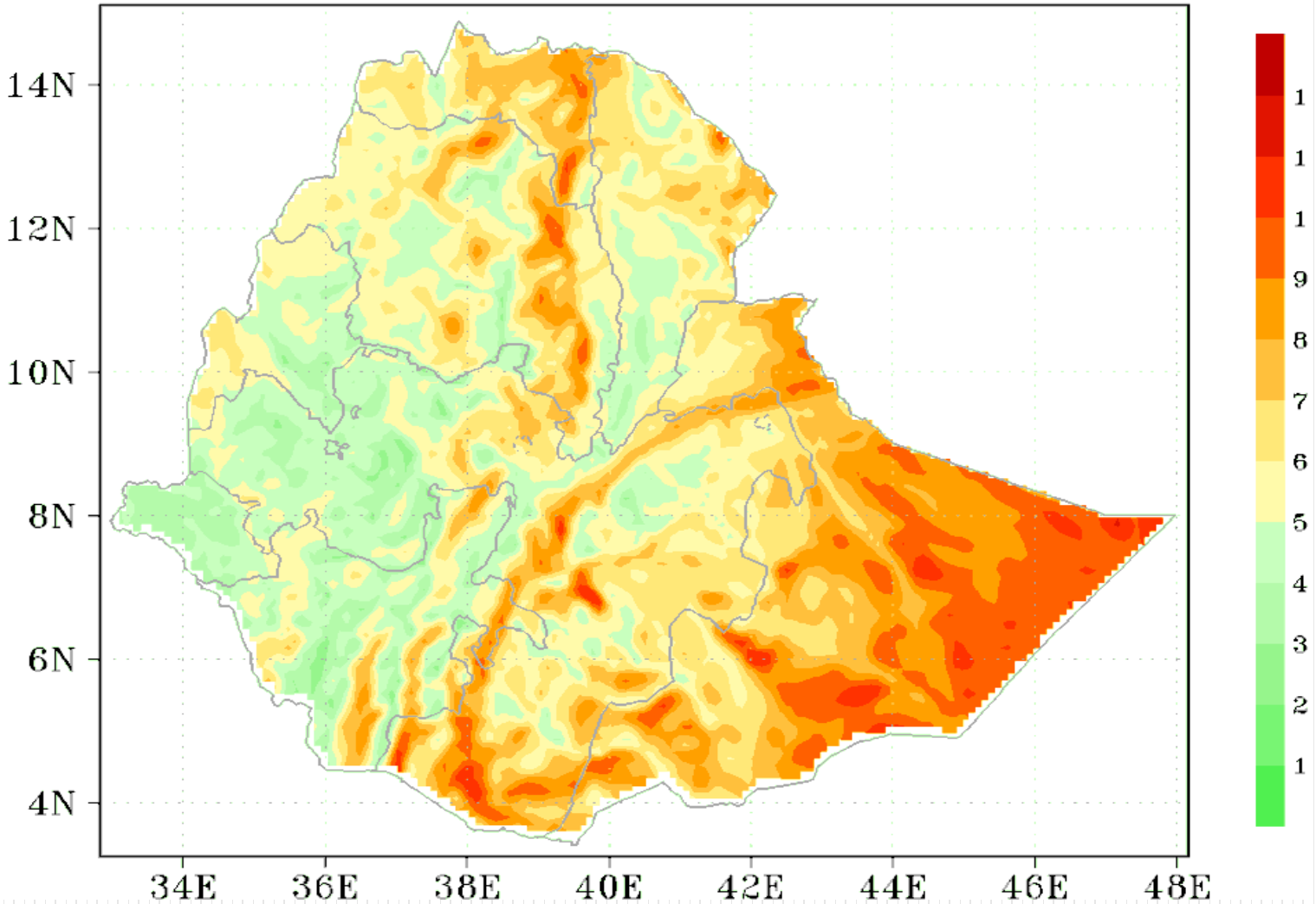
Distribution of average annual total solar radiation in kWh/(m^2.a) (1980-2009)



List of Recommended sites for short term Solar PV power Development

NO.	NAME	CAPACITY(MW)	AREA(KM2)	REGIONS
1	*Debre Berhan Pv power station*	10	0.39	Amhara
2	*Metehara pv power station*	50	1.6	Oromiya
3	*Dera solar energy Pv power station*	60	1.59	Oromiya
Total		**120**	**3.58**	

Distribution of Average Wind Speed, m/s (Height: 50m, 1980~2009) 1,350 GW potential for exploitation



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
Gembela	24.6	0
Oromiya	320.0	75
Benshagul	49.5	0
Somali	300.3	1,060
Ethiopia	1,103.6	1,350

ADAMA WIND FARM
51 MW (each 1.5 MW generating unit)

Phase I (30 MW) Operational Alstom wind turbines

Power Plants Under Construction

No	Hydro Plants	Installed Capacity MW	Average energy (GWh/yr)
1	Genale III	254	1,200
2	Gibe III	1,870	6,240
3	Grand Renaissance	6,000	15,700
	Total	8,124	23,140
	Wind Farms	MW	
4	Ashegoda	120	450
5	Adama II	153	479
	Grand Total	8,397	23,514

Candidate Wind Power projects for investment @ GTP

No.	Project Name	MW	Average energy (GWh/yr)
1.	Assela	100	197
2.	Aysha	300	592
3.	Debre Berhan	100	197
4.	Mossobo	42	104
	Total	542	1090

Wind Farm Site Selected in Ethiopia

No.	Name of site	Capacity (MW)	Area (km2)	Grading in preliminary selection	Domicile
F1	Nazret wind farm	300	254	100	Oromiya
F2	Mek'ele South wind farm	100	77	85	Tigray
F3	Sheno wind farm	100	56	88	Oromiya
F4	Ch'ach'a wind farm	100	56	86	Amhara
F5	Phase I wind farm inIteya	100	66	95	Oromiya
F6	Sulalta wind farm	100	60	92	Oromiya
F7	Gondar West wind farm	50	49	82	Amhara
F8	Imdibir wind farm	50	47	90	SNNP
F9	Dire Dawa wind farm	50	40	91	Dire Dawa
F10	Dilla East wind farm	300	268	96	SNNP
F11	Mek'ele North wind farm	200	185	85	Tigray
F12	Debre Markos East wind farm	200	143	87	Amhara
F13	Soddo wind farm	200	160	84	SNNP
F14	Sendafa North wind farm	100	70	88	Oromiya
F15	Sendafa South wind farm	100	70	88	Oromiya

F16	Gondar North wind farm	100	65	80	Amhara
F17	Phase II wind farm inIteya	100	70	95	Oromiya
F18	Bu'i East wind farm	100	80	83	SNNP
F19	Aysha wind farm	100	60	83	Somali
F20	Phase I wind farm in Bolo	100	60	90	Oromiya
F21	Diche Oto wind farm	50	100	78	Afar
F22	Bahir Dar wind farm	50	80	82	Amhara
F23	Assela wind farm	50	71	93	Oromiya
F24	Jacho wind farm	600	330	73	SNNP
F25	Phase II wind farm in Bolo	500	300	90	Oromiya
F26	Hula wind farm	300	220	64	Oromiya
F27	Dilla West wind farm	300	230	96	SNNP
F28	Dangla wind farm	200	170	67	Amhara
F29	Debre Markos West wind farm	200	150	87	Oromiya
F30	Ambo wind farm	200	130	72	Oromiya
F31	Babile wind farm	200	130	56	Oromiya
F32	Dabat wind farm	100	61	56	Amhara
F33	Phase I wind farm in Weldiya	100	43	70	Amhara


Internationally awarded HPP arch dam
2010
300 MW
Tekeze HPP


420 MW HPP 26 KM Tunnel

GIBE III Dam
(1870 Mw Generating capacity) 73% completed


6,000 MW Grand Ethiopian Renaissance Dam Project under construction (The nation's project) (22% completed)

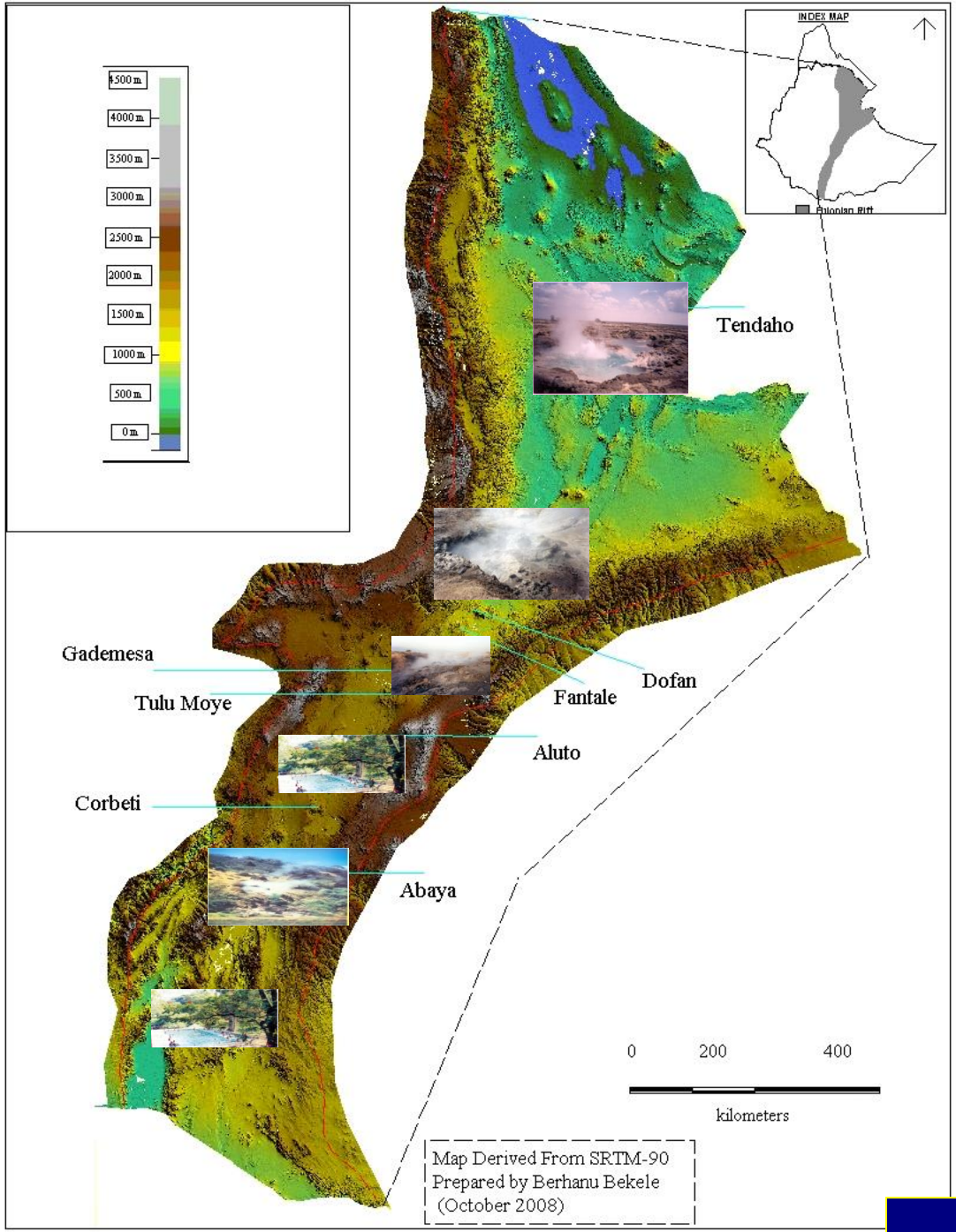
Candidate Hydro Power projects for investment

No	Name of the project	Installed capacity MW	Status
1.	Tekeze II	450	Under Feasibility S
2.	Derbu I & II	250 +325	Feasibility S. Comp
3.	Geba I & II	366	Feasibility S. Comp
4.	Gojeb	153	Feasibility S. Comp
5.	Genale V	100	Reconnaissance
6.	Beko Abo	1,700	Under Feasibility S
7.	Baro I & II and Genji	900	Feasibility S. Comp
8	Mendeya (Blue Nile)	2,000	Under Feasibility S
9	Tams	1,060	Reconnaissance
10	Dabus	425	Reconnaissance
11	Birbir R	467	Reconnaissance
12	Gibe V	660	Under Feasibility S
13	Gibe IV	1,400	Under Prefeasibility S
14	Lower Didessa	613	Reconnaissance
15	Wabishebele 18	87	Feasibility S. Comp
	Total	10,956	

East African Countries Geothermal Resources

- Djibouti
- Eritrea
- Ethiopia*
- Kenya* (largest producer)
- Malawi
- Tanzania
- Uganda
- Zambia *
- Rwanda
- Burundi
- DRCongo
- Comoros Islands

*Plant installed



- Exploration began in 1969 (UNDP & EG)
- 16 Geothermal Prospect areas were identified for Electricity generation
- The resource is also for direct uses (agriculture, agro-industry etc)

Candidate Geothermal Power projects for investment

No.	Project Name	MW	Status
1.	Aluto-Langano	75	
2.	Tendaho	100	
3.	Corbeti	75	
4.	Abaya	100	
5.	Tulu Moye	40	
6.	Dofan	50	
	Total	440	

THE ALUTO-LANGANO GEOTHERMAL

7.3 MW PILOT POWER PLANT

Private Sector Participation

- Although the power sector is led by the public utility, the 1998 investment code (No 116/1998) has been formulated to promote private sector participation in the power generation business.
- Given the present laws and regulations, the foreign private sector can participate in hydropower generation without capacity limit. Can also invest in electrical equipment manufacturing like transformer, cable, wire etc… and in off grid rural electrification.
- The Ministry invites private sector for construction of Dam, Biogas digesters, Solar PV, Solar lanterns, water heater, and efficient cooking stove manufacturing and distribution in all regions of the country.

Conclusion

Ethiopia has huge RE potential, which is distributed through all regions and makes the country favorable for RE power development and ideal for developers. More over the government of Ethiopia gives special attention and put in place a lot of favorable conditions and good working environment for developers to participate in the energy sector.

Ethiopia will be climate resilient and have zero carbon growth by 2025

Thank You!!!