

# **Current Capacity Building Initiatives in Ethiopia for Water Resources Development and Management**

**ABITI GETANEH GEBREMESKEL**  
**Ministry of Water and Energy\_ Ethiopia**  
**P.O.Box 5744**  
[abitigetaneh@yahoo.com](mailto:abitigetaneh@yahoo.com)  
Addis Ababa  
Ethiopia

## **1. Introduction**

Ethiopia, officially known as the Federal Democratic Republic of Ethiopia, is a country located in the Horn of Africa, and is the most populous landlocked country in the world. It is bordered by Eritrea to the north, Djibouti and Somalia to the east, Sudan and South Sudan to the west, and Kenya to the south. Ethiopia is the second-most populous nation on the African continent, with over 84,320,000 inhabitants, and the tenth largest by area, occupying 1,100,000 km<sup>2</sup>. Its capital, Addis Ababa, is known as "the political capital of Africa."

Achieving broad-based, accelerated and sustained economic growth so as to eradicate poverty has been and is a key objective of the Government of Ethiopia. The government has designed, and is implementing, strategies, policies and plans to guide and manage the overall development of the country accordingly. The major emphasis is on the water resources development.

Water is an expensive economic and social resource. Water availability in quantity and quality is limited in space and time. It is the major input for an irrigation farm & hydropower development. Hence, water contributes a lot to an increase in agricultural production and productivity. Water is also used as an input to the industrial production. Ethiopian water resources and its geographical landscape provide a good opportunity for hydropower generation. Water resource potential has direct relation with aquaculture like fishery development. Though its development is so low these days, water resource also plays a conspicuous role for transport and tourism service development. This indicates that the water sector serves to the large number of the economic sectors in our country. Because water is used for drinking, accessing water at a reasonable distance at required quantity will do an irreplaceable contribution for the creation of healthy and productive citizen. Therefore, we can simply recognize economic growth and water contribution cannot separately be seen.

Water plays an eye-catching role to meet up the government vision to align the country along the middle-income countries in 2025 and the country's a yearly minimum 10.4% economic growth plan.

## **2. Water Sector Objective, Policies and Strategy**

The MoWE (Ministry of Water and Energy) develops sector development strategies and policy, generalized Water Resource Management and development strategies and policy Objectives are presented as follows

- Develop the countries water resources on equitable and sustainable way to assure highest economic and social benefits;
- Bring about efficient utilization, and equitable water allocation and distribution embracing sustainability of water resources through all inclusive and integrated water resource management plan with effective water sharing principles;

- Mitigation and prevention of drought effects by efficiently and suitably developing and use of the water resources in accordance with the countries strategic plan;
- Prevent and control flood disaster by taking sustainable, preventive, rehabilitative and other similar measures;
- Sustainable prevention, conservation and development of water resources and its general environment;

## **2.1 Irrigation and Drainage Sub Sector**

- Implement systems that help irrigation development works beneficial for long time and sustainability;
- Develop and distribute standards, manuals and systems assuring that irrigation farms and systems sustainable operation and maintenance are satisfactorily monitored and improved;
- Create appropriate conditions to develop medium and large scale irrigation; select low cost technologies; develop strong contract administration and management capacity; strengthen private and government contractors;
- Cost sharing of irrigation development costs like the hydropower and other sub-sectors; give priority for multipurpose irrigation development projects;
- Search fund from other sources besides the government budget for medium and large scale irrigation development projects;
- Create appropriate conditions to and support the private sector to participate on medium and large scale irrigation development projects;
- Design projects to consider gender issues and focus on conditions that make women highest beneficiaries on projects to be constructed;
- Draw and implement working procedures and systems for sustainability of finance sources and feasibility of medium and large scale projects;

## **2.2 Hydropower Study and Design Sub Sector**

- Update hydrological geographical / survey and mapping/, social, economic and environmental information that serve for sustainable feasibility study of each selected electric generation areas;
- Integrated and successive assurance of study of hydro power generation projects whose feasibility is assured to implement them as soon as fund is secured;
- Consider hydropower development projects inseparable and part to other multi sector development projects so as to minimize the unit cost of production;
- Identify and fully record the specific features of the country's hydropower potential and put in to use these potentials; take measures that brings benefit;
- Encourage local consultants and contractors to participate in the design, construction and management of hydropower generation;
- Provide appropriate training to the local staffs and strengthen the internal capacity to gradually reduce dependence on external experts and build capacity at federal level in the following streams:
  - ✓ Study and design of medium and large scale hydropower development;
  - ✓ License those who like to involve in hydropower development projects;
  - ✓ Control water related constructions.

## **3. Water Resources Potential and Current Development in Ethiopia**

Ethiopia has a huge water resources potential with surface water resources around 122 billion cubic meters per annum and groundwater potential 36 billion cubic meters. The following table presents the major river basins their catchment area, discharge, and annual runoff

Table. Surface Water Resources of Ethiopian River Basins

No.	River Basins	Catchments Area(km <sup>2</sup> )	Annual Runoff (BM <sup>3</sup> )	Specific Discharge (l/s/ km <sup>2</sup> )
1	Abbay (Blue Nile)	199812	52.6	7.8
2	Awash	112700	4.6	1.4
3	Baro-Akobo	74100	23.6	9.7
4	Genale – Dawa	171050	5.8	1.2
5	Mereb	5700	0.26	3.2
6	Omo-Ghibe	78200	17.90	6.7
7	Rift Valley Lakes Basin	52740	5.60	3.4
8	Tekeze	89000	7.63	3.2
9	Wabe Shebele	200214	3.15	0.5
10	Denakil (Afar )	74000	0.86	-
11	Ogaden	77100	0	-
12	Aysha	2200	0	-
		<b>1136816</b>	<b>122.00</b>	

Source: Ministry of Water Resources, water sector development programme 2002-2016, 2002 and, review and update of fifteen year water sector development program, vol.3

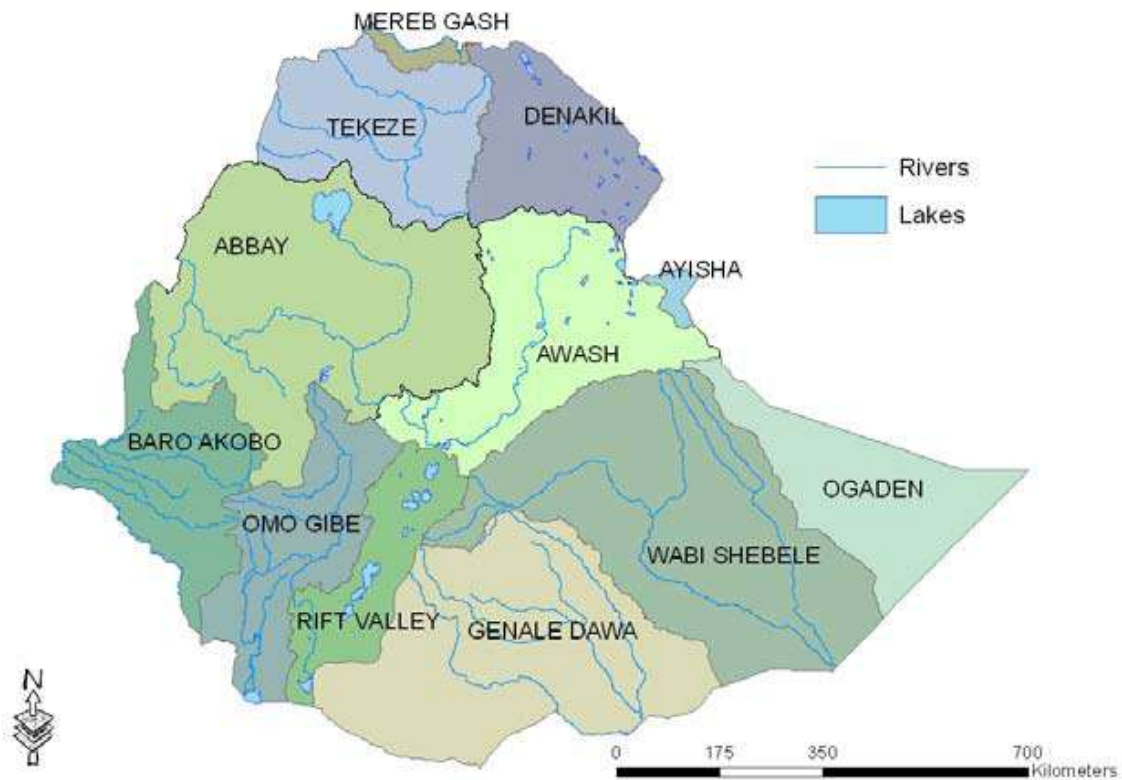


Fig. Major river basins of Ethiopia

### 3.1 Development Potentials & Planned Development Programs

The geographical location of Ethiopia and its endowment with favorable climate provides a relatively higher amount of rainfall in the region. The primary characteristics of Ethiopia's water resources are extreme inter-annual and intra-annual rainfall variability, and the international nature of its most significant water resources. The big and main water resources development problem in Ethiopia is the uneven spatial and temporal occurrence and distribution. Between 80-90% of Ethiopia's water resources is found in the four river basins namely, Abbay (Blue Nile), Tekeze, Baro Akobo, and Omo Gibe in the west and southwestern part of Ethiopia where the population is no more than 30 to 40 per cent. Integrated development master plan study of 8 river basins has been completed.

The three largest river basins (Abbay, Baro-Akobo, and Omo-Gibe) contribute 76 per cent of the total runoff from a catchment area comprising only 32 percent of the total area of the country. Those three river basins have much larger specific discharges than the other river basins. Their large runoff stems from the fact that the river basins occupy the western and southwestern parts of Ethiopia, where the highest concentration of rainfall occurs. The western parts of the country have a uni-modal rainfall starting in February/March and ending in October/November. Bimodal rainfall seasons are also found in the eastern parts, with one major and one minor season, whereas the bimodal season in the southern parts are more evenly distributed. The three eastern river basins (Afar-Danakil, Aysha, and Ogaden) are the dry once. The Abbay, or Blue Nile, Basin contributes 62 percent of the annual average flow reaching Aswan. When combined with the Tekeze and the Baro-Akobo Rivers, the total contribution from Ethiopia to the flow of the Nile at Aswan is 86 percent.

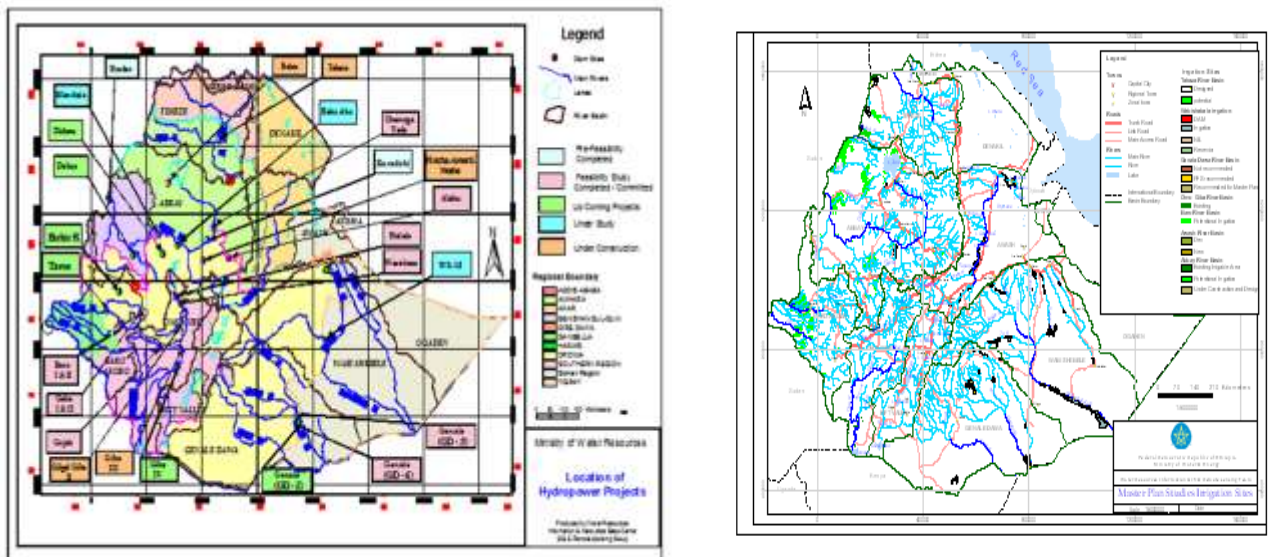


Fig Identified Hydropower & Irrigation Development sites

#### 3.1.1 Irrigation Development

Estimates show that irrigable land potential of the country is around 5.3 million ha (3.7Mha from gravity-fed surface water, 1.1Mha from groundwater and 0.5Mha from rainwater harvesting, and currently developed irrigable land is around 640,000ha. In the GTP-2 it is planned to increase the developed irrigable land to 5 million ha



Fig . Current Irrigation Development Project (koga)

### 3.1.2 Hydropower Development

The country has a hydropower potential of 45,000MW. Until now it is able to produce around 2060MW .In the GTP-1 (Growth and Transformation Plan -1) period the activities are undergoing to arrive at 10,000 MW hydropower production capacities. In the GTP-2 it is planned to increase the hydropower production up to 15000MW from the hydropower potential.



Fig.3 Constructed Hydropower Dam (Tekeze Arch Dam)

## 4. Man Power Requirement

Strengthening institutional capacity is critical to implement the GTP policies, strategies and programs and there by achieve satisfactory results. Apart from other existing, structural and institutional constraints, the country's economic growth and social development are hindered by organizational capacity constraints. Government has designed national programs, policies, and a strategy that strengthens and sustains the country's planned implementation capacity, institutionally and organizationally. This is a vital contribution to the on-going process of development endeavors and democratization as well. The capability of civil servants, at federal, regional and local levels and the private sector will be strengthened, and then can only be the desired development goals achieved.

### 4.1 Objective

The objective of the capacity building initiatives are to train high level local professionals to fill the gap of manpower need for the execution of the planned development programs in the sector their by to insure sustainable development which could be manifested in the reduction of cost both for study and implementation.

### 4.2 Methods and Considerations

To identify the training fields and the number of trainees for the execution of the planned projects both in GTP 1 & GTP-2, assessment was made on the current development projects at various level in terms of execution capacity (trained man power and supplies) as bench mark both for the private and public sector partners. The assessment result indicates the current level of national professional input is 20% and supplies can be said nil. The majority of identified gaps are listed as follows starting from Feasibility Study, Detail Design, Construction, Construction Supervision, and Operation and Maintenance both for irrigation and hydropower development. More specifically the identified gaps are summarized based on the water resources development directions as follows

Irrigation development

- Feasibility Study & Detailed design
- Infrastructure development
- Water Administration

Hydropower Development

- Feasibility Study & Detailed design
- Infrastructure development
- Planning & Distributions

Groundwater Resources Development

- Feasibility Study & Detailed design
- Infrastructure development
- Monitoring & Administration

Generally on all Water resources Development

- Dam Construction Feasibility Study and Design
- Dam Construction Monitoring & Administration
- Geotechnical and Geophysical investigations (Studies)
- Grouting
- Dam Break Analysis

Water Resources Development input Supplies (Industrial out puts)

- Supplies required for irrigation Developments
- Supplies required for Hydropower Developments
- Supplies required for Groundwater Development
- Supplies required for Dam Construction

The identified fields of specializations were

No.	Area of Specialization
1	Civil Engineering Specialization in Dam Engineering
2	Civil Engineering Specialization in Material Engineering
3	Civil Engineering Specialization in Grouting
4	Civil Engineering
5	Tunnel Technology
6	Civil works Drawing
7	Material Engineering
8	Cost Control Engineering
9	RCC Engineering
10	Quality Control & Assurance Engineering
11	Hydraulic Engineering Specialized in Dam Engineering
12	Hydraulic Engineering
13	Irrigation and Drainage Engineering / Irrigation Network Design Engineering
14	Hydrology
15	Geotechnical Engineering
16	Geotechnical Engineering Specialization in Grouting
17	Hydro-geology
18	Structural Geology
19	Seismic Engineering
20	Geophysicist (Geophysical Investigations)
21	Foundation Treatment of Hydraulic structures

No.	Area of Specialization
22	Electromechanical & Hydromecchanical Engineering
23	Electrical Engineering
24	Transmission Line Design
25	Substation Design Expert
26	Electrical works Drawing
27	Generation Operation Engineering
28	Distribution Design & Planning Engineering
29	Transmission Engineering
30	Substation Engineering
31	Specialization in Pumping Station/Major Pipeline
32	Drilling Engineering
33	Mechanical Engineering
34	Hydro steel structures
35	Turbines Design
36	Hydraulic Turbines
37	Hydro mechanical Drawing
38	Irrigation Agronomy
39	Power and Energy Economy
40	Software Engineering
41	Hardware Engineering
42	SCADA Hardware & Soft ware Engineering
43	System Operation Engineering

The above areas of specialization narrowed and regrouped in to

- Irrigation and Drainage engineering
- Hydraulic and Dam Engineering
- Hydrology and Hydro system engineering
- Hydropower Engineering
- Electric Power and Energy Engineering
- Mechanical Engineering (Hydraulic Turbines )
- Power & Energy Economics
- Electromechanical Engineering
- Drilling Engineering

Based on the identified and generalized field of specializations national institutions have been identified and consecutive consultation was held with the institutions including other respective stakeholders. The Identified Higher Learning Institutions are:

- Addis Ababa University /Institute of Technology
- ArbaMinch University
- Adama University
- Bahir Dar University
- Hawassa University
- Haromaya University
- Jimma University
- Mekelle University

#### 4.3 Curriculum Design

Even if curriculum design is the responsibilities of higher learning institutes, the industry presents to the university the profile of trained engineers as per the assessment observed. Base on these universities presents their curriculum with certain modification if they have initially or newly prepared. A national workshop was conducted including the private sector, the industry and universities. Finally universities are selected for certain type of specialization for finalizing the curriculum as per the comment provided to them during the workshop and to be shared to other universities for implementation.



#### **4.4 External Relation**

To maintain the quality of the trainees and for technology and knowledge transfer twinning agreement with international universities via universities alone or with rough the industry was tried.

#### **References**

*Federal Democratic Republic of Ethiopia. 2010 Growth and Transformation Plan 2010/11 – 2014/15*

*Ministry of Water Resources\_FDRE, water sector development programme 2002-2016, 2002 and, review and update of fifteen year water sector development program, vol.3*

*Ministry of Water Resources\_FDRE 1999. Ethiopian Water Resources Management Policy*

*Different Integrated Development Master plan studies*

#### **Author**

A.G. Gebremeskel graduated in Agriculture (Irrigation Agronomy) and Remote Sensing and GIS from the Haromaya University-Ethiopia and Geo-Information Science and Earth Observation center the Netherlands respectively. He worked both for the government and private institution especially in feasibility and detailed design studies of irrigation projects in both fields of specializations. Currently working at the Ministry of Water and Energy \_Ethiopia as Director for Research and Development Directorate.