Public Private Partnerships for Community Electricity

PACE

Ethiopia, Nepal, Sri Lanka, Uganda

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Overview of the Electricity Sector in Relation to Public Private Partnerships in ETHIOPIA

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1. Introduction

1.1 PACE Project Background

Access to affordable, safe electricity is a fundamental step in the transition from a poor community to one showing sustainable economic growth and social development. Energy for productive uses, particularly in the agro-processing sector, is a key driver in improving local economic and social opportunities. Grid extension to rural areas in many countries is happening very slowly and even where the grid is present, in urban or peri-urban areas, many businesses, communal services and households are still unable to access power due to high connection charges or discrimination (e.g., licensing, traditional housing type, tenant status, etc.).

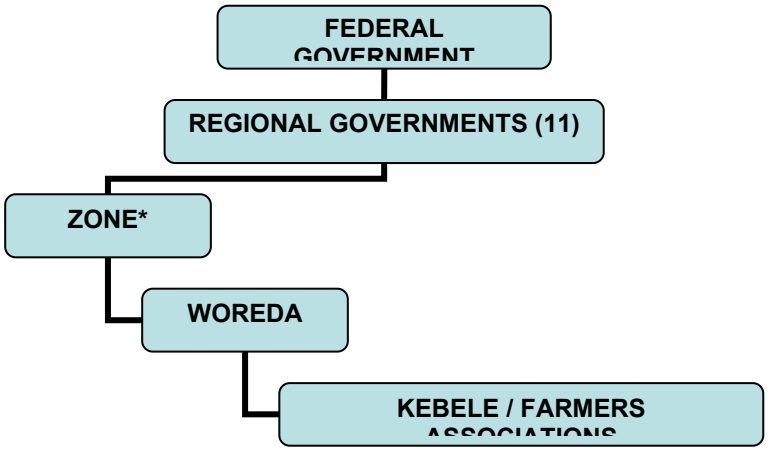
A growing number of communities in many developing countries do not have access to electricity, as traditional monopoly utilities in most of these countries could not keep in pace with increasing population growth, and increasing demand for electricity services for businesses, institutions and households. Increasing decentralisation of government to local levels in many countries provides opportunities for these bodies to become involved in supplying electricity services.

The Department for International Development of the United Kingdom (DFID) is funding a four-country program to review and pilot alternative models for Public Private Partnerships for the delivery of electricity services to communities in developing countries. This report provides an overview of the country situation in Ethiopia.

1.2 Local Government Structure in Ethiopia

Presently Ethiopia is administered by Federal structure. Since the Government recognized that the country is composed of diverse nations and nationalities, it accepted their right to self-determination, giving them regional authority (autonomy) in geographic areas they inhabited. Hence, there are 9 regional and 2 autonomous states in Ethiopia with the power of self-administration (Addis Ababa administrative state is one). The Federal Government is responsible for national defence, foreign relations and general policies of common interest to all states (regional and autonomous) (see chart below).

Chart 1: Local Government Structure: Federal Democratic Republic of Ethiopia



* Zones are temporary arrangements between Regions and Woredas

1.3 Institutions Involved in the Energy Sector in Ethiopia

A number of governmental institutions are involved in the research, development, production, promotion and policy formulation of energy sector activities.

A. Ministry of Infrastructure

The Ministry of Infrastructure (MoI) is the directly apprehensive body assigned by the Federal Government of Ethiopia. It is a newly structured Ministry responsible for the development of infrastructures in energy, transport, communication and construction sectors in the county. MoI is a responsible body in the energy sector for undertaking policy matters, monitoring development activities and developing energy administration systems.

Under the auspices of the Ministry, there are four institutions that are directly involved in energy related matters. They are:

i. Ethiopian Electric Power Corporation (EEPCO)

The Ethiopian Electric Power Corporation (EEPCO) was restructured as a public Enterprise by Regulations No. 18/1997 on July 7, 1997.

The Corporation is an institution engaged in the business of generating, transmitting, distributing and sales of electricity, in accordance with economic and social development policies and priorities of the country. EEPCo is governed by Board of Directors.

ii. Ethiopian Electric Agency (EEA)

The Ethiopian Electric Agency (EEA) was established as a regulatory body for the electricity sector by a Proclamation Number 86/1997 of July 7, 1997. The objective of the Agency is to promote the development of efficient, reliable, safe and economical electricity services.

EEA is responsible to issue license, set tariff and supervise the generation, transmission, distribution, sales, import and export of electricity. The Agency also issues regulations and directives necessary to carry out duties, certificates of professional competence for electric contractors.

In addition, EEA is a care-taking body managing the preparation of the private sector led rural electrification and renewable energy activities. Currently, EEA is preparing the legal and institutional ground for the establishment of Rural Electrification Secretariat/Agency (RES) and Rural Electrification Fund (REF).

iii. Rural Electrification Agency (REA)

The Rural Electrification Agency is an autonomous institution that will be established under either the Ministry of Infrastructure or Ministry of Rural Development in the near future. The Agency will be responsible for the preparation of an indicative rural electrification plan, provide information on potential project sites to prospective investor, review proposals for investments, prepare specific projects to solicit private sector interest and provide technical support to interested investors. The Agency will also serve as a Secretariat for Rural Electrification Board (REB), which is its highest governing body.

iv. Rural Electrification Fund (REF)

The Rural Electrification Fund is a new fund, which will be established under the Ministry of Infrastructure in the near future. Primary purpose of the Fund will be facilitation of rural electrification efforts through provision of flexible loans and “smart subsidy” to private and public sector electricity service providers in rural areas. The Fund will be the primary source of rural electrification financing and technical assistance.

v. National Petroleum Reserve Depots Administration (NPRDA)

The National Emergency Depots Administration was established by Proclamation Number 82/ 1997 issued in June 1997. The objective of the Administration is to maintain reliable and sufficient petroleum supplies required to meet the country’s demand. Security of petroleum supplies is the main purpose of establishing this institution.

Other Central and Regional Government Institutions

Outside the Ministry Infrastructure, there are Public enterprises, Regional governments, Ministries and Academic/Research institutions involved in energy sector activities. These include:

B. Ministry of Mines

The Ministry of Mines is the indirectly apprehensive body assigned by the Federal Government of Ethiopia. Under the auspices of the Ministry, there are three institutions indirectly involved on energy development and promotion. Subsequently, these are:

i. Petroleum Operations Department (POD)

The Petroleum Operations Department is responsible for looking into the means of exploiting the different oil resources of the country. It undertakes promotional activities in petroleum exploration and development, initiates investors and encourages them by providing available information and data. Preparation of policy documents and developing the country's petroleum administration systems falls within its responsibility. The Department closely works with Mining Institutions, both private and public, and other economic sectors.

ii. Mineral Operations Department (MOD)

The Mineral Operations Department is a responsible body for licensing the mineral resources of the country. Investors are encouraged to be involved in mining in different ways. The Department prepares policy documents and develops the country's Mining Administration System (mining regulation, directives, guidelines and model agreements). The Department is also responsible to collaborate with Mining Institutions (both private and public); Regional Water, Mineral and Energy Resource Development Bureaus and other economic sectors. The Department is also issues certificate of professional competence.

iii. Ethiopian Geological Survey (EGS)

The Ethiopian Geological Survey undertakes studies on mineral (coal and oil shale), ground water and geothermal resources. It also conducts geo-physics through regional and geological mapping activities of the country. The Institute provides services through Chemical laboratory, Drilling and Geo-information Centre.

C. Ethiopian Rural Energy Development & Expansion Centre (EREDPC)

The Ethiopian Rural Energy Development and Promotion Centre (EREDPC) is under the Ministry of Rural Development and is responsible for adapting and promoting energy technologies and resources that can be appropriate inputs to bring about a sustainable and integrated rural development.

D. Ethiopian Petroleum Enterprise (EPE)

The Ethiopian Petroleum Enterprise (EPE) is the sole responsible body for the sourcing and purchase (internationally) and import of petroleum products in the country. It is an autonomous body run by Board of Directors and reports to the Prime Minister's Office. The Enterprise supplies petroleum products to the four Oil Distribution Companies; namely, Mobil, Shell, Agip[1] and Total.

E. Other Government Institutions

Ministries and Central Government Organizations are involved in various ways to ensure an integrated energy studies, development and management. These are:

- The Ministry of Finance, Economic Development and Co-operation (MoF, EDaC)
- The Ministry of Waters Resources (MoWR)
- The Ministry of Agriculture (MoA)
- The Ministry of Trade and Industry (MoTI)
- Environment Protection Authority (EPA)
- Ethiopian Science and Technology Commission (ESTC)

F. Regional Water, Mineral and Energy Resources Development Bureaus

The Regional States and Administrations have Water, Mineral and Energy Resources Development Bureaus or Departments, which look after energy activities within the region. The Regional States and Administrations are:

- Oromia National Regional State
- Amhara National Regional State
- Tigray National Regional State
- Southern Nations, Nationalities and Peoples National Regional State
- Afar National Regional State
- Benishangul-Gumuz National Regional State
- Somali National Regional State
- Harari National Regional State
- Gambella National Regional State
- Addis Ababa City Administration
- Dire Dawa Administrative Council

[1] Agip sold out to Shell; and there are only three multi-nationals engaged in distribution of petroleum products in Ethiopia.

1.4 Energy Sector Overview

The table below gives some key demographic indicators for Ethiopia.

Demographic data:

Land Area	1,098,000 sq. km.
Location	North eastern Africa (Horn of Africa) 3^0 – 15^0 N of Equator
Climate	Temperate on Plateau and Hot in Lowland
Temperature	Highland – 20^0C (68^0F) Lowland – Tropical Climate
Rainfall	Average 250mm (34 inches) Main rain season - June – September Lesser annual rainfall – February – April
Population	63.0 million
Population Growth Rate	2.92
Urban Rural Population Matrix	15% Urban / 85% Rural
Economically Active Population	14-60 years of age (50% of population)
GNP Per Capita	US$ 110
Inflation Rate	4.8%
Literacy Rate	32.8%
Percentage Electrification of Population	13.4%
No. of households connected to electricity	534106
Total number of customers to EEPCO	625496
Power generation Installed Capacity	493.39 MW

Source: Dr. Kinfe Abraham, Ethiopia: The Dynamics of Economic Reforms EIIPD, 2001, & EEPCO, Facts in Brief, 2001.

See Appendix II for a summary of some policy issues related to energy and electricity in Ethiopia.

The Ethiopian energy sector is split between the "Traditional" and the "Modern". Traditional refers to biomass fuels such as fuelwood, branches, leaves and twigs, bagasse and organic residues - dung and agricultural residue, whereas modern refers exclusively to petroleum products and electricity.

Like so much else in the economy, energy sector is also reflected by the low level of per capita energy consumption, 0.295 tones of oil equivalent (toe) in the year 1995/96. Of which about 0.02 toe (6%) was derived from modern energy resources (10% electricity and 90% from petroleum products) while the remaining 0.282 toe (94%) was secured from traditional fuels.

The Energy Resource Potential

Ethiopia has substantial energy resources consisting mainly of biomass, hydropower and fossil fuels (especially natural gas and coal). Renewable energy resources like solar is available in abundance almost throughout the year while geothermal and wind resources are available in a relatively smaller proportion. Although currently dominated

by traditional biomass consumption, other energy sources such as hydropower and natural gas can potentially offer the nation for major development opportunities.

The biomass energy sources are estimated to cover 39% of the total potential. Despite the continuous dwindling of forest reserves in the country, wood fuel still accounts for the largest proportion of the current use of energy, 76.7% (World Bank, 1995).

Dung and crop residues, which fall under organic residue, are also important energy resources. These fuels are used at places where firewood is scarce. Households, especially those in rural areas, are forced to use dung and crop residues, which otherwise should be used as natural fertilizers.

Hydropower, which accounts for 23.2% of the total energy potential of the country, is the largest sustainable energy resource (World Bank, 1995). However, its development has been hampered due to slow progress of the economy coupled with lack of capital. To-date only 1.5% of the total potential is harnessed (EEPCO, 1998).

The hydropower potential is estimated to be 650 Tera Watt Hour (TWH) (CESEN 1986). The economically affordable hydropower energy and power estimates at 40% of the theoretical potential are about 260 TWH and 29.68 Giga Watt (GW), respectively. However, due to lack of capacities, the timely harnessing and management of the water resources have remained difficult and confined to very few number of river basins and sub-basins.

The country with such hydropower potential invites the construction of small, medium and large-scale hydropower plants to absorb the future increasing power demand. The development of hydropower plant is given good attention in the energy policy. However, it calls for a very substantial investment, good engineering capability and experience. Therefore, the necessary financial and technical support from international community is needed to develop the hydro potential of the country to speed-up economic development and to change the living standard of the people.

The total installed capacity of electric supply is 493.39 MW. The major source of the electricity supplied in the country is from hydropower, which contributes about 91.4% (450.75 MW) of the total supply. This amount is, however, only 1.5% of the economically viable hydropower capacity... Seven hydro plants supply the main interconnected system (ICS) with a total capacity of about 444.6 MW while the thermal and geothermal plants capacity are 21.5 and 7.3 MW respectively. The grid serves most of the larger population and commercial centres, but many medium size localities receive only part time, unreliable service from diesel generators operated as part of the self-contained system (SCS). On the contrary, most towns, villages and rural areas generally lack any access to electricity. So far, it is only 13.4% of population is said to have access to electricity. The current electric energy consumption per capita is estimated to be 27.9 kWh, which is one of the lowest consumption rates among the least developed countries.

The table below shows the current installed capacity of EEPCO both in the Interconnected System (ICS) and the Self-Contained Systems (SCS).

EEPCO Generation Installed Capacity

SOURCE	ICS		SCS		TOTAL	
	MW	%	MW	%	MW	%
Hydro	444.6	93.9	6.15	30.8	450.75	91.4
Thermal	21.5	4.5	13.84	69.2	35.34	7.2
Geothermal	7.3	1.5	-		7.3	1.5
TOTAL	473.4	100.0	37.62	100.0	493.39	100.0

Source: EEPCO, Facts in Brief, 2001.

There are 625,496 customers to EEPCO with the household sector comprising 85% (534,106) of the total number.

2 Renewable Energy and Energy Efficiency Developments

Much has been left undone by government, NGOs, donors, and the private sector in renewable energy and energy efficiency developments.

2.1 Small and Micro Hydropower Development

Small and micro hydropower resource potential assessments have been carried in different parts of the country.

A. The Small Hydro-power Investigation Team from the People's Republic of China

According to the technical and economic cooperation agreement signed between the governments of China and Ethiopia on October 9, 1971, the Chinese government agreed to send a group of experts to take up the mission of small hydropower resource investigation in Ethiopia. It had completed its mission in 1988. The Ethiopian counter part was Rural Development department under the Ministry of Agriculture.

During this mission, reconnaissance survey and feasibility studies on 57 sites in 7 different regions in the country were carried out. Among the 57 sites 29 have been selected as short-term development goals based on hydraulic structure layout, construction and access road conditions, energy-economy indices, and in combination with local power demand. The 29 stations have a

total installation capacity of 6191.57 kW, and they can provide electricity for 445,011 people (detail studies on each site can be referred from The Small Hydro-power Investigation Team from the P.R.C., April, 1989).

The actual construction of the schemes, which should follow the feasibility studies, was halted when the previous Ethiopian government collapsed in 1991.

B. Technical Support from Italian Government

In mid 1980s, the Italian government had granted a fund for feasibility studies and site selection for installation of small-scale hydropower schemes for rural electrification in Ethiopia. With the fund obtained, Ethiopian Rural Energy Development and Promotion Centre (EREDPC) had studied some 18 sites during the first phase of the project. Before the second phase, which is the construction of schemes on selected sites commenced, the Italian government changed its external policy in regard with foreign development and that put an end to the project.

C. Japanese Overseas Development Co-operation

In 1998 the Japanese government granted 8.5 million dollar for development of mini and micro hydro development for electricity generation. A team of experts from Japan visited EREDPC to discuss how the project should be implemented. However, according to the organizational structure it had then, EREDPC had no mandate to operate in the field of mini or micro hydro power developments. Hence, the team was advised to contact and work with the Amhara regional bureau. Pre-feasibility study has been carried out on Fetam river.

Apart from this very few church groups and non-governmental organisations are involved in micro-hydro developments in Ethiopia.

2.2 Solar Energy

Even though solar energy is abundantly available, the domestic market either for thermal use or photovoltaics is not developed. Very few units have been introduced to the country through some NGOs and government organisations for sectors as health, education and water supply or the telecommunications industry in some remote areas. Apart from this, they could not make any substantial change by penetrating the private sector for purposes such as lighting.

The existing suppliers and installers of PV systems in the country have not taken any action to invest on the promotion of the technology. Nor has there been any systematic effort by the government to promote this important industry in the past. As a result of poorly developed market infrastructure, the few existing PV equipment dealers concentrate only on marketing to donor led projects in sectors such as health, education and water supply or the telecommunications industry. An estimated 1.2 MW of PV is installed throughout the country over the past 20 years or so.

2.3 Wind Energy

Since the wind resource in Ethiopia is limited only for water pumping purpose, no units are installed for electricity generation. All units installed in the country to date are for the purpose of water pumping.

2.4 Biomass Energy

Since biomass fuels are the main energy resources in Ethiopia, heavy dependence and inefficient utilisation of the resources have highly depleted the resource base. Hence, the government has devised supply augmented and demand management strategies in order to alleviate the problem and bring about sustainable utilisation of forest resource. The demand management strategies included improved efficiency in household energy utilization especially for cooking, through introduction of improved cooking stoves. In this regard, a number of governmental and non-governmental institutions involved in stove design, production, dissemination as well as information assessment and compilation, whether directly or indirectly (through financial and technical contributions), as early as 1970s in the history of Ethiopia.

The primary institution that should be mentioned in the promotion and dissemination of cooking stoves (regardless of thermal qualities) is the 'Informal Sector'. This sector as far back to the beginning of the 19th century until the present is contributing to the cook stove market of traditional as well as improved stoves of different size and dimension. Although, a single figure, which quantifies the penetration rate of these stoves, is not available, it has been evident that this sector plays a big role in the supply of biomass conversion devises in the country at large.

As studies indicated, prior to the 1970s the Ministry of Agriculture (MoA) was promoting improved stoves as a part of community development along with other stakeholders.

The government policy towards importing of kerosene in mid 1980s transformed some 90% of the householders in Addis Ababa and other major urban towns into kerosene stove users. In fact, in 1980s kerosene was not a cooking fuel in Ethiopia but electricity was used by as many as 10% of households in Addis Ababa to prepare 'Injera' on Electric stove. This was a measure as a temporary relief for forests mainly focusing on Addis Ababa.

International Labor Organization (ILO) executed a project on Cooking Efficiency Program Planning in Ethiopia (CEPPE) addressing household cooking options. The study identified a major intervention in improving the use of biomass efficiency in the households, specifically wood and charcoal. Portable metal wood and charcoal stoves were designed and tested with an ultimate aim of massive dissemination of the stoves after undertaking field tests and acceptability assessment.

Other than this, the Ministry of Agriculture (MoA) also continued to promote improved stoves programs at different places. The Rural Technology Promotion Centres (RTPCs) under the MoA developed and promoted improved charcoal, wood and

confined stoves in different regions of the country. Side by side, the Ministry of Education (MoE) funded by UNICEF has also promoted improved mud stoves through Burayu Basic Technology Centre. The German Development Service (DED) has also promoted improved mud-stoves in the Ambo area.

The Cooking Efficiency Improvement and New Fuels Marketing Project (CEINFMP) implemented by Ethiopian Rural Energy Development and Promotion Centre with funds obtained from the World Bank succeeded in developing and commercializing an improved charcoal stove named 'Lackech Charcoal Stove" which has an overall efficiency improvement of 25 per cent (tested in the households) compared to the traditional charcoal stove in Addis Ababa. In 1994, 22% of households in Addis Ababa owned a 'Lackech' improved charcoal stove thereby showing a penetration rate of 18% as compared to other charcoal stoves. The rapid payback plus the fact that the stove is attractive and fit well for the traditional coffee ceremony are the two main reasons behind its rapid dissemination in Addis Ababa. This rapid dissemination, which is driven entirely by consumer demand met by private sector producers can be characterized, as no less than a stunning success relative to most stove programs that never attain double-digit penetration rates even after many years effort.

The dissemination of injera stove known as 'Mirt' is also another success story of CEINFMP. After the CEINFM Project phased out at the early stage of 'Mirt' stove dissemination, funds obtained from DfiD helped to promote the stove in a number of regions.

3 Private Sector Involvements in Electricity Provision

3.1 General

Electricity was first introduced to Ethiopia around 1898 during Emperor Menilik's era as the then German government provided a generator as a gift to the Emperor mainly to supply electricity for lighting service to his palace. In 1903 the Emperor imported the second generator for the purpose of supplying power to machines that produced coins with his image on them. This was the first power generator used for industrial purpose. Later, use of electricity expanded and since early 1930's it was used to provide public services like street lighting.

The first private electric power generating company (an Italian company) was established during the Italians invasion and started selling electricity to the public for the first time. In 1940 there were seven diesel-powered generators that supplied electric power to Addis Ababa and seven other towns. Hydro-electric power generation was introduced by this company for the first time in the country in 1940 with three generators installed at Akaki river with total installed capacity of 3060 kW. The second hydro power plant was constructed in Jima with capacity of 120 kW.

After the Italian invasion a local government body was managing the existing plants and continued electricity expansions to other parts of the country. Later in 1956, Ethiopian Electric Light and Power Authority (EELPA) was established with the main

objective of power generation, transmission, distribution and sales throughout the country. EELPA remained to be the sole actor in the power sector until 1997. After restructuring EELPA, it has been reorganised as the Ethiopian Electric Power Corporation (EEPCO) to be engaged in the business of generation, transmission, distribution and sales of electricity. The government is now encouraging the involvement of the private sector in power generation and selling their produce to EEPCO, as a single buyer, for transmission, distribution and commercialisation.

Though electric power generation was fully controlled and owned by EEPCO, in some rural towns municipalities and local council offices organize the community to raise funds and set up their own diesel gensets and isolated grid systems to supply electricity to households and service sectors in towns. Beside this, even though there is no operational legal and regulatory framework at present supporting and facilitating the involvement of the private sector in generation and selling of electricity, there exists some sort of partnership with the private sector and the public. It is not uncommon in rural towns to find that a number of individuals generating electricity with small diesel or petrol generators for self-consumption and selling the extra power to the surrounding neighbourhoods. The common practices of partnership are basically of two types:

1. Fully private:

   Since there is no operational legal framework at present to bind the contract between service providers and consumers, system capacities and service qualities are kept to the minimum in order to avoid risks involved with high amount of investment. Generation capacity of systems usually is not more than 5 kW.

2. Works and service contract:

   Works and service contract may include system sizing, tariff setting, installing the system and provision of regular and major maintenances. In earlier days a certain community after making funds available for such systems, they preferred to wait for years for EEPCO to do the installation. This situation is changing now. Though the involvement of the private sector is at a very low stage at present, it indicates that some sort of trust and partnership is being established between the private sector and the public. Perhaps, at this stage where there is no working legal framework, this is the only type of contract agreement that can be legally supported.

   This model of private-public partnership is becoming a common practice at the present mode of community electrification. Commonly the management for the systems is a committee composed of representatives from the community and the local government. Operators will be hired with a fixed monthly salary. Generation capacities in such systems are usually in the range of 100kW to 150 kW. Tariff for lighting a 40W bulb for 5 hours a day for a month is between 6 - 8 Birr (0.66-0.88 USD) depending on the generator operating load.

There are cases where certain communities enquire the private sectors for stronger partnership such as operation and maintenance contracts. Some declined fearing that it will be difficult to collect bills and control illegal connections. In other cases the local and regional governments' attitudes towards such a strong partnership was not accepted.

3.2 Assessment of PPP models

In this section, two case studies are used to show the typical issues associated with community electricity schemes in Ethiopia.

A. Isolated grids leased to the private sector

Gunion is a small town located 15 km from the local capital Welaita Sodo, in Southern Nations and Nationalities region. It has a population of 3000. There is an all-weather road, which connects the town to the local capital. The economy of the town is closely tied with agriculture as a large proportion of the households are engaged in farming. Trade is also a major source of livelihood making the town the local rural market center. Cash income is considerable as more than fifty percent of the households have monthly cash income of Birr 100 (11 USD) or more. The town has a school, a clinic, more than eighty commercial establishments and eleven grain mills.

About a third of the households use kerosene lanterns while the rest use wick lamps. The town installed a 20 KW diesel generator in 1995 at the cost of Birr 50,000 (5,500 USD). The residents' of the town raised the money partly as a contribution and the remaining was obtained from the town council. The distribution line was constructed with assistance from EEPCo with all costs covered by the community. Electricity was supplied for 200 households, several commercial establishments and a clinic for lighting. Customers used to be charged by the number of bulbs they used. Customers used to get lighting for four hours a night on ordinary days and six hours on the main market day. The tariff was Birr 3.00 (0.33 USD) per month for every 40 Watt bulb owned by the households. This is about 0.6 Ethiopian Birr (0.07USD) for a Kwh.

The system was functional only for three months after which service was terminated due to operational and technical problems. The main problem with the system was operational in that the amount obtained from monthly charges could not cover the fuel cost and salaries for the operator and the guard. Assuming that a 40 Watt bulb consumes about 5 kWh per month at 0.5 litres/kWh fuel consumption rate and Birr 2.50 / litre cost of diesel (0.27 USD), the fuel cost alone was 2.5 litre/bulb or Birr 6.25/ bulb (0.73 USD).

As part of an effort to solve the problem and regain access to electricity, the operation was passed over onto a private individual on concession basis. However, the new arrangement could not solve the problem either primarily because revenue collected from electricity sales under the existing tariff was not sufficient even to cover running costs. In the third round, certain private individuals were also interested to operate the system on concession. However, they all concluded that

the generator required major overhaul for which they were not prepared to commit the required inputs.

Fourth, another private entrepreneur showed interest in supplying power to the community from his own generator using the already established grid. This operator used to charge Birr 7.00 per month per bulb (0.77 USD) and gave free power to the town council offices and street lights in return to free access to the existing mini-grid. This operator too, could not manage to cover costs. With this private operator some of the problems aroused were conflicts with users illegally connecting more bulbs than they were paying for. There were also technical problems caused by users short-circuiting the system.

After repeated failures to gain access to this important service, electricity, both the community and the council became weary of rehabilitating the generator or allowing new private operators come in to supply of power in the community. In stead, they are waiting for their connection from the grid when EEPCO extends the service. It has been over three years since they are waiting for their connection to the grid. It is not certain that this town will be connected in the near future.

B. ESCO: Independent Utility Producer/ Distributor led electrification

Amarokelle is located at 473 km from Addis Ababa in Southern Peoples region. The population is about 8000. The economic setting is more like small-scale business and government employment rather than agrarian.

The community used to own and operate a micro hydro scheme that was providing both milling service and electricity. The plant was set up in 1988 with financial and technical support obtained from the contribution of the community and the local parish church of Ethiopian Evangelical Chruch Mekane Yesus (EECMY). The community and the parish church identified a couple of potential sites and asked the head office of EECMY for further site surveying and development of one of the sites. It was then decided to construct the scheme on Beyway river on the place where there was an old traditional hydro mill.

The community first raised 25% of the total amount of money required and the remaining 75% was paid back from the revenue obtained from the operations of the scheme. The local parish church took the responsibility to pay back all the money. Though the scheme was the property of the community, the management was fully controlled by the parish church until all the money was paid back. Then it was handed over to the community and local officials (kebele). The total cost of the scheme was about Birr 115,000 (12.650 USD), of which Birr 70,000 (7700 USD) was the cost of the generator.

The scheme was constructed by diverting portion of the water from Beyway river. A simple earth canal (which was used for the old mill) of about 300 meters length to the intake was used. The head was 15 meters with the metal penstock extending 20 meters from the intake to the turbine. A T-250 cross flow turbine was used and the scheme had an installed capacity of about 10 kW that was used for mechanical

milling and electricity generation. The mill and the alternator were aligned in line and were driven from the same turbine using a belt.

The mill had a maximum capacity of grinding 14 quintals of grain a day when there was sufficient water. On the average the mill used to give service to some 50 customers grinding about 7 quintals per day. The charge of milling was Birr 10 (1.1 USD) per quintal of grain. This was a bit cheaper compared to the nearby diesel mill that charged Birr 15 (1.65 USD) per quintal.

The nominal power of the alternator was 33 kVA. About 110 households were connected with a total number of 300 bulbs. Unless there was a technical problem electricity supply was for 12 hours a night from 6:00 pm up to 6:00 am.

The tariff was Birr 2.00 (0.22 USD) per bulb per month. There was no regulation or means to limit the power the households should use. However, as observed in some households 25W, 40W and 60W bulbs were used.

During dry season the flow in the river reduces and the scheme could not generate enough power. During this time the milling capacity as well as the electricity generated decreases. Electricity used to be rationed in dry seasons.

For maintenance of the turbine, the part would be dismantled and sent to EECMY in Addis Ababa. Otherwise a technician from EECMY would come and fix it at the site. EECMY used to charge them for all maintenance fees including transportation costs and allowance for the technician.

Electricians from a place called Dilla would be called whenever there was a problem on the alternator.

Management of the Scheme

The scheme had three employees: an operator, a cashier and a guard. The local council set the tariff. The revenue obtained from the mill and the electricity charge was sufficient enough to pay the salaries, maintenance and the loan. The scheme was functioning properly for three years and after it paid back the loan, the management was taken over by the local officials (Kebele).

However, after it was handed over to the management of the local officials, the scheme was no more able to pay the salaries and maintenance expenses. Due to lack of parts the mill was not functioning for more than two years (1991-93). It was fixed in 1993 and after working for one month it broke again and that put an end to it. However, the alternator was functioning until 1996 though the service was not regular and the quality was not very good. The scheme is now totally abandoned.

Present Condition

The community raised Birr 300,000 (33000 USD) and installed a 150 kVA (120 kW) diesel system. A private company installed the local grid. Households, schools, commercial establishments and clinics are connected for lighting. The generator runs for 6 hours during day time and 6 hours at night. During day time, electricity is

supplied to small technical services like metal workshops. At night, some 500 households, evening schools and clinics get lighting. Street lighting service is provided on the main streets.

A committee composed of the community and local officials manage the scheme. There are permanent employees to operate the generator. The community contracts out regular services and necessary maintenances to a private sector.

4 Conclusions

With government monopolized electricity expansion, it became possible to cover only 13% of the population in about 60 years despite the government's hard effort. Actually, the recent government policy change, which is in-favour of private sector participation, will pave the way for off-grid rural electrification in isolated systems. Indeed it has been envisaged that there are considerable commercial opportunities. The design of the new Rural Electrification Fund (see 1.3) is one such vehicle that should serve to accelerate progress and investment.

Apart from this government's long-term strategy of agricultural based industrialization process requires, among other things, provision of modern energy sources and strengthening of rural energy institution such as rural electrification. This requires the participation of the private sector in response to the new governments effort in the development process.

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Appendix I - Public Private Partnership Model Types already tested

		1	2	3a	3b	3c	4	5	6	7
	Input	Direct subsidy to private entrepreneurs (including subsidy for PV SHS)	Formation of a private sector company, to own manage the system after its construction by a public body	ESCO: Independent Utility Producer/Distributer led electrification	ESCO: Energy Management and Services	ESCO: Generator only (IPP) - (public or private ownership)	Distribution systems leased to Private or NGO-type or community-based organisations	Isolated grids leased to the private sector (both generation and distribution)	Construction by Private Sector: BOOT, BOT BOO	Concession Model - geographic
Exists? Yes/No	Y/N	No	No	Yes in Amarokelle	No	No	No	Yes (in Gunino). Now it is abandoned.	No	No
Number of schemes	Number			About 10 similar schemes in the country.				1		
Total Installed (MW)	Number			120 kW				20 kw		
Years of successful operation	Number			It's been two years since the community diesel genset installed.				It worked for one year with frequent on and off		
Financially viable (Y/N)	Y/N			Yes, because proper tariff is set				No. Because the tariff set was very		

								low		
Who is served (Govt, inst, priv bus, HH)	G/I/B/HH			All in the community				G/I/B/HH		
Who is excluded (same catagories)	G/I/B/HH			None. Because street lighting, evening school, etc are for all public use.				None, because at least the street light is for all		
Replicable in-country (Y/N)	Y/N			Yes				Yes, if proper tariff is set.		
Primary use of electricity	Describe examples			Lighting, power supply to mini metal workshops				Lighting		
Estimated Population served	Number			3000				200 households which is about 1000 people		

Initiator (organisation/agency)	Name of agency			First the local church introduced MHP and later the community and the council initiated the diesel system				The community and the local council		
Community Buy-in (Y/N)	Y/N			Yes				Yes		

Appendix II - Government Policy Issues Related to Electrification and Energy

Government Policy, Laws, and Strategies regarding Rural Electrification

The government of Ethiopia has been practicing an ad-hoc energy policy program since 1994. This comprehensive energy policy was issued to fulfil major objectives of ensuring sustainable supply of energy and environmental protection, providing guidelines and strategies, prioritising the development of energy resources and removing bottlenecks inherent to energy resource development and utilization. Recently, few changes has been made on the framework of policy, which the government makes a shift in paradigm emphasizing that the development of the energy resources is open for any private investor as well.

The policy gives first priority to the development of hydropower resources followed by exploitation of natural gas deposit and exploration for oil resources. The third priority is development of agro-forestry systems in the rural areas through fuel wood plantation and forestation.

To this end, for the implementation of the energy policy sub-sector strategy, law and regulations were also issued and some are underway.

The government of Ethiopia has also passed the Electricity Proclamation and the Electricity Regulation, which clearly indicated the responsibilities of the regulatory body (Ethiopian Electric Agency) and level of liberalization in the sector. Accordingly, electricity generation from hydro within the interconnected generation, transmission and distribution system as well as isolated systems in all segments is open for any investor. However, thermal power generation up to 25MW and distribution in a self-contained system is allowed for Ethiopian nationals, but this is being under review for possible removal.

In the electric sub-sector specific issues at present are the low rate of population access to power supply, its inability to connect large new commercial and industrial customers and high cost of future generation investment. Correspondingly, the government has design related strategies to deliver timely solutions:

a. The Government of Ethiopia has adopted increasing and promoting electricity access as an integrated part of its strategy to promote income-generating activities and social services outside major urban centres and decentralize the delivery of services through out the country respectively.

b. Another is the Rural Electrification strategy, which has also been envisaged and put on the way recently. The strategy includes among other things: (i) the government's long-term vision of increasing the rural population access to electricity; and (ii) the establishment of an independent Rural Electrification Board and Secretariat; (iii) source of funds for the co-financing the initial capital expenditure for rural electrification scheme.

   The rural electrification strategy coupled with EEPCO's grid based program is expected to increase access to electricity from the existing 13% to 20% in the coming 10 years.