

Challenges & Opportunities in Mainstreaming & Implementing Water and Energy Nexus in Ethiopia

Mandefro Nigussie, Semu Moges and Seleshi Bekele

Outline

1. Introduction

1.1. The Water Situation

1.2. The Energy Situation

2. Nexus Challenges

3. Nexus Opportunities

4. Mainstreaming Water & Energy Nexus

5. Summary and Way forward

1. Introduction

Ethiopia:

- **Agenda 2030 of the UN**
- **Africa Agenda 2063**
- **Vision 2025**
 - **Middle income country**
 - **Access to W&E is expected to be 100%**

1.1. The Water Situation

- Water is getting a scarce resource in many places.
- Water cannot **provide ecosystem services** such as the provision of clean water, natural filtration services, natural habitat for fisheries etc.
- **Climate change**, population growth, change in living standards and energy demand impact water supplies.

1.2. The Energy Situation

- **Power generation**
 - **Functional, under construction & feasibility studies**
- **National Electrification Program**
 - **fast paced ambitious grid connections rollout program**
 - **enhanced design & reach off-grid access rollout program**
 - **Government sustained commitment**
 - **Least-cost rollout strategy (grid and off-grid)**

2. Water and Energy Nexus Challenges

2. Nexus Challenges

- ❖ **Nexus challenges are threats to equitable and sustainable access to water and energy due to the interactions between Water and energy**
 - ❖ **Rapid population growth**...*quantity, quality & sustainability*
 - ❖ **Rapid growth in irrigated agriculture** ...*water & energy need*
 - ❖ **Booming urbanization** ...*water & energy need*
 - ❖ **Flourishing industrial parks** ...*water & energy need*
 - ❖ **Climate change** ...*water & energy availability*

Figure 3: Projected distribution of urban centers in Ethiopia- 2030 (CSA, 2012)

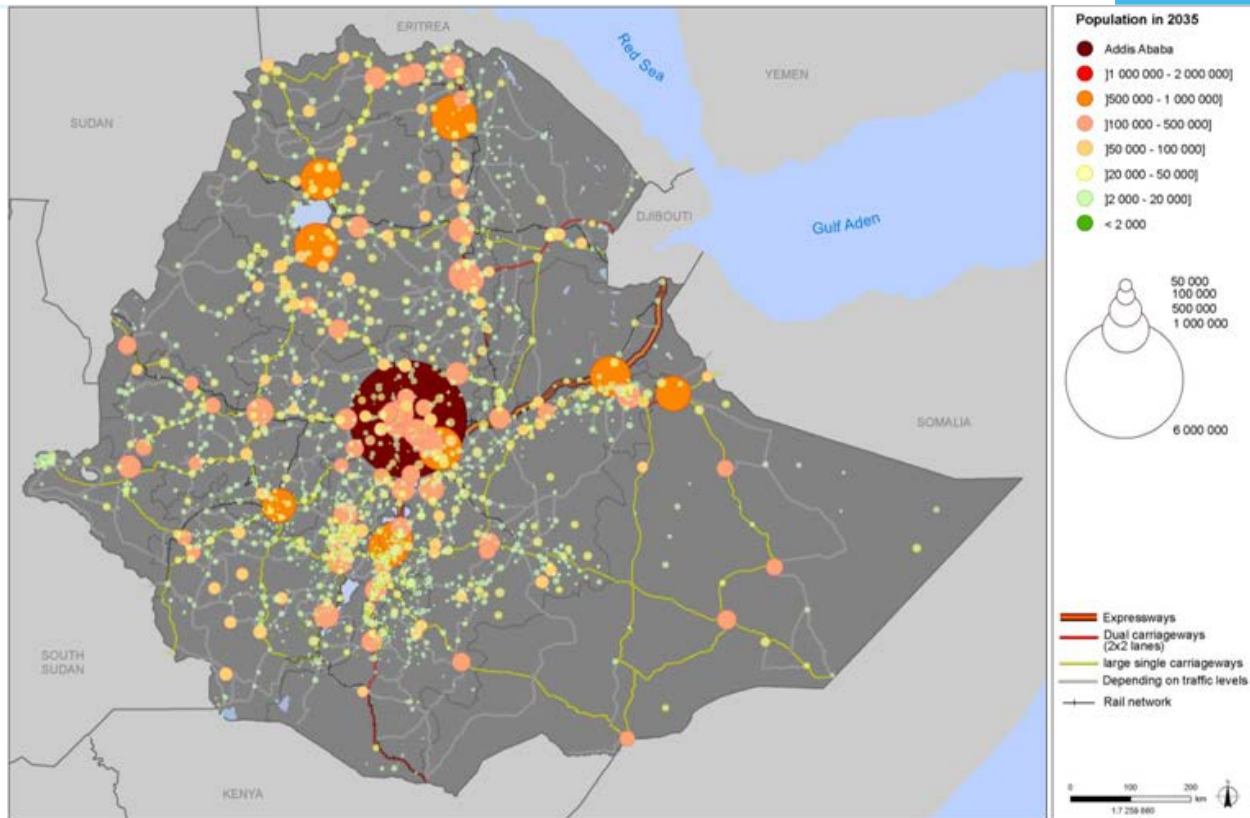
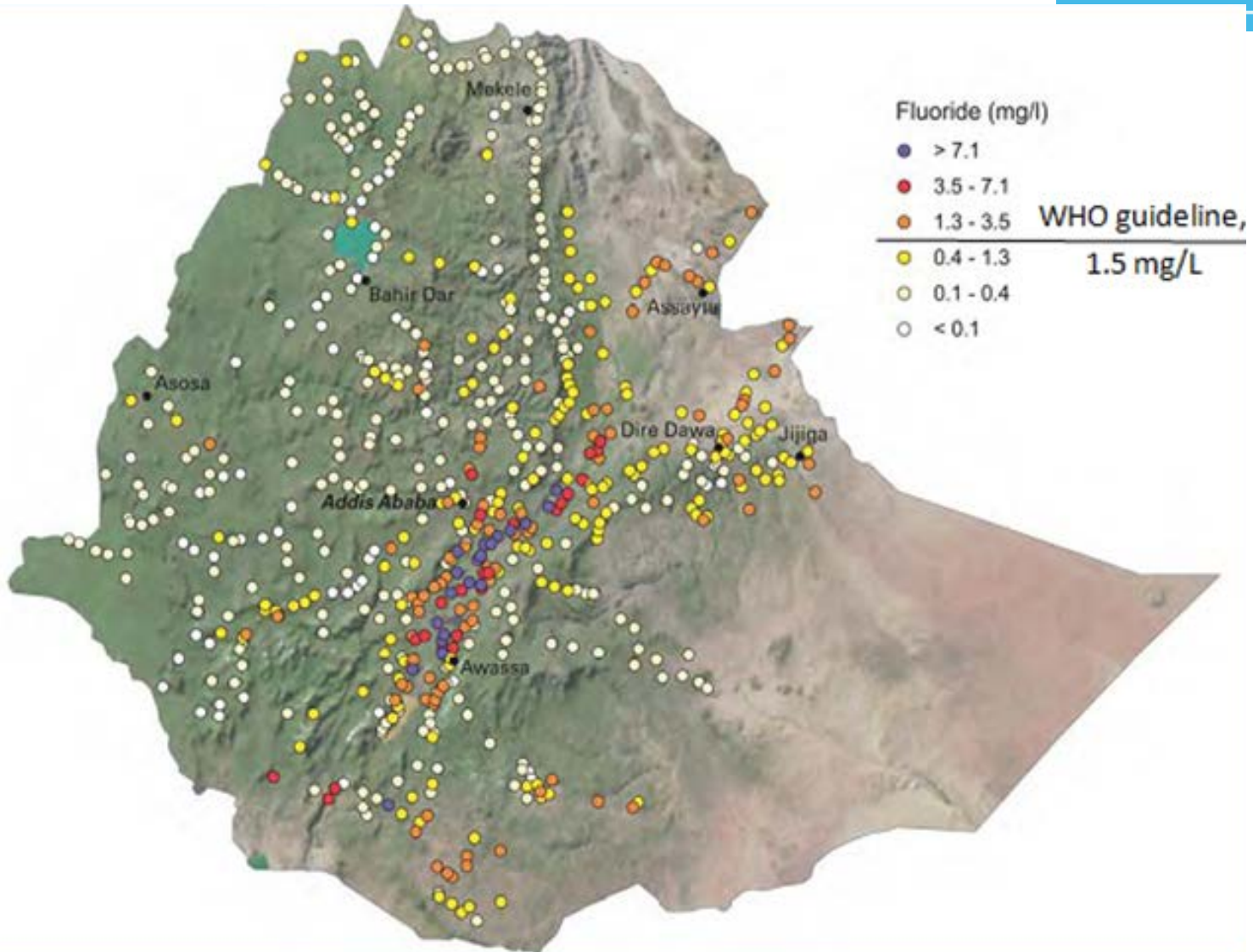


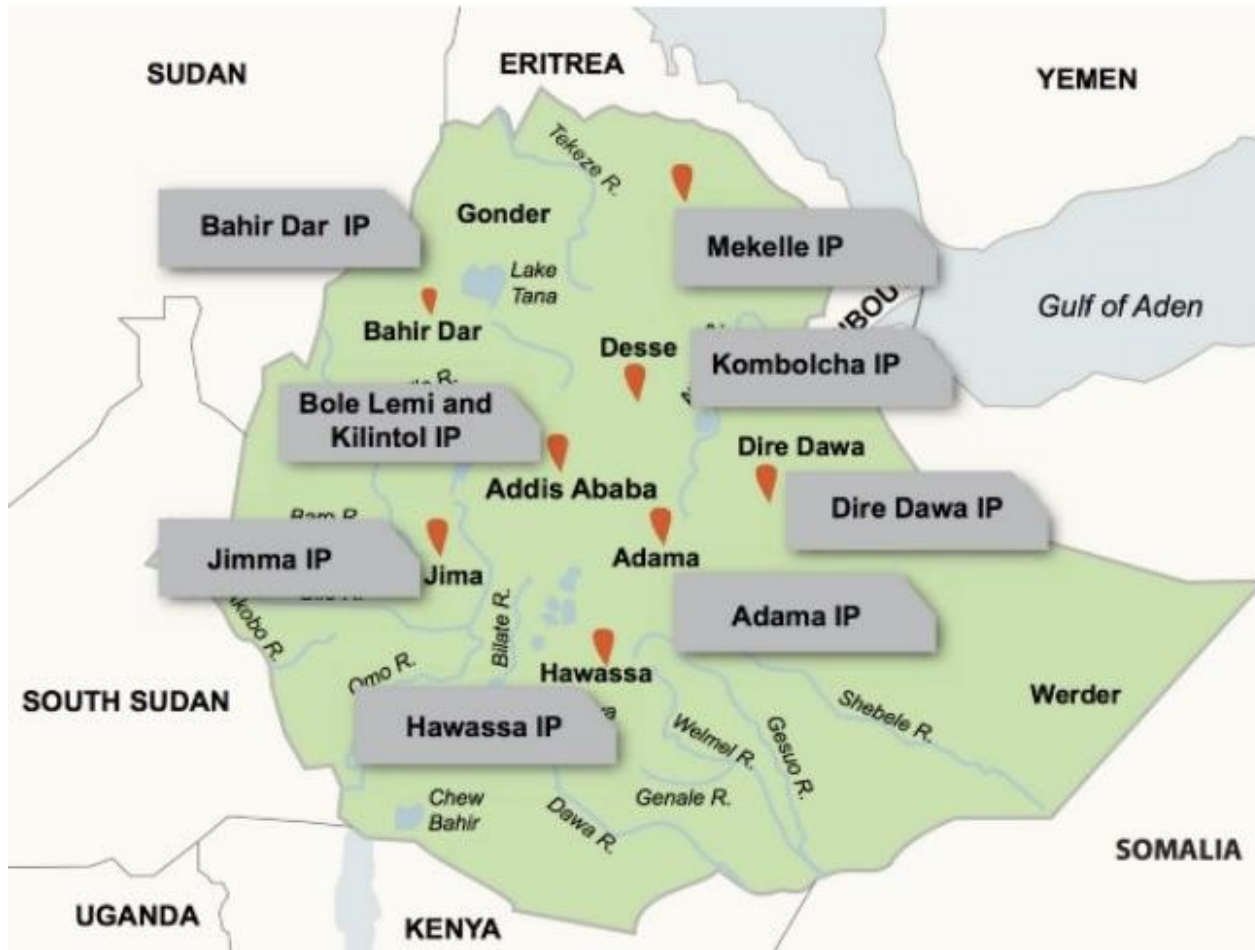
Figure 3: Spatial distribution of fluoride concentration in Ethiopia



Water scarcity ...Droughts



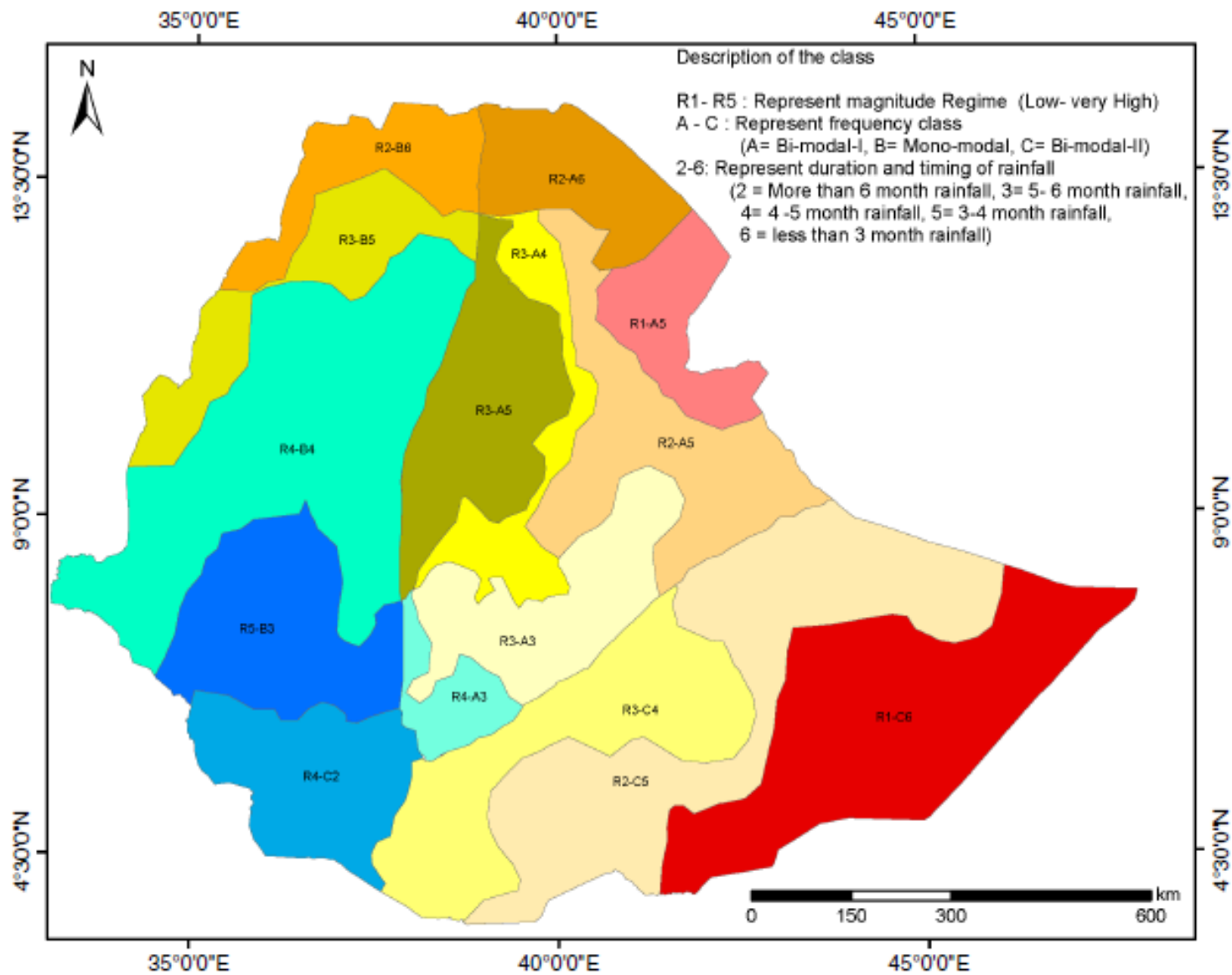
Fig 4: Major Industrial parks in Ethiopia (MoUDC, 2012)



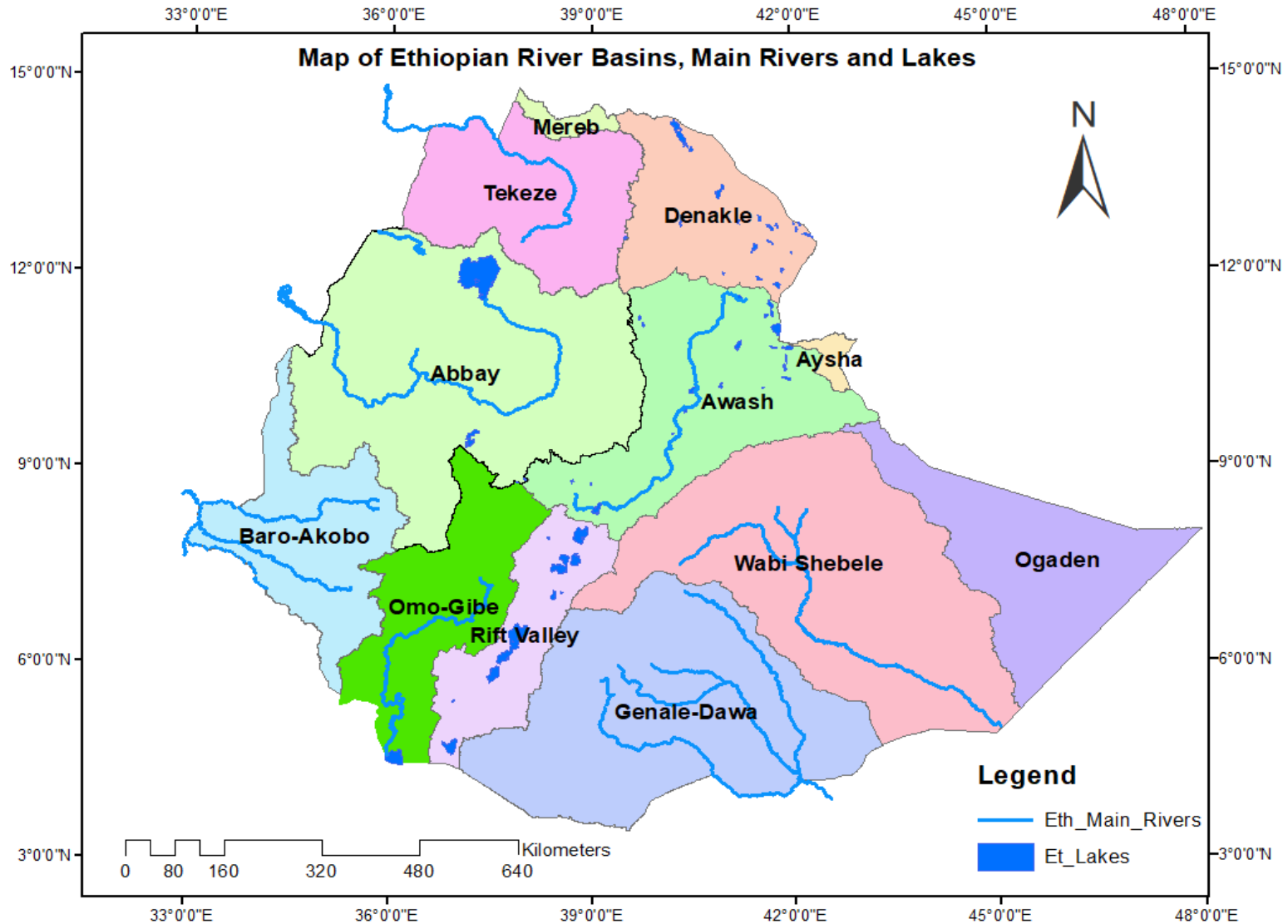
3. Opportunities

- **Availability of water resources**
- **High level policy, strategy & roadmap**
- **Government is heavily investing**
- **Renewable energy share and mix**
- **Stakeholders engagement**
- **Strategic partners**

Figure 5: Rainfall shape regimes of Ethiopia (Berhanu, et al, 2016)



4. Opportunity cont.



4. Opportunities cont.

SN	Location	River Basin	Area (km ²)	Water Resources (BCM)	Percentage Share (%)
1	West	Abay	199,776	54.80	69.83
2		Baro-Akobo	75,825	23.60	
3		Tekeze	82,453	8.20	
4		Mereb	5,854	0.65	
5	East	GenaleDawa	172,889	5.88	7.58
6		WabiShebele	192,960	3.16	
7	South	Rift Valley	53,034	5.60	17.94
8		Omo-Gibe	77,827	16.60	
9	N. East	Awash	121,962	4.90	3.95
10	Dry basins	Ayasha	1,962	-	0.69
11		Denakil	58,268	0.86	
12		Ogaden	89,051	-	
Total			1,131,860	124.25	100

Table 3: Storage regulated hydropower developments in Ethiopia, MoWIE, 2017

Project Name	Basin	Stage	Capacity (MW)
Aba samuel	Awash	Functional	6.6
Koka I	Awash	Functional	42.3
Fincha	Abay	Functional	100
Fincha Amerti Neshe	Abay	Functional	38
Melka Wakena	Wabeshebele	Functional	153
Gilgel Gibe I	Omo-Gibe	Functional	184
Tekeze	Tekeze	Functional	310
Gilgel Gibe III	Omo-Gibe	Functional	1870
GERD	Abay	under construction	6000
Genale Dawa III	Genale	under construction	254
Karadobi	Abay	Feasibility study	1600
Baro	BaroAkobo	Feasibility study	896
Wabe-shebelle (WS18)	Wabeshebele	Feasibility study	87.75
Genale (GD-6)	Genale	Feasibility study	257
Mandaya	Abay	Prefeasibility study	2400
Border	Abay	Prefeasibility study	800
Kesem	Awash	Detail Design	15

4. Opportunities cont.

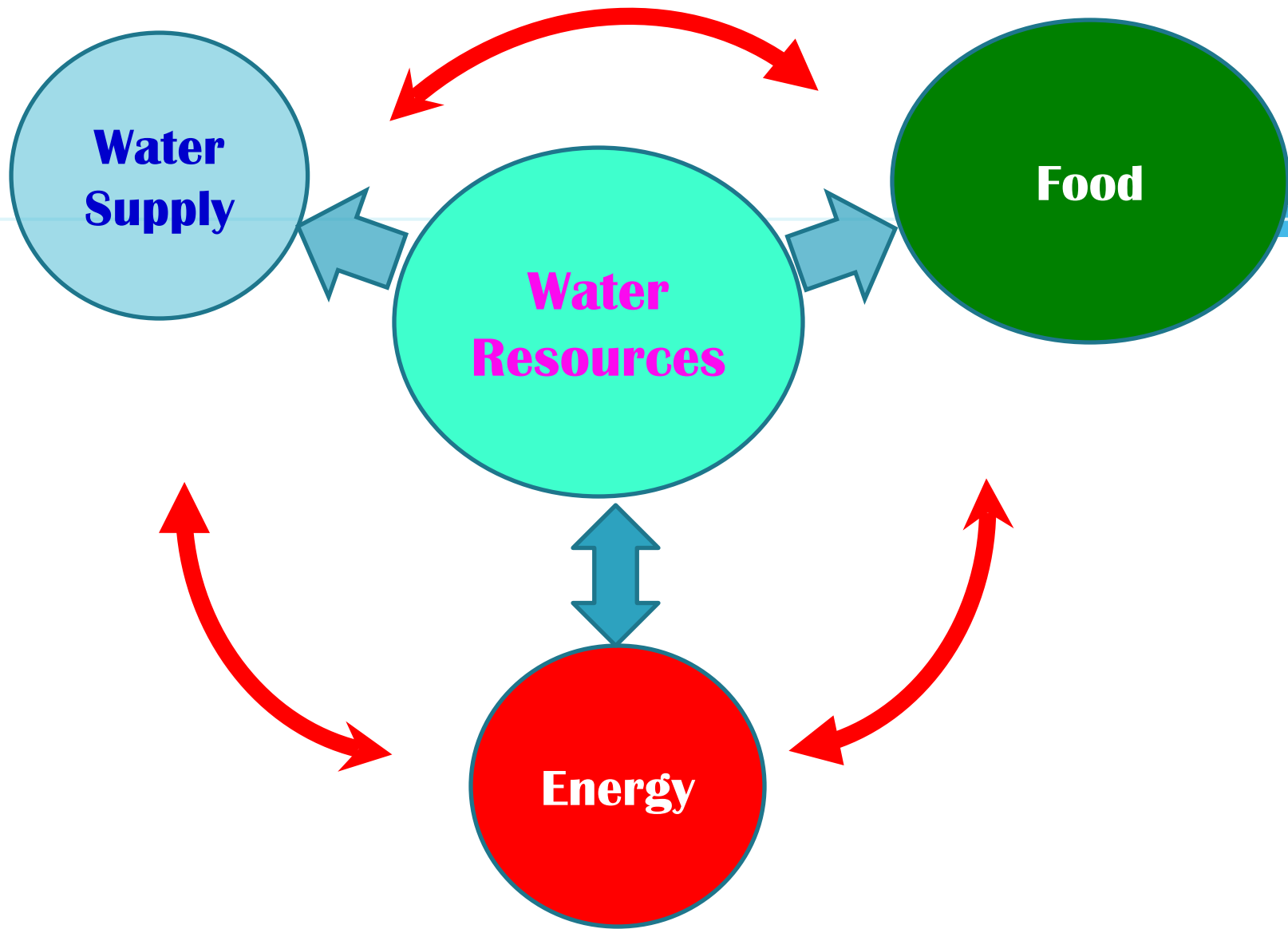
Grand Renaissance Dam



Table 4: Grid and Off-Grid Connections Program and Electricity Access (MoWIE, 2017)

Time Period		On-grid Connections Added (million)	On-grid Cumulative Connections (million)	On-grid Connections Access	Off-Grid Connections Access	Total Access Rate
GTP I	2010-15	~1.0	~3.5	~18%	~8%	~26%
	2016	0.1	3.6	20%	10%*	30%
GTP II	2017	0.2	3.8	21%	13%	31%
	2018	0.5	4.3	23%	16%	37%
	2019	0.7	5.0	25%	18%	43%
	2020	0.8	5.8	32%	20%	52%
	2021	1.0	6.8	40%	23%	63%
GTP III	2022	1.5	8.3	45%	26%	71%
	2023	2.0	10.3	52%	30%	82%
	2024	2.0	12.3	58%	32%	90%
	2025	2.0	14.3	65%	35%	100%
	2026	2.0	16.3	71%	29%	100%
GTP IV	2027	2.0	18.3	78%	22%	100%
	2028	2.0	20.3	85%	15%	100%
	2029	2.0	22.3	92%	8%	100%
	2030	2.0	24.3	96%	4%	100%

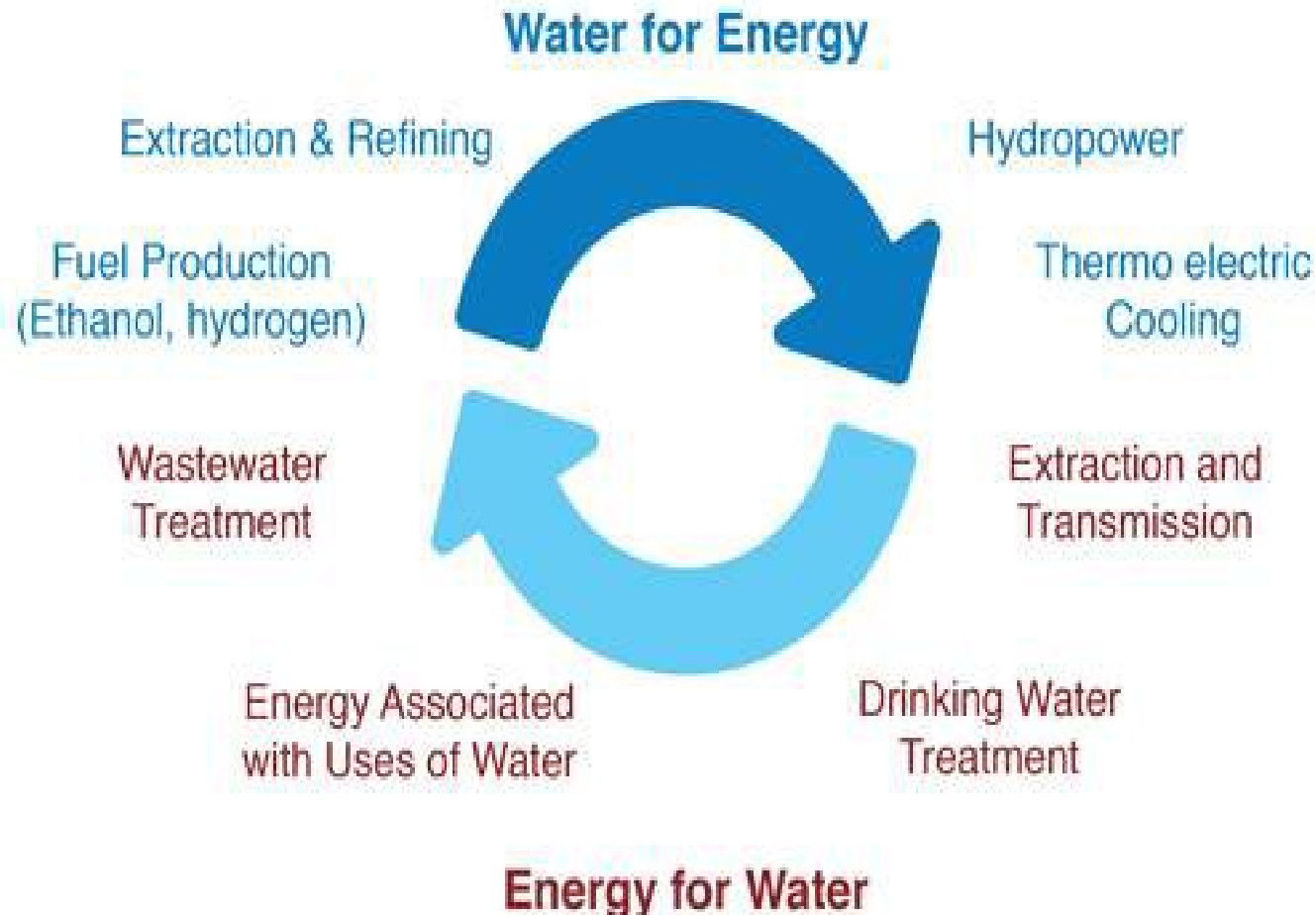
4. Mainstreaming Nexus



The Water, Food and Energy Nexus

4. Mainstreaming Water-Energy Nexus

- **Water-Energy Nexus refers to the relationship between water and energy in many ways.**

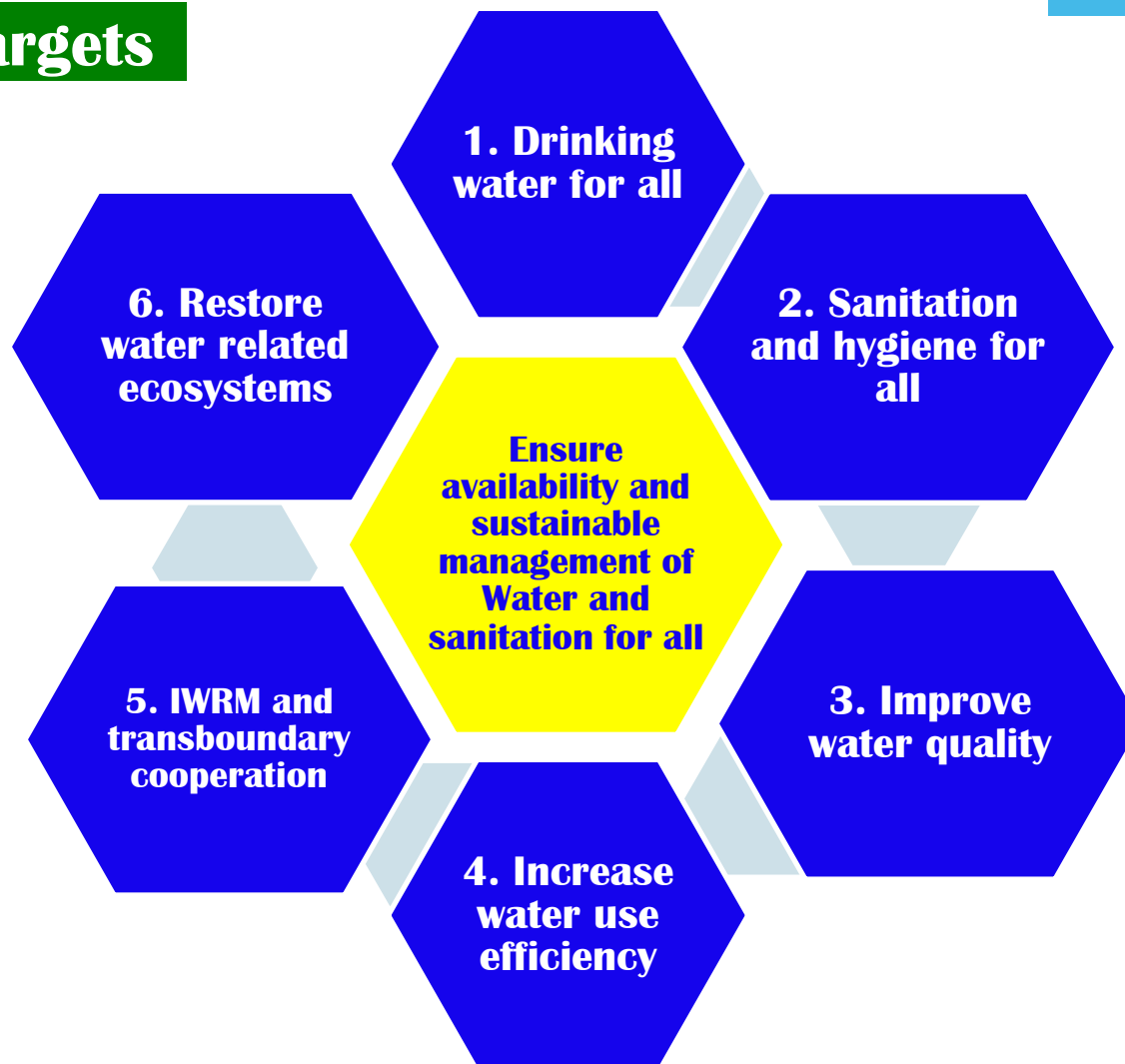


4.1. Mainstreaming processes

- ❖ **Three Working Groups established by MoWIE to identify key challenges and opportunities in water and energy sectors by answering the following questions:**
 - **What are the key challenges that Water and energy sectors are likely to face in the coming 15 years (2016-2030)**
 - **What are the key opportunities for advances in water and energy sectors?**
 - **What fundamental knowledge and skill gaps exist that limit the ability of MoWIE staff to respond to these challenges and take advantage of the opportunities?**
 - **What are the areas of support to fill these knowledge and skill gaps?**

Goal 6: Ensure availability and sustainable management of water and sanitation for all

Water Targets

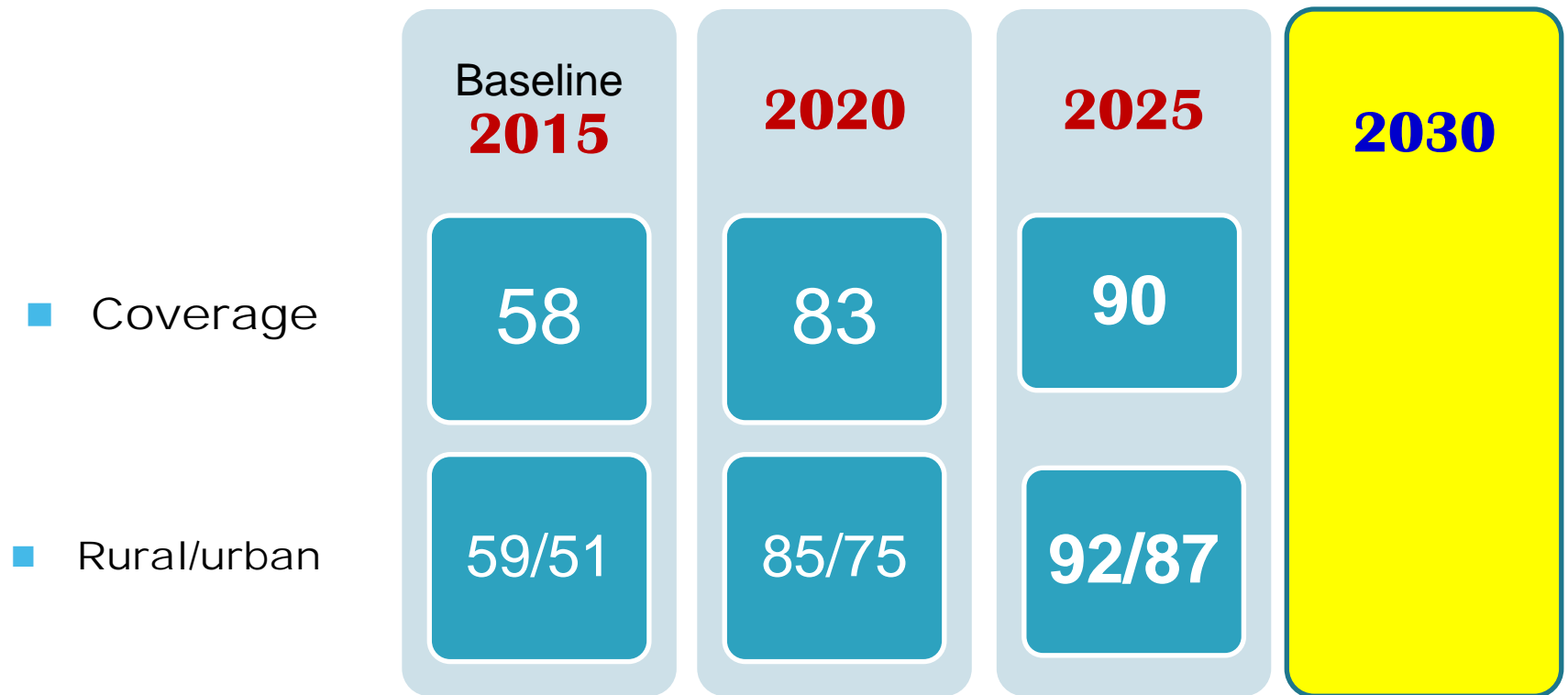


4.1. Results of mainstreaming efforts

- ❖ **Gaps scope & depth of Goals and Targets set by SDGs 6 & 7 vs. Growth and Transformation plan-II (GTP-II) of Ethiopia**
 - **GTP-II is from 2016-2020 while SDGs are from 2016-2030**
 - **GTP-II standards vs. sphere standards**
 - **GTP-II electric consumption per capita**

- ❖ **Developing targets for GTP-III and IV**

Goal 6: Ensure access to water and sanitation for all



Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services

7.2 By 2030, increase substantially the share of renewable energy in the global energy mix

7.3 By 2030, double the global rate of improvement in energy efficiency



Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all

	Baseline 2015	2020	2025	2030
■ Coverage/ access (%)	60	90	?	
■ Customer, M	2.455	6.955	?	
■ Percapita, gws	86	1269	?	

5. Summary

- ☐ **Population growth**
- ☐ **Urbanization**
- ☐ **Climate change**
- ☐ **Capacity**

- √ **Availability of surface & ground water**
- √ **Investment in water and energy sectors**
- √ **Willingness of the government for policy changes**

5. Summary cont.

- **Mainstreaming W-E Nexus is meant to:**
 - **Improve coordination across sectors and support decision-making**
 - **Identify risks and options in sustainability planning**
 - **Improve efficiency/ effectiveness of resource use**
 - **Guide policy response.**
 - **Customizing Nexus elements based on local context**



Thank You