
Department of Public Administration and Development Management
Master of Public Management and Policy

# The Challenges and Prospects of Electricity Access in Ethiopia

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## Table of Contents

Acknowledgment ..... iii

List of tables ..... vii

List of Figures ..... vii

Appendix ..... vii

Acronyms ..... viii

Abstract ..... x

Chapter one: Introduction ..... 1

1.1 Background of the study ..... 1

1.2 Statement of the problem ..... 2

1.3 Research questions ..... 3

1.4 Objective of the study ..... 3

1.4.1 General objective of the study ..... 3

1.4.2 Specific objectives of the study ..... 3

1.5 Scope of the study ..... 3

1.6 Limitation of the study ..... 4

1.7 Significance of the study ..... 4

1.8 Organization of the study ..... 5

Chapter Two: Literature review ..... 6

2.1 Definitions and concepts of electricity access ..... 6

2.2 Electricity access and socio- economic development ..... 7

2.3 The global electricity access scenario ..... 9

2.4 Prospects of electricity access in developing Countries ..... 10

2. 5 Major issues in electrification ..... 11

2.5.1 Financing ..... 11

2.5.2 High costs of supplying rural and peri-urban households ..... 12

2.5.3 Lack of appropriate incentives ..... 12

2.5.4 Population growth ..... 13
2.5.5 Electricity demand growth ..... 13
2. 6 Power sector reforms and Private sector participation ..... 14
Chapter three: Methodology ..... 16
3.1 Research design ..... 16
3.2 Data source ..... 16
3.3 Data collection technique ..... 16
3. 4 Sampling method and sample size ..... 17
3. 5 Data analysis technique ..... 17
3.6 Ethical considerations ..... 17
Chapter Four: Data presentation and analysis ..... 19
4.1 Introduction ..... 19
4.2 Ethiopian electricity sector overview ..... 19
4.2.1 Energy resource and generation capacity ..... 19
4.2.2 Electricity demand forecast ..... 21
4.3 Institutional structure of the electricity sector ..... 22
4. 3.1 Electricity sector structure at federal Level ..... 22
4.3.2 The Electricity and Energy sector structure at regional level ..... 25
4. 4 Policy, strategy and GTP of the electricity sector ..... 26
4. 4.1 Energy policy ..... 26
4. 4.2 Climate Resilient Green Economy (CRGE) strategy ..... 27
4.4.3 Growth and Transformation Plan (GTP) of the electricity sector ..... 28
4. 4.3.1 Growth and Transformation plan I (GTP I) ..... 28
4.4.3.2 Growth and transformation Plan II (GTP II) ..... 29
4.5 Universal Electrification Access Program (UEAP) ..... 30
4.5.1 Overview of the electricity access program ..... 30
4.5.2 UEAP First Phase (2005/06-2009/10) ..... 32
4.5.3 UEAP under the GTP I ..... 34

4. 5.4 Electrified towns and villages during GTP I....36
4. 5.5UEAP's GTP II plan....37
4. 6 Private sector participation and financing in the electricity sector....40
4. 6.1 Financing in the electricity sector....40
4. 6.2 Private sector engagement....45
Chapter Five: Summary of findings, conclusion and recommendations....46
5.1 Summary of findings....46
5.1.1 Electricity sector policy and strategies....46
5.1.2 Institutional structure of the electricity sector....46
5.1.3 Financing and private sector participation....47
5.1.4 Electricity access program....47
5. 2 Conclusion....49
5. 3 Recommendations....50
References....52
Annexes....55
Annex I:....55
Annex II:....56

## List of tables

Table 1: Indigenous energy resource potential..... 20
Table 2: Projects under construction.....20
Table 3: Future electricity demand growth rates..... 22
Table 4: Electricity and energy sector structure at regional level……..25
Table 5: Towns and villages planned to be electrified under UEAP first phase..... 32
Table 6: Electrified towns under the UEAP first phase.....33
Table 7: Electrified towns and villagesuntill 2010..... 33
Table 8: Towns and villages planned to be electrified during GTP I..... 34
Table 9: Annual quota of regions during GTP I..... 36
Table 10: Electricty acess rate annual target during GTP I..... 37
Table 11: Total electrified towns and villages upto the end of GTP I.....38
Table 12: Twons and villages to be electrified under UEAP's GTP II……..37
Table 13: Electrified towns and villages during GTPII's first year……...38
Table 14: Electrified towns and villages during GTPII's second year……..39
Table 15: Domestic electricity sales tariff rates……..42
Table 16: Number of existing and planned customers.....43
Table 17: Electricity export sales to Djibouti and Sudan……...44

## List of Figures

Figure 1: Organizational chart of electricity sector at federal level..... 23

## Appendixes

**Annex I:** Existing power plants and electricity generation capacity----------61
**Annex II:** Interview questions ----------62

## Acronyms

| | |
|---|---|
| **AfDB** | African Development Bank |
| **CRGE** | Climate Resilient Green Economy Strategy |
| **DBE** | Development Bank of Ethiopia |
| **EEA** | Ethiopian Energy Authority |
| **EEP** | Ethiopian Electric Power |
| **EEPCo** | Ethiopian Electric Power Corporation |
| **EEU** | Ethiopian Electric Utility |
| **ESMAP** | Energy Sector Management Assistance Program |
| **ETB** | Ethiopian Birr |
| **GDP** | Gross Domestic Product |
| **GERD** | Grand Ethiopian Renaissance Dam |
| **GTP I** | Growth and Transformation Plan I |
| **GTP II** | Growth and Transformation Plan II |
| **GW** | Giga Watt |
| **IEA** | International Renewable Energy Agency |
| **IMF** | International Monetary Fund |
| **IPP** | Independent Power Producers |
| **IRENA** | International Renewable Energy Agency |
| **KV** | Kilo Volt |
| **KWh** | Kilo Watt hour |
| **MoFED** | Ministry of Finance and Economic Development |
| **MoWIE** | Ministry of Water, Irrigation and Electricity |
| **MW** | Mega Watt |
| **PPA** | Power Purchase Agreement |
| **PPP** | Public Private Partnership |
| **REF** | Rural Electrification Fund |
| **SE4All** | Sustainable Energy For All |
| **UEAP** | Universal Electrification Access Program |

| | |
|---|---|
| **UN** | United Nations |
| **UNDP** | United Nations Development program |
| **UNEP** | United Nations Environmental Program |
| **USD** | United States Dollar |
| **WB** | World Bank |

## *Abstract*

*Eventhough Ethiopia is investing a lot in electricity generation and infrastructure, the electricity access rate in the country is one of the lowest in Africa mainly due to inadequate expansion of electricity connection in rural areas. The purpose of this study was to assess the key challenges and the prospect of electricity access in the country and to recommend the way forward to address the electricity access gap. This study mainly used secondary data collected from extensively reviewed documents and also interviews with purposely selected experts and officials to substantiate the findings. According to the findings of this research, the electricity access programs of the country were not effective to meet the electricity access gap. The institutional instability of the sector, less attention to decentralized or off-grid electricity access programs ,lack of financing and private sector engagement have been some of the challenges hindering the enhancement of electricity access in the country. Therefore, establishing a long term and stable institutional structure in the electricity sector, strengthening and expanding decentralized (off-grid) electrification programs, setting a cost reflective electricity tariff (both for local and export) for the sector's sustainability and enhancing the private sector engagement are some of the recommendations of this study to reach the universal electricity access targets of the country.*

# Chapter one

# Introduction

## 1.1 Background of the study

Electricity plays a driving role in social-economic development and improvement of the quality of life of a society and it is also linked to all sectors of the economy. Lack of access to electricity is seen as a major constraint to economic growth and increased welfare in developing countries. It drives economic and social development by increasing productivity, incomes, and employment; reducing workloads and freeing up time for other activities; and facilitating the availability of higher-quality or lower-priced products through local production (Ana and Ramy, 2015).

According to UN (2015), more than 1 billion people (one-seventh) of the world's population and mostly poor do not have access to electricity. About the same number do have access but receive electricity services that do not meet standards for the quantity and reliability of service that an efficiently performing sector should provide. Out of the 1.1 billion people without electricity access, 99 million are in East Asia and Pacific region, 378 million in South Asia, and 591 million in Sub-Saharan Africa. The challenge is most acute in Sub-Saharan Africa, which accounts for 40% of the world's 51 low-access countries (WB, 2014).

Electricity access in Ethiopia is also one of the lowest in the Africa. Only 25 % of the population is has access to electricity while the geographic electricity network coverage reaches 60% (GTP II, 2015).The country is endowed with huge renewable energy resources including hydro, wind, geothermal, solar and bio-energy. According to MoWIE (2015), the gross hydro-energy potential of the country is 45,000MW, wind (1035GW) geothermal (7,000 MW), solar (5.2 kWh/m2). However, the country has utilized insignificant amount of its energy resource potential. The electricity generation capacity of the country is about 4228MW of which more than 90% is from hydro while wind, geothermal and diesel power plants are also in the mix (MoWIE, 2016). Due tothe low electricity generation and distribution capacity of the country, almost 90% of the country's energy use is based on traditional biomass. Electricity only covers less than 3% of the total energy needs of the country while hydrocarbon, which is mostly, used in the transport sector covers about 7% (MoWIE, 2015).

Hence, enhancing adequate, reliable, and affordable electricity access is vital for the country's socio-economic development and transformation since it is a key input to all sectors in the economy. The electricity access challenge in the country has also been further intensified with increasing population and rapid urbanization in addition to the increasing electricity demand in already electrified urban areas due to the modern life style and expanding industrialization. Therefore, this study tries to assess the critical issues and challenges related to electricity sector policy, institutional structure of the sector, electricity access program, financing and private sector engagement which affect the universal electricity access targets of the country.

## 1.2 Statement of the problem

Even though Ethiopia has been investing a lot in electricity generation, electricity access in Ethiopia is one of the lowest in Africa (WB, 2014).Only 25% of the population, out of the estimated 100 million is connected to electricity services (GTP II, 2015).The per capita consumption of electricity in Ethiopia is also very low which stood at about 100 kWh per year (MoWIE, 2015).According to IEA (2011) ,electricity access is defines as the annual consumption of at least 250 kWh of electricity in rural areas and 500 kWh in urban areas for a household.

The county has been implementing the UEAP since 2005 to extend the national electricity grid to the rural areas and to increase electricity access however; the electricity access gap has still been enormous. The main focus of the UEAP has been expanding the electricity grid network to the rural areas however; the household connectivity rate has been insignificant. In total, only 2.03 million households, mainly in major urban areas have been connected to electricity services in the country at the end GTP I. The country also planned a more ambitious target of reaching 7 million household electricity connections and enhancing the electricity network coverage to 90 % at the end of 2020 ( GTP II ,2015).

However, achieving universal electricity access requires comprehensive policy, strategy and a very strong institutional capacity. Moreover, electricity sector is considered as one of capital intensive sectors hence it requires a substantial public and private investment. The Ethiopian electricity sector has been dominated and characterized by public sector investment and management. The government has been the main entity engaged in addressing the electricity access gap while the private investment has been insignificant in the sector. Therefore, this study tried to assess the major challenges and issues contributing for the low level of electricity access in the country and recommends the way forward to address the electricity access gap.

## 1.3 Research questions

1. What are the institutional structure gaps in the electricity sector in general and electricity access in particular?
2. What are the country's energy policy and strategy gaps related to the electricity sector?
3. How and to what extent the Universal Electricity Access Program /UEAP/ has been implemented?
4. What are the challenges of financing electricity access in the country?
5. What are the bottlenecks for private sector engagement in the electricity sector?

## 1.4 Objective of the study

### 1.4.1 General objective of the study

The main objective of this study is to assess the major challenges and prospects of electricity access in the country.

### 1.4.2 Specific objectives of the study

1. To assess the institutional structure of the electricity sector in general and electricity access in particular.
2. To review the existing energy sector policy and strategy of the country related to the electricity sector and electricity access.
3. To evaluate the implementation and the effectiveness of the electricity access program of the country.
4. To assess the challenges of financing in the electricity sector in general and electricity access in particular.
5. To assess the bottlenecks for private sector engagement in the country's electricity sector.

## 1.5 Scope of the study

The country has implemented electricity access initiatives and projects prior to the establishment of the UEAP in 2005 however; the magnitude of electricity access activities has been insignificant in the past. The UEAP has introduced a very ambitious plan of enhancing the very low electricity access coverage of the country. Therefore, this study mainly covers and evaluates the implementation of the UEAP over the period of ten years since its establishment in

2005. Moreover, this study tried to assess the general electricity sector issues and challenges related to electricity sector of the country during this period.

## 1.6 Limitation of the study

Electricity sector in general and electricity access in particular is a broad aspect which involves many stakeholders. However, due to time and financial constraint, this study does not involve the opinions of the wide range local as well as international stakeholders, which have been directly engaged in the country's electricity sector such as the regional energy offices, international institution such as WB country office, AfDB country office and other government institutions. This study, therefore, was mainly done based on the federal level electricity sector institutions and electricity access program. Despite its limitation, this study tried come up with comprehensive observation and assessment on the issue.

## 1.7 Significance of the study

Electricity is one of the prominent inputs of socio-economic development of a country. However, electricity access in Ethiopia is still very low and the challenge is being further intensified with growing population and rapid urbanization in the country. The main objective of this study is to identify the challenges and issues contributing to low level of electricity access in the country. Therefore, the main significance of this study is to provide alternative policy inputs for the decision makers in the sector to accelerate and achieve the electrification targets of the country. Even though this study is carried out with a delaminated scope, it could be helpful to have a deeper knowledge regarding the complexity of the challenges and issues in the country's electricity sector in general and electricity access in particular. Moreover, in addition to its contribution to address the challenges of electricity access in the country, the findings of this study is expected to provide inputs for further research in this area**.**

## 1.8 Organization of the study

This research comprises of five chapters. The first chapter includes the background, statement of the problem, research questions, objective, scope, limitation and significance of the study. The second chapter contains a literature review which is related to the concepts and definitions of electricity access and the global electricity access scenarios. The third chapter describes the methodology used to conduct this research. Chapter four contains data presentation and analysis. The last chapter summarizes the findings, makes conclusions and recommendations.

# Chapter Two

# Literature review

## 2.1 Definitions and concepts of electricity access

'Access' to electricity has been defined in different contexts in literature. According to Ana and Ramy, (2015), traditional electricity access definitions focus on electricity connection however, this definition fail to capture the amount of energy services that this connection can provide as well as its adequacy and reliability. Because, the poverty impact that electricity can realize depend on how much and for what it is used, the amount and quality of the service are crucial for understanding its poverty reduction potential. IEA (2002) defines electricity access at the household level, i.e. the number of people that have electricity in their home. It comprises commercially sold electricity, both on-grid and off-grid. However, to be meaningful for human and social development, access to electricity must be measured by the quality and range of usage of electricity via appliances to improve quality of life and workplace productivity (Shashi B. et.al, 2014).

Electrification is also defined in terms of the level of electricity consumption. It is defined as the annual consumption of at least 250 kWh of electricity in rural areas and 500 kWh in urban areas, for a household of 5(IEA, 2011).Electricity access in Ethiopia has been mainly stated as the area where the grid network is extended but the actual electricity connectivity of households has been very low especially in rural areas. The per capita electricity consumption in Ethiopia is estimated to be 100KWh, a low level, compared with a Sub-Saharan Africa average of 521kWh (MoWIE, 2015).

ESMAP (2015) redefines energy access from the traditional binary count to a multi-dimensional definition as "the ability to avail energy that is adequate, available when needed, reliable, of good quality, convenient, affordable, legal, healthy and safe for all required energy services". That is, having an electricity connection does not necessarily mean having access to electricity under the new definition, which also takes into account other aspects, as for example reliability and affordability. Energy access is measured in the tiered-spectrum, from Tier 0 (no access) to Tier 5 (the highest level of access).The tier assumptions are based on the electricity consumption level which ranges from 4.5KWh per year for tier 1, mainly used for lighting and phone charging to annual electricity consumption level of greater than 3000 KWh, which is a very high level of consumption associated with higher income.

Lack of electricity access impairs progress in human welfare and quality of life. Directly or indirectly, electricity access enables transformative progress in education, health care, access to water, essential communications, and information, and access to financial services and opportunities for income generation. Power supply inadequacy (shortages in generation and supply) undercuts the productivity of manufacturing and commerce and reduces overall economic growth (WB, 2014).

## 2.2 Electricity access and socio- economic development

Various studies have shown the direct relationships of electricity access on the socio economic development of a country. Electricity has become an indispensable prerequisite for enhancing economic activity and improving human quality of life. Agricultural and industrial production processes are made more efficient through the use of electricity. Households need electricity for many purposes, including cooking, lighting, refrigeration, study and home-based economic activity. Essential facilities, such as hospitals, require electricity for cooling, sterilization and refrigeration (IRENA, 2012).The lack of access to electricity forms a vicious cycle with underdevelopment: less developed countries do not have the means to invest in electrification, and the low levels of electrification limits development.

According Paul(2013), electrification enables livelihoods in several ways in rural areas. By stimulating employment and income generating activities, where people build assets such as the expansion of dairy milk production and achieve better cash flows. It also argued that electrification enables people to use surplus resources made possible through their entrepreneurship that contribute to the emergence of credit and savings schemes based on the newly available cash. Extra electric lighting and improved water from better pumping facilities are likely to reduce women's workload in fetching water and create opportunities to set up other businesses.

The study by Ana and Ramy(2015) also states access to different tiers of electricity could have a direct impact on productivity by lowering costs of production, due to less labor needed, lower costs of energy, the preservation of products for a longer time, the reduction of information costs , higher quality of products and services, increased volume of production range of products ,extension of operating hours, which may translate into higher production or sales of products which may translate into higher sales volumes and revenues. In addition to these direct impacts, electricity may

contribute to indirect impacts, mainly higher profitability and income for the owner of the businesses, higher employment and higher wages, which may be expected to increases in income for poor people would contribute to raise them out of poverty reduction.

In addition to the economic benefits electricity access would also have various social benefits especially in rural areas. According to Ram and Jiwan (2015),improved lighting with better access to electricity, which replaces kerosene, candles, and other traditional lighting sources in rural areas and provides brighter and more reliable lighting. Educational benefits mainly associated with improved lighting due to electricity access, which makes extended hours of study possible and enables the achievement of better educational outcomes over time. Health benefits related to improved hygiene as households are better able to store food properly, indoor air pollution is reduced, and electrified medical facilities and clinics provide better health care. Entertainment and communication benefits associated with the use of electricity to operate devices such as radios, television sets, and mobile phones.

According to Ana and Ramy (2015), access to electricity supply is not enough to trigger productive uses. These depend on a number of other enabling factors. The availability and affordability of suitable equipment for productive uses due to lack of financial resources or limited access to loans and poor knowledge on how to use the electrical equipment affects the electricity usage for productive uses in rural areas. A market for the additional production is also seen as a challenge for the increased productivity in rural areas. A growing local economy with demand for non-basic goods can provide this market. External markets can provide further possibilities, but skills are required to access them. Saturation of the market is a key problem for new enterprises.

Hence, an integrated development program is crucial for the productivity increase resulted due to electricity access. These include roads that allow access to external markets, access to credit to purchase end-use technologies, training programs and professional support for enterprise creation, business promotion and development, demonstration projects of the use of electricity appliances for irrigation and for industries, technical assistance in converting enterprises to electricity. Creating awareness and provision of enough time for the end users is also important. It takes time for users to learn about the different services that electricity can provide. Experience shows that low electricity consumption levels after electrification give way to higher consumption after a few years.

In general, to achieve meaningful conclusions regarding the linkage between provision of improved electricity supply and impacts on poverty it has been therefore necessary to establish which factors enable utilization of available electricity access for productive purposes, and which factors contribute to these productive uses leading to additional income generation. Therefore, it is necessary to see the overall aspects which affect the socio economic development of a society in addition to increasing electricity access in rural areas.

## 2.3 The global electricity access scenario

Achieving universal access to electricity is one of the most important goals set for the energy sector by governments in the developing countries. Energy access is increasingly seen as a vital catalyst to wider social and economic development, enabling education, health and sustainable agriculture, and creating jobs. Energy for productive uses is particularly important to enable local business innovation and create a more vibrant economy for communities and countries, while providing societal benefits as well (SE4ALL, 2012).

The UN Sustainable Development Goals (2015) states that over 1.2 billion people one in five people of the world's population do not have access to electricity. Without electricity, women and girls have to spend hours fetching water, clinics cannot store vaccines for children, many schoolchildren cannot do homework at night, and people cannot run competitive businesses. Another 2.8 billion people rely on wood, charcoal, dung and coal for cooking and heating, which results in over four million premature deaths a year due to indoor air pollution. . Out of the total 1.2 billion people without electricity access, 99 million are in East Asia and Pacific region, 378 million in South Asia, and 591 million in Sub-Saharan Africa (World Bank, 2014).

According to IEA (2014), nearly 730 million people use hazardous, inefficient forms of cooking, a reliance which affects women and children disproportionately. Meanwhile, those who do have access to modern energy face very high prices for a supply that is both insufficient and unreliable. Overall, the energy sector of sub-Saharan Africa is not yet able to meet the needs and aspirations of its citizens. The problem is expected to worsen in sub-Saharan Africa as population growth outpaces the increase in electrification (Shashi B. et.al (2014).

Average electricity use in Africa today is 620 kWh per capita. For sub-Saharan Africa without South Africa it was just 153 kWh per capita in 2009, which will rise to 235 kWh in 2020 in a

business-as-usual scenario. In comparison, in 2010/11 India will consume640 kWh per capita and the world average was2,730 kWh per capita in 2009 ( IRENA, 2012).

## 2.4 Prospects of electricity access in developing Countries

The UN Sustainable Development Goals (2015) sets a goal on energy including the target to achieve universal access to energy by 2030. The number of people without electricity expected to fall to 800 million by 2030 and the number without access to clean cooking fuels will decline only gradually to 2.3 billion in 2030. The electricity access challenge is acute in Sub Saharan Africa in the next 15 years (2015–2030).

The IEA energy access outlook (2017) summarizes the future electricity access scenario in two broad statements. Due to rapid progress in India and other countries, Asia achieves near-universal household electrification by 2030.In Sub-Saharan Africa, progress in electrification is mixed, as electrification rates continue to increase but the total number of non-electrified households also grows with population. In Asia by 2030, only 54 million people (less than 1% of total population) will be without electricity. In Sub-Saharan Africa, the number grows from today's 588 million (48% of total population) to 602 million (36% of total population) due to population growth. Asia's success in household electrification means that electricity access will increasingly be about affordability and reliability. The study shows that in India's energy-poor states, for example, the quality of electricity access remains very low. Bihar and Uttar Pradesh have not only struggled to electrify households, but also supply fewer than ten hours per day to households with electricity access. For electricity access to play a meaningful role in rural development in Asia, issues of affordability and quality must be front and center.

The nature of rural electrification will also change. Only half of all new electricity connections will be to the electric grid, while the other half comes from mini-grids and micro-grids. This departure from total dominance of grid extension reflects both improvements in distributed power generation and the simple fact that many non-electrified households today live in sparsely populated areas that are difficult to connect to the grid (IEA, 2017).

IEA's Energy Access Outlook(2017)states that the challenge of household electrification is less about connectivity at the global level, and more one of supplying rural households with affordable

and reliable power. Sub-Saharan Africa is the only region of the world that will face a connectivity problem in 2030, and even there the challenge of moving beyond basic energy access is already emerging.

According to IRENA (2012), Africa has 147 GW of installed capacity, a level comparable to the capacity China installs in one or two years. Average per capita electricity consumption in sub-Saharan Africa (excluding South Africa) is just153 kWh/year. This is one-fourth of the consumption in India and just 6% of the global average. Nearly 600 million people in Africa lack access to electricity. Electricity blackouts occur on a daily basis in many African countries. Faced with this situation, people and enterprises often have to rely on expensive diesel power generation to meet their electricity needs, costing some African economies between 1% and 5% of GDP annually. To meet its growing demand Africa has an urgent need to raise the level of investment in its power sector. Analysis of a range of country and regional studies suggests the continent will need to add around 250 GW of capacity between now and 2030 to meet demand growth. The projected expansion in installed capacity and transmission and distribution networks requires large infrastructure investments. Total 2010–2030 cumulative investments are projected in the order of USD 300–350 billion, representing an average of USD 15–19 billion, per year. The highest investment requirements are for western & central Africa, where 55% of the newly connected population lives. The region requires investments for the refurbishment of existing power plants, significant capacity addition to meet the growing electricity demand, and an extension of the high voltage transmission and distribution network to provide electricity to more than 50% of the newly connected population. In contrast, total investment requirements in the Republic of South Africa are relatively low. The country already owns an extensive grid, to which a large share of the population is connected; therefore, the projected investments are mostly for expanding generation capacity.

## 2. 5 Major issues in electrification

### 2.5.1 Financing

The power sector requires huge capital investment. According to UN Sustainable Development goals (2015)**,** the world needs to triple its investment in sustainable energy infrastructure per year; from around $400 billion now to $1.25 trillion by 2030.The World Bank (2010) estimated that

$860 billion would be needed to connect 600 million additional households to achieve universal access by 2030.

The cost of improving access to modern energy sources is large, but not insurmountable. Worldwide universal energy access by 2030 will require an investment of USD 34 billion per year over and above the baseline investments, with USD 32 bn per year extra for electricity and USD 2 bn for cooking fuels (IEA, 2011). About 60% of these additional investments (USD 20 bn per year) would have to be in Africa just for universal electricity access by 2030. In comparison, total African power sector investment including operation and maintenance is today around USD 50 billion per year (IRENA, 2012).

To meet increasing demand and support economic growth, the power sector in Africa needs to install an estimated 7,000 megawatts (MW) of new generation capacity each year. Adequately financing the development of the energy sector in sub-Saharan Africa is expected to require the mobilization of funds in the order of USD 41 billion per year, which represents 6.4 per cent of the region's GDP. A large financing gap exists because the focus of much of the current spending is on maintenance and operation of the existing power infrastructure, with little remaining to fund long-term investments and to address the power supply gap (UNEP, 2012).

### 2.5.2 High costs of supplying rural and peri-urban households

Most rural communities, as well as many peri-urban areas, are characterized by a low population density and a very high percentage of poor households. Demand for electricity is usually limited to residential and some agricultural consumers, and many households consume less than 30 kilowatt-hours (kWh) per month. The combination of these factors results in high costs of supply for each unit of electricity consumed (World Bank, 2010).

### 2.5.3 Lack of appropriate incentives

According to World Bank (2010), the high costs of electricity supply in rural areas and the limited capacity of households to pay for the service make it difficult to attract investment in rural electrification. To do so requires a system of tariffs and subsidies that ensures sustainable cost recovery while minimizing price distortions. However, such a revenue-generation scheme is absent in many countries. All too often, tariff subsidies are designed to favor the large majority of consumers, including the well-off, while failing to provide utilities with incentives to invest in

rural electrification. Such ill-designed tariff schemes are found is particularly in Sub-Saharan Africa, where subsidies applied to residential consumers are highly regressive.

### 2.5.4 Population growth

According to IRENA (2012), in many countries with rapid population growth, an increasing rate of access to electricity does not necessarily mean a reduction in the absolute level of population without access. The population of Africa is growing fast (2.3% per year).At the same time, per capita income levels are rising and Africa is urbanizing. These three trends will drive energy demand growth and consumption patterns in the coming decades. The current urbanization rate ranges from 18% in Ethiopia to 50% in Nigeria, but it is well above 70% in some North African countries. In Africa today, 34% of population lives in cities and 66% in rural areas. The trend is towards a 20 percentage point increase of the urban share by 2050. This means that more than half of the sub-Saharan population will live in cities and the urban population will more than double.

### 2.5.5 Electricity demand growth

According to IRENA (2012), in developing countries, electricity demand tends to grow at least as fast as GDP. Demand in the Central and Eastern regions will grow at the rate of GDP growth plus 2% (so more than 7% electricity demand growth per year between now and 2030); while in the West it will grow at 1% above GDP growth. In southern Africa it is assumed that electricity growth will match the rate of GDP growth (so not more than 3-4% electricity demand growth per year), while in North Africa, electricity demand is assumed to grow at a slower rate than GDP, given the relatively high electrification rate and electricity consumption, and the larger industrial base. Urbanization rates are projected to rise by about 20 percentage by2050. Almost two-thirds of Africans will live in cities in 2050, compared to less than 40% today. In Ethiopia, only 60 % of the population resides in areas served by the network, less than 25 percent is connected to electricity services, with just 10 percent receiving service in rural areas. Sustained economic growth in Ethiopia will further fuel electricity demand, which is predicted to increase at above 10 percent per annum in the medium term (Ethiopian national electrification strategy, 2014).

## 2. 6 Power sector reforms and Private sector participation

Power sector reform strategies should be designed to fit an overall framework for delivery of modern energy services to promote poverty alleviation and economic growth. Governments face critical decisions in reforming their power sectors. They must decide the relative roles of public and private sectors in providing power services; the governance and reform of public enterprises operating in the sector; restructuring to introduce competition, including unbundling and the development of power markets; and regulatory reforms (World Bank, 2004).Power sector in developing countries is characterized by inefficient, low financial and institutional capacity and lack of private sector participation. According to World Bank/USAID (2004), reform in emerging markets has four major drivers:

**Lack of private sector investment**

Historically, developing country governments had financed their largely state-owned power utilities and supplemented their capital requirements with multilateral development bank loans, it was recognized that these two sources would be entirely inadequate to finance power sector investment in the decades to come. The private sector was seen as the only additional source of capital that could close the power sector's financing gap. It was recognized the private sector required higher financial returns than those needed by MDBs or governments; it was expected that the efficiency gains from private sector involvement would more than offset the higher cost of capital such involvement would entail. The challenge is reforming the power sector to attract the needed private investment.

**Economic inefficiencies**

In most developing countries, the power sector has been troubled by high technical losses, a lack of cost recovery pricing, poor maintenance, low equipment reliability, high staff levels, low productivity, corruption, a crippling on-payments problem, and mounting debt. These factors have resulted in the commercial unsustainability of many developing countries' power sectors, which are unable to attract the needed private investment. If the power sector is unable to charge the consumer for the full cost of power, the public must then make up the difference in one form or another through direct or indirect taxes that support subsidies. These state subsidies necessary for financing the power sector's financial shortfalls have become a mounting burden that is no longer sustainable for many developing countries.

**Persistent poverty**

The lack of reliable power and other infrastructure (particularly water, telecommunications, and transportation) has had a notably adverse impact on growth and has contributed to perpetuating poverty. The shortage of capital means power is rationed and that only those regions, major industrial or commercial consumers, or residential consumer blocks that can pay, have a chance of receiving reliable power. The links between unreliable power and reduced economic growth have been established and reinforce the imperative to reform the power sector.

**Debt and deficits**

The power sector in many developing countries is saddled with large debts accumulated from years of not charging cost recovery tariffs, not collecting from all consumers, not disconnecting consumers who do not pay, and using the utility as a vehicle for subsidies and political patronage for jobs and other favors. These power sector debts have led to non-payment to the central government and to governments having to channel sizable shares of their budgets into subsidizing the power sector. These subsidies, along with other expenditures, have led to serious budget deficits that concern the international financial community and the IMF in particular. For these reasons, power sector reform and privatization have been seen as attractive solutions to the problems of debt and deficits by transferring the power utilities to private companies that then assume the responsibility for eliminating the losses.

# Chapter three

# Methodology

## 3.1 Research design

The research design is the main part of the methodological framework. The main objective of this study is to identify the challenges of enhancing electricity access in the country related to institutional structure; policy financing and private sector engagement in the sector. In order to meet the objectives of this research descriptive research design has been used. The descriptive research design has been selected mainly due to the nature of the research questions such as 'What' and 'How' which have been assumed more appropriate for investigating and understanding the various aspects of this study. Moreover, both qualitative and quantitative research methods have been employed in this research. The qualitative research method is mainly aimed to collect primary data through semi-structured interviews from purposely selected respondents. In addition, the quantitative method is mainly used to collect statistical and secondary data for the analysis.

## 3.2 Data source

Both Primary and secondary data sources were used to conduct this study. However, secondary data is the main data source for this research. The primary data was mainly gathered from specific target institution for this study such as MoWIE, EEP, EEU and EEA. Experts and officials who are assumed to be appropriate and relevant for this study in the selected departments of those institutions were used as a primary data source. In addition, secondary data was gathered from published and unpublished documents such as such as Energy policy, UEAP reports and data base, GTP I&II, CRGE, EEPCo Power master plan, Proclamations, regulatory documents, reports and other related documents were collected from the relevant institutions. Moreover, other publications from international institutions such as WB, AfDB, IEA, and IRENA Websites are used as a secondary data source for this study.

## 3.3 Data collection technique

In order to gather the necessary information for this study, document review has been considered as a major technique for collecting data. A series of document reviews that reflect the range of issues and objectives of this study have been made and summarized. In addition to this, the study

has used key informant interviews. For the interview, experts and officials in the target institutions who were assumed to be appropriate to give the necessary information and inputs on the issue were selected. Accordingly, a total of 10experts from the selected institutions such as MoWIE, EEA.EEP, EEU, were interviewed to obtain the relevant information for this study. The interviews were mainly designed based on the mandates of each institution however a few common questions were included to get the views of each respondent on the overall issue.

## 3. 4 **Sampling** method and sample size

Interview was used to collect primary data for this research and sampling method to select respondents is purposive sampling, also known as judgmental or selective, which is a non-probability sampling technique. This sampling method has been selected due to its advantage to gather information from selected and appropriate experts and officials in the sector who could provide the necessary input for this research. The interview was conducted in a semi structured way, which includes a per-determined set of questions and gives the respondents a chance to explain further issues related to the study. A total of 10 experts and officials which are relevant and capable to provide detail information on the issue were interviewed from the target institutions.

## 3. 5 Data analysis technique

In order to achieve the objectives of this research, this study employed descriptive data analysis technique. The qualitative and quantitative data collected through review of necessary documents and key informant interviews with purposely selected experts and officials in the sector were analyzed using tables, and descriptions to make a reasonable analysis of the issue. Based on the findings of this study, concrete conclusions and relevant recommendations have been drawn.

## 3.6 Ethical considerations

A sound research is a moral and ethical endeavor and should be concerned with ensuring that the interests of those participating in a study are not harmed as a result of research being done. According to Anjum (2006), there are globally accepted ethical principles in conducting research the following principles need to be followed in conducting a qualitative research:

**Informed and voluntary consent:** researchers are expected to obtain informed consent from all those who are directly involved in research or in the vicinity of research. These usually include prior information on key elements of research such as purpose, procedures, time period, risks, benefits, and a clause stipulating that participation is voluntary and the participants have the right to withdraw from the study.

**Confidentiality of information:** this principle is also concerned with offering respect and protection to research participants through assurance of confidentiality of information shared and anonymity by not revealing the identity of the individuals and institutions involved.

**No Harm:** according to this principle researchers are expected to provide the participants with an outline of the risks and benefits involved to the participants in the study.

According to the above ethical principles, the participants involved in the data collection and interviews in this research process have been well informed about the objectives and the purpose of this study. Moreover, the information and data gathered through interview and reviewing documents have been in line with the principles of confidentiality and no harm principles.

# Chapter Four

# Data presentation and analysis

## 4.1 Introduction

This chapter presents and analyzes both the primary and secondary data collected from different institutions related to the objectives of this study. The interview questions for this study were designed to collect primary data from experts and officials based on the mandates of each institutions selected for the purpose of this study. Accordingly, the issues related to the policy and strategies and institutional structure of the sector are mainly the mandates of MoWIE, the private sector engagement issues are associated with EEA, the electricity generation and transmission aspects are related to EEP, the UEAP, electricity distribution and electricity sector financing are mainly related to EEU. However, some general issues related to private sector investment, electricity sales tariff and financing are also presented and analyzed based on the interviews. The primary data is presented and analyzed in each section of this chapter in order to capture different perspectives on the issues.

The secondary data presented in this chapter includes the overview of the electricity sector, the institutional structure of the sector both at federal and regional level, the policy and strategy of the sector, the GTP I & II, financing and private sector engagement in the sector and the detail implementation and analysis of the UEAP since its establishment.

## 4.2 Ethiopian electricity sector overview

### 4.2.1 Energy resource and generation capacity

Ethiopian is endowed with a huge renewable energy potential. However, the country has managed to develop insignificant amount of its potential. The country has variety of renewable energy resources including hydro, wind, geothermal, solar and bio-energy. The gross hydro-energy potential of the country is 45,000MW. The country has also a huge wind and geothermal energy resource potential estimated about 1,350 GW and more than 7,000 MW respectively (MoWIE, 2016). The table below shows the overall energy resource potential of the country and the exploited level of each resource so far.

**Table 1: Indigenous energy resource potential**

| Resource | Unit | Exploitable Reserve | Exploited Percent |
|---|---|---|---|
| **Hydropower** | MW | 45,000 | <10% |
| **Solar/day** | $kWh/m^2$ | Avg. 5.5 | <1% |
| **Wind: Power Speed** | GW m/s | 1,350 > 6.5 | <1% |
| **Geothermal** | MW | 7000 | <1% |
| **Wood** | Million tons | 1120 | 50% |
| **Agricultural waste** | Million tons | 15-20 | 30% |
| **Natural gas** | Billion $m^3$ | 112 | 0% |
| **Coal** | Million tons | 300 | 0% |
| **Oil shale** | Million tons | 253 | 0% |

**Source: MoWIE's Brochure, 2015**

The overall electricity generation capacity of the country is about 4228MW more than 90% from hydro and the remaining from wind (MoWIE, 2015).During GTP I, the country planned to reach a generation capacity of 10,000 MW however it is currently generating less than half of its targets. Moreover, the GTP II also set an ambitious target to increase the electricity generation capacity of the country to 17, 000MW. However, the generation capacity is only expected to reach 10000MW once the ongoing major projects GERD (6000MW) and Genale Dawa III (254 MW) become operational at the end of GTP II.

**Table2: Projects under construction**

| No | Plant name | Type of plant | Installed Capacity (MW) | Avg. Energy production (GWh/ year) |
|---|---|---|---|---|
| **1** | Genale Dawa III | Hydro | 254 | 1,200 |
| **2** | Grand Ethiopian Renaissance Dam (GERD) | Hydro | 6,000 | 15,177 |
| **3** | Aluto Langano | Geothermal | 75 | 591 |
| **4** | Repie power plant | Waste to Energy | 50 | 185.6 |
| | Total | | 6379 | 17,154 |

**Source: MoWIE's Brochure, 2015**

The interview conducted with both EEP planning department and Energy Study and Development Follow Up directorate in MoWIE indicates that most of the generation projects were delayed. According to the opinions of EEP planning department, some of the generation projects under GTP II were planned to be developed by the private sector however, it has not been effective as planned due to unclear direction and methodology on how to invite the private sector investment. Previously the projects were planned to be awarded on direct negotiation scheme with the companies but the government has recently changed its approach to use an auction for awarding the projects. This process has created a delay on some of the projects which were planned to be developed within the period of GTP II. Generally, the delay of the electricity generation projects has a negative impact on the electricity access targets and the growing electricity demand due to rapid urbanization, electricity railway projects and increasing industrial parks in the country.

Regarding electricity access, only 60 % of the population resides in areas served by the electricity network, however less than 25 % is connected to electricity services (GTP II, 2015).The country's energy sector is predominantly based on traditional biomass at household level, which accounts for nearly 89% of the energy needs while hydrocarbons mainly used for the transport sector accounts for 9% and electricity covers about 3 % of the total energy needs of the country. (MoWIE, 2015).The per capita consumption of electricity per annum is also low level which stood at 100 kWh per year compared to a Sub-Saharan Africa (SSA) average of 521kWh electricity per capita consumption (SE4All action plan, 2014).

### 4.2.2 Electricity demand forecast

According to Power System Expansion Master Plan (2014), the average compound electricity sales growth of the interconnected system from 2001– 2011 was 11.4% per year. The three largest consumer categories of domestic, commercial and industrial grew on average by 12.4%, 11.2%, and 10.5% respectively each year. The forecasts show high growths, which are mainly driven by the very large planned growth in the industrial and agriculture (irrigation) sectors, and the demand of the new railways specially in the first 10 years of the planning period (2012-2022). Beyond 2022 new specific industrial projects are not known, and such electricity demand growth is related to estimated economic growth rates. The average growth rates of electricity in reference, high and low scenarios are presented in the table below:

**Table 3: Future electricity demand growth rates**

| Period | Reference | High | Low |
|---|---|---|---|
| **2012-2017** | 31.6% | 34.8% | 28.9% |
| **2017-2022** | 14.3% | 14.9% | 12.8% |
| **2022-2027** | 6.9% | 8.4% | 4.9% |
| **2027-2032** | 6.7% | 8.6% | 4.9% |
| **2022-2037** | 5.9% | 8.1% | 4.4% |
| **2012-2037** | 12.7% | 14.5% | 10.8% |

**Source: EEPCo power master plan, 2014**

According to the opinions of Energy Study and Development Directorate in MoWIE, the electricity demand growth rate is outpacing the electricity infrastructure development especially in urban areas. Moreover, it is indicated that it will be difficult to meet the ever growing electricity demand with current trends and directions in addition to the task of addressing the existing low level of electrification in rural areas.

## 4.3 Institutional structure of the electricity sector

### 4. 3.1Electricity sector structure at federal Level

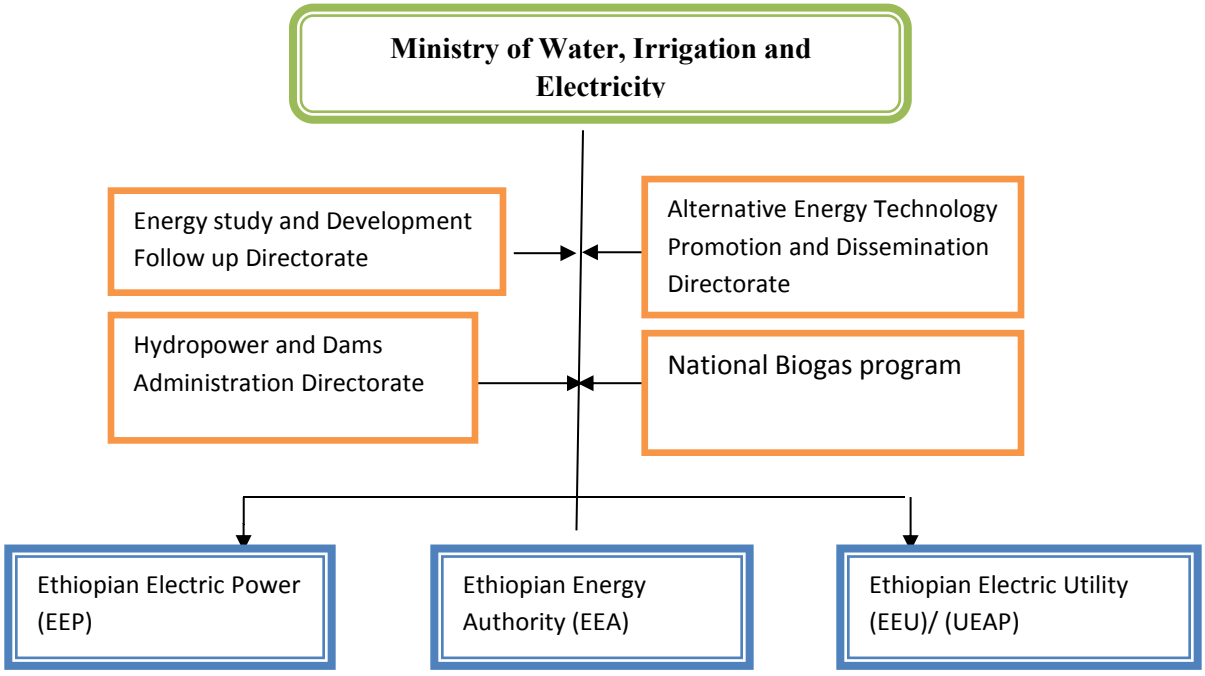
According to the interviews conducted with Energy Study and Development Directorate in MoWIE, the institutional structure of the energy sector in general and the electricity sector in particular has been unstable. It has been merged and unbundled with other sectors several times in the last few years. The sector used to be under Ministry of Mines and Energy and it was merged with the former Ministry of Water Resource to form Ministry of Water and Energy in 2010.After the new arrangement in 2010, the Ministry of Water and Energy at federal level has changed its structure twice within the last five years. The Ministry had been renamed as Ministry of Water, Irrigation and Energy and in the middle of GTP I it is restructured as Ministry of Water, Irrigation and Electricity.

The Interviews with both Energy Study and Development Follow Up and Alternative Energy Directorates in MoWIE indicates the frequent structural changes have created instability and uncertainty in the sector. It also has been taking substantial amount of time to make the new adjustment which in turn affected the implementation of the ambitious plans in the sector including

electricity access. Moreover, it is mentioned that the continuous changes also affects the growth of the electricity sector and long term plans in the sector.

The current structure of the Ministry absorbs three huge sectors together namely water, irrigation and electricity which is not mostly seen in other countries. As it is mostly seen in other developing countries, with a better electricity access rate, the energy sector in general and the electricity sector in particular has been independently established. For instance, in Kenya the electricity sector structured as Ministry of Water and Petroleum (Energy. go, n.d.).In Egypt the electricity sector is named as Ministry of Electricity and Renewable Energy, (MoEE.gov, n.d). In addition, India has two ministries that deal with renewable energy; Ministry of New and Renewable Energy (Mnre.gov, n.d) and a separate Ministry on Electricity called Ministry of Power (Powermin.nic, n.d).This indicates that the electricity sector is a huge sector which needs a strong and sustainable structural arrangement. However, the institutional structure in Ethiopia has been facing continuous changes in its institutional set up. The current organizational structure of the Ministry is shown in the chart below:

**Figure 1: Structure of the electricity sector at federal level**




**Source: MoWIE, 2016**

The above MoWIE's electricity sector organizational structure shows that, the Ministry has not changed its internal structure since its new arrangement. The Ministry and its departments posses the names and mandates of the former Ministry of Water, Irrigation and Energy such as Energy Study and Development Follow Up directorate, Alternative Energy Technology Promotion and Dissemination directorate and National Biogas program. According to opinions of Energy Study and Development Follow up directorate in MoWIE, energy is a broad sector which includes biomass, hydrocarbon and electricity sectors. However, the Ministry still lacks a dedicated departments and units that focus on electricity access activities.

The former EEPCo was also unbundled in to two separate companies in 2013 namely Ethiopian Electric Utility /EEU and Ethiopian Electric Power/EEP under a proclamation No 303/2013 and 302/2013 respectively. The EEU focuses on the low voltage electricity distribution and electricity sales where as the EEP is mandated for electricity generation and high voltage transmission line according to their respective proclamations. The UEAP has also been restructured since the unbundling of the EEPCo. According to the interview with UEAP planning department, the UEAP used to be under EEP at the beginning however since 2016 it has shifted to EEU. This has caused a transitional gap on its electricity access activities and targets. Moreover, it is mentioned that the UEAP has still been working in high voltage transmission projects, which are not its mandates under the EEU. The interview with EEU planning department also indicates the transition has caused financial and operational challenges due to the two companies share a lot of resources before the unbundling.

The Ethiopian Energy Authority/EEA was established under proclamation No 810/2013 which replaced the former Ethiopian Electric Agency. The new proclamation gives a broader mandates for the EEA which includes:

- Issue and renew license for electricity generation, transmission, distribution sales, import and export.
- Approve PPA and NW service agreements.
- Determine quality and standards of electricity services
- Review electricity tariff and submit to government for approval
- Issue professional competency certificate

According to the interview with the licensing department in the EEA, even though the mandates of the former Agency were enhanced by the current arrangement, the Authority has not exercised and implemented its mandates due to lack of regulations, guidelines and institutional capacity. So far, Apart from some exploration license for geothermal, the Authority has not given electricity generation license to private investors. Moreover, it is mentioned that it has not yet approved electricity retail tariff for small scale private and community based micro and min grids, which in turn affects the decentralized electricity access approach.

### 4.3.2 The Electricity and Energy sector structure at regional level

According to the documents reviewed and interviews with Energy Study and Development Follow UP directorate in MoWIE, at regional level the energy sector is structured in different arrangements among the regional states. The regional energy bureau are responsible for implementing many of the energy sector plans, initiatives and projects set by the Ministry of Water, Irrigation and Electricity. Some of the activities done at regional energy offices include: following up UEAP program in their respective regions, dissemination and promotion of solar technologies for the rural communities, dissemination of improved cook stoves and other initiatives. The current institutional arrangement of the electricity and energy sector at regional level is shown in the table below:

**Table 4: Electricity and Energy sector structure at regional level**

| No | Region | The names of electricity and energy sector offices |
|---|---|---|
| **1** | Tigray | Mines and Energy Agency |
| **2** | Oromiya | Water, Mines and energy Bureau |
| **3** | Amahara | Mines and Energy resource Development and Promotion Agency |
| **4** | Afar | Mines and Energy Development Office |
| **5** | Somali | Environmental Protection, Forestry, Mining and Energy Development Agency |
| **6** | Benishangul Gumuz | Water, Mines and Energy Development Bureau |
| **7** | Harari | Investment, Mines and Energy Office |
| **8** | Gambela | Water and Energy Development Bureau |
| **9** | SNNP | Mines and Energy Agency |
| **10** | Dire Dawa (City administration) | Water, Mines and Energy Bureau |
| **11** | Addis Ababa(City administration) | Environmental protection Bureau |

**Source: MoWIE, 2016**

As it is indicated in the above structure of the regional offices, the energy and electricity sector is merged with several sectors and is not consistently structured in all regions. According to the opinions of the interviewed experts and officials in Energy Study and Development Follow Up and Alternative Energy Technology Promotion and Dissemination directorates in MoWIE, the institutional instability of the electricity sector at federal level has also affected the institutional arrangements in the regional energy offices. This has created a challenge in implementing and following up different energy sector and electricity access programs. Moreover, it is stated that the regions have often given less attention to the energy sector and allocate lower budget for the energy offices and the energy sector programs.

## 4. 4 Policy, strategy and GTP of the electricity sector

### 4. 4.1 Energy policy

The existing energy policy of the country was formulated in 1994 during the transitional government period. According to the interview with Energy Study and Development Follow up directorate in MoWIE, the Ministry has prepared a draft energy policy in 2015 however; it has not been approved by the Council of Ministers yet. Therefore, the policy which was formulated during the transitional government in 1994 is considered as the legal energy policy of the country. The existing policy gives high priority on hydro power resource development, as hydrological resources are Ethiopia's most abundant and sustainable energy forms. The policy also states that Ethiopia's Energy consumption is predominantly based on biomass energy sources. An overwhelming proportion (94%) of the country's energy demand is met by traditional energy sources. The policy was primarily intended to enhance and foster "Agricultural Development Led Industrialization (ADLI)" strategy and is consistent with other sector polices (Energy policy, 1994).However, the policy is outdated to accommodate the existing changes and challenges in the electricity sector both locally and globally. The country's economic growth, population growth, rapid urbanization and increasing electricity demand need a comprehensive and updated energy policy.

According to the interview with one of the energy policy committee member in MoWIE, who updated the energy the policy, the draft policy tried to be comprehensive and looks issues from local to international perspectives. However, it is indicated that the policy lacks back ground study of the actual energy sector situation of the country and it was revised based the ongoing

initiatives and trends in the electricity sector locally and internationally. Some of the rationales stated for the updating of the existing energy policy include:

- To be consistent with the national vision of building a middle income country in 2025
- To align with global energy development initiatives and climate change issues.
- To meet the energy needs of the fast economic growth of the country.
- To include recent technological innovations and changes related to energy sector.
- To strengthen energy efficiency and conservation in both the supply and demand sides.
- To reduce the pressure on foreign currency reserves by maximizing the market share of indigenous resources in energy goods and services through manufacturing and construction inputs, services, labor, technology transfer, building national capacity and the like, needs to be a policy focus.

- To include regional power interconnection and integration as the country is endowed with large hydro power and other renewable energy resources. Besides being a source of foreign currency, power interconnection will play a critical role for geopolitical stability in the region.
- To enhance power generation mix from different energy sources such as wind, solar, geothermal and nuclear.

Generally, the sector is still in need of a new energy policy which accommodates the existing electricity sector situation of the country. The electricity access in the country is very low and it is further intensifying with the growing population and urbanization. Hence, energy policy with clear strategies and programs is crucial for the development of the electricity sector in general and to enhance electricity access in particular.

### 4. 4.2 Climate Resilient Green Economy (CRGE) strategy

According to CRGE (2011), Ethiopia will become a middle income country by 2025 by following the green development path. Expanding electricity generation from renewable sources of energy for domestic and regional markets is one of the four pillars of the Strategy. One of the main objectives of the strategy is to avoid uses of traditional fossil fuel which result in a sharp increase in GHG emissions and unsustainable use of natural resources. The strategy states under current practices, greenhouse gas (GHG) emissions would more than double from 150 Mt CO2e in 2010 to 400 Mt CO2e in 2030.The power sector is considered as low carbon emitting sector in

the strategy since the electricity generation mainly comes from renewable energy source mainly from hydro.

Regarding electricity access, the strategy targets to expand the electricity grid network of the country to nearly 100% not measured in household electricity connection. In general, even though the strategy puts the expanding electricity network as one of the main objective it gives less attention how to enhance the low level of electricity connectivity and access in the country.

### 4.4.3 Growth and Transformation Plan (GTP) of the electricity sector

#### 4. 4.3.1 Growth and Transformation plan I (GTP I)

The government introduced Growth and Transformation Plan (GTP) for the overall growth and transformation of the country's economy. According to MoFED (2010),the electricity sector also set targets to be achieved during the first Growth and Transformation Plan (GTP I) in the period of five years between2010/11-2014/15.The main targets included in the GTPI of the energy sector are:

- Increase electricity generation capacity from 2000 MW in 2009/10 to 10,000 MW in 2014/2015
- Increase number of electricity connectivity from 2 million in 2009/10 to 4 million in 2014/2015.
- Increase coverage of electricity services from 41 % in 2009/10 to 75 % in 2014/2015.
- Increase total length of rehabilitated distribution lines from 450 km in 2009/10 to 8130 km in 2014/2015.
- Increase total length of distribution lines from 126,038 km in 2009/10 to 258,000 km in 2014/2015.
- Reduction of power loss from 11.5% in 2009/10 to 5.6% in 2014/2015.

However, at the end of GTP I, most of the plans were not achieved especially the electricity access targets. According to GTP II (2016), the geographic electricity network coverage reached 60% while the number of electricity connection only reach 2.3 million at the end of GTP I. The additional electricity connection during the planning period is almost 15% of the plan. Moreover,

the electricity generation capacity reached 4180 MW less than half of its target at the end of the planning year.

According to the interviewed officials in Energy Study and Development Follow up and Alternative Energy and Technology Dissemination Directorate in MoWIE, the main reason for the low level implementation of the ambitious targets of the GTP I was lack of proper planning, weak implementation capacity and coordination of activities among different institutions in the sector.

On the other hand, the interviews with the planning departments in EEP and EEU indicates, the reason for the delay of most of the generation, transmission and distribution projects is mainly due to lack of finance and implementation capacity which in turn affected the electricity access targets. Moreover, some of the generation projects which were planned to be developed by the private sector have not materialized. This indicates that it is difficult to meet the ambitious electricity sector targets of the country through public sector investment alone mainly due to the capital intensiveness of the sector and strong implementation capacity requirement.

#### 4.4.3.2 Growth and transformation Plan II (GTP II)

Eventhough the GTP I targets were not achieved, the GTP II has set even more ambitious targets than the GTP I to be accomplished in the period of five years between 2015/16 and 2019/20. According to GTP II (2016), some of the electricity sector GTP II targets include:

- To enhance the electricity generation capacity to 17,000MW from 4180MW in 2015
- To increase the household electricity connection to 7 million from 2.3 million at the end of GTP I
- To increase the electricity grid network coverage to 90% from 60% in 2015
- To increase the total length of power transmission lines from 16,018km in 2014/15 to 21,728 km in 2020.

Moreover, it is also planned to disseminate 3,600,000 solar lanterns, 400,000 household solar PVs, 3600 institutional solar PVs, 500 solar thermals and 3,600 solar cookers by 2019/20(GTPII, 2015).

However, according to the interviews with Energy Study and Development Follow Up directorates in MoWIE, the GTP II's first two years progress shows most of the targets are not on

track. It is mainly due to the delay of most of the GTP I targets and the focus has been in completing the projects which are under construction. The electricity generation projects under construction in GTP II are mainly GERD (6000MW) and Genale Dawa (254 MW) hydro electric projects. Up on the completion of these projects, the generation capacity will be about 10000MW at the end of GTP II, which is 7000MW short of the plan. On the other hand, the interview with EEP planning department indicates some of the generation projects in the GTP II were planned to be developed by the private sector to minimize the burden of financing the projects however the progress of engaging the private sector has been slow.

According to the interview with EEU planning department, electricity connectivity is 2.5 million in 2016 and it indicates a slow progress in achieving the 7 million electricity connection targets of the GTPII, which is mostly planned to be met through grid connection. Shortage of finance and low implementation capacity has been mentioned as major factors affecting the electricity connectivity targets.

## 4.5 Universal Electrification Access Program (UEAP)

### 4.5.1 Overview of the electricity access program

According the interview with UEAP planning department and the documents reviewed, the country has been implementing different programs and initiatives to enhance the electricity access. The first major rural electrification initiative was started in 1999/2000, when the government undertook the implementation of the Rural Electrification Project. This Project focused essentially on extending the electricity network to Woreda towns and major towns located close to sub-station or existing distribution lines. In total, 164 towns were electrified over the 1999/2000 to 2004/05 period. In 2005 the government has introduced the Universal Electrification Program (UEAP) to enhance the grid electricity coverage to rural towns and villages of the country. The UEAP is a more ambitious project than its predecessor the Rural Electrification Project. Launched in 2005/2006 for a five year period, it mainly includes the expansion transmission and distribution networks. In terms of generation, the UEAP includes the construction of nine small-localized off-grid electric power generating stations. The main objective of UEAP is to promote the socio-economic development of rural areas in the country by expanding the electricity network coverage to 90%.The scope of the program has been to

extend the transmission line, build substations, low voltage distribution networks and installation of transformers. The task of connecting to individual customers by installing meters has not been included in the scope of the UEAP. It has been the mandate of the distribution department in the EEU (UEAP, 2016).

According to the interview with the UEAP's planning department, the Program is funded by several stakeholders, including the government which allocates 2.5 billion ETB per year. Some of the other partners include the World Bank, Bank of Arab for Economic Development in Africa (BADEA), the Kuwait Fund, African Development Bank (AfDB) and bilateral cooperation from development partner countries like Indian Government (UEAP, 2016).

According to the interviews with UEAP's planning department, the UEAP has been in a continuous restructuring in the last few years. The program was established under the former EEPCo but after the unbundling of the EEPCO in 2013 into two separate entities EEP and EEU, there have been changes in the Program's institutional arrangements. At the first stage of the unbundling, the UEAP has been under EEP but since the beginning of 2016 the program has been under the EEU. The UEAP has a federal level program office and 8 regional offices in Afar,Tigray,Ormiya,Amahara,Gambella,SNNP, Benishangule and Somali regions. The Harari region and Dire Dawa city administrations are under Oromiya regional office while the program has no office in Addis Ababa city administration since it's assumed to be fully electrified.

In addition to the grid based electrification program, the government has also established Rural Electrification Agency to promote and deploy alternative energy technologies such as solar, efficient cook stove and biogas technologies for rural households. Accordingly, a Rural Electrification Fund was established in 2003 to provide electricity access for the rural communities which are not electrified by the national grid. According to the interviews with REF department and Documents reviewed, the program was started by installing 21 diesel generators in rural areas and also has installed more than 25000solar home systems so far. Moreover, more than 600 institutional solar systems have been installed by the program. However it is indicated that the off-grid program has not been given much attention and it has been facing challenges because of lack of operating budget and absence of a dedicated offices in the regional states.

Generally, the government's main focus has been extending the national grid to rural towns and villages in the country through the UEAP eventhough the connectivity rate so far has been

insignificant. The off grid electrification has not been a top priority even though it has been established before UEAP in 2003. However, off grid electrification is mostly seen as a fastest and less costly approach to increase the electrification rate in rural areas which are far and expensive to be connected to the national grid.

### 4.5.2 UEAP First Phase (2005/06-2009/10)

According to the interview with UEAP planning department and the documents reviewed, the UEAP's first phase pan was to electrify 6000 small and medium sized rural towns in the period of five years between 2005/06 and 2009/10.The table below shows the towns and villages planned to be connected during the UEAP's first phase plan:

**Table 5: Towns and villages planned to be electrified under UEAP first phase**

| Year | Number of towns and villages planned |
|---|---|
| 2005/06 | 172 |
| 2006/07 | 857 |
| 2007/08 | 1,714 |
| 2008/09 | 1,714 |
| 2009/10 | 1,543 |
| **Total** | 6,000 |

**Source: UEAP's plan, 2005**

At the end of the first phase of UEAP, 3886 rural towns and villages were electrified between 2005/06 and 2009/10, which is 65% of the target of the planning period. A total of 2114 rural towns and villages remain as a backlog during the first phase. As a result, the electricity network coverage reached to 41% by 2010/11(UEAP report, 2011).According to the UEAP's engineering department ,the main reason for not achieving the first phase targets was lack of inputs such as poles ,transformers and weak implementation capacity. The electrified towns and villages during UEAP first phase are presented in the table below:

**Table 6: Electrified towns under the UEAP first phase**

| Regions | Number of towns planned | Number of towns electrified | Difference |
|---|---|---|---|
| **Tigray** | 448 | 289 | 159 |
| **Afar** | 107 | 83 | 24 |
| **Amhara** | 1753 | 1125 | 628 |
| **Oromiya** | 2263 | 1428 | 835 |
| **Somali** | 204 | 97 | 107 |
| **Benshangul** | 119 | 89 | 30 |
| **S.N.N.P.** | 963 | 710 | 253 |
| **Gambella** | 115 | 44 | 71 |
| **Harari** | 10 | 8 | 2 |
| **Dire Dawa** | 18 | 13 | 5 |
| **Total** | **6000** | **3886** | **2114** |

**Source: UEAP report, 2011**

Before the start of the UEAP in 2005, 667 towns and villages were electrified between the periods of 1921 and 2005.A total of 5394 towns and villages were electrified until the end of the first phase of the UEAP implementation. The following table shows the electrified towns and villages in each region until the end the UEAP's first phase in 2010:

**Table 7: Electrified towns and villages until 2010**

| No | Regions | Electrified towns and villages (1921-2005) | Electrified towns under UEAP (2005-2010 ) | Electrified towns (Total ) (1921-2010) |
|---|---|---|---|---|
| **1** | Addis Ababa | 1 | 0 | 1 |
| **2** | Afar | 14 | 103 | 117 |
| **3** | Amahara | 118 | 1345 | 1463 |
| **4** | Benishangule | 7 | 110 | 117 |
| **5** | DrieDawa | 1 | 21 | 22 |
| **6** | Gambela | 3 | 54 | 57 |
| **7** | Harari | 25 | 8 | 33 |
| **8** | Oromiya | 313 | 1677 | 1990 |
| **9** | SNNP | 120 | 907 | 1027 |
| **10** | Somali | 19 | 121 | 140 |
| **11** | Tigray | 46 | 381 | 427 |
| | **Total** | **667** | **4727** | **5394** |

**Source: UEAP report, 2010**

### 4.5.3 UEAP under the GTP I

According to the interview conducted with the UEAP's planning department, the Program planned to connect 4234towns and villages during the GTP I. Moreover, the GTP I incorporated the 2114 rural towns and villages which remain as backlog from the UEAP's first phase implementation. Hence, the total number of towns and villages planned to be connected during GTP I was 6276.The planned towns and villages were in nine regions, namely Tigray, Afar, Amhara, Oromiya, Somali, Benshangule, S.N.N.P, Gambella, and Harari regions and one city administrative council i.e. Dire Dawa. The selection of towns and villages to be electrified each year is the responsibility of the regional states. Each regional state selects towns and villages based on allocated equity quota, technical, socio-economic and political criteria. It is expected that electricity will create new economic activities and improve the existing services such as grain milling, educational services, health services and irrigation activities. It was also targeted to increasing the electricity network coverage from 41% to 75% at the end of 2014/15 .The table below shows the rural towns and villages which were planned to be electrified during GTP I period:

**Table 8: Towns and villages planned to be electrified during GTP I**

| No | Region | No of Villages planned before GTP I | No of Villages electrified before GTP I | No of Villages transferred from previous UEAP to GTP I | Number of villages required | Total number of villages planned during GTP I |
|---|---|---|---|---|---|---|
| **1** | Tigray | 448 | 289 | 159 | 173 | 332 |
| **2** | Afar | 107 | 83 | 24 | 96 | 120 |
| **3** | Amhara | 1753 | 1125 | 628 | 892 | 1520 |
| **4** | Oromiya | 2263 | 1428 | 835 | 1722 | 2557 |
| **5** | Somali | 204 | 97 | 107 | 178 | 285 |
| **6** | Benshangule | 119 | 89 | 30 | 110 | 140 |
| **7** | S.N.N.P. | 963 | 710 | 253 | 963 | 1216 |
| **8** | Gambella | 115 | 44 | 71 | 80 | 80 |
| **9** | Harari | 10 | 8 | 2 | 9 | 11 |
| **10** | Dire Dawa | 18 | 13 | 5 | 11 | 16 |
| | **Total** | **6000** | **3886** | **2114** | **4234** | **6276** |

**Source: UEAP (GTP I), 2011**

According to the interview with UEAP's planning department, the quota is allocated by the UEAP by considering the population of towns and villages in each region however, the selection of towns

and villages to be electrified within the regions have been done by the regional governments. Moreover, it is indicated that in some cases the regions select and prioritize the towns based political criteria rather than population and economic parameters. This has created a negative impact on UEAP's implementation and the Program has also faced many challenges and complains from the towns and villages the regions. The table below shows the allocation of quota of towns and villages to be electrified in each region during GTP I:

**Table 9: Annual quota of regions during GTP I**

| No | Region | Total number of villages to be electrified during 2011-2015 period | Annual quota of regions during GTP I | | | | |
|---|---|---|---|---|---|---|---|
| | | | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 |
| **1** | Tigray | 332 | 42 | 42 | 74 | 74 | 100 |
| **2** | Afar | 120 | 15 | 15 | 26 | 26 | 38 |
| **3** | Amhara | 1520 | 195 | 195 | 332 | 332 | 466 |
| **4** | Oromiya | 2557 | 327 | 327 | 556 | 556 | 790 |
| **5** | Somali | 285 | 36 | 36 | 62 | 62 | 89 |
| **6** | Benshangul | 140 | 18 | 18 | 30 | 30 | 44 |
| **7** | S.N.N.P. | 1216 | 156 | 156 | 270 | 270 | 364 |
| **8** | Gambella | 80 | 10 | 10 | 17 | 17 | 26 |
| **9** | Harari | 11 | 2 | 2 | 2 | 2 | 3 |
| **10** | Dire Dawa | 16 | 2 | 2 | 3 | 3 | 6 |
| **Total** | | **6276** | **803** | **803** | **1372** | **1372** | **1927** |

**Source: UEAP (GTP I), 2011**

During GTP I, a total of 6276 additional towns and villages were expected to be electrified at the end of 2014/15. Table below shows the yearly number of towns and villages to be electrified and the corresponding electricity network expansion targets over the planning period.

**Table 10: Electricity access rate annual target during GTP I**

| Year | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | Total number of towns to be electrified |
|---|---|---|---|---|---|---|
| **Number of towns to be electrified** | 803 | 803 | 1372 | 1372 | 1927 | **6276** |
| **Access target** | 46% | 51% | 58% | 65% | 75% | |

**Source: UEAP (GTP I), 2011**

## 4. 5.4 Electrified towns and villages during GTP I

During the GTP I, the UEAP planned to electrify a total of 6276 towns and villages but the program only managed to electrify 1589 towns and villages. The number of towns and villages electrified since the start of the UEAP program has reached 4727 at the end of the GTP I period. This has increased the number of towns and villages electrified to 5394 including the electrified towns prior to the start of UEAP. Hence, the electricity network converge in the country has reached 54.25% at the end of the GTP I period even though the target was to reach 75%.According to the interview with UEAP's engineering department, the main reason for the low implementation of the GTP I was shortage of the necessary input supplies such poles, transformers and other logistical inputs. Moreover, weak implementation capacity of local contractors has contributed for its low performance during GTP I.

**Table 11: Total electrified towns and villages up to the end of GTP I**

| | Before the start of UEAP (Before 2005) | UEAP performance | | | Total Electrified towns and villages up to the end of GTP I |
|---|---|---|---|---|---|
| | | UEAP (2005/06-2009/10) | UEAP under GTP I (20010/11-2014/15) | Total | |
| **Electrified towns and villages** | **667** | **3138** | **1589** | **4727** | **5394** |

**Source: UEAP report, 2016**

## 4. 5.5UEAP's GTP II plan

Even though the GTP I plan of the UEAP was not achieved, the program has planned to electrify 10,205 rural towns and villages and to enhance the electricity network coverage of the country to 90%. Accordingly, the Program needs to electrify 2000 towns and villages each year to meet the GTP II target. However, during the GTP I, the UEAP has electrified 1589 towns out of the 6276 towns planed and only managed to reach 54.25% geographic electricity coverage level from the 75% access target. According to the opinions of the UEAP planning department, the Program has not addresses the major bottlenecks related to budget allocation and availability of inputs such as concrete poles to implement the ambitious targets of GTP II. The table below illustrates the towns and villages to be electrified each year and the electricity network expansion targets during GTPII:

**Table 12: Towns and villages to be electrified under UEAP's GTP II**

| Fiscal year | GTP II targets | |
|---|---|---|
| | **Planned towns** | **Annual access increment target (%)** |
| **2015/16** | 2042 | 8 |
| **2016/17** | 1068 | 2.09 |
| **2017/18** | 2618 | 8.9 |
| **2018/19** | 2914 | 10.93 |
| **2019/20** | 3207 | 12.27 |
| **Total** | 10,205 | 35.75 |

**Source: UEAP GTP II, 2015**

During GTP II first year (2015/16), the UEAP has electrified in total 462 towns which include 398 new towns and villages and system rehabilitation of 64 previously electrified towns out of the planned 2042 towns and villages. This indicates that only 19 % of the planned towns have been electrified during GTPII's first year. Moreover, the system upgrading of 64 electrified towns have been done by replacing the old distribution systems which were originally done by wood poles and by upgrading the substation and transformer capacity of the towns. As per the opinions of the relevant UEAP Engineering department, the main reason for the low performance has been the

Program's focus on rehabilitation works of the already electrified towns and villages which has taken a lot of resource and time, which should have been used to electrify new towns and villages. Electrified towns and villages during the first fiscal year of the GTP II are shown in the table below:

**Table 13: Electrified towns and villages during GTP II's first year**

| No | Region | GTP II's plan | Electrified towns in 2015/16 | Electrified towns by rehabilitation project in 2015/16 | Total |
|---|---|---|---|---|---|
| **1** | Afar | 239 | 13 | 8 | 21 |
| **2** | Amahara | 2558 | 104 | 7 | 111 |
| **3** | Benshangule | 237 | 17 | 3 | 20 |
| **4** | Oromiya | 3926 | 129 | 18 | 147 |
| **5** | Dire Dawa | 24 | 0 | 1 | 1 |
| **6** | Gambela | 136 | 3 | 0 | 3 |
| **7** | Harari | 24 | 0 | 0 | 0 |
| **8** | SNNP | 1934 | 82 | 8 | 90 |
| **9** | Soamli | 512 | 10 | 9 | 19 |
| **10** | Tigray | 615 | 40 | 10 | 50 |
| **Total** | | **10205** | **398** | **64** | **462** |

**Source: UEAP report, 2016**

According to the interview with the UEAP planning department, eventhough the Program is expected to electrify 2000 towns and villages each year, only 1068 new towns and villages have been planned during the second year of the GTP II. Moreover, the plan includes the system rehabilitation of 159 previously electrified towns and villages. In total, 1227 towns and villages are planned to be connected during the 2nd fiscal year of the GTP II period. The table below shows towns and village electrified up to November 2016.

**Table 14: Electrified towns and villages during GTP II's second year (2016/17)**

| Regions | Electrified towns | | | | Total | | Performance (%) |
|---|---|---|---|---|---|---|---|
| | System rehabilitation | | New towns and villages | | | | |
| | Planned | Electrified | Planned | Electrified | Planned | Electrified | |
| **Afar** | 12 | 1 | 12 | 9 | 24 | 10 | 41.67 |
| **Amahra** | 32 | 23 | 203 | 82 | 235 | 105 | 44.68 |
| **Benishangule** | 5 | 5 | 18 | 8 | 23 | 13 | 56.52 |
| **Dire Dawa** | - | 0 | 3 | 1 | 3 | 1 | 33.33 |
| **Gambela** | 3 | 2 | 9 | 4 | 12 | 6 | 50.00 |
| **Harari** | - | 0 | 3 | 3 | 3 | 3 | 100.00 |
| **Oromiya** | 77 | 57 | 327 | 136 | 404 | 193 | 47.77 |
| **SNNP** | 6 | 5 | 162 | 78 | 168 | 83 | 49.40 |
| **Somali** | 18 | 3 | 31 | 11 | 49 | 14 | 28.57 |
| **Tigray** | 6 | 4 | 50 | 14 | 56 | 18 | 28.57 |
| **Total** | **159** | **100** | **818** | **346** | **977** | **446** | **45.65** |

**Source: UEAP report, 2016**

As it is indicated in the table above, during the second year (2016/17) of GTP II, 446 towns and villages were electrified out of the planned 1068 until April 2017.The implementation of the UEAP during the GTP II first two years shows, the electricity access target of electrifying 10205 towns and villages during GTP II are unlikely to be achieved. According to the interviews with planning department of UEAP, the low performance is due to insufficient budget allocation of MoFEC for the Program. It is indicated that the program requires 6 billion ETB per year to electrify 2000 towns each year during GTP

II however only 2 billion birr has been allocated for the Program. This created a delay of payments for local contractors and purchase of inputs. Moreover, according to the opinions of the Engineering department of the UEAP, the Program has been focusing on the system rehabilitation and upgrading of the already electrified towns and villages in contrary to its main objective of electrifying the new towns and villages, which has taken a lot of its resource and time.

## 4. 6 Private sector participation and financing in the electricity sector

### 4. 6.1 Financing in the electricity sector

According to the EEPCo power master plan (2014), which studied the country's generation and transmission planning for 25 years, the country needs to invest around a total of 177billion USD over the planning years (2013-2037). In line with the master plan study, the country has planned to reach 17MW generation capacity by the end of GTP II. Moreover, during the GTP II, the UEAP has planned to electrify 10,000 towns and to enhance electricity access to 90% by 2019/20 (GTP II, 2015).

According to the interview with planning department in EEP, in order to achieve the ambitious target, the sector needs to generate a substantial amount of revenue in addition to the concessional loan from the international lending institutions such as WB, AfDB and bilateral loans. However, it is indicated that the international institutions' loan mainly focus on the transmission and distribution projects not to the electricity generation projects, which requires a substantial amount of investment. This is mainly due to the social, environmental and geo-political issues related to huge hydro dam projects. Hence, it has been difficult to get loans for large generation projects especially the large hydro projects such as GRED, Gile Gibe III and other candidate projects. This has created a huge financial burden and delay on both EEP and EEU projects.

According to the interview made with UEAP planning department , the UEAP's GTP II plan alone requires at least 6 billion ETB per year to electrify 2000 towns and villages per year to meet the GTP II targets of electrifying 10000 towns. However, only 2 billion ETB was allocated by the government for the Program for 2016/17 fiscal year due to mainly lack of budget. Moreover, it is indicated that, due to the shortage of budget allocation, the program has been unable to meet its targets and has been forced to minimize its targets.

According to the interview with Energy Study and Development Follow Up directorate in MoWIE, the main reason for the financing challenge is the low electricity sales tariff in the country, which is considered as the lowest in Africa. It is indicated that, due to the low level of electricity tariff, the

sector has not to be able to recover its cost and to pay its foreign debt. Moreover, the lack of finance has been a big challenge in attaining the ambitious targets of electricity access at the end of GTP II.

According to EPPCo master plan (2014), the electricity retail tariff is on average 3 USD cents per KWh while the cost of generating, transmitting, distributing electricity is estimated at 7 USD cents per KWh. This indicates a huge gap between the cost of providing the electricity and the revenue generated by the sector. According to the interview with of planning department in EEU, the tariff structure consists of four major consumption categories namely domestic, commercial, industrial and street light. The domestic and commercial categories are block tariffs with rates increasing with higher levels of intake while the street lighting tariff is charged with a simple flat rate. All categories include both monthly service charge plus a per unit energy charge.

Moreover, it is indicated that, the industries pay lower rates than the commercial and higher block domestic customers to encourage industrial development in the country. However, the low tariff has been affecting the operation and maintenance activities of EEU due to lack of budget to purchase inputs for its daily operations and maintenance. This has resulted in unreliable power supply and frequent power outages for industries which in turn affected their productivity. On the other hand, the Utility is also unable to address the increasing new electricity connection requests for all customer categories due to lack of budget to purchase inputs such as meters, transformers and electric poles. The table below shows the domestic electricity retail tariff for the respected consumer categories:

**Table 15: Domestic electricity sales tariff rates**

| Tariff category and blocks | Monthly consumption (KWh) | ETB /KWh | Remark |
|---|---|---|---|
| **1. Domestic** | | | |
| **1stBlock** | 0-50 | 0.2730 | progressive rate |
| **2nd Block** | 51-100 | 0.3564 | |
| **3rd Block** | 101-200 | 0.4993 | |
| **4th Block** | 201-300 | 0.5500 | |
| **5th Block** | 301-400 | 0.5666 | |
| **6th Block** | 401-500 | 0.5880 | |
| **7th Block** | Above 500 | 0.6943 | |
| **2.Commercial** | | | |
| **1stBlock** | 0 - 50 | 0.6088 | Semi Progressive |
| **2nd Block** | Above 50 | 0.6943 | |
| **3. Industry** | | | |
| **Low Voltage Time of Day 3.Industry** | | 0.5778 | Flat Rate |
| **High Voltage Time of Day Industry** | @ 15KV | 0.4086 | Flat Rate |
| **High Voltage Industry** | @ 132KV | 0.3805 | Flat Rate |
| **4. Street Lighting Tariff** | | 0.4843 | Flat Rate |

**Source: EEU, 2016**

As it is shown in the table below, the EEU is collecting its revenue from the electricity sales from a total of 2.4 million customers in 2016/17 and has planned to connect 2.9 million customers at the end GTP II in 2019/20.However, the national GTP II target is to reach 7 million electricity connection by 2019/20. According to the interview with EEU's planning department, the remaining amount is assumed to be connected through off-grid or micro-grid systems but it has not been materialized yet. The table below shows the EEU's existing and planned electricity connections:

**Table 16: EEU's number of existing and planned customers**

| No. | Description | Budget year | | | | |
|---|---|---|---|---|---|---|
| | | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 |
| 1 | Domestic | 1,945,943 | 2,043,240 | 2,145,402 | 2,274,126 | 2,410,574 |
| 2 | Commercial | 351,744 | 369,331 | 387,797 | 411,065 | 435,729 |
| 3 | Street Light | 4,475 | 4,699 | 4,934 | 5,230 | 5,544 |
| 4 | Industrial LV | 336 | 353 | 370 | 393 | 416 |
| 5 | Industrial HV | 42,364 | 45,329 | 48,502 | 51,898 | 55,531 |
| 6 | Own consumption | 2,090 | 2,194 | 2,304 | 2,442 | 2,588 |
| **Sub Total** | | 2,346,951 | 2,465,146 | 2,589,310 | 2,745,154 | 2,910,382 |

**Source: EEU's Brochure, 2016**

Moreover, the EEP generates revenue from electricity export at high voltage (>132KV) to Djibouti and Sudan. According to opinions of the planning department in EEP, eventhough the foreign currency earned by exporting electricity is essential to finance the electricity infrastructure development in the country, the electricity export tariff is very low when compared to the domestic electricity tariff of the importing countries.

According to the opinions of Energy Study and Development Follow Up directorate in MoWIE, the electricity export tariff is very low however; the government focuses on regional integration mainly due to geopolitical issues on the trans-boundary rivers such as Nile, Gibe. The government also considers spot market tariff once the East African Power Pool/EAPP/ is operational to get better revenue from electricity export in the future. The table below illustrates the electricity exported to Djibouti and Sudan and the corresponding revenue collected at a rate of 0.0656-0.0700 and 0.05USD cents per KWh respectively.

**Table 17: Electricity export sales to Djibouti and Sudan**

| Year | Electricity Export (KWh) | | Total sales (KWh) |
|---|---|---|---|
| | **Djibouti** (@0.0656-0.0700USD cents) | **Sudan** (@0.05USD cents) | |
| **2011** | 17,310,416 | - | 17,310,416 |
| **2012** | 330,937,854 | - | 330,937,854 |
| **2103** | 386,132,166 | 175,305,665 | 561,437,831 |
| **2014** | 329,784,587 | 381,269,709 | 711,054,296 |
| **2015** | 164,649,800 | | 164,649,800 |
| **Total electricity export (KWh)** | 1,228,814,823 | 556,575,374 | 1,785,390,197 |
| **Total Revenue (USD)** | **80,610,252.39** | **27,828,769** | **108,439,021.39** |

**Source: EEP report, 2016**

Generally, the interview with the EEU's planning department shows that, the existing low electricity tariff has created a huge budget deficit due to the low level of revenue generation. Moreover, it is indicated that, the total amount of budget required to implement the electricity infrastructure projects such as generation, transmission, distribution and other operational activities for both EEP and EEU is about 120 billion ETB for 2016/17 fiscal year. However, according to the opinion of EEU's planning department, the Utility has not generated a revenue more than 5 billion ETB per year for the last 5 years from electricity sales locally and abroad. This revenue will be allocated to the EEU and EEP on 40% and 60% scheme respectively. This implies the amount of revenue generated from the electricity sales is about 4% of the total budget requirement for the sector in 2016/17 fiscal year.

### 4. 6.2 Private sector engagement

The Ethiopian electricity sector has been mainly dominated by the public sector. All the electricity generation, transmission and distribution of electricity so far has been done by the public companies namely EEP and EEU. According to the interview with Energy Study and Development Follow up directorate in MoWIE, the energy policy of the country allows the private sector engagement in electricity generation without limitation on generation capacity however, electricity transmission and distribution is mandated to EEP and EEU. Moreover, it is indicated that the main reason for the lack of private sector engagement has been the low electricity sales tariff. This has discouraged the private sector to invest in power generation projects. The absence of regulation and guidelines for IPP and PPP schemes in the electricity sector has also contributed to the issue.

According to the opinions of the Electricity licensing department in EEA, there is no private company currently engaged electricity generation at a larger scale. The private sector has been limited to construction of power plants on EPC scheme. However, the first geothermal IPP project was signed in 2013 to generate 1000 MW in two phases in Corbetti and Tulu Moye sites along the Ethiopian rift valley. It is indicated that, the Icelandic Reykjavik geothermal signed a 25 year PPA with the former EEPCo to generate power from the sites and sell it to the national grid. The investment cost of the project is expected to be around $4 billion USD. However, the project has not yet started its activities due to several legal and regulatory issues which have not been in place for the first IPP in the country due to high risk associated with geothermal resource exploration. Hence, the private sector is reluctant to take such kind of risks and needs a huge guarantee from the government in the detail PPA agreement which makes it difficult for the two parties to materialize the project as planned.

According to the interview with planning department in EEP, the reason for low participation of the private sector in electricity generation has been the unclear direction and methodologies on private sector engagement. It is indicated that, previously the projects were planned to be awarded on negotiation scheme with the private companies however, it is the government has changed its approach to give the projects on competitive tendering scheme. Moreover, the very low electricity retail tariff, the capital intensiveness of the sector, the political and business risks are some of the issues mentioned for the lack of private sector investment in the sector.

# Chapter Five

# Summary of findings, conclusion and recommendations

## 5.1 Summary of findings

Enhancing electricity access is crucial for the socio-economic development and transformation of a country. The country has been implementing the UEAP to bring universal electricity access in the country however, electricity access has been very low and the challenge has been further intensified with growing population, economic growth and the expanding urbanization. This summary, therefore, tries to cover the major findings related to the overall electricity sector policy and strategies, institutional structure of the sector, the challenges of financing and private sector engagement and electricity access programs.

### 5.1.1 Electricity sector policy and strategies

The finding of this study shows, the energy policy, which was formulated in 1994 during the transitional government has still been used as an official policy of the sector. However, since the formulation of the policy, the country's population has grown, urbanization is expanding and the economy is also rising. However, the sector still lacks an up to date energy policy to enhance the low level electricity access of the country. According to the findings of this study, MoWIE has tried to revised energy the policy in 2015 in 2015 however it has not been materialized and the policy daft lacks background study of the current and future scenarios of the electricity sector and it mainly focuses on the incorporation of the ongoing initiatives and programs of the sector rather than putting proactive policy instruments.

Moreover, the findings of this study indicates that the electricity access strategies and directions of the county mainly focus on extending the electricity grid network rather than household electricity connection which has resulted in low electricity connectivity rates in rural areas.

### 5.1.2 Institutional structure of the electricity sector

The findings of this study indicate that, the electricity sector institutional structure has passed through several changes in the last few years. The changes has been primarily seen in the sector's

structure at the federal level and correspondingly seen in the regional energy offices. The former EEPCo has also been unbundled into two separate companies namely EEP and EEU in 2013.

However, the findings indicate that, the frequent structural changes were not based on detail study and analysis. Moreover, the justifications for the changes in the institutional structure has not been clear and discussed with relevant stakeholders which creates uncertainty and instability in the sector. This has negatively affected the electricity access targets and the broad electricity sector plans of the country.

Moreover, the frequent changes in the institutional structure of the sector also affected the various foreign financed energy initiatives and programs by creating delays in their implementation. The already very low level private sector participation in sector has also been affected by the institutional instability of the sector.

### 5.1.3 Financing and private sector participation

The other major finding of this study is related to the challenges of financing in the electricity sector and lack of private sector engagement. The country's electricity sector is heavily dependent on public finance and absorbs a substantial amount of government budget and foreign loans. On the other hand the sector is not generating enough to revenue to cover its costs this is mainly due to low electricity tariff. Hence, the sector is facing challenge in meeting the ever growing electricity demand and universal electricity access targets.

Lack of private sector investment has also increased the burden of financing in the sector and achieving the electricity access targets. The country's energy policy allow private sector engagement but has not yet materialized due to mainly the low electricity tariff and uncertainty of direction regarding the modalities of private sector involvement in the sector.

### 5.1.4 Electricity access program

The country has been implementing the UEAP to enhance electricity access since 2005; however, the electricity access is still very low in rural areas. According to the findings of this study, the following are some of the issue and challenges of the UEAP:

- The UEAP has been focusing in extending the electricity grid network however the household connectivity rate has been very low in rural areas. Moreover; the ambitious electrification targets did not consider the actual implementation capacity of the UEAP.

- Even though the UEAP's original objective is to electrify new towns and villages, the Program is spending a lot of resource and time in system rehabilitation of the already electrified towns. This has created huge backlog and delay in meeting the electricity access targets.
- The shortage of budget allocated for local payment such as payment for local contractors, locally purchased inputs such as cement, concrete poles and other inputs has also affected the UEAP implementation.
- The delay of the major electricity infrastructure projects such as hydro electric dams, transmission projects has also affected the UEAP implementation. It indicates that UEAP's plan has not been in line with the country's electricity generation, transmission, distribution capacity and plans.

## 5. 2 Conclusion

Electricity access has been one of the critical challenges for the country's socio economic development. Therefore, it is very important to enhance the very low electricity access rate to bring a sustainable socio-economic development in the country. This study tied to assess the challenges and the bottlenecks hindering the development electricity sector in general and electricity access in particular to come up with the following conclusions:

The electricity sector in general and the electricity access in particular lacks an updated and clear policy and strategy. The grid based electrification approach has not been effective to bring universal electricity access in the country due to its capital intensiveness and low implementation capacity of the sector while the off-grid or decentralized electrification has not been given much attention. There is still uncertainty on how the universal electricity access targets should be achieved. The challenge is further intensifying with the growing population and the ever growing demand of electricity due to rapid urbanization and economic growth.

The instability of institutional structure and arrangement has also been one of the main challenges facing the electricity sector. The institutions in the electricity sector are not well structured and stable both at federal and regional level. The frequent changes and inconsistency of mandates among the federal and regional institutions has created instability and uncertainty in achieving electricity access targets.

The universal electricity access program which was planned to expand electricity access in rural areas has not been effective in meeting its plans. It has also been focusing on extending the electricity network to the rural towns but not connecting to the end use households. This has resulted in low level of electricity connection rate in rural areas even though the grid is extended in those towns and villages.

Shortage of finance has also been a critical challenge in the electricity sector. The country's electricity sector is heavily dependent on public finance and absorbs a substantial amount of government budget and foreign loans. On the other hand, the sector is not generating enough revenue to cover its costs. This is mainly due to the low electricity tariff which is one of the lowest in Africa. Hence, the sector is facing a challenge in meeting the ever growing electricity demand and universal electricity access targets.

Lack of private sector investment has also increased the burden of financing in the sector and achieving the electricity access targets. The private sector has not so far engaged electricity generation, transmission and distribution in the country. The country's energy policy allows the private sector engagement especially in electricity generation but it has not yet been materialized due to mainly the low electricity tariff and unclear methodologies regarding private sector engagement.

## 5. 3 Recommendations

To improve the existing low level of electricity access in the country, the following recommendations have been stated related to the sector's policy, institutional structure, electricity access program, financing and private sector engagement in the sector to ensure universal electricity access in the country:

- The electricity sector in general and electricity access in particular needs an up to date policy and strategy. Both the energy policy and the strategies of the country focus on expanding the electricity grid network coverage not on household level electricity connection. The grid based electrification policy approach has not achieved the universal electrification targets of the country mainly due to huge capital requirement and weak implementation capacity. Hence, decentralized (off-grid) electrification strategy should be given a high attention to provide electricity to the remote rural areas at a cheaper cost and fastest time line. A clear distinction of areas to be electrified by the national grid and the off-grid scheme should also be clearly identified.
- The sector also needs a stable institutional arrangement which can implement the ambitious targets set by the GTP and beyond. Since the electricity sector is one of the key sectors in the country it needs to be established independently from the continuous merging with other sectors. The establishment of ministry of energy or electricity at federal level should been given emphasis in the near future as it is mostly seen in other countries. The corresponding regional energy office structures should also be consistent and should have a clear mandates with the required budget and implementation capacity.
- The UEAP, which has been the main program, established to achieve universal electricity in the country should be strengthened to meet its targets. The program needs to focus on connecting households in addition to extending the grid to the rural towns and villages. Hence, the mandates of the UEAP should include household connection in order to

enhance the low electricity connection rate in rural areas. The Program should strengthen its implementation capacity and should have adequate budget allocation from the government. Moreover, the program needs to focus on connecting new towns and villages instead of system upgrading of the already electrified towns.

- Financing has also been the challenge in enhancing the electricity access in the country. Increasing both the local and export electricity sales tariff is essential to enhance the sector's self financing capacity of electricity access programs. The sector is heavily dependent on government subsidy and foreign loan. Hence, setting a cost reflective electricity tariff will enable the sector to recover its costs and be able to finance the electricity access programs. Moreover, electricity tariff improvement will enhance private investment in the sector.
- The public sector investment alone cannot bring universal electricity access in the country hence, private sector engagement in electricity sector is crucial. The private sector should engage in electricity generation in different modalities other than EPC schemes such as in IPP, PPP projects. Moreover, the private sector should also engage in owning mini and micro grid systems to provide electricity for local communities in remote rural areas, which are not feasible to be connected by the national grid. Hence, establishing a legal frameworks and institutions for the private sector engagement, increasing the electricity tariff, putting clear mechanisms and regulatory frameworks for setting electricity tariff for mini and micro grid systems in rural areas and to sale excess electricity to the national grid will enhance the private sector investment in the sector.

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# Appendixes

## Annex I: Existing power plants and electricity generation capacity

| | Power Plant | Hydro | Diesel | Geothermal | Wind | Total |
|---|---|---|---|---|---|---|
| **1** | Koka | **43.20** | **-** | **-** | **-** | **43.20** |
| **2** | Awash II | **32.00** | **-** | **-** | **-** | **32.00** |
| **3** | Awash III | **32.00** | **-** | **-** | **-** | **32.00** |
| **4** | Finchaa | **134.00** | **-** | **-** | **-** | **134.00** |
| **5** | Meleka Wakena | **153.00** | **-** | **-** | **-** | **153.00** |
| **6** | Tis Aby I | **11.40** | **-** | **-** | **-** | **11.40** |
| **7** | Tis Abay II | **73.00** | **-** | **-** | **-** | **73.00** |
| **8** | Gilgel Gibe | **184.00** | **-** | **-** | **-** | **184.00** |
| **9** | Aluttu Langano | **-** | **-** | **7.30** | **-** | **7.30** |
| **10** | Kaliti | **-** | **14.00** | **-** | **-** | **14.00** |
| **11** | Dire Dawa | **-** | **38.00** | **-** | **-** | **38.00** |
| **12** | Awash 7 killo | **-** | **35.00** | **-** | **-** | **35.00** |
| **13** | Tekeze | **300.00** | **-** | **-** | **-** | **300.00** |
| **14** | Gilgel gibe II | **420.00** | **-** | **-** | **-** | **420.00** |
| **15** | Beles | **460.00** | **-** | **-** | **-** | **460.00** |
| **16** | Fincha Amerti Neshi | **97.00** | **-** | **-** | **-** | **97.00** |
| **17** | Ashegoda | **-** | **-** | **-** | **120.00** | **120.00** |
| **18** | Adama I | **-** | **-** | **-** | **51.00** | **51.00** |
| **19** | Adama II | | | | **153** | **153** |
| **20** | Gibe III | **1870** | | | | **1870** |
| | **Total** | **3810** | **87** | **7.3** | **324** | **4228** |

## Annex II: Interview questions

This interview questions are prepared to get information on the existing electricity access challenges in the country based on the mandates of the institutions selected for this research. A total of 10experts and officials were interviewed 4 from MoWIE, and 3 respondents each from EEA, EEP and EEU.

**Ministry of Water, Irrigation and Electricity /MoWIE**

- What are the gaps and issues related to the policy and strategy of the country regarding electricity access?
- What are the institutional structure issues and challenges in the electricity sector in general and electricity access in particular?
- What is the mechanism of the Ministry to follow up of electricity access programs?
- Do you think the current electricity access direction or trend in the country is the way forward to meet the low level of electrification?

**Ethiopian Electric Utility (EEU) and Universal Electricity Access Program/ UEAP/**

- What is the level of electrification in the country?
- What are the institutional structure and financial challenges related to UEAP program and the Utility in general?
- How is the follow up and monitoring of activities done in the electricity access program?
- What do you recommend to improve the low electricity access rate in the country?

**Ethiopian Electric Power /EEP**

- Is the power generation capacity in line with growing electricity demand and electrification programs?
- How is the progress of the high voltage transmission line and substation projects to meet the electricity access gap?
- What is your general recommendation to meet electricity access gap?

**Ethiopian Energy Authority /EEA**

- How is the involvement of the private sector in the electricity sector both in the on- grid and off- grid projects?
- What are the regulatory framework and institutional gaps for the private sector engagement in the sector?