

# Energy Extension for Sustainable Development and Gender Equality in Ethiopia

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## Abstract

The aim of this study is to analyze and realize the application of energy extension to hold sustainable green economy of the country. Energy extensions improve access of energy to the most of the rural areas, reduce emissions of local and global pollutants, and create local socioeconomic development opportunities. These concerns have rekindled interest in energy efficiency, energy conservation, and the development and commercialization of renewable energy technologies. The study recommends that more energy extension should be carried out to enhance energy management, performance improvement and also, environmental protection to ensure human healthy and gender equality. And Policies should focus on promoting energy extension, especially in the residential and commercial sectors to drive green economic growth.

**Keywords:** Energy extension, Energy policy, Gender equality, Renewable energy, Sustainable

## 1. Introduction

Energy is central to reducing poverty, providing major benefits in the areas of health, literacy and equity. In people's daily lives, energy provides essential services for cooking and heating, lighting, food production and storage, education and health services, industrial production, and transportation (Yianna L., Grazia P., 2006). Developing countries need energy to raise productivity and improve the living standards of their populations. Ethiopia is one of the countries which are on transition /developing/ process, but still with great problem of energy supply, however it has huge amount of hydropower, wind, geothermal and solar potential (Awash et. al., 2013). It is well known that in most rural parts of the country is highly dependent on fire wood for cooking purposes. And have addressed their energy needs by expanding the supply base with little attention to the efficiency and energy conversion. For this reason, the rural area is highly exposed to deforestation and for several eye and breathing related diseases. Wood fuel dependence was thought to contribute directly to deforestation and environmental degradation in rural areas of developing countries and reducing household demand was a logical solution. One response to reducing the pressure of the local community on their rural hinterlands could be switching from one fuel source to another, known as energy transition. Switching from fuel wood to other renewable energy, for instance, leads to reduce pressure on the forest resources and lower indoor air pollution (Awash, 2013).

Significance of energy in any economy cannot be over emphasized; sectors such as manufacturing, health, construction, entertainment, education and communications significantly depend on the production of power for their activities. Energy extension is an essential for sustainable development; and any decision-making about energy use has complex linkages with policies affecting poverty, food security, health, population, gender disparities, environmental quality, investments, foreign exchange, trade and national security (Yianna L., Grazia P., 2006). Increased recognition of the contribution of energy extension makes to rural development, lower health costs (linked to air pollution), energy independence, and climate change mitigation is shifting renewable energy from the fringe to the mainstream of sustainable development.

Health extension is adopted so money year in the country whereas energy extension is almost none. This energy extension is the vital program to introduce self-energy supply to the rural and urban community. This program support rural farmers and pastorals in developing locally available sustainable energies for electricity generation, heat production and producing sustainable fuels (Rahul M. et al., 2013). And it improves access to energy by most of the rural community, and also reduces emissions of local and global pollutants and may create local

socioeconomic development opportunities. The rural community's challenge is to recognize the economic changes being driven by alternative energy (Hyatt Bosman, 2012). So, the aim of the paper is to show energy extension contribution for sustainable development and gender equality and how to solve rural and urban energy scarcity and health problems by giving the programme on the performance improvement, new technology adoption and energy conversion technique to the farmers, pastoral and semi-pastoral societies. And this activity helps to achieve a reduction on fuel wood consumption, collection time and indoor air pollution related to the traditional use of biomass. The programme should engage communities in renewable energy training to build the capacity of local community, and preparing them to successfully assess the impacts of renewable energy technologies (Eric Romich, Nancy Bowen-Ellzey, 2013). Because, energy security, economic growth and environment protection are the national energy policy of the country and the programme helps to ensure the policy and improve the living standard of community people by promoting the use of renewable energy technology for protecting the environment through energy extension.

## 2. Current Energy Situation of Ethiopia

Ethiopia is well endowed with renewable and non-renewable energy resources that far exceed its energy demand requirements for the next century. But paradoxically, most Ethiopian peoples are characterized by energy poverty and poor energy access, and a reflection of their low income and general state of economic underdevelopment. In spite of having plenty of energy resources and potentials, Ethiopia suffers a very low supply of electricity. And vast rural areas are being affected by load shedding. Due to power failure irrigation, production of products, water supply and daily activities are being disturbed. Presently, Ethiopia electricity is facing a serious energy crisis despite strong economic growth during the past decade and consequent rising demand for energy, worthwhile steps have been taken to install new capacity for generation of the required energy sources. To solve this, EEPCo energy strategies focuses on progressive of energy infrastructure to expand the availability of electricity. But, 80% of Ethiopia's 70 million people live in rural areas (Source: IEA 2011), and the dispersed nature of rural communities and their low commercial energy consumption, a grid-based approach is not economically viable in many places.

Grid-based electrical power does not reach many rural and poor urban communities in developing countries, nor do they receive adequate distribution of gas or other cooking and heating fuels (UNDP 2011). Reaching un electrified rural population is often only possible through decentralized energy extension systems, due to low potential electricity demand and economic development in these areas and sometimes also for political reasons, grid power is not a feasible option. This energy extension helps to simplify conventional challenges and capacity barriers including technical, technological, economic and institutional weaknesses (GTZ, 2007). In rural and urban areas, access to diesel is very scarce, thus photovoltaic, and solar and biofuel and biogas represent a real opportunity to develop and deliver a manageable source of energy. Energy sources consumption in Ethiopia varies with different type of sectors and fuels. Household is the maximum energy consuming sector; and biomass is the largest total energy share (**Table 1**). So, having energy training program in the rural areas means decreasing 89 % stress of the deforestation and air pollution in the local community.

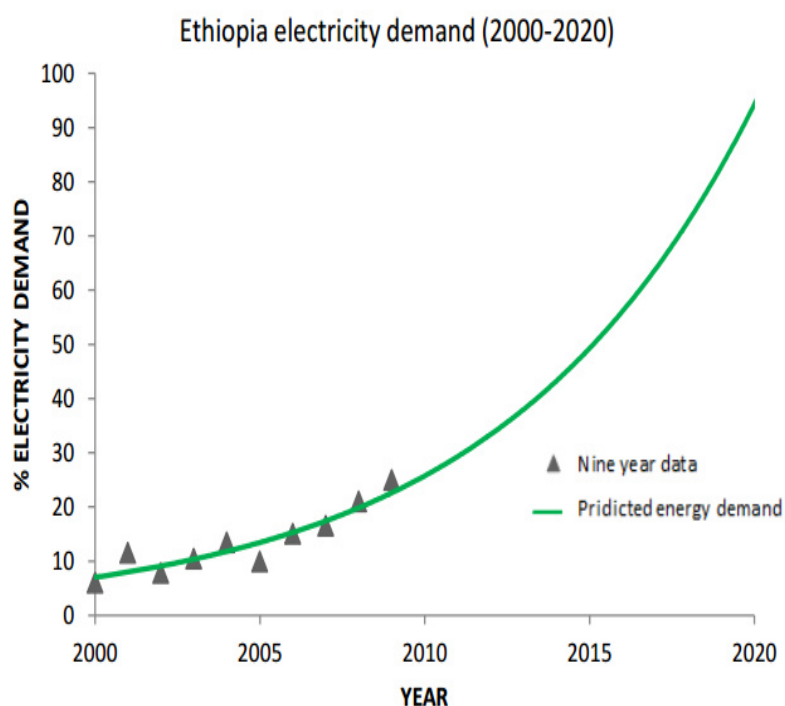
**Table 1:** Energy Consumption and fuel type in Ethiopia (GIZ, 2011)

%	Share of Total Energy	Fuel Type		
		Biomass	Petroleum	Electricity
Sector				
Household	89	96.0	15.0	33.0
Industry	0.6	0.0	1.0	40.0
Services	3.5	3.0	2.0	26.0
Transport	6.0	No BF	80.0	No Ele.
Agriculture	0.9	1.0	2.0	1.0

Ethiopian energy demand increases exponentially in the previous decades, due to that energy poverty increases dramatically (**Fig.1**). The majority of citizens suffer from energy poverty as they lack sufficient access to adequate, affordable, effective and environmentally sustainable energy services that could support economic and

human development. Energy poverty has an effect on, and is affected by, other aspects of poverty, it is vital to explore issues surrounding it, including the gender aspect.

It is no gain say any longer anywhere in the world over that the demand for energy is growing faster than its supply; this trend has necessitated renewed efforts by the government both in developing and developed countries to boost energy supplies in order to meet the demand (Bamidele P. Abalaba, 2013). Because, due to rapid growth of energy demand in Ethiopia has wide impacts and much of the additional energy needed will be supplied by imported oil, and rising oil imports will further burden and already saddled with high oil import bills.



**Figure 1:** Historical background and predicted electricity demand in Ethiopia (Awash et.al, 2013)

### 3. Energy Extension for Energy Crisis Management In Ethiopia

Energy extension is the catalyst without which other goals on issues such as health, education and gender equality cannot be achieved. Extension has defines by many approaches and authors, traditionally been defined as the delivery of information and technologies to farmers. Swanson et al. (1997) defined energy 'extension', as extending relevant energy information to people. The World Bank defines extension as the process of helping farmers to become aware of and adopt improved technology from any source to enhance their production efficiency, income and welfare. This leads to the technology transfer model of extension, seen by many as the main purpose of energy extension (Moris, 1991). Based on the idea, energy extension services enable farmers to take up innovations, improve efficiency, and protect the environment and to reduce the differential between potential and actual energy yields in rural areas by accelerating technology transfer (i.e., to reduce the technology gap) and helping rural people become better Energy managers (i.e., to reduce the management gap). It is an off-campus training program (or non-formal education) which improves the life of rural community. The content of the training related to energy saving, efficiency improvement, alternative energy production and conversion technology using different communication techniques and aids for more expansion throughout the country. Generally, Energy extension shows positive effects on knowledge, technology adoption, efficiency improvement and environmental protection of the rural household.

#### 3.1 Energy Extension for Improving Energy Supply and Efficiency

Currently in Ethiopia the largest (or almost all) portion of electricity supplier is EEPCo using grid system with high transmission energy lost, Even though, the largest portion of the people is survive without electricity. By

using decentralized energy extension method, EEPCo can increase energy efficiency and distribution overall the rural areas of the country. Energy efficiency is related to the provision of the desired environmental conditions while consuming the minimal quantity of energy. As an energy resource, energy efficiency has the unique potential to contribute simultaneously to long-term energy security, economic growth, and even improved health and well-being; in particular it is a key means to cut energy consumption and greenhouse gas emissions (Emer Dennehy, 2014). Solution to the problems of climate change, air pollution, water pollution, and energy insecurity requires a large-scale conversion to clean, perpetual, and reliable energy at low cost together with an increase in energy efficiency (Mark Z. Jacobson, Mark A. Delucchi, 2011). Renewable energy and energy efficiency options have been identified as important for the development of the Ethiopian energy sector. However, these options have not yet attracted a significant level of investment or policy commitment. Efficient energy use will improve the productivity and efficiency of energy systems, while reducing waste and pollution, saving money, improving reliability, and delaying the need for expensive new generating capacity (USG lead: DOE). Because increasing energy efficiency is the quickest and least costly way of addressing energy security, environmental and economic challenges. To raise the efficiency of the energy sector, develop the necessary institutional and manpower capabilities building by introducing appropriate incentive measures. These are:

- ✓ Generate helpful policy and institutional frameworks
- ✓ Encourage private sector participation
- ✓ Develop micro-enterprise
- ✓ Build projects around local needs and capacities

### **3.2 Energy Extension for Adoption of Efficient Energy Conversion Technology**

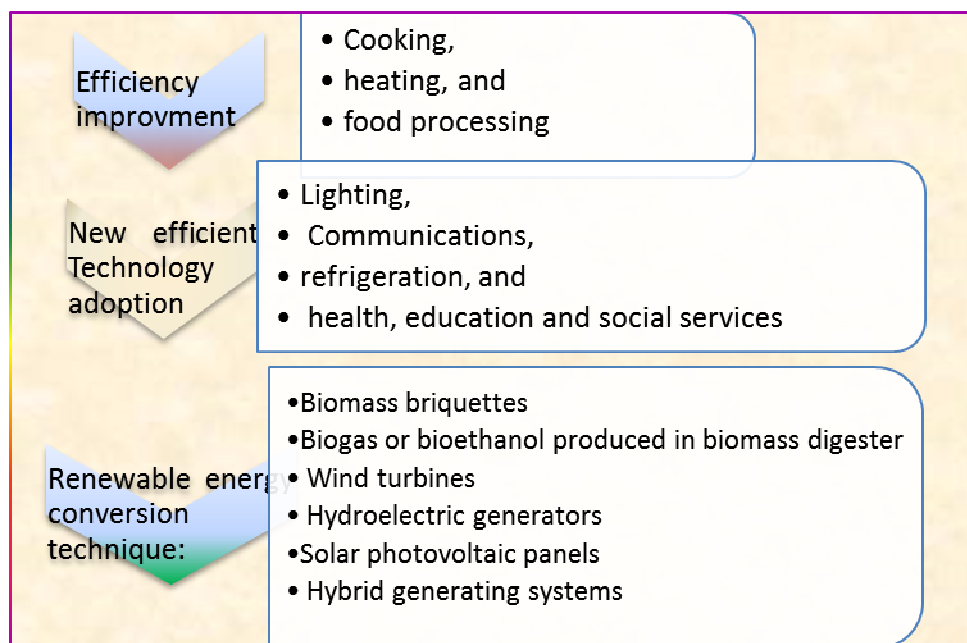
Simple and effective technologies are available to deliver clean and efficient energy to energy poor communities, both in remote rural settings and in towns and cities. Technology performance and costs improve with experience, and there is a pattern to such improvements common to many technologies. Access to modern energy equipment means the ability to satisfy basic energy needs through the use of reliable, efficient, affordable and environmentally friendly modern energy technologies. Available improved technologies can improve the efficiency of supplying and converting energy into useful forms and of developing multi domestic energy resources. And it can also moderate the environmental effects of energy production. A number of other innovative low-cost energy technologies suitable for the rural African poor have been developed and are beginning to demonstrate positive levels of success. Within each category, a range of renewable energy technologies has become reliable and cost effective; these 'new' technologies are now accepted for successful business and industry (UN-ENERGY/Africa, 2007). Such technologies are:

- ✓ Biomass thermal generation,
- ✓ Biofuel engine generators.
- ✓ Improved bio-fuel cook stoves;
- ✓ Low-cost solar pasteurizing units;
- ✓ Ram pumps for irrigation and heat pumps;
- ✓ Efficient manually operated water pumping and agro-processing technologies
- ✓ Small wind turbines and
- ✓ Efficient Solar cooker – can effectively supply the energy necessary for poverty reduction.

Energy extension tries to explore energy transition and technology adoption as the possible means of reducing the pressure of urban and rural centers on the rural hinterlands.

### **3.3 Energy Extension for Environmental protection and Renewable Energy Options**

Environmental pollution is a major problem facing all nations of the world. Achieving solutions to environmental problems that we face today requires long-term potential actions for sustainable development. In this regard, renewable energy resources appear to be one of the most efficient and effective solutions. Among the renewable energy options that are currently insignificant use in some regions and now should ready for large scale introduction in many of the rural areas.

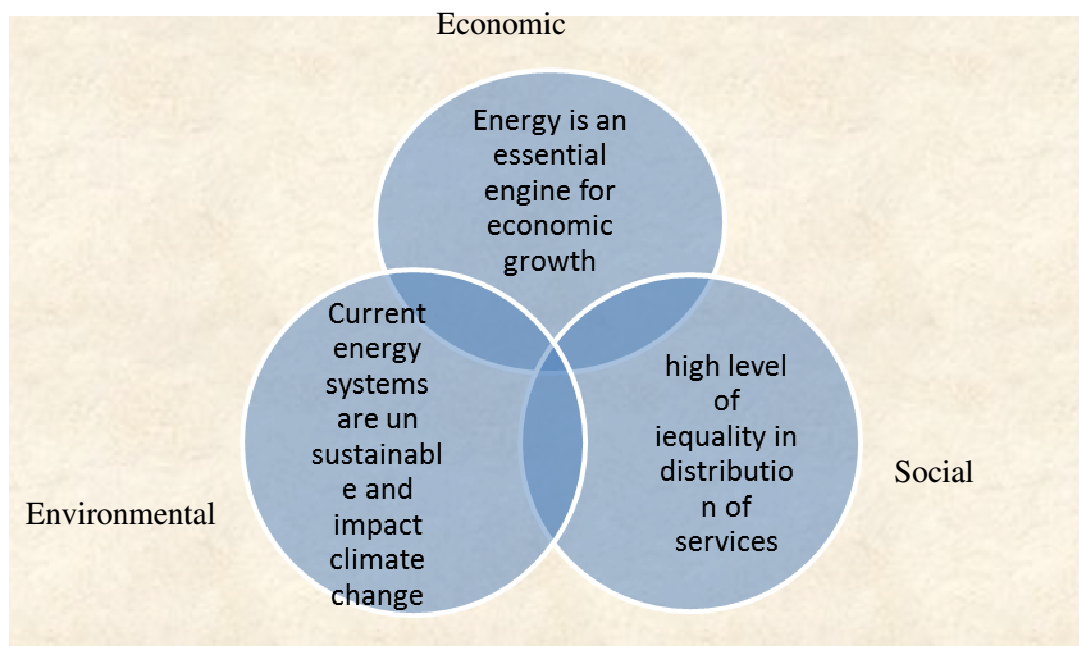


**Figure 2:** Energy extension application for rural and remote areas (source: NERGIA (2011), Zerisenay Habtezion (2012))

There are abundant sustainable renewable natural resources of all types spread all over Ethiopia including rural, remote, isolated areas which can be tapped to produce modern energy services for the rural poor (Wolde-Ghiorgis W., 2002, & Awash et. al. ,2013). Biogas, solar, biofuel and other efficient renewable technologies helps the local community to improve their life style and protect the forest around them. Energy extension helps to identify type and use of renewable energy, because it has multi-application for sustainable development and poverty reduction by ensuring efficiency improvement, new technology adoption and other renewable energy technique (**Fig. 2**). Traditional household energy sources are renewable, but the rate of consumption is much greater than the rate of production. Evidently, traditional energy is not sustainable. Traditional energy use increases the rate of deforestation and land degradation, which in turn can lead to excess soil erosion and loss of soil fertility and environmental pollution.

#### 4. Energy for Gender Equality

In the Least Developed Countries, wood, dung and crop residues serve as the primary fuel sources, and it is principally women and children who carry out the task of collecting these fuels (Yianna L., Grazia P., 2006). Many women and children suffer from health problems related to gathering and using traditional fuels. In addition to the time and physical burdens involved in gathering fuel, women suffer serious long-term physical damage from strenuous work without sufficient recuperation time. Energy planners and policy-makers still tend not to consider women at all (Zerisenay Habtezion, 2012) and this lack of recognition of the role of women in the energy sector often leads to 'gender-blind' energy policies as well as their financing and execution (ENERGIA, 2007). Due to that women are time-poor and disproportionately exposed to health risks associated with some forms of energy production. Reduced drudgery for women and increased access to non-polluting power for lighting, cooking, and other household and productive purposes can have dramatic effects on women's levels of empowerment, education, literacy, nutrition, health, economic opportunities, and involvement in community activities.



**Figure 3:** Energy as a sustainable development challenge (Source: UNDP, 2011)

Approaches focusing on small scale decentralized energy extension systems, integrated with measures for improving access to credit, information, technical training and markets, can offer improved economic opportunities for rural women while helping to prevent environmental damage. And Failure to fully integrate energy and gender into the three strands of development hinders the achievement of the ‘triple wins’ of sustainable development (**Fig. 3**). The empowerment of women and girls is necessary for energy development and energy security; gender perspectives need to be incorporated into energy projects, policy and planning to ensure their effectiveness and sustainability. Energy planning, production and use, using non formal (or off – campus) training on the energy and options can promote the use of fuel efficient solar, biogas, electric and biomass cook stoves. These improvements in women’s lives can, in turn, have significant beneficial consequences for their families and communities.

## 5. Conclusion and Recommendation

Energy is the vital to reducing poverty, providing major benefits in the areas of health, literacy and equity. Energy extension improves access to energy by most of the population, and also reduces emissions of local and global pollutants and may create a private local socioeconomic development opportunities. And it is the catalyst without which other goals on issues such as health, education and gender equality cannot be achieved. The study recommends that more energy extension should be carried out to enhance energy management, performance improvement and also, environmental protection to ensure gender equality and sustainable development. And Policies should focus on promoting energy extension, especially in the residential and commercial sectors to drive green economic growth.

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