



International Journal of Sciences: Basic and Applied Research (IJSBAR)

ISSN 2307-4531
(Print & Online)

<http://gssrr.org/index.php?journal=JournalOfBasicAndApplied>



Rural Energy Sources and Energy Consumption Pattern in Selected Districts of Jimma and Illubabor Zones, South- western Ethiopia

Dubale Befikadu^{a*}, Yonas Ragassa^b

^{a,b}Jimma Agricultural Mechanization Research Center, P.o.Box 358, Jimma, Ethiopia

^aE-mail: dubebefikadu@gmail.com

^bE-mail: yregassa@yahoo.com

Abstract

The study looks in to identifying rural energy sources and energy consumption pattern in the selected representative rural districts and villages of Jimma and Illubabor zones. It also aims at identifying the existing cooking stoves and generates essential information for further interventions in their improvement and promotion activities. The analysis of the result indicates that the study area is characterized by covering almost the whole household energy consumption by fuel wood and very insignificant of free and renewable energy sources, such as hydro and solar energy sources. Vast majority of the rural households (more than 97%) use traditional cooking and baking stoves well known in losing fuel energy and very low level of promotion and access to improved rural energy technologies was also identified as main factor aggravating deforestation and health problems of rural families. Leaving rural inhabitants to continue on the course of the current use pattern of traditional energy sources, will have highly negative consequences for the rural economy at large, as well as the environment and the ecosystem balance.

*Corresponding Author

E-mail address dubebefikadu@gmail.com

Based on results and analysis solutions for curving rural energy related problems with minimum harming effect to the environment were forward in terms of extensive utilization of alternative energy sources, Subsidy provision for improved rural energy technologies that run by renewable energy resources, exemption of tax and value added tax (VAT) while importing equipments of rural energy technologies, establishment and expansion of rural energy fund up to local levels in order to create enabling environment to attract private sector, in the development & dissemination of rural energy technologies including improved fuel saving cooking and baking stoves and also strengthening communication and collaborative work between rural energy technology promoting agents.

Keywords: Consumption Pattern; Rural; Energy; Sources

1. Introduction

Consumption of traditional fuels has negative environmental, economic and health impacts. That is, increased use of fire wood and charcoal leads to deforestation, leading to ecological imbalance and increased use of agricultural residues and animal dung depriving the land off essential nutrients that are necessary for soil fertility. The inefficient way people use energy is another factor aggravating deforestation. Furthermore, smoke from the use of fuel wood and dung for cooking contributes to acute respiratory infections. This latter problem, i.e. indoor air pollution is worse in poor countries where households' houses are not equipped with separate living and cooking places. Nonetheless, almost 2 billion people are dependent on biomass fuel and all of these are in low income countries [1].

Fuel wood gathering is one of the major contributory factors to excessive deforestation that results in fuel wood crisis in many countries out of which Ethiopia is one whose mainstay is agriculture accounting for about 50% of GDP, 90% of exports and 85% of employment [2,3]. There are important factors influencing deforestation in the tropics. These factors vary from country to country and from region to region, and may change over time. Among others, the main causes of deforestation in Africa are fuel wood collection, logging, agricultural expansion, and population pressure [4]. It has experienced heavy dependence on traditional energy consumption with all the negative repercussions associated with it. In similar pattern the household energy consumption of Jimma and Illubabor depends entirely on fuel wood among the biomass fuels with insignificant share from renewable and alternative energy sources like hydro, solar and wind [5].

Various studies conducted in the energy sector since the early 1980s have consistently identified the household sector as the major consumer of energy, which is almost entirely used for domestic purposes. Such heavy reliance on biomass fuels for domestic cooking has thus resulted in profound environmental degradation in most parts of the country. Household energy is a key issue recognized in the national economy of Ethiopia in general, and the energy sector in particular. Studies show that the household sub-sector is the major consumer of energy, and almost the entire energy demand of this sub-sector is met from biomass resources [6].

The attempt to influence the existing consumption patterns requires identification of those factors significantly contributing to the exiting situation, and the possible options through which one can influence them. To this

effect, identification of the factors governing the current energy consumption patterns will be helpful to show the appropriate target variables in the attempt to influence the existing patterns and hence bring about the envisaged transition [2]. Knowledge about various factors underlying the existing consumption pattern helps policy makers to prescribe measures that will strengthen the conditions that will encourage use of modern fuels while opting for measures that will weaken reliance on traditional fuels. In general formulation and implementation of energy related policy requires detailed knowledge of existing consumption pattern, substitution possibilities among the various household energy demands to changes in prices and income [2].

2. Methods and Materials

The study was conducted in a purposively selected eight representative woredas from Jimma (Gera, Goma, Dedo, Nada) and Illubabor zones (Gore, Alle, Bedelle, Boracha). Its altitude varies from 800 to 3360 m.a.s.l and the mean annual rain fall ranges from 1200mm to 2650mm. the average minimum and maximum annual temperature is 12.9°C and 26°C respectively. Vegetation of the area is characterized by mixtures of trees, shrubs and grasses of different species [7].

A structured questionnaire was developed and applied to interview the household farmers for gathering primary data. The interview was conducted by a team of researchers and expert from rural energy, extension and post harvest research divisions of the center in collaboration with development agents and experts from zonal and districts Agricultural Development office. The selected areas were based on relative forest availability. Five peasant associations and seven household farmers were randomly selected from each ana to make total number of sample households 280. Interview was conducted to gather data on rural energy source and consumption rates, type of cooking stoves used and other information related to rural energy use. Descriptive statistics was used to analyze both the qualitative and quantitative data.

3. Results

Rural energy sources in the study area include: Fuel wood, Charcoal, Agricultural Residues, and very little amount of kerosene fuel, dry cell batteries, hydro electricity, solar energy and small factory by-products. Energy sources application for different household activities include cooking (fuel wood, charcoal and agricultural residues), space heating (fuel wood and charcoal), Lighting (hydro electricity, fuelwood, kerosene and dry cell batteries), entertainment appliances powering (hydro electricity and dry cell batteries) and Rural Telephone powering (solar power).

The household energy consumption rates (Kg/person/day) of the area figures: fuelwood (4.5), charcoal (0.05), agricultural residues (0.52). Traditional fuels contributed 99.8% of rural energy consumption in the study area, with fuel wood being by far the most important (87.4%), followed by agricultural residues (10.8%), and small amount of charcoal (1.6%). The remnant energy demand of the rural household is met from kerosene; hydroelectricity, dry cell batteries, and small factory by-products like saw dust and coffee husk.

3.1 Utilization and potentials of renewable alternative energy sources

The available renewable and free energy sources (solar, hydro and wind) are not being utilized for household energy demand except solar energy application through solar panels telephone services in some rural localities and hydroelectricity power (184MW) generated from Gilgel Gibe River for households electrification purpose in the region [8]. The yearly average daily radiation reaching the ground is 4.65 kwh/m² which varies significantly during the year, ranging from minimum of 4.25 kwh/m² in July to a maximum of 5.1 kwh/m² in October. The average wind speed of the study area is 0.6 m/s to 0.9 m/s while it varies from 3.5 m/s to 5.5 m/s country wise. The study area (Jimma and Illubabor zones) has a total area of 35,648km² and mean annual rain fall ranging between 1200mm-2800mm. it is the origin of perennial rivers like Gibe, Gojeb, Dedessa, Geba, Sore and various smaller rivers and streams forming a dendrite pattern over the zones [8]. Long rainy season and high altitude variation 500m to 3360m also exists in the zones. These features make the two zones suitable for generation of water powered technologies for the rural communities.

Table 1. Type of cooking stoves under use and extent of users

Type of cooking stoves	Percentage of users (%)
Open fire	97
Traditional fixed mud injera stove	1.4
Mirt injera stove	4.6
Improved charcoal saving stove (Lakech)	3.6
Home (own) made metallic or clay type of traditional stoves	4.6

3.2 Problems in the area of rural energy sources and rural energy technologies

Majority of rural households of the study area use clay cooking pots on open-fire (three stone stove) to cook their food without any heat insulating mechanism hence resulting in great energy loss. Locally made traditional clay stoves were also blamed for short service life and even inaccessibility in some rural localities. Women and children in the study area spend several hours a day for purchase of kerosene for night lighting, collection of fuel wood and other energy sources. Accessibility and affordability to kerosene for night lighting is even the main problem of the study area's remote locations.

4. Conclusion

Rural areas studied is characterized by covering almost the whole household energy consumption by fuel wood and very insignificant of free and renewable energy sources, such as hydro and solar energy sources. Vast majority of the rural household (more than 97%) use traditional cooking and baking stoves well known in losing fuel energy and very low level of promotion and access to improved rural energy technologies was also identified as main factor aggravating deforestation and health problems of rural families. Leaving rural inhabitants to continue on the course of the current use pattern of traditional energy sources, will have highly negative consequences for the rural economy at large, as well as the environment and the ecosystem balance.

The following points of recommendation are forward to curve rural energy related problems without harming the environment.

- The use of alternative energy sources should be highly utilized, especially in remotest rural areas.
- Subsidy should be provided for improved rural energy technologies that run by renewable energy resources and tax & VAT should be exempted while importing equipments of rural energy technologies.
- Rural energy fund should be set up and expanded up to local levels in order to create enabling environment to attract private sector, in the development & dissemination of rural energy technologies including improved fuel saving cooking and baking stoves.
- There should be strong communication and collaborative work between rural energy technology promoting parties/agents.

Acknowledgements

Authors acknowledge the financial support of Oromia Agricultural Research Institute (OARI).

References

- [1] Anderson, T. *Rural Energy Services: A Hand book for Sustainable Energy Development*. IT Publications, 1996, 23.
- [2] Bereket, K.. *Affordability of Fuels and Patterns of Energy Demand in Urban Ethiopia*, Nairobi, AFREPREN , 2001.
- [3] Gamtessa, S.F. *Household's Consumption Pattern and Demand for Energy in Urban Ethiopia*. *International Conference on African Development Archives*. Paper 76, 2003.
http://scholarworks.wmich.edu/africancenter_icad_archive/76
- [4] Nebiyu, A.. *Domestic Energy Consumption and Deforestation in Harari region Assessment of Students' Awareness and Views*. M.A. Thesis. Addis Ababa, Ethiopia: Addis Ababa University. 4 pp. 2009.
- [5] GTZ. *Household Energy: Project Brief*. Addis Ababa, Ethiopia, 2000.
- [6] Getachew, O. *Some Socio Economic Aspects of Biomass Energy in Ethiopia: A Review*. Desta et al (eds). *Energy in Ethiopia: Status, Challenges, and Prospects*. Proceedings of energy Conference 2002, Professional Associations Joint Secretariat, Addis Ababa, Ethiopia, 2002.
- [7] EIAR (Ethiopian Institute of Agricultural Research). *JARC Meteorological data*, Jimma, Ethiopia, 2004.
- [8] EEPKO (Ethiopia Electric Power Corporation). *Facts in Brief*. Addis Ababa, Ethiopia, A leaflet Published by Corporate Relations, 2000.