December 2018

Energy Efficiency Strategy For Industries, Buildings and Appliances.

Supported by
Ethiopian Energy Authority (EEA)

Executive Summery

This is the first Energy Efficiency Strategy for Ethiopia. It is the first consolidated Governmental document geared towards the development and implementation of energy efficiency practices in the country. The Strategy takes its mandate from the Energy Proclamation 810/2013, and from the energy Regulation 308/2014 — "Establishment of the EEA". The proclamation gives EEA a range of core responsibilities especially on energy efficiency and conservation, including:

- Licensing EE&C auditing, consulting and contracting services;
- Setting standards and producing labeling programs for equipment and appliances;
- Creating awareness and disseminating information;
- EE&C programs in industry;
- EE&C programs in buildings; and
- Collection and administration of an EE&C Fund

This Strategy allows for the immediate implementation of low-cost and no-cost interventions, as well as those higher-cost measures with short payback periods. These will be followed by medium-term and longer-term investment opportunities in energy efficiency. The Strategy acknowledges that there exists significant potential for energy efficiency improvements especially on industrial sectors, buildings and use of appliances.

From the energy consumption analysis it is observed that the electricity consumption is the highest in industrial sector, followed by residential and commercial buildings. The fuel oil consumption is highest in the transport sector followed by industries sector. Any energy conservation activity should begin with industries. The methodology for energy reduction programs me in commercial buildings is similar to industries. The energy conservation activity in the residential sector can be through promotion of energy efficient appliances.

Strategic Energy Efficiency Framework for Industries

The Strategic Energy Efficiency Framework for Industries consists of the following main elements:

- Implementation of a set of Energy Conservation Programs in industries
- Development of databases and promotional campaigns
- Establishment and Utilization of an Energy Conservation Fund

- Capacity building for development, implementation and evaluation of energy Conservation programs

EEA could design and conduct an industrial customer survey to obtain statistically reliable data on equipment, types of equipment and their capacities and efficiency ratings, utilization patterns, and customer decision-making regarding the equipment. Following this EEA could then engage competent and experienced energy auditors to undertake comparative studies in these industries to identify technical and nontechnical reasons for variations in performances and to retain feasible and generic solutions on the basis of cost-benefit analyses. EEA should derive the specific energy consumption of industries and bench mark them with other industries among the various sub sectors of the industries group. Using the data available from the industry EEA should categorize the industries as Designated Consumer. EEA can initially consider industries above 1000 MW as Designated Consumers for which Energy Auditing shall be made mandatory. Similarly the selection should also consider the consumption of fuel oil in industries.

To enable industries to make a judicious choice at the time of procurement, EEA shall obtain the data on energy efficient equipment like motors, transformers, boilers, pumps, fans, air compressors, air conditioning systems which are generally used in industries. EEA should also conduct regular training programs on industrial energy audit with the help of engineers who are trained in energy auditing. The other very important issue is the availability of energy audit instruments for auditors. As the instruments are very expensive EEA can think of innovative methods of making the instruments available for auditors to carryout energy audits. This will enable the consultants to do instrumented energy audit of industries.

Energy efficiency finance program.

There is a need for an Energy Efficiency Fund that will facilitate the development and growth of an energy efficiency infrastructure that includes energy service providers such as ESCOs to help energy consumers develop and implement cost-effective EE projects. The Energy Proclamation already has a provision for setting up an Energy Conservation Fund.

Financial barriers limit the implementation of energy efficiency activities. Many of these barriers can be addressed by the development of creative financial products such as a Partial Credit Guarantee (PCG). The International Finance Corporation and the Global Environment Facility (GEF) have successfully developed and applied the PCG approach to stimulate the markets for EE. All the possible financial mechanisms are discussed in EE fund guideline in detail.

Strategic Energy Efficiency Framework for Buildings

The buildings in Ethiopia can be categorized into Government or Public buildings and new upcoming large buildings which houses hotels, malls etc. the major energy consumption equipment in public buildings are office equipment, lighting and standalone room air-conditioners.

The strategy for improving efficiency in Public buildings is to have demonstration projects by identifying select buildings and involving equipment supplier for retrofitting it with energy efficient equipment in the lighting and Air Conditioning systems. The funding shall be made available from the EC fund.

A database of Energy Performance Index (EPI) which is Annual energy consumption divided by square feet area need to be maintained. This will help in comparative analysis on the performance of energy consumption and will give a trend in how buildings are performing.

Strategic Energy Efficiency Framework for Appliances

There are Opportunities for improving energy efficiency of appliances. One of the very effective tool is implementing energy efficiency standard and labeling program. Standards and labels are meant to help the consumers to identify energy efficient equipment and enable Suppliers to deliver higher efficiency products to the market. Appliances can be identified and prioritized to implement EES&L program according some selection criteria. The following five items are the most important appliances and equipment in the context of efficiency improvement as they use significant amounts of energy.

- Injera mitad and cook stove
- Electric ovens and cooking plates
- Refrigerators
- Air conditioning machines
- Clothes washing machines

Implementing a Standards and Labeling Program.

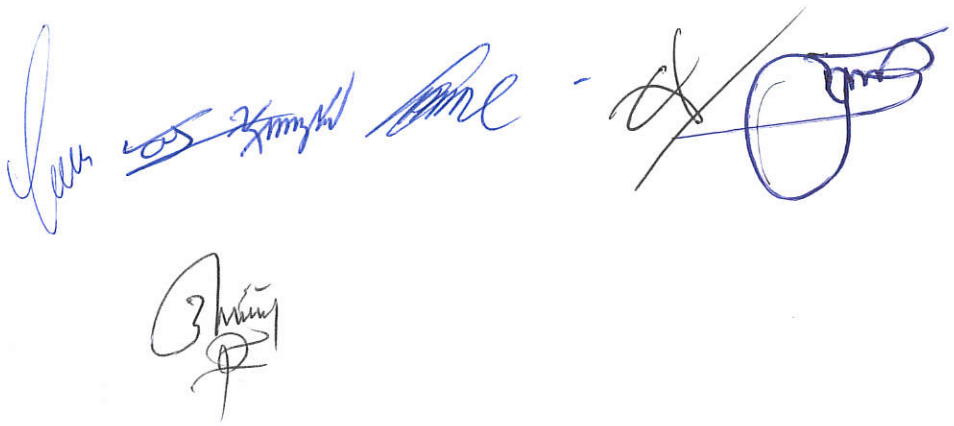
The basic steps for implementing energy efficiency standard and labeling program are:

- Decide whether and how to implement energy efficiency standards and labels
- Develop testing capability
- Analyze and set standards
- Design and implement a labelling program
- Design and implement a communications campaign
- Ensure program integrity
- Evaluate program performance and refine

Before a labeling program can be designed, policy makers need to decide which products should be included in the program. As a general rule, energy labeling will work best for products

- that use a significant amount of energy,
- that are present in most households (or where rapid growth is predicted), for which energy-efficient technology exists that is not being used in most products on the market, for which the purchaser pays the energy bills,
- that are purchased by the consumer at a retail business (i.e., where the consumer inspects items prior to purchase), and

- for which there is (or could easily be) significant variation in the energy efficiency of different units.



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1.0 Introduction

Overview

Ethiopia has one of the lowest rates of access to modern energy services and its energy supply is primarily based on biomass. With a share of 87% of Ethiopia's energy supply, waste and biomass are the country's primary energy sources, followed by Fuel (10.4%) and hydropower (2.6%)

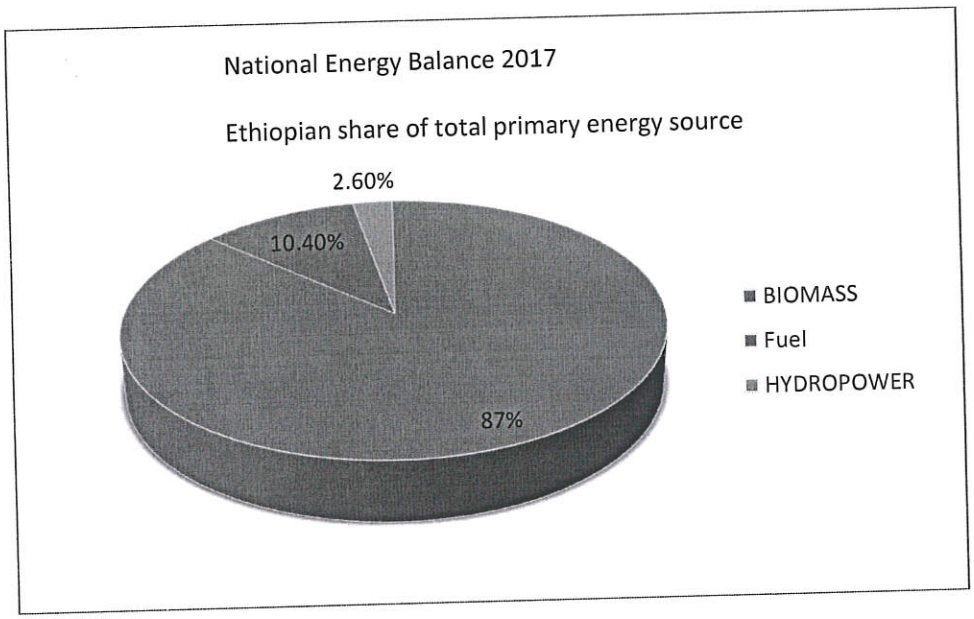


Figure 1: Energy Supply in Ethiopia

Almost 99% of household s, 70% of industries and 94% of service enterprises use biomass as energy source. Household s account for 88% of the total energy consumption, industry 4%, transports 3%, and services and others 5%.

The installed electricity generating capacity in Ethiopia is about 4,300 MW (88% Hydro, 8.2% Wind, 3.5 Diesel and 0.3% Geothermal) and the production meets only about 10% of the national energy demand. The country is completely reliant on imports to meet its petroleum requirements.

Electricity Sector

According to the EEP total electricity generation from December 2017 to December 2018 almost for one year is about 6348 GWh. (88% Hydro, 8.2% Wind, 3.5 Diesel and 0.3% Geothermal)

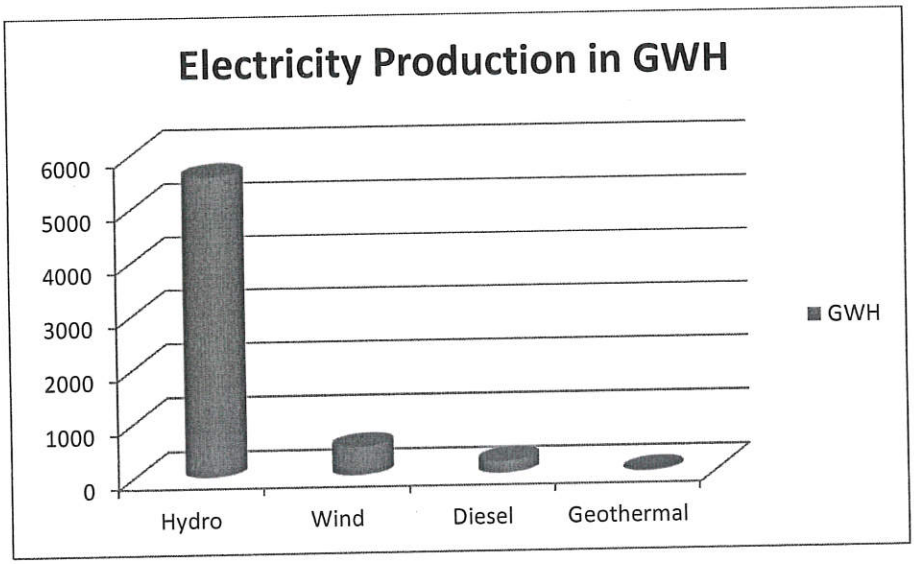


Figure 2 Energy Generation by different energy sources

Although hydropower contributes to only 2.6% of the total energy supply, it generates 89% of electricity and is thus the country's dominating electricity source, followed by wind (8.6%) and diesel (3.4%) based electricity generation (see Fig. 2).

System losses are calculated to be 23%. This figure represents technical and non - technical losses and a major share is attributable to the poor design of the distribution network.

The household sector accounts for 88.2% of total final energy consumption and transport sector 8.4% Industry and construction 2.3% and service 1.2%. Household energy used from biomass (88%), electricity and petroleum products together accounted for 12% in 2017.

Approximately 87% of the costumers are domestic households consuming about 37.2% of the electricity, 24% by commercial and 37% by industrial establishments whereas only 0.1% is used for street lightning. The average consumption per connected household is rather low about 50 kWh/ year per capita compared to other African countries, leaving a lot of potential for further growth by deepening the current network and increasing the level of power consumption.

The Growth and Transformation Plan (GTP), targets to increase the power generating capacity of the country from 4,180MW in 2014/15 to 17,208MW by 2019/20; of which, 13,817MW is planned to be generated from hydropower, 1224MW from wind power, 300MW from solar power, 577MW from geothermal power, 509MW from reserve fuel (gas turbine), 50MW from wastes, 474MW from sugar and 257MW from biomass

Renew able Energy Resources

Ethiopia is well endowed with renewable energy sources. These include not only hydro, but also wind, geothermal, solar as w ell as biomass. As of August 2009, only 7% of the estimated 54 GW economically exploitable power generation resources was either developed or com mitted to be developed.

Hydropower

It is estimated that Ethiopia's hydropower potential of 45,000 MW is the 2n d highest in Africa. Approximately 30,000 MW are estimated to be economically feasible which is equivalent to electricity generation of 162 TWh . The current production of 5.10 TWh thus equals an exploitation of only 2.5%. In general, Ethiopia's terrain is advantageous for hydropower projects.

The largest hydro project in the pipeline is the controversial dam and hydropower plant Gilgel Gibe III (MW 1870), which recently came close to financial closure with an agreement between Ethiopia and China. Another big hydro project is the Renaissance Dam , formerly know n as Great Millennium Dam . This Hydro project will have a maxim um capacity of 5.25 GW.

Small-Scale Hydropower

Ethiopia is endowed with considerable hydropower resources. Out of this potential, about 15% is from un-regulated river run-off potential, usually in the category of mini, micro and pico-hydropower plants. Data on about 232 small-scale hydropower potential sites have been collected with capacities ranging from 26 kW to 9,840 kW.

The total installed capacity of the entire 232 small scale hydropower plants is estimated to be about 500 MW. Only a small fraction of these small scale hydropower plants has been developed to date. The small scale hydropower sites developed before 2001 generated about 1522 kW. However, most of the sites have ceased operation currently.

Terminology	Capacity limits	Unit
Large	>30	MW
Medium	10 - 30	MW
Small	1 - 10	MW
Mini	501 - 1,000	kW
Micro	11 - 500	kW
Pico	≤10	kW

Pico and Micro Hydropower

The definition of hydropower schemes in Ethiopia differs from other countries. Typically Pico hydropower (PHP) plants have a capacity of up to 3 kW. They are characterized by the absence of a distribution grid and supply one or two household s. Nonetheless the Pico hydropower range in Ethiopia

is extended up to 10 kW. The total theoretical potential for micro hydropower schemes in Ethiopia is 100 MW.

Solar Energy

Ethiopia receives a solar irradiation of 5000 – 7000 Wh/ m ² according to region and season and thus has great potential for exploitation of solar energy. The average solar radiation is more or less uniform, around 5.2 kWh/ m ^{2}/ day. The values vary seasonally, from 4.55-5.55 kWh/ m ^{2}/ d ay and with location from 4.25 kWh/ m ^{2}/ day in the extreme western low land s to 6.25 kWh/ m ^{2}/ d ay in Adigrat area, Northern Ethiopia.

With an installed capacity of approximately 5 MW and an estimated PV market potential of 52 MW, with a majority in the **solar home system (SHS)** market and a further expansion of the telecommunication sector, not even 10% of the potential is exploited. In the near future, large and particularly grid -connected solar energy system s will thus compete with small-scale hydropower system s. Apart from PV SHSs, there is also a market for **solar water heating (SWH**) system s that use solar irradiation to heat up water, which can significantly reduce fuel wood and electricity consumption.

Biomass

Biomass resources include wood, agro-industrial residue, and municipal waste and bio fuels. Wood and agricultural as w ell as livestock residues are used beyond sustainable yield with negative environmental impacts.

According to estimates m ad e by a recent stud y, at the national level, there appears to be a surplus supply of woody biomass. However, the same stud y revealed that there is a severe deficit of supply when the data is disaggregated to lower local levels.

Among the key issues that characterize the Ethiopian energy sector and stand out are:

- The energy sector relies heavily on biomass energy resources,
- The household sector is the major consumer of energy (which comes almost entirely from biomass) and ,
- Biomass energy supplies are mainly sourced from an unsustainable resource base (which has catastrophic environmental implications).

There is how ever a good energy production potential from agro-processing industries (processing sugarcane bagasse, cotton stalk, and coffee hull and oil seed shells). As of yet there are no grid - connected biomass power plants. Several sugar factories are using sugarcane bagasse for station supply since the 1950s. A total of 30 MW of capacity surplus could be fed into the grid by sugar factories. Municipal waste and biofuels on the other hand are barely used as energy resources. Estimates of municipal waste power production potential are not available. Power production potential of landfill gas is estimated to be 24 MW.

Wind Energy

Ethiopia has good wind resources with wind speed s ranging from 7 to 9 m / s. The wind energy potential is estimated to be 10,000 MW. The Ethiopian **National Meteorological Services Agency (NMSA)** began work on wind data collection in 1971 using 39 recording stations located in select locations.

Wind power resource potential is emerging to be more promising than that was originally thought. As a result of Adama I, Adama II, and Ashegoda wind parks currently produce a maximum of 324 MW for the national grid.

Geothermal Energy

Ethiopia's geothermal resources are estimated to be 5 GW of which 700 MW is suitable for electric power generation. Geothermal resources are primarily located in the Rift Valley area, w here temperatures of 50 – 300°C prevail at a depth of 1,300 – 2,500 m . Only one 7.3 MW geothermal power plant has been com missioned so far. This started operating in 1998/ 1999, but was shut down due to lack of technical maintenance in 2002. It re-commenced operations, but only at a much reduced generation rate. Exploration of geothermal resources is still on going.

Demand Side Management

The Ethiopia power system is almost exclusively based on hydropower, making the system vulnerable to climate change. Climate change events such as increasing temperatures, droughts and reduced rainfall can negatively affect the water availability. It can reduce and change the flow s into the hydropower reservoirs. This can result in reduced power availability and substantial power shortages. Demand Sid e Management (DSM) is a mean to optimize the consumers" use of the existing power system. However, due to lack of information it is currently impossible to define the most efficient measures to improve energy efficiency and apply DSM policy actions in Ethiopia. The Nordic funded project has systematically collected end use data from different types of customers in different geographical areas of Ethiopia. This database has been used to identify, evaluate and propose DSM measures for the power sector. The main project output has been a complete assessment of DSM actions and recommendations of a program me of activities for DSM in Ethiopia in the form of an action plan report "DSM Potential and Proposed Actions in Ethiopia". The recommended DSM actions can result in savings of even up to 1 TWh/ a of electricity in 10 years if successfully implemented.

The sectors that are identified by the project are residential, industrial and commercial. The major initiatives proposed under the DSM program me are;

- Innovative tariff pricing
- Load control of hot water heat storage system s
- Special campaign for energy efficiency devices like CFL
- Labelling and Energy Efficiency standard s for certain appliances
- Loans for customers for buying EE equipment
- Energy Audits in industries and commercial places
- Development of ESCO business
- Voluntary agreements on energy efficiency with industry and public sector

- Development of energy saving fund for subsidies/ grants/ rebates for energy efficiency projects
- Demonstration of new technologies
- Tax reduction of EE investments
- Energy efficiency advice centers.

2.0 Sect oral background and energy consumption

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

The industry sectors that have been identified are:

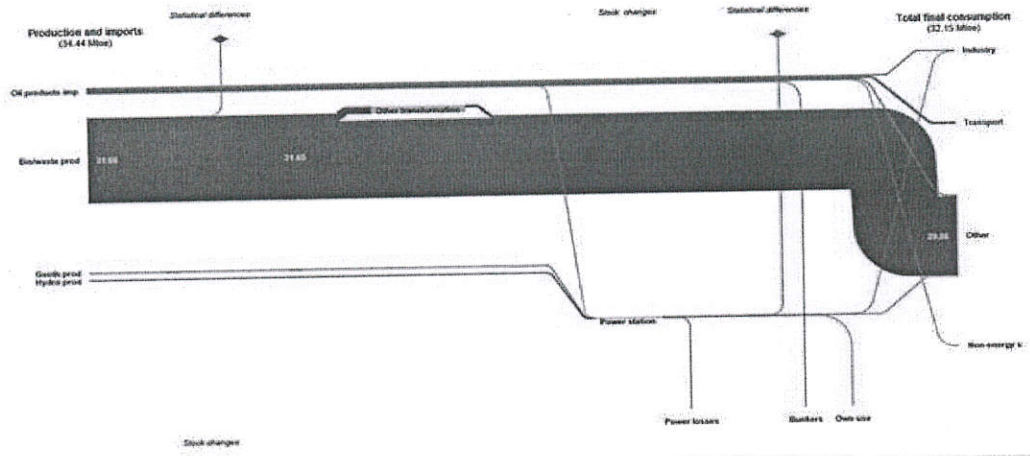
- Micro and small scale enterprise development
- Textile and garment industries
- Leather and leather products manufacturing industries
- Cement industry
- Metal and metal engineering industries
- Chemical industries
- Pharmaceutical industries
- Agro-processing industries

Current energy use by sectors

The key indicator table by the International Energy Agency (IEA) shows s that in 2011 the total energy production of Ethiopia was 34 Million Tone's Oil Equivalent. This number is expected to grow not only in an exponential rate but with a faster rate than the GDP per Capita.

The 2011 energy balance diagram show s that the energy production was 34 million tones of oil equivalent and the consumption was 32 million toes.

The Sankey diagram show s the energy balance on the production side.



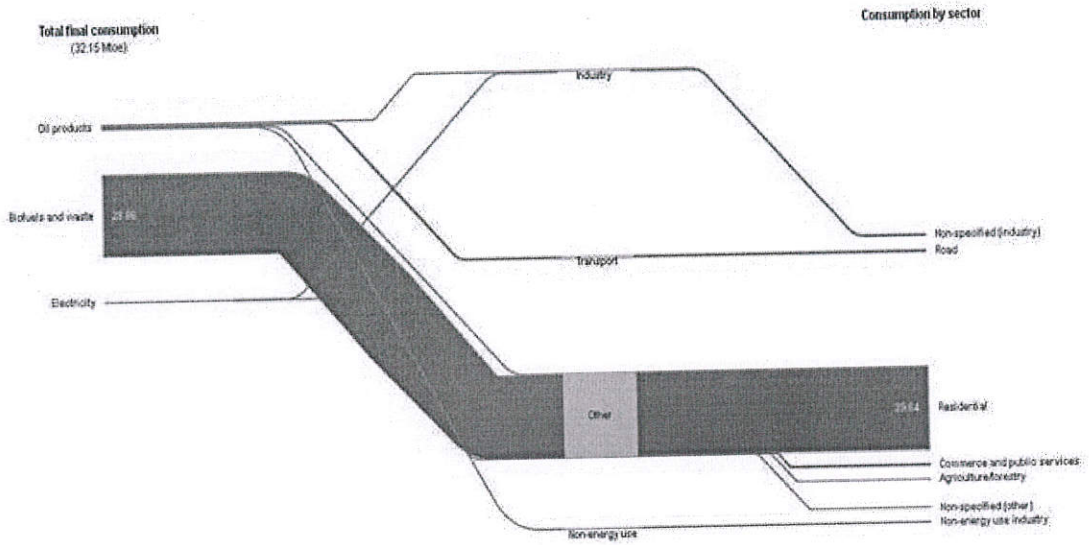
The main source of energy production is from biomass which accounts for 31.6 M toe. The remaining energy was generated from Hydroelectric dam s (0.44 million tone's oil equivalent) and Geothermal (16 million tone's oil equivalent). In the same year Ethiopia imported 2.32 Million tons of oil equivalent energy in the form of oil products. The Table 3.1 summarizes Ethiopia's energy use and sources.

Table 3.1 Summary of Ethiopia's energy use and source in 2011 (to be updated)

Particulars	Coal & Peat	Crude oil	Oil products	Natural gas	Nuclear	Hydro	Geothermal	Biofuels & waste	Total
kilo toe									
Production	0	0	0	0	0	439	16	31658	32114
Imports	0	0	2315	0	0	0	0	0	2315
Export	0	0	0	0	0	0	0	0	0
International aviation bunkers	0	0	-365	0	0	0	0	0	0
Total primary energy supply (TPES)	**0**	**0**	**1950**	**0**	**0**	**439**	**0**	**31658**	**34064**

The IEA table also gives fuel consumption details by economic sectors. It shows what portion of energy generated from specific sources is consumed by each sector. Much of the energy is consumed for residential purposes. The industrial & service sectors consumed less than a percent of the total energy. Other sectors like agro forestry consume negligible amounts of energy.

The following Sankey diagram gives the energy balance on the consumption side.

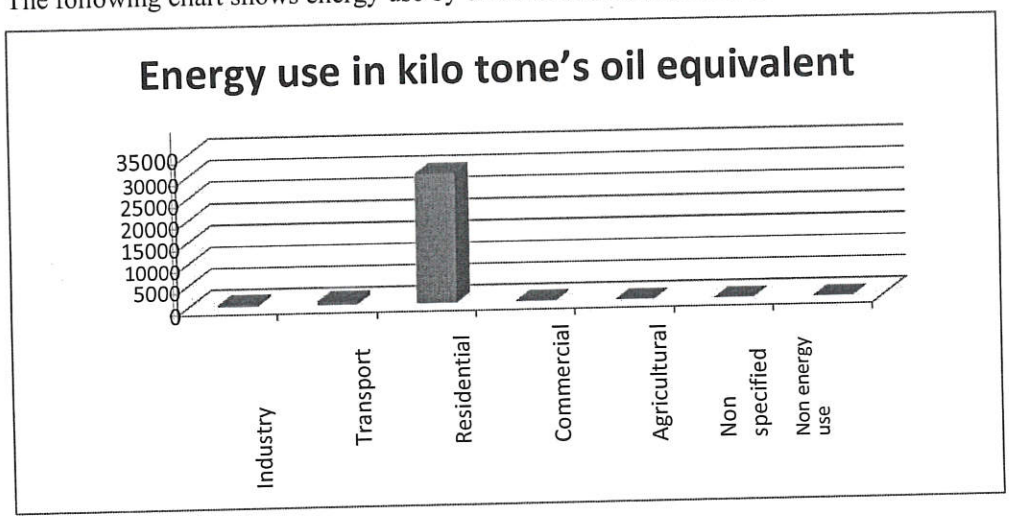


The Table 3.2 gives the energy consumption in different sectors of Ethiopia.

Table 3.2 Energy consumption in different sectors of the country in 2011

Particulars	Oil products	Biofuels & waste	Electricity	Heat	Total
kilo toe					
Total final consumption	**1937**	**29862**	**348**	**0**	**32147**
Industry	435	0	123	0	564
Transport	945	0	0	0	945
Others	**475**	**29862**	**219**	**0**	**30556**
Residential	277	29636	129	0	30043
Commercial	34	225	87	0	316
Agricultural	83	0	3	0	83
N on specified	0	0	0	0	84
N on energy u se	0	0	0	0	82

The following chart shows energy use by economic sectors in 2011 based on IEA data.

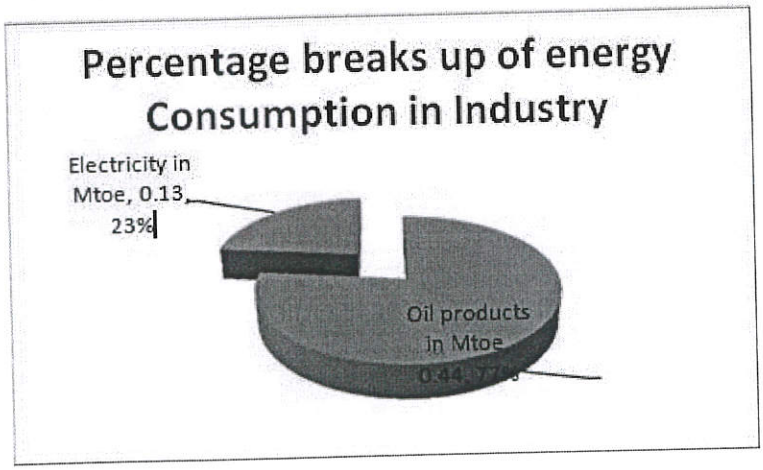


The energy consumption sector wise along with sources of energy are given in the following sections.

Industrial Sector

Energy consumption by industrial sector consists of large and small industries and accounts for 5.4% of the total energy consumed. The sector is also an important electricity consuming sector, consuming 1497 GWh in 2011, which is about 37 % of the total electricity consumption in the country. Besides electricity diesel is also widely used.

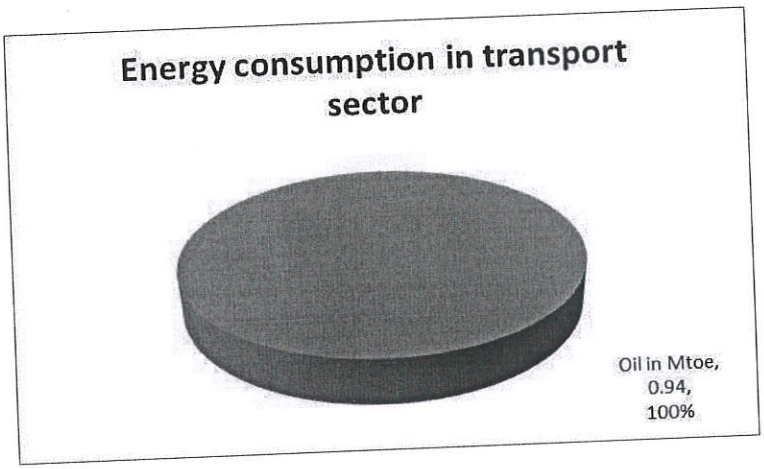
Industry	**M toe**
Oil products in M toe	0.44
Electricity in M toe	0.13
Total	**0.57**



Transport Sector

Diesel and gasoline are the main fuels consumed in the transport sector. Alternative fuels like com pressed natural gas (CN G) and LPG are not used for transportation in Ethiopia. The economy meets its entire energy demand through imports. The transport sector consumes 2.9% of the total energy.

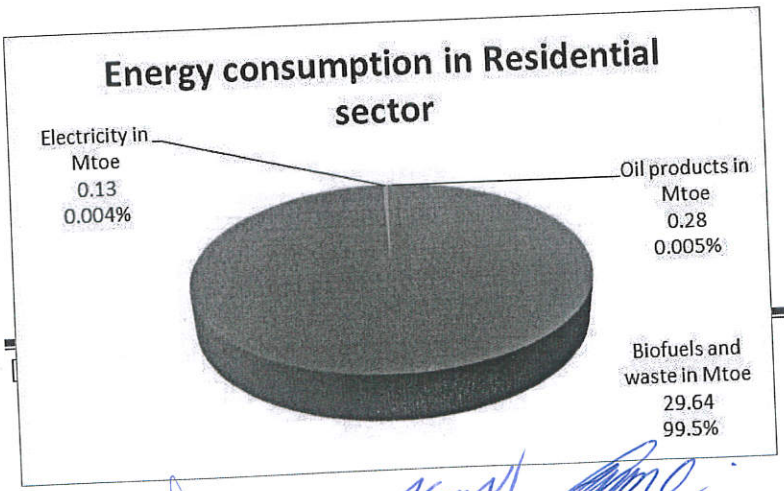
Transport	M toe
Oil in M toe	0.94
Total	**0.94**



Residential Sector

The residential sector accounts for 94% of the total energy consumption, making it the highest energy consumer. The sector's 98% demand is met by biomass, and the remaining 2% is accounted for by electricity and kerosene. The residential sector uses fuel wood and kerosene as major fuels apart from electricity. The energy consumption in the residential sector in Ethiopia is dominated by high consumption of fuel wood and relatively low use of modern fuels like LPG. In electrified areas electricity is the preferred m od e for cooking, lighting and other applications.

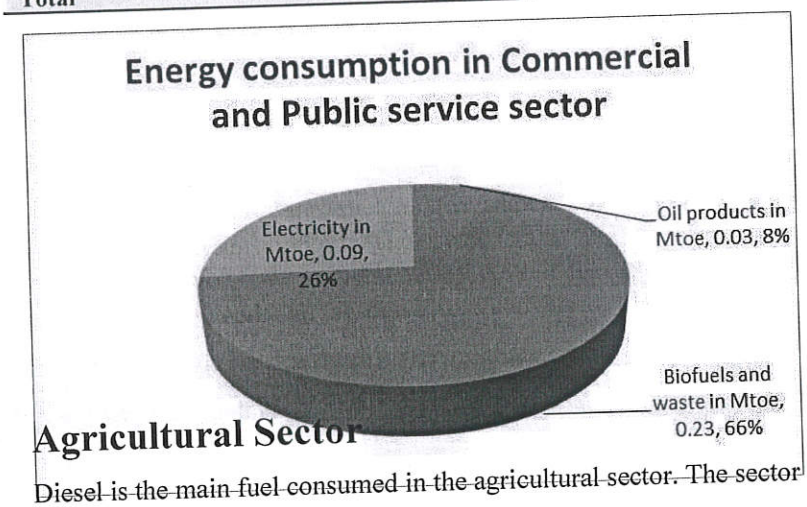
Residential	M toe
Oil products in M toe	0.28
Biofuels and waste in M toe	29.64
Electricity in M toe	0.13
Total	**30.05**



Commercial Sector

Energy consumption by the commercial sector consists of establishments such as shops and hotels, and institutional establishments such as government offices, schools, hospitals, etc., accounting for 1% of the total energy consumption. The sector is also an important electricity consuming sector consuming 1009 GWh in 2011, which is about 19.5 % of the total electricity consumed in the country. Besides electricity, fuel wood, and diesel is also widely used.

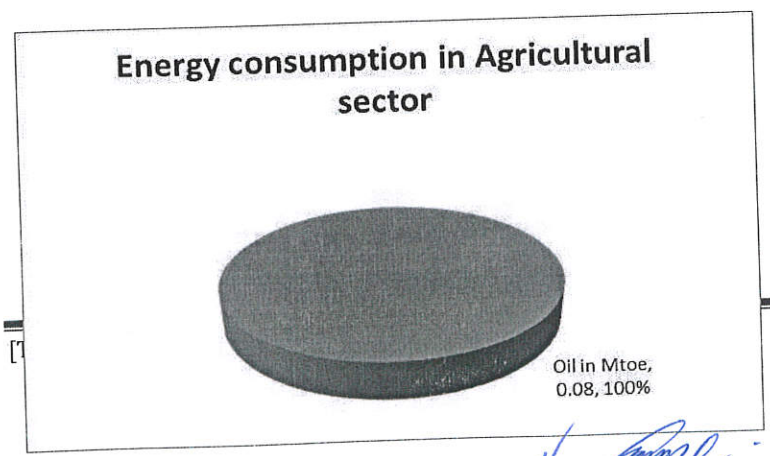
Commercial and public service	M toe
Oil products in M toe	0.03
Biofuels and waste in M toe	0.23
Electricity in M toe	0.09
Total	**0.35**



Agricultural Sector

Diesel is the main fuel consumed in the agricultural sector. The sector consumes 0.3% of the total energy.

Agriculture	M toe
Oil in M toe	0.08
Total	0.08



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Any energy conservation activity should begin with industries. The method ology for energy reduction programs me in commercial buildings is similar to industries. The energy conservation activity in the residential sector can be through promotion of energy efficient appliances.

3.0 Strategic Energy Efficiency Framework for Industries

Introduction

A Strategic Energy Conservation Plan has been developed as a blueprint for energy conservation activities in Ethiopia. This is consistent with EEA"s responsibilities as the Authority for the implementation under the Energy Proclamation and the need s to develop mechanisms to balance the State's electricity supply and demand.

The Strategic Plan consists of the following elements:

- Implementation of a set of Energy Conservation Program me s
- Development of databases and promotional campaigns
- Establishment and Utilization of an Energy Conservation Fund
- Capacity building for development, implementation and evaluation of energy conservation program me s

The Strategic Plan will be reviewed by EEA with representatives of the key stakeholders within the Ethiopian government as w ell as ad visors from utilities, academia and donor agencies. The Plan will be implemented by EEA in cooperation with relevant government agencies and participation of the private sector in the implementation process.

Overcoming barriers to energy efficiency

Despite the fact that energy efficiency measures have been demonstrated to contribute to business competitiveness and raise productivity, energy efficiency actions and improvements are still not typically or widely viewed as a strategic investment in future profitability. Because energy efficiency potential is highly fragmented and spread across several locations and devices, this dispersion ensures that energy efficiency is the least priority one.

In addition, a number of financial, behavioral, technical and organizational barriers to energy efficiency prevent companies from undertaking investments and actions. Barriers refer to all obstacles that prevent financially and technically feasible energy efficiency measures from being implemented (IPCC, 2001).

To overcome the barriers an Energy Conservation action program me is discussed here which has to be implemented in a stipulated time frame.

Program Objectives

To find generic solutions to the constraints of lower productivity and higher specific energy consumption in industries in targeted sub-sectors.

- Ensure implementation of the identified generic solutions across a wide range of enterprises
- Facilitate the development of a market for energy efficiency products and processes

Program Design

Emphasis on Improving Productivity - The program will emphasize on improving productivity of the industries by promoting better management of production process, improved operation and maintenance practices and adoption of simple and cost-effective generic technological solutions. Industries are likely to respond better to this approach which, while focusing on increasing revenues and ensuring employment of their personnel, helps to improve the efficiency of resource use (raw material, energy, etc.) and lower the generation of waste and minimize adverse impacts on the environment.

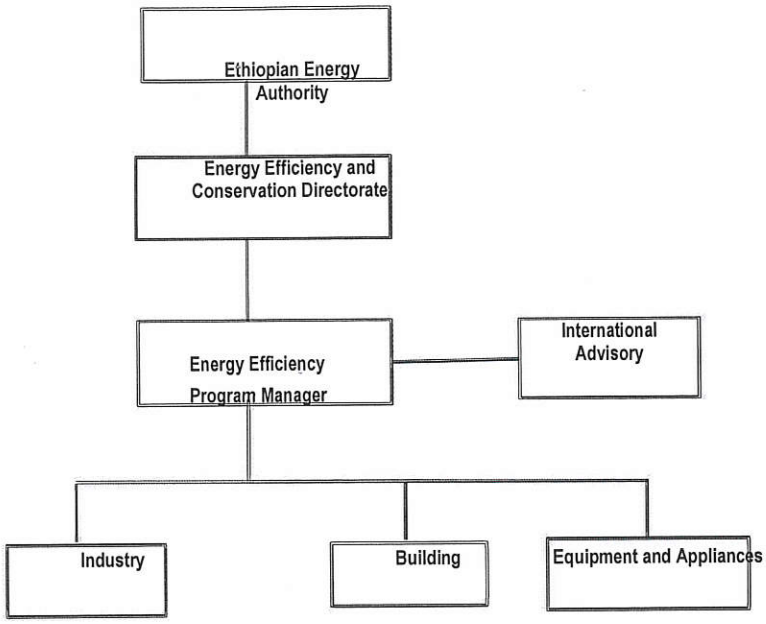
Catalytic Role of EEA - EEA will play the catalytic role of involving the stakeholders that are closely associated with industries to identify the industrial sub-sectors that contribute to high industrial production and employment creation while accounting for higher shares of energy consumption. EEA will assist the stakeholders in defining procedures for gathering data necessary for setting up baseline energy performance indicators to correlate the production with energy use.

Organizational Structure

The Ethiopian Energy Authority is the focal organization in implementing the energy efficiency program. A separate division for Energy Efficiency operates within the authority which takes care of issues related to it. The Energy Efficiency Division is a headed by Director and has a team of engineers who are trained in the methodology to carry out energy audits. The division, which handles works pertaining to industries, buildings and Standards and labelling, should be grouped further.

A typical organizational structure is given as a chart which can facilitate easier implementation of the various programs.

Ethiopian Energy Authority



Development of Industry Database and Evaluation Plan

EEA should enforce the Industry to appoint a person as Energy Manager who will co-ordinate with the EEA on a regular basis for sharing types of energy used, energy efficiency data and production related information for different sub sectors of industries. The designated officer should be a qualified engineer with good understanding of the energy domain.

The nominated engineers should be trained by EEA or external trainers on the nature of data being furnished to EEA.

Ethiopian Power Company maintains a database of all the industries and their energy consumption. Using this data EEA could design and conduct an industrial customer survey to obtain statistically reliable data on equipment, types of equipment and their capacities and efficiency ratings, utilization patterns, and customer decision-making regarding the equipment.

Following this EEA could then engage competent and experienced energy auditors to undertake comparative studies in these industries to identify technical and nontechnical reasons for variations in performances and to retain feasible and generic solutions on the basis of cost-benefit analyses. EEA should derive the specific energy consumption of industries and bench mark them with other industries among the various sub sectors of the industries group.

Using the data available from the industry EEA should categorize the industries as Designated Consumer. EEA can initially consider industries above 1000 kW as Designated Consumers for which Energy Auditing shall be made mandatory. Similarly the selection should also consider the consumption of fuel oil in industries. This group plays a crucial role in the rapid and balanced development of the country. Also this group represents a large potential for energy efficiency improvement. The industries which are above 500 kW will have a substantial share of the overall energy consumption of Ethiopia.

EEA should be in a position to complete the selection of industries as designated consumers in one year period from the day of starting the exercise. The database of designated consumers should be completed in a maximum period of three years covering at least a minimum of 300 industries.

The output of this activity can be installation of a complete Knowledge Management Systems of the program.

Database of Energy Efficient Technologies

EEA shall obtain the data on energy efficient equipment like motors, transformers, boilers, pumps, fans, air compressors, air conditioning systems which are generally used in industries. The data on these products can be obtained from the following sources:

- Manufacturers and suppliers
- Technical journals and publications
- Academic and research organizations

The data thus obtained as a database should be made readily available to industries. This will enable the industries to make a judicious choice at the time of procurement. The database should also contain the approximate cost which will help industries to calculate the ROI. The maintenance of the database is a continuous process and should be updated periodically.

Technical Training for Engineers

EEA should conduct regular training programs on industrial energy audit with the help of engineers who are trained in energy auditing. Training should be provided to engineers working in industries, Ethiopian association for engineers, industries association and university students. EEA should also explore the possibility of bringing in third party international trainers for carrying out training programs. Candidates who are bright can be identified and sent for advanced overseas training which will help in understanding systems and practices in other countries.

Technical training should be given on the following topics to the maintenance & operating staff and the technicians.

- Training on systematic and regular measurement, recording and analysis of the energy use in the industries and buildings.
- Adopting the most appropriate energy efficient technology by specifying to the suppliers in detail about what technology is needed, based on the work requirements and environmental conditions
- Training on how to reduce avoidable losses and thereby reducing the component of energy purchase and bills
- Training on managing energy usage at the highest energy efficiency and improving energy use efficiency at every stage of energy conversion and usage, by phasing out inefficient equipment and appliances.
- Training on procuring all the energy needed at the lowest possible price. Buying from original sources and reviewing the purchase terms on a continuous process

It is essential that industries adopt best practices of energy management to measure any success in energy conservation. Technical training for the industrial maintenance and operating staff and technicians is important to bring awareness and enable them to follow best practices of „Energy Management". EEA

can also develop best practices manuals on equipment and different sub sector groups for the benefit of different stakeholders.

Instrumentation for Energy Audit

EEA should procure multiple sets of complete Energy Audit instruments. Instrumented energy audits should be promoted than mere walk through audit. This is mainly because instrumented audit will have higher chances in realizing the energy savings that are projected.

The engineers who are trained in Energy audit and the firms who will be carrying out energy audits in future should be able to access the instruments to carry out the studies. As the instruments are very expensive EEA can think of innovative methods of making the instruments available for auditors to carryout energy audits. EEA can hire these instruments to the firms on rent. This will enable the consultants to do instrumented energy audit of industries.

End Use targeted

The end uses targeted will include both generic end uses common to industries such as motors, lighting, boilers, heat recovery, refrigeration, fans and pumps, etc. as well as process-specific applications such as process integration, heat recovery, process technology and equipment upgrades, cogeneration, etc.

Marketing Strategy

Program marketing activities will focus on the following:

- Information and education for industries owners and managers in the selected industrial sub-sectors to convince them that energy efficiency goals go hand in hand with enhanced productivity, higher profits and less adverse impact on the environment
- Development of a cadre of experienced energy auditors to motivate them to form an expert team with required skills for undertaking comparative studies in different industries and deriving generic cost-effective technologies
- Cooperative marketing and promotion with manufacturers and vendors of energy efficient products and processes to ensure their involvement to trigger the market for energy efficiency products
- Cooperation with agencies/organizations and financial institutions specifically catering to industries to get their support for interacting with Industries and setting up demonstrations of suitable technologies, and extending support to them in training.

Energy Efficiency Finance Programs

Financial barriers limit the implementation of energy efficiency activities. There is a need for an Energy Efficiency Fund that will facilitate the development and growth of an energy efficiency infrastructure that includes energy service providers such as ESCOs to help energy consumers develop and implement cost-effective EE projects. The Energy Proclamation already has a provision for setting up an Energy Conservation Fund.

The financial support to industries for implementation of the findings of energy audit should be made available from the Energy Conservation Fund, which should be provided at low interest for industries.

A number of financing barriers limit the implementation of EE projects by the private sector. Financing issues include limited capital availability on the part of project hosts as well as the ESCOs seeking to implement projects, lack of understanding and an undue perception of risk on the part of financial institutions, high development and transaction costs for preparing and financing "investment grade" or "bankable" projects, and the poor creditworthiness of many project hosts.

Many of these barriers can be addressed by the development of creative financial products such as a Partial Credit Guarantee (PCG). The International Finance Corporation and the Global Environment Facility (GEF) have successfully developed and applied the PCG approach to stimulate the markets for EE.

A partial credit guarantee facility can reduce the risk of financing EE projects to financial institutions and encourage them to make more and larger loans to EE projects. The standardizing of project agreements and project evaluation requirements through the PCG program will help streamline the development of bankable EE projects and reduce the development and transaction costs for such projects.

The PCG facility will be combined with a Technical Assistance (TA) program to increase the knowledge and awareness of financial institutions (FIs) regarding the structuring of EE projects and their benefits. This will help reduce the FIs" perceptions of risks of these projects. The TA will also provide assistance in developing new financial structures and products customized to the needs of specific market segments. The TA funds will be targeted at developing standardized energy service agreements and financing agreements and appropriate credit enhancement tools for the target market segments.

The program objectives are:

- Increase financing of energy efficiency projects
- Mitigate ESCO risks and increase number of ESCO projects
- Change the risk perceptions of financial institutions regarding energy efficiency projects

EEA will use funds from the Energy Conservation Fund (EC Fund) to provide partial credit guarantees (PCG) for 50% of the project cost. If the customer or ESCO defaults, the financial institution will be guaranteed to receive a minimum of 50% of the payments due to the ESCO. This guarantee does not apply to any ESCO performance shortfalls in terms of savings delivered or other ESCO contractual obligations under the energy services agreement. EEA will work with ESCOs and banks/financing institutions to develop a standardized credit guarantee process and agreement.

The ESCO will use the guarantee as part of its project structuring effort and contractual process to complete the sale. Since the customer's credit has been enhanced and the credit risk has been reduced, the ESCO and the financial institution will be able to offer better terms to the customer. The EC Fund will charge a small fee to the financial institution for the guarantee.

The financing scheme can also be made available through commercial banks where the EC fund is made available to companies by submission of Detailed Project report duly verified by EEA.
The output of this activity will result in

- Improved quality of audit reports to avail national and international funding for energy efficiency projects

- Improvement of competencies of business chambers with respect to energy efficiency
- Improvement in awareness on energy efficiency among banking professionals, industry and government sectors due to seminars and training programs

The use of the output will be the government which can make use of this in framing new policies and regulations.

Database on Energy Stakeholders

In its role as a promoter of energy conservation, EEA shall maintain lists of parties who may have a role in the implementation of energy conservation activities. These will include:

- Energy Service Companies (ESCOs)
- Industry associations
- Consumer groups
- NGOs
- Manufacturers and suppliers of EE equipment

4.0 Strategic Energy Efficiency Framework for Buildings

The buildings in Ethiopia can be categorized into Government or Public buildings and new upcoming large buildings which houses hotels, malls etc. In public buildings the major energy consumption equipment are office equipment, lighting and standalone room air-conditioners. However, the new private buildings that are coming up have centralized AC systems and elevators along with lighting.

A database on baseline energy consumption and end use in government buildings is needed to support the development of energy conservation programs for these buildings and to monitor and evaluate the benefits of these programs.

The database should include the number of buildings by type, energy consumption, major end uses, energy consuming equipment, and utilization patterns.

EEA could obtain the data on number of buildings and annual energy consumption by building type from the electric utilities. Using this data EEA can design and conduct a survey of government buildings to obtain statistically reliable data on equipment saturation, types of equipment and their capacities and efficiency ratings, utilization patterns, and customer decision-making regarding equipment purchase and use.

The strategy for improving efficiency in Public buildings is to have demonstration projects by identifying select buildings and involving equipment supplier for retrofitting it with energy efficient equipment in the lighting and Air Conditioning systems. The funding shall be made available from the EC fund. If the savings are substantial in the range of 30-40%, the same methodology can be adopted for other public buildings also. The building energy program should be linked with Standards and Labelling program as major recommendations are for retrofitting with energy efficient equipment.

A database of Energy Performance Index (EPI) which is Annual energy consumption divided by square feet area need to be maintained. This will help in comparative analysis on the performance of energy consumption and will give a trend in how buildings are performing.

5.0 Strategic Energy Efficiency Framework for Appliances

Introduction

The Ethiopian appliance market is characterized by locally manufactured injera mitad and imports of electrical appliances. All major appliances used in Ethiopia are imported and there is no manufacturing base.

Opportunities for improving energy efficiency

1. Present in the supply of more efficient models of electric and non-electric appliances, and equipment used in industrial, commercial and residential sectors.

2. On the improvement of locally manufactured injera mitad and stoves.

Based on the extent of usage, degree of energy consumption and energy conservation potential, the main equipment and appliances include motors, variable-speed drives, boilers, heaters and furnaces, freezers, ventilation and lighting in the industrial sector and air conditioning, refrigeration, boilers, water heaters and cooking stoves in the commercial and residential sectors. By far most appliances and equipment are imported into the Ethiopian market as well as for some of the Eastern African Community market.

Supporting the Implementation of EE S&L

Standards and labels are meant to help the market recognize energy efficiency and enable suppliers to deliver higher efficiency products to the market. Labels allow consumers to make informed decisions about the true cost of a product, and manufacturers with the opportunity to differentiate their offerings. Standards can be set to ensure that obsolete and inefficient technology does not continue to dominate the market. This is much more effective than the actions of individual end-users. Households on a low income are often inclined to buy the cheapest product on the market. This burdens them with much higher running cost for years to come, and countries need to invest much more in energy supply networks than would be needed if all products would comply with minimum energy performance requirements. Neither one household nor one manufacturer alone can alter this situation. Governments, however, with technical support, can implement standards and labelling programs that protect the poor from such expensive „cheap products", and protect manufacturers of highly efficient products from competitors saturating the market with these expensive „cheap products". The cost to the government to roll out standards and labelling programs is very low.
Key elements of any EE S&L framework are:

- Policy development: A national policy framework for EE S&L, including Policy objectives and targets, and Legal framework for setting standards and labels and enforcing compliance;

- Defining organizational mandates and responsibilities;

Approach to international harmonization of testing procedures, performance standards and label categories;

- Mutual recognition of test results in a region.
- Market introduction: A national strategy for the introduction of EE S&L in the market, including:
- Information and education of supply chain parties, manufacturers, importers and retailers;
- Information and awareness raising among consumers and other end-users of appliances and equipment;
- Promotional activities by the government or in collaboration with market parties, utilities and NGOs.
- Verification and enforcement: Organizations and procedures to check compliance with EE S&L legislation, including:
- Testing infrastructure for verifying energy performance of products by setting up national test laboratories or establishing access to laboratories in other countries;
- Establishing procedures for verifying energy performance of products, including rules about obtaining products for testing, allowed test tolerances and the legal follow up to non-compliance;
- Establishing procedures for verifying the sales of products (allowed by standards and properly labelled) in shops and other retail channels;
- Training of (state) inspectors in verifying shops and other retail channels.
- Enforcement of comparative labeling on locally manufactured products like injera mitad and cook stove

Product Selection Criteria

Products should be selected by adopting the following criteria:

- Firstly a assessment should be made of the share of the national energy demand that products represent now, and are likely to represent in the next decade.
- It should be assessed whether products stem primarily from mass manufacturing, or are typically custom-built or custom-assembled. Product policy is typically effective only for mass-manufactured products.

- According to assessments the capacity in Ethiopia for developing standards and labels from scratch is limited, and that the likely impact of dedicated Ethiopia or East African standards and labels is also very limited, due to the characteristics of the market (since it is imports the country is not in a position to dictate major changes to products). Therefore, products can be selected that are already subject to product policy in one of the major global trade blocks (EU, US, Asia).

- EEA can influence the trade ministry to regulate the import of appliances from Western (Ghana)/South Africa and India which all have functional star labelling program. The information available on labelling on the appliances from the above countries can be adopted initially.

Additional criteria for final selection:

- Availability of intervention opportunities within the Ethiopian context. The product should be assessed based on viable intervention opportunities for a product policy. Only those products that show a realistic potential should be considered for successful intervention.
- Estimated savings potential of the product. For the pre-selected products, an estimate was made of the potential energy savings from an intervention strategy.

This was intended to remove products with a low savings potential from the selection, and to prioritize the remaining products based on their savings potential.

The data from Hifab report prepared with Nordic support gives the list (see Table 5.1) of electrical appliances imported by Ethiopia till 2009.

Table 5.1 Selection of imported electrical appliances and equipment

Import items	2000	2005	2009	
				Ratio to 2009 to 2005 import (iv/iii)
I	II	III	IV	V
Air conditioning machines	649	3,342	8,214	2.46
Refrigerators	13,241	54,730	80,116	1.46
AC generators	162	795	2,213	2.78
(< 75 kW) AC motors (< 75 kW)	2,073	10,890	NA	NA
Air compressors	1,291	1,436	3,117	2.17
Water pumps	21,059	40,301	12,792	0.32
Electric ovens & cooking				

plates	NA 1,576	46,062	186,845	4.06
Smoothing irons		11,017	21,056	1.91
Coffee and tea making machines		21,917	NA	1.80

Table 5.2 Imported electrical appliances and equipment in order of significance

Order of significance	By volume of import	By growth rate of import
1	**Electric ovens and cooking plates**	Ac generators (< 75 kW)
2	**Refrigerators**	Air compressors on w heeled stand
3	Smoothing irons	**Electric ovens and cooking plates**
4	Water pumps	**Clothes washing machines**
5	**Air conditioning machines**	**Refrigerators**
6	**Clothes washing machines**	**Air conditioning machines**
7	Air compressors on w heeled stand	Ac motors (< 75 kW)
8	Ac generators (< 75 kW)	Smoothing irons
9	Microwave cookers	Coffee and tea making machines
10	Ac motors (< 75 kW)	Microwave cookers
11	Coffee and tea making machines	Water pumps

Table 5.2 is best used to compare the growth of volume of imports for appliances and equipment based on the number of units imported.

The items that fall within the first half of the Table (i.e. within the first six rows, in both of the columns) are the following:

- Injera mitad and cook stove
- Electric ovens and cooking plates

- Refrigerators
- Air conditioning machines
- Clothes washing machines

These five items are the most important appliances and equipment in the context of efficiency improvement as they use significant amounts of energy. This finding will be referred to under various issues that are discussed in this document.

A sample ToR Market Survey leading to Design & Implementation of Labelling Program in Ethiopia for Electrical Injera Stoves, within the Standard & Labelling Program of EEA, is prepared and given below in **Annexure I**.

Baseline Information for the most Appropriate Products

The baseline situation for each of the selected products is summarized in the following sections, including information about sales and usage. The Hifab report has identified an energy saving figure as given in Table 5.3.

Table 5.3 Expected energy savings for selected electrical appliances and equipment

Appliance	Average energy consumption (kWh/year/unit)		Energy savings per unit** (kWh/year)	No. of units imported in 2022	Energy saving total for 2022 (kWh)
	2 star*	3 star			
Refrigerator	410	306	104	276,400	28,745,600
Clothes washing machine	529	414	115	473,631	54,467,565

The Government of Ethiopia anticipates new electricity connections in households to double in the next decade to 4 million. The increase in end-user access to electricity is supported by the Government sponsored rural electrification program. Hence increase in appliance usage is also expected to increase due to increased consumers connected to the grid combined with anticipated economic growth.

Barriers Encountered in the Uptake of Energy Efficient Products

The key barriers for the transformation of the Ethiopian appliance and equipment market are listed in order of priority:

- Lack of product energy efficiency test procedures, standards and labels
- Lack of adequate verification procedures for product (energy) quality
- Lack of distributor and retailer awareness of product energy efficiency
- Lack of end-user awareness of product energy efficiency
- Lack of financial resources for more energy efficient products

Implementing a Standards and Labelling Program

The step by step procedure in implementing the energy efficiency standards and labelling program are:

- Decide whether and how to implement energy efficiency standards and labels
- Develop testing capability
- Analyze and set standards
- Design and implement a labelling program
- Design and implement a communications campaign
- Ensure program integrity
- Evaluate program performance and refine

Before a labeling program can be designed, policy makers need to decide which products should be included in the program. As a general rule, energy labeling will work best for products:

- that use a significant amount of energy,
- that are present in most households (or where rapid growth is predicted), for which energy-efficient technology exists that is not being used in most products on the market, for which the purchaser pays the energy bills,
- that are purchased by the consumer at a retail business (i.e., where the consumer inspects items prior to purchase), and
- for which there is (or could easily be) significant variation in the energy efficiency of different units.

If one or more of these conditions are not met, then the effectiveness of energy labelling may be diminished. For products that do not meet these conditions, policy makers should explore alternative program measures. For some products, energy-efficiency standards, rather than labelling, may be the best alternative.

A labeling program is unlikely to be effective unless a testing program is in place. Initiating a testing program requires access to competent testing laboratories - either government-owned or in the private sector. Testing laboratories should be accredited and/or certified to ensure accuracy and confidence in the test results. The results of initial testing of a sample product can be used to:

- characterize the efficiency of the market,
- estimate the potential savings from the labeling program,
- serve as the basis for developing the label categories, and
- Provide energy-performance results used to label each product.

An energy label works in three main ways. The label

- provides consumers with data on which to base informed choices (to select the most efficient and suitable product available),
- encourages manufacturers to improve the energy performance of their models, and
- Encourages distributors and retailers to stock and display efficient products.

On the consumer side, energy labels promote the purchase of efficient models. Energy labels provide consumers with information that would otherwise be unavailable and allows them to factor operating costs and energy use into the decision-making process.

Design of the Testing Program m e

The testing program for any given product should include the following three essential elements:

- A description of the test that must be performed on the product to yield a valid energy consumption value that will be finally shown on the energy label must be available. For example, the test might specify energy use per day, per hour, per month, or per cycle.
- A description of other measurements or separate tests that must be performed to establish the product's capacity (e.g., kW cooling capacity for air conditioners, internal volume in litres for refrigerators) or function/performance (e.g., a washing and drying index for dishwashers).
- Rules specified by regulators to ensure that values reported by the tests are within acceptable error bands and to provide for re-testing and resolving any apparent differences in results.

Setting the Standard

The analysis for setting the Standards may include:

- documentation and assessment of available information (quality, quantity/coverage, applicability);
- collection of new data;
- synthesis of information from diverse sources, including data analysis, model building, and consistency checks;
- scenario analysis to account for alternative assumptions or different possible future conditions;
- uncertainty analysis to build confidence in the policy; and
- Importance analysis to determine which assumptions are the key factors.

Implementation

The Standard and Labeling program should be implemented through the active participation of different stakeholders with minimal enforcement. There should be fair, consistent and practical criteria in certifying energy efficiency products. Any compliance that needs to be met by the stakeholders must be practical and within available resources. The program should be monitored continuously and compliance and non- compliance should be reported to the concerned authorities. Suitable penalties and administrative processes are to be built for non-compliance.

Goals, objectives, activities and outcome for implementing a Standards & Labelling program

The goal of the proposed initiative is to reduce Ethiopia's energy efficiency of selected appliances and equipment in residential and commercial sectors.

The objective is to remove the barriers that are currently hampering the rapid and widespread uptake of energy efficient refrigerators in residential and commercial sectors; air-conditioners in the commercial sector; and lighting in residential, commercial and industrial sectors.

Activities

The key outcomes to ad dress barriers for energy efficient appliances and equipment market transformation in Ethiopia are:

Outcome 1: Selection and adoption of international test procedures, minimum energy performance standards and label classifications.

This component targets barrier 1 - the lack of product energy efficiency test procedures, standards and labels.

Outcome 2: Development and implementation of a verification and enforcement system.

This component ad dresses barrier 2 - the lack of ad equate verification procedures for product (energy) quality.

Outcome 3: Awareness raising campaign for standards and labels targeting distributors, retailers and end-users.

This component ad dresses the need to inform distributors, retailers and end -users with information about appliance and equipment energy efficiency (barriers 3 and 4).

Outcome 4: Development of voluntary agreements for efficient commercial display refrigerators and hotel air conditioners.

This component addresses the need to inform distributors, retailers and end -users with information on appliance and equipment energy efficiency, specifically focusing on display refrigerators and air conditioners in the commercial sector (barriers 3 and 4).

Outcome 5: Policy support & policy framework.

This component targets multiple barriers and can be considered cross -cutting.

Outcome 6: Learning and replication.

This outcome targets multiple barriers and can be considered cross -cutting, thereby including replication for other appliances.

The outcomes are to a large extent inter-dependent hence all have to be addressed to remove the barriers. The sequencing of the activities planned to be undertaken are as follow s:

Outcomes	Year 1	Year 2	Year 3	Year 4	Year 5
1: Test procedures, MEPS, labels					
2: Verification and Enforcement					
3: Awareness raising					
4: Voluntary agreements					
5: Policy support & framework					
6: Learning, replication					

Each of the six outcomes is associated with specific outputs and a set of envisaged activities as described below. By successfully implementing these activities, the project will contribute toward s the achievement of the goal and objectives mentioned earlier.

Outputs and Activities

Outcome 1: Strengthening of testing facility in Ethiopia.

Ethiopian Standard s Agency (ESA) which will be one of the key stakeholder in the Standards and Labelling program should be strengthened. It should build its capacity for testing products that will be introduced for energy efficiency. IEC test procedures for all products should be identified. If IEC is not available, identification of EN norm s should be practiced.
Activities:

In this outcome the necessary testing equipment for implementing the program have to be procured for ESA.

Output 1.1: Selection and ad option of appropriate minim um energy performance standard s for appliance energy efficiency in Ethiopia.

Activities:

In this outcome an inventory is to be m ad e of the most appropriate international appliance energy performance test procedures, minim um energy performance standard s (MEPS) and energy label schemes for ad option in Ethiopia. This serves to prepare the ground for future extensions of the program.

Output 1.2: Selection and adoption of appropriate international label classification.

Activities:

- Identification of EU label or other largest trading block classifications for products.
- Selection of most appropriate schemes based on similarities in product design s and manufacturers.
- Ad option of label classifications, for mandatory application for Air Conditioners, and domestic refrigerators, and for voluntary application for all other products.

Outcome 2: Development and implementation of a verification and enforcement system.

This outcome addresses the lack of ad equate verification procedures for product (energy) quality. It includes the addition of energy performance compliance checking with the pre - export inspections, the building of capacities of custom s for intervening with shipments of second -hand products, and the improvement of trade inspections with importers and distributors.

Output 2.1:.*Pre-export inspections by Ethiopian Standards Agency for compliance of product energy performance*

Activities:

- Development of a list of test procedures and product standard s that need to be included.
- There should be a method for pre-export inspections w here ESA can check with the accredited labs from which the products are imported.

Output 2.2: Capacity building at the Ethiopian Customs Authority for inspection of imported second-hand products.

Activities:

- Strengthening the capacity of EEA and Ethiopian Custom s Authority for tracking imported second -hand products and banning them.
- Training of inspectors in new regulations for second -hand products.

Output 2.3: Establishment of trade inspections at distributors and retail outlets to identify counterfeit and fraudulent products.

Activities:

- Strengthening capacity of EEA and trade inspectors for checking distributors and retail outlets for product compliance.
- Training of trade inspectors for compliance checking at distributors and retail outlets.

Output 2.4: Establishment of a legal enforcement system to follow-up on non-compliance with regulations.

Activities:

- Development and implementation of an enforcement system to follow -up on product non-compliance with regulations (on import).
- Development and implementation of an enforcement system for distributor and retailer non-compliance (on sales).

Outcome 3: *Awareness raising campaign for standards and labels, targeting distributors, retailers and end-users.*

This outcome includes the provision of information in co -operation with main importers and the power utility about the costs and benefits of energy efficient products, information about test procedures and minim um energy performance standards, and an explanation of energy labels and classification (for home appliances). A training program will be prepared for distributor and retail staff, to help them inform end -users about the benefits of purchasing efficient products, as well as help them understand the business opportunities of selling efficient appliances.

Output 3.1: Informing importers, distributors and retailers about appliance energy efficiency in Ethiopia

Activities:

- Providing information about energy efficiency principles of the appliance, costs and benefits to end -users and costs and benefits to retailers of more efficient appliances.
- Providing information about new energy efficiency regulations, d ate of entry of these regulations, compliance requirements, national S&L program , support opportunities and consequences of non -compliance.

Output 3.2: Development and delivery of a training program for distributor and retailer sales staff in Ethiopia.

Activities:

- Development of a training program for distributor and retailer sales staff, focusing on the benefits of these more energy efficient appliances.
- Trial run with a major distributor and major retailer (domestic).
- Delivery of the training program to the sales staff of at least the top 5 distributors and retailers.

***Outcome 4**: Development of voluntary agreements for efficient commercial display refrigerators and hotel air conditioners.*

For display refrigerators and for hotel air conditioners, a discussion will be initiated with the key purchasing parties about voluntary compliance with a minim um energy performance level.

Output 4.1: Analysis of appropriate targets for energy performance of commercial refrigerators and hotel air conditioners.

Activities:

- Analysis of internationally marketed products and the additional costs and benefits versus the products currently marketed in Ethiopia.
- Selection of appropriate target levels based on a least lifecycle cost analysis.

Output 4.2: Discussion of a voluntary agreement with stakeholders

Activities:

- Stakeholder analysis of the involved parties focusing on incentives for their long -term involvement.
- Conducting a series of meetings with the main parties to discuss the analysis and possible agreements.

Output 4.3: Proposing and if agreed implementing a voluntary agreement.

Activities:

- Developing d raft agreements between the governments of Ethiopia, the national utility, the main buyers of the products, if possible the main suppliers, and other interested parties.

- Providing technical support during the implementation of the agreement, including maintaining a list of products com plying with the agreement.

***Outcome 5**: Policy support & policy framework.*

The outcome will review and w here necessary refine the policy framework and the institutional arrangements necessary for the w ide spread uptake of energy efficient appliances in the Ethiopian market.

Output 5.1: Refining and putting in place a policy and implementation framework that increases the uptake of energy efficient equipment and appliances by major market players in residential, commercial and industrial sectors.

Activities:

- Reviewing the current energy policy from an energy efficient product market transformation perspective and make recommendations for improvement of the current energy policy and its implementation framework.
- Indicate measures to be taken to implement the recommendations. This includes a menu of policy, fiscal and other type of incentives to spur energy efficient product market transformation.

Output 5.2: Strengthening the capacity of individuals and institutions that are involved in creating the enabling policy setting and implementation environment for increased uptake of energy efficient equipment and appliances.

Activities:

- Identify the required skills and experiences for monitoring, revising and implementing an energy policy which supports energy efficient product market transformation, and design and implement a clearly focused hand s-on training program. Please note that monitoring energy efficiency developments will play a key role under this output and hence it will receive ample attention within the capacity strengthening activities.
- International stud y tours will be organized to regions of the world w here successful market transformation initiatives for energy efficient products have been designed and implemented. The focus will be on supportive policies and supporting policy frameworks required . A minim um of two stud y tours will be organized - one in the early start of the program m e and the other m id - w ay.

***Outcome 6**: Learning and replication*

This outcome is to improve the understanding (i.e. learning) about practicalities in energy efficient product market transformation followed by dissemination of experience and lessons learned to promote rapid implementation throughout Ethiopia. The implementation of components 1 to 6 will be closely followed and lessons learned will be actively looked at to develop an improved understanding on w hat conditions have to be in place for large scale dissemination of the market transformation activities.

Activities

- Prepare a program for replication of activities implemented for new products.
- Define a method ology to monitor the impacts of the various proposed market transformation activities and apply that method ology.
- Extract information that can be used by the Project Management Unit for steering the implementation of the project.

Enhancing the Capacity of National Experts for Development and Implementation of EE Standards and Labels

Implementing standard s and labels in a country is impossible if there is a lack of w ell-trained experts that understand the core aspects of EE S&L development and can manage an EE S&L program. In the past, many projects have underestimated the amount of development and implementation work needed for standard s and labels, and assumed that national experts could set-up a national strategy without much training. Local experts often have a good understanding of the technical aspects of product performance, but typically have little know ledge of international appliance and equipment markets, product development strategies employed by leading manufacturers and of the mechanics of standard and label development and implementation.

Within this framework, a regional program could enhance the capacity of national experts, by facilitating specific training and information exchange on these issues of energy efficiency standard s and labels development, and by providing better access to state of the art information, technical support and international practice in this field. This enables countries to continue with the development or adoption of standard s and labels in their country, without having to rely on outside experts for every step. This can reduce the cost for governments to move ahead with an EE S&L program m, and give more control over its course.

This part of the framework should include the provision of guidelines and background material to national experts; training program for government, energy agency and university experts; establishment of a regional, multilingual internet platform for access to quality information and the exchange of experiences; thematic workshops for national experts; and technical support for the definition and initiation of national projects.

Regional Strategy and Harmonization of Appliance and Equipment to EE Standards and labels

Since energy-using products are increasingly traded globally, there is an increasing tendency to harmonize elements of product policy between countries and avoid major trade blocks. More and more products are also designed for the requirements of major markets tailored to the specific demand s of their test procedures, minim um energy performance standard s and energy label classifications. This limits the scope of smaller economies to effectively set their ow n standard s, as these m ay not elicit the same response from appliance and equipment manufacturers when compared to what a regionally or internationally coordinated effort could achieve – thus rendering uncoordinated national programs less effective.

Ethiopia can benefit from this trend in several ways:

- By harmonizing their test procedures and appliance and equipment energy efficiency requirements with their main trade partners they can benefit from product improvements already developed for other markets;
- The same mechanism allow s product manufacturers, established in the country, to take advantage of their investments in more energy efficient products, as they can sell these easily as a recognized energy -efficient product in other countries that have ad opted the same procedures and requirements;
- By ad opting test procedures, standard s and labels of other countries in the region, countries can benefit from the analysis and development work already done, and reduce their need to invest significant resources in the development of national standard s and labels.

A regional program could analyze the regional appliance and equipment markets to create an overview of the products sold and the trade patterns between countries in the regional market. This could include an analysis of the countries of origin of products, typical product designs that are common on national and regional markets and which international standard s or labels influence product design. A second in-depth analysis of appliance and equipment energy efficiency test procedures, test laboratories and practices will provide countries with a good overview of the test standard s and performance criteria that can be adopted relatively easily (as performance criteria relate to test procedures). This analysis would allow countries also to compare themselves with their neighbors and with international best practice for EE S&L.

Summary

To summarize, the important points for implementation of standards and labelling program me are:

1. Regulations only deliver when they are properly mandated and well implemented.
2. Access to testing laboratories is essential.
3. Leading market suppliers ask for w ell-implemented EE S&L program.
4. Manufacturers can benefit from introduction of EE S&L program.
5. Energy efficiency standard s and labels deliver.
6. An appropriate m ix of standard s and labels is needed.

6.0 Conclusion

The challenges that Ethiopia is facing on the energy sector is massive needing immediate intervention. Ethiopia needs to boost its electrical energy genera ting capacity for the following reasons;

1. To compensate for energy from the running out of biomass materials
2. To rep lace or augment oil as the source of energy primarily for transportation with the introduction of electric trains and other locomotives
3. Electrification of rural areas
4. To enable techno logy introduction and advancement
5. To cope up with future demand growth

Under the present energy consumption scenario if Ethiopia is able to replace 50% of the current energy consumption from biomass to electric energy it will need to generate 170,000 GWH (Giga Watt hours) of electrical energy or need s to have an additional generating capacity of 19,400 MW. This is only to replace 50% of energy from combustible materials which is basically wood. This shows the urgency of the issue.

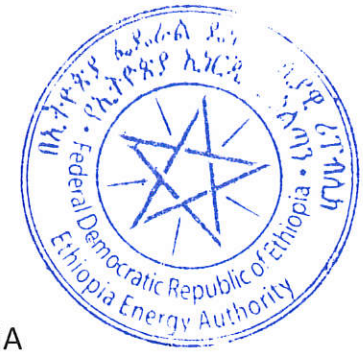
The Ethiopian population is expected to reach 133million by 2030 and the economy is expected to grow on an average of 11%. If these two projections hold true, the energy demand of the country is expected to grow at a faster rate. Taking a modest projection of 11% the total energy demand of the country will reach 250 million tons of oil equivalents.

If Ethiopia is to supply its people with alternative energy source, it is electricity that is feasible. Recent technological advancements are showing that most technologies are opting for electricity as a source of energy for their products. So the need to generate more electricity is inevitable. If Ethiopia is to supply 50% of its energy consumption in a form of electricity, then it need s 165 Giga watts of generating capacity by 2030. It is impossible to generate that much of energy only from Hydro resources alone. Hence, all potential resources need to be considered. To meet this demand solar energy has to play a greater part as w ell.

Ethiopia needs to look at Energy Efficiency improvement in a big w a y to curtail its growing demand for energy. But the challenge requires aggressive initiatives and efforts from every stakeholder. All stakeholders need to understand the seriousness of the issue of depletion of Ethiopian forest and its consequences on every household.

Though Ethiopia does not, emit significant amount of carbon to d am age the environment; it is contributing to the worsening of global w arming by depleting its forest cover.

A sincere and suitable effort need s to be taken to diversify its energy sources from biomass to electricity generation with prudent energy management initiatives.



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