Assessment of trend and determinant factors for household energy utilization choice in urban areas of Ethiopia: Case of Eastern Amhara

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The major energy consuming sector in Ethiopia is the domestic usage. Cooking takes the major share from household energy consumption. Although urban areas of Ethiopia are mainly accessible to electricity, most households still mainly depend on biomass-based energy sources, which are very traditional and associated with inefficient technologies. The primary objective of this study is to assess the general trend of household energy utilization and the factors that affect the choice of energy sources and the associated energy technologies in urban areas of Eastern Amhara. The study analyzes the primary and secondary data collected from the selected sample of households and experts in the study area. The study covers the determinant factors for household energy choice, especially for cooking application; the community awareness level, the energy appliance types in use, the energy experts' contribution, and the future energy/energy technology demand. The analysis is conducted mainly based on demographic variables such as residence type, educational status, and availability of technology. The result shows that the energy sources type and the energy technology preference at the household level are largely depend on the education level of house heads and type of residence they live in. For instance; 76.3%, 34.1%, and 22.5% of the households are who are living in the condominium, own apartment, and rented houses respectively are using electricity for injera baking. Model to validate the findings of the descriptive statistics, to estimate the trend and relations among different factors for the whole population of the study region has been developed.

keywords: *Household energy, Injera baking, Stew cooking, Utilization trend, Eastern Amhara.*

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1. INTRODUCTION

Modern energy access is crucial to any economic development and well-being of the community. Access to modern energy enhances both individual income generation and national development through improving education, reducing indoor and outdoor air pollution, and ensuring environmental sustainability. On the other hand, societies in most developing countries are deprived of both for access to modern energy and heavy reliance on traditional biomass energy sources to meet their growing basic needs such as cooking, lighting, and powering of low power appliances. It has been reported that about 1.3 billion people lack access to modern electricity and it is almost one in five of the world's population [1]. The report further disclosed that 2.6 billion people rely on traditional use of biomass for cooking, which is the major energy consuming activity for developing countries. This means, even part of the people who have access to electricity may not use the electricity for cooking purposes due to different reasons.

Researches showed that energy demand is growing rapidly in the world. The annual energy investment in the global energy supply amounted to $1600 billion between 2011 and 2013 [1]. In the report, it was estimated that the overall energy supply investment needs to rise steadily over the coming decades, from $1630 billion in 2013 to nearly $2000 billion per year by 2030s. Actually, the investment in 2016 was reached $1.7 trillion, which shows that the average rate of investment was more than $5100 per year and this account for 2.2% of global GDP [2].

Biomass energy source, consisting of firewood, charcoal, dung, and crop residues, remains the main source of energy in Sub-Saharan Africa [3]. It has been reported that only 35% of the population in Sub-Saharan Africa has access to electricity

and 80% rely significantly on traditional biomass in the form of fuelwood, charcoal, animal dung and agricultural residues for most household energy consumption [4]. Ethiopia as one of the sub-Saharan African countries, is one of the fastest growing countries, but with one of the lowest rates of access to modern energy services whereby the total energy supply is primarily based on biomass energy source with a share of 92.4% followed by oil (5.7%) and hydro-power (1.6%) [5]. It has been reported that the household sector in Ethiopia predominantly utilized inefficient rudimentary stoves, which could cause adverse environmental and welfare effects [6]. On the other hand, the country is endowed with various renewable energy resources. The estimated potential is reported as for hydropower is 45 GW, the wind is 10 GW, geothermal is 5 GW, and solar irradiation ranges from 4.5 to 7.5 $kWh/m^2/day$ [7].

The total energy demand for Ethiopia was projected to increase from 1358 PJ(pico-joules) in 2012 to about 2120 PJ in 2030 [8]. The forecast of the research showed that the demand for all fuel sources including the fuelwood is increasing between 2012 and 2030 but the demand for oil, electricity, and LPG(liquefied petroleum gas) will grow rapidly over this period at an annual growth rate of 11.3%, 9.7%, and 8.3%, respectively. Fuelwood still reported as it would continue to comprise the largest share of energy demand in 2030 at 79.9% of the total energy demand of the country. Most of the energy supply thereby is covered by bio-energy, which is usually stemming from unsustainable sources. Urbanization and increased per capita income usually result in greater use of modern fuels, such as gas, electricity, and a fall in the share of traditional biomass; however, this has not happened in many African cities, including Ethiopia.

Researches showed that in developing countries like Ethiopia, the major energy consuming sector is for domestic household purpose and this sector is mostly associated with poor energy utilization practice. The household sector in Ethiopia accounts for about 89% of the total energy consumption. It has been reported that the sector utilizes about 96%, 15%, and 33% of the total biomass, petroleum, electricity energy consumed, respectively [9]. In the year 2017, Ethiopia's final energy consumption was reported as around 40,000 GWh, where 92% was consumed by domestic appliances, 4% by the transport sector and 3% by industry [10]. The share of households' energy consumption in Ethiopia is dominated by firewood. On the other hand, it has been reported that the electric consumption of the residential households (34% of the total national electric energy consumption) in the year 2014/2015 was more than the energy sold to the commercial or the industries' tariff groups within the same year [11]. This report confirms that the major energy consuming sector in Ethiopia is a household that is for domestic purpose.

The urban electrification rate in Ethiopia was reported as about 85% and it was better than the sub-Saharan Africa average, which was 63% [12]. Even though the electrification rate is relatively better in urban areas of Ethiopia, the energy consumption trend is mostly limited to lighting and some home appliances, and rarely used for food cooking. The research conducted in Bahir Dar city disclosed that Charcoal and firewood were found the dominant energy sources and accounted for nearly 78% of the energy demand of households in the year 2014 [13]. In the research, electricity was reported about 20.8% of the total energy consumption of the households in Bahir Dar city of Ethiopia.

It has been reported that cooking of Injera, the cultural staple bread food item in Ethiopia, is known for its intensive energy consuming activity [14]. The electric injera Mitad in Ethiopia has been estimated to consume about 60% the power demand of a typical residential household [15]. The non-electrical injera Mitad even could consume more than this value as it is subjected to lots of losses. Netsanet et al. [13] reported that in Bahir Dar city more than 63% of households use firewood and around 33.5% use electricity for injera baking. A review was done to show a number of efforts undertaken to improve the performance of injera baking stoves [16]. The existing electrical Mitad technology in Ethiopia is believed to be in the market for about 40 years and the performance is at a lower level and it is not standardized so far as shown in Fig. 1. The other energy intensive process is cooking of Stew (locally called Wot) and this process also consumes a significant share of household energy usage. The worst condition for stew cooking is that still most of the stoves are very traditional and there is considerable energy loss (see Fig. 2).

Fig. 1. Three-stone stove for injera baking.

Fig. 2. Some traditional types of stoves for stew cooking.

The main reason for using a certain type of energy for a particular household application may be the availability of the technology/ energy source or other factors that could affect the choice. The study of the reason for using a certain type of energy source or energy technology has to be conducted in order to forecast the energy demand. The determinants of household energy choice have been studied by different authors [17–19]. Mekonnen et al. [18] conducted research on the determinants of fuel choice in urban areas of Ethiopia and reported that as households' total expenditures rise, they increase the number of fuels used. Alemayehu [20] has pointed out that due to availability of labor time for cooking, households that are lead by females use mostly traditional fuels as the major cooking fuels. Mengistu et al. [21] examined the factors that affect households' decisions on adoption of biogas technology in Ethiopia. A review was conducted on the choice of fuel for household cooking and adoption of improved cook-stoves in developing countries [22]. The review highlighted the factors that influence households' cooking fuel choices and adoption of improved stoves, including

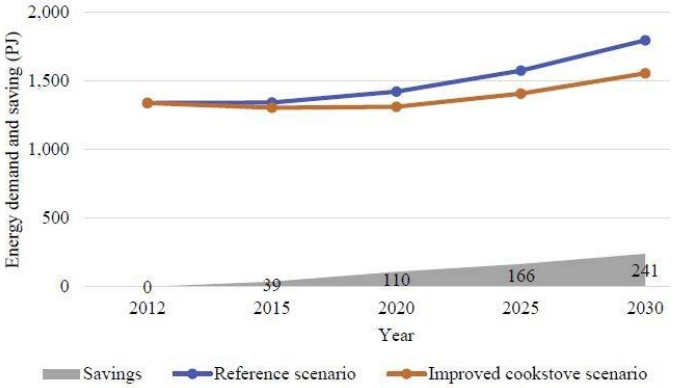

Fig. 3. Energy demand (PJ) in the household sector under the improved cookstove scenario compared to the reference scenario' [8].

Fig. 4. Map showing location of study areas (Eastern Amhara).

socioeconomic (access and availability, collection costs and fuel prices, household income, education and awareness), behavioral (food tastes, lifestyle), and cultural and external factors (indoor air pollution, government policies).

It has been shown that the major energy consuming sector that is the domestic sector is mostly associated with poor energy utilization practice. As shown in Fig. 3, it has been reported that without changing the energy source and only using the improved cooking stoves, the residential sector could save 13.4% of the total energy in the year 2030 [8]. This result suggests that efforts to promote and strengthen the energy efficiency improvement program will help the country to meet future energy demand as saving from huge consumption sector is noticeable while contributing to the sustainable energy development program. Based on the researchers finding, it could be generalized that the country could save more than the energy consumption of other sectors other than household sector through improving the efficient utilization of energy by using the improved stoves. Gebreegziabher [23] described the effect of using improved stoves for minimizing land degradation. The researcher pointed out that improved household technologies would lead to less energy demand, which could result in fuelwood consumption reduction.

Countries have been suggested that they should diversify their energy sources and introduce energy-efficient devices and equipment at all levels of the economy to improve GDP growth rate [24]. Furthermore, there shall be a mechanism that could predict and show the composition for future energy demand. Understanding of key determinants of household energy consumption and energy technologies is important for the design and implementation of effective policies to enhance access to clean energy utilization. Furthermore, in recent years, there have been major drives for the adoption of energy efficient devices in the residential sector [25]. Modeling of energy consumption in the residential sector has been developed in order to forecast future projections based on socio-economic and demographic variables [26]. An optimal grid-interactive photovoltaic system energy consumption model has been proposed for an urban residential purpose [27]. It has also been suggested that increasing the share of renewable energy and promote the associated energy technologies in addition to better strategies of the demand side management could raise the efficiency of energy consumption as well as decrease carbon dioxide emission [28].

Decentralized energy networks were rapidly spreading, based on super-efficient end-use appliances and relatively low-cost photovoltaics and other renewable energy alternatives. Ref. [29] prepared documents on how the decentralized energy system is supported by critical and widely available information technologies, particularly mobile phones and virtual financial services.

Even though Ethiopia is endowed with a variety of renewable energy sources and the urban electrification rate is better than the sub-Saharan Africa average, the country's households energy demand rely heavily on biomass fuel. The heavy reliance on biomass fuels has been one of the prime causes of forest degradation and deforestation. Furthermore, the dependence on traditional use of biomass energy is inefficient and unclean and involves huge negative socioeconomic and environmental consequences.

Despite the huge land resources in the Amhara region, various literature show that woody biomass is highly degraded and most households are facing severe scarcity of domestic energy sources. At present, most households use non-woody biomass such as cow dung and crop residue as a primary source of domestic fuel, though highly needed to maintain soil fertility. This study has been carried out in the eastern Amhara region located within 200-600 kms range from the regional capital, Bahir Dar (see Fig. 4).

As it is understood, energy is one of the basic inputs that determine the status and sustainability of development. A better understanding of the energy utilization trend, the future energy demand particularly for the household and identifying the different determinant factors that affect the transition to different fuel sources and energy technologies will help to design interventions by both governmental and non-governmental organizations working on energy. Therefore, this research work attempts to evaluate the energy utilization practice and the determinant factors for fuel and technology choice in urban households of Ethiopia, particularly in the Eastern Amhara region. The research will also address the trend of the household in choosing energy technologies and the associated factor to choice.

2. RESEARCH DESIGN

A. Data

Two separate data sets were used in the study to analyze the household energy utilization trend and the determinant factors for fuel energy and technology choice. The primary data set is from energy experts working in the government energy-related offices and at the service of the community, which provides data on the common types of fuel energy source and energy efficient cook stoves distribution, preference, and challenges. The secondary data source employed in the study is the primary data source provided by every household selected based on the demographic variables such as residence types, educational status of house heads, etc. The survey mode is a single-stage, stratified cluster sample survey designed to be representative of all types of households. The data provide a wide selection of background variables, such as proximity, living standard, and housing types for sampling and descriptive purposes.

B. Sample characteristics

For the purpose of the study, three-level categorization of the municipalities according to the degree of urbanization is done and six cities from three urban categories have been selected. Based on the size of city, five to Eight kebeles (divisions of the city) from each urban are selected and data is collected with a systematic approach and Fifteen to Twenty households from those selected kebeles were identified and interviewed. Totally, data have been collected from more than 760 households. The cities considered are Dessie, Kombolcha, Woldya, Showarobit, Debrebirhan, and Kemise. Additionally, a total of 37 data were collected 12 from regional to city level energy experts, 8 from experts working NGOs on energy related missions and 17 agents who manufacture and sell energy technologies.

C. Research process and tools used

To analyze the collected primary and secondary data, statistical process control tools such as Excel and Statistical Package for Social Science (SPSS) have been used for description and correlation analysis between factors. The analysis process involves three steps:

The first step is a descriptive data analysis that is the analysis of existing energy utilization with reference different factors inferential analysis to develop a model for energy utilization with respect to different reference category and energy shift trend analysis. In this analysis, the overall energy utilization trend and the main determinant factors will be found for choosing fuel energy types and technologies. The collected data then is summarized and categorized. Then the relationships between variables are correlated using inferential statistics for the whole population.

After sorting out the data, from the inference of the analysis and discussions, identification of major factors for choosing energy types, technological preference, future needs, and general energy perceptions of the community has been identified. Generally, the second step is to discuss overall energy consumption situation in the household sector, particularly for cooking activity.

The third part of the study is summarizing and recommending the result on the findings brought by descriptive and inferential statistics approach. This part may be used, particularly by policy makers.

Table 1. Summary of energy for injera baking choice versus residence type

Energy source	Residence type		
	Condominium	Own apartment	Rented
Electricity	76.30%	34.10%	22.50%
Electricity & wood	15.80%	13.30%	8.60%
Fire Wood	2.60%	49.70%	58.80%
Other	5.30%	2.90%	10.10%
Total	100%	100%	100%

Table 2. Summary of energy choices for injera baking versus house heads educational status

Education status	Percentage of energy type in use		
	Electricity	Wood	Wood & Electricity
Non-Educated	6.30%	29.80%	5.90%
Elementary	13.40%	28.20%	23.50%
High school	26.50%	21.40%	20.60%
Diploma	23.50%	11.50%	20.60%
Degree & above	30.40%	9.20%	29.40%

3. DATA ANALYSIS

A. Descriptive data analysis

A.1. Energy preference based on residence type

On the basis of the demographic variables; urban dwellers from the selected cities and kebeles (divisions of cities) were interviewed for their energy use trend. The analyses are majorly done for injera baking and stew cooking, as these two are the main household energy consuming activities and the result is presented as indicated in Table 1. The total number of respondents who respond to the energy preference were 298 households (92 from the condominium, 125 from own apartment, and 81 from rented dwellers). From the analysis, 58.8% and 22.5% of the households who live in a rented house, are using firewood and electricity respectively to bake injera.

A.2. Energy preference based on house head educational status

Based on the collected data, the educational level of the house head is considered as one of the determinant factors for the types of energy in use to bake injera and could be seen as Table 2. Similarly to the injera baking activity, the type of energy use is analyzed for the stew cooking in relation to the educational status of the house heads (see Table 3).

A.3. Appliance types and reason to choose for injera baking

Firewood and electricity are the most common energy sources for injera baking in the studied urban areas. With respect to the appliance type, out of those users who use firewood 36% are using the most inefficient and traditional three-stone stove, 36% use bahilawi zig stove, and 27% use Mirt stove. The energy utilization of the households has also been assessed by experts, NGOs, and technology providers and 37 data were collected. The data collected from such experts is more of a descriptive type in order to elaborate the tendency and awareness level of the community in using different energy sources. The overall,

Table 3. Energy use percentage for stew cooking versus educational status (percentage of households)

Educational Status	Percentage of energy type in use						
	Electricity	Electricity& charcoal	Fire wood	Fire wood & charcoal	charcoal	charcoal & Kerosene	Kerosene
Non-educated	7.4	4	40.9	36.4	22.7	11.1	16.7
Elementary	18.9	26	27.3	36.4	22.7	11.1	0
High school	26.3	24	18.2	27.3	21.6	33.3	16.7
Diploma	20	16	4.5	0	16.5	0	16.7
Degree & above	26.3	28	4.5	0	13.4	44.4	50
Total(%)	100	100	100	100	100	100	100

finding showed that the community awareness level is limited. Most community is dependent on the existing culture of energy utilization. Some still believe that a better test of food could be found when using firewood or charcoal. On the other hand, some who could read and evaluate the technologies are demanding modern technologies except retreating of the repeated power cut-off.

B. Inferential data analysis

B.1. Residence type as a factor

From different energy source types, electricity is considered to be used as a modern and clean energy source. Considering condominium residence as a reference category, prediction on electricity utilization model for the whole population is developed for injera baking and stew cooking. The electricity utilization model for injera baking:

$$Y = 0.539 - 1.198 \times A - 1.776 \times R \quad \textbf{(1)}$$

where, A- Apartments, R-Rented houses, and Y-indicates the dependent variable electricity utilization trend and the electricity utilization model for stew cooking as:

$$Y = -0.318 - 0.639 \times A - 0.589 \times R \quad \textbf{(2)}$$

where, A- Apartments, R-Rented houses, and Y-indicates the dependent variable electricity utilization trend. From the models, it is clearly noticeable that the electrical energy utilization trend is less in the apartment and rented houses as compared to condominium houses for both injera and stew cooking. For both cases, the correlation is negative and this indicates use that for every new unit of an apartment built and a rented house, the probability of using electricity is limited. The model further indicates that the type of appliance/energy source for injera baking is more dependent on the type of residence than for Stew cooking. Injera baking using electricity in a rented house is the most uncommon practice.

B.2. Household head educational status as a factor

Educational status of the house heads has been taken as a factor to compare its impact on using the modern energy source, electricity as the main energy source for household cooking purposes. Using the SPSS analysis tool and considering houses lead by diploma holder as a reference category and the model for both injera baking and stew cooking have been developed, as shown below. For injera baking:

$$Y = -0.256 + 0.039 \times H - 0.968 \times E + 0.348 \times D - 1.559 \times U \quad \textbf{(3)}$$

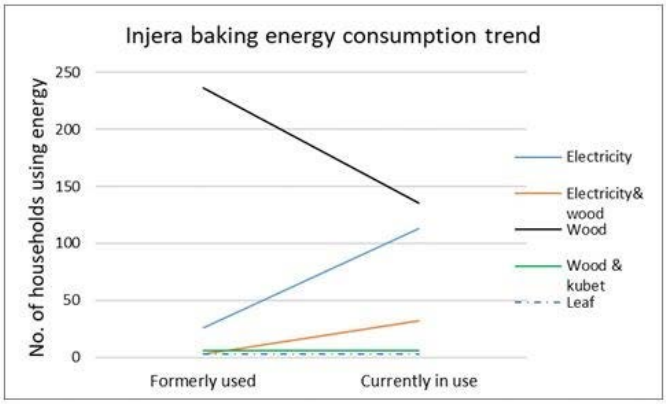

Fig. 5. Energy trend shift for injera baking.

where H is the high school level, E is the elementary, D is the degree and above, U is the uneducated (illiterate), and Y is the dependent variable electricity utilization trend. For stew cooking:

$$Y = -0.56 - 0.113 \times H - 0.421 \times E + 0.09 \times D - 1.256 \times U \quad \textbf{(4)}$$

According to Eqs. (3) and (4), the developed models clearly show that the trend of using the modern energy type electricity seems to have a direct relation with the educational status, that is as the educational background of the house head is at a higher level, the tendency of using modern energy type electricity also increases together for both injera and stew.

C. Energy shift trend

The data were also collected from the household energy consumers and from the experts about the trend of energy consumption(source of energy and technology). To this fact, data were analyzed descriptively in accordance with earlier usage, current usage, and future demand of energy for each household. The descriptive analysis of the energy utilization trend in urban areas shows that almost all of the non-modern energy sources that are biomass-based energy utilization is shifting to the modern, clean, and environmentally friendly type of energy source. The energy shift trend for injera baking is given in Table 4 and in Fig. 5 as well as for stew cooking, is shown in Fig. 6.

4. RESULT AND DISCUSSION

As given in Table 1, among those households who live in condominium houses, 76.3% use electricity, 15.8% switch between

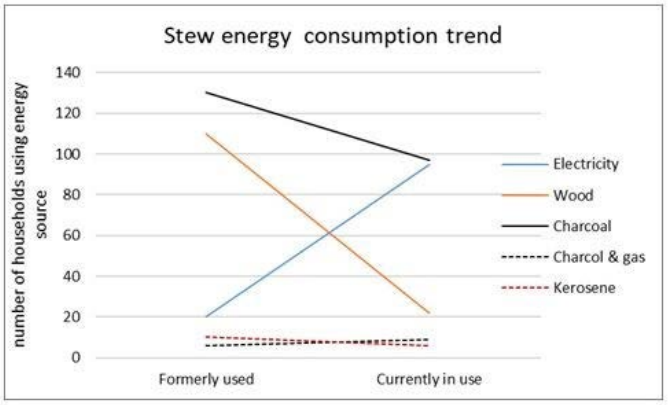

Fig. 6. Energy shift trend shift for stew cooking.

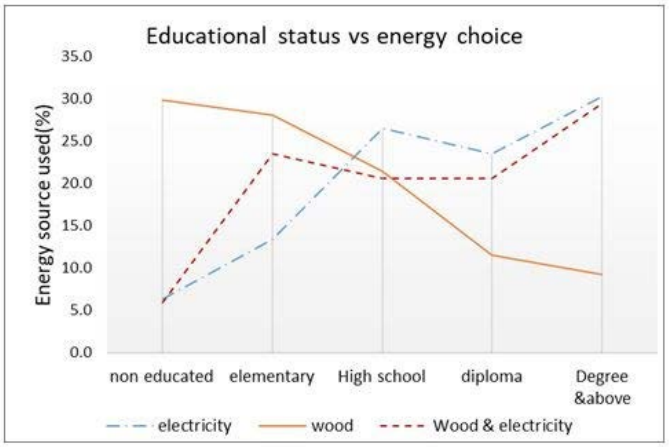

Fig. 7. Energy choice for injera versus educational status.

Table 4. Energy shifting trend in injera baking

Energy source	Households	
	Formerly used	Currently in use
Electricity	26	113
Electricity and wood	3	32
Fire wood	236	135
Fire wood and Kubet	6	6
Leaf	3	3

electricity and firewood interchangeably when there is electric power cut/fluctuation and only 2.6% depend on biomass energy for injera baking. This indicates that almost all condominium dwellers are electricity dependent as far as electric power is accessible. The rented house restricts the households to mostly depend on non-modern energy sources like firewood as the utilization percentage of firewood is more than the firewood consumption trend of the own apartment dwellers and the condominium house situation forces the community to change their living situation to more modern energy consumption trend.

Out of 304 respondents in the education category for energy preference include 34 non-educated,66 elementary, 72 high schools, 53 diploma, and 70 degrees & above holders. As can be seen in Table 2, out of all electricity consumers for injera baking, 6.3%,13.4%, 26.7%, 23.5%, and 30.3% the house-heads are noneducated, elementary level, high school completed, diploma holders, and degree & above holders respectively. As can be understood from the results, modern energy consumption is directly related to the educational level of the house-heads. As the educational level increases, the utilization rate of electricity for baking injera increases. The reverse is true for the utilization of non-modern energy sources like firewood. This is clearly demonstrated in Fig. 7.

As it could be seen in Table 3, the utilization of modern fuel source like electricity and kerosene for stew cooking generally increases as educational level advances. whereas the dependence of non-modern fuel sources like; firewood, charcoal, and firewood & charcoal decreases as the level of educations of house heads increases. The community whose house-heads have less educational background are mostly depending on traditional fuels for their stew cooking.

Though the growing interest of using modern energy seems promising still the inefficient type three-stone stove appliance is greatly in use. From 283 respondents for the reason for choosing different energy technologies 36% say that the reason for choosing energy type is the cost of appliance, and same proportion of the respondents (36%) raising health as their prior criteria, 9% of the claim their reason is only ease of access to the stoves, and few which accounts only 6% say that they are choosing energy technologies that they are using because of ease energy access. The rest respondents reply that they have no reason for using that particular appliance. Here, It is also understood that there is a gap in identifying the less cost technology as some household consider the initial cost of technology and they did not evaluate the energy consumption and the life time of the technology.

As an indicator, the tendency of using electrical energy is by far more in the condominium households, moreover when we compare stew and injera relatively more people seem to use electricity for stew than they are using for injera. For instance, in Eqs. 1 and 2 own apartment and rented houses have negative coefficients, so they are expected to use electricity less than the expectation of condominium houses for both baking injera and cooking stew. Furthermore, from Eq. 1 it is seen that rented houses have by far less chance of using electricity than their own apartment for injera baking and injera baking is more affected by residence type than stew cooking. In this regard, our analysis suggests that residence types, where dwellers live, have a direct effect on the type of energy used in houses. From condominium houses, the share for those who are using biomass-based energy for injera baking and cooking of stew is by far less than 10%, whereas for those who live in rented houses, as the awareness of the house owners towards electricity cost is very less, the owners do not let the renters use electricity and that is why the rented house dwellers electricity utilization accounts only 22%. Most households who live in rented houses are using the traditional three-stone stove for baking injera. Baking of injera in the three-stone stoves, with an efficiency of 5-15%, consumes huge amounts of firewood and leads to consequent problems like deforestation, global warming, and household air pollution [14].

As shown in Figs. 5 and 6, for both injera baking and stew cooking (the two main household energy consuming processes), the demand for firewood usage is showing highly at a declining rate, whereas electricity utilizing trend for injera baking is almost taking part of firewood consumption declining and it

is the implication of the resemblance to modern energy types utilization in urban areas. Especially, the shift towards electricity is highly accelerating than the declining rate of firewood consumption demand. This may be because of the expectation of repeatedly power cut off and households are not confident to completely stop using firewood.

5. CONCLUSION AND FUTURE TRENDS

The overall findings of this study indicate the existing energy utilization trend, determinant factors for the energy types choice, awareness of the community regarding different energy sources, and future outlook of household-level energy consumption.

The findings from descriptive analysis and models developed are indicating that household energy reliance is highly influenced by the residence type in which they are living in. In the apartment and rental dwellers, fire woods are mostly used, whereas those living in a condominium (which accounts for 76.3% of condominium dwellers) are using electricity.

Dweller's energy trend also indicates that the educational status of the house heads is in linear relation to the utilization of modern electrical energy utilization for the main energy consuming activity called cooking. As the educational status increase, there is also an increase in the tendency to use electricity more than any other types of energy sources and on the contrary, utilization of biomass-based decrease with the advancement in educational status. Most of the households (55.4%) whose house heads are having a diploma and above use electricity, and only 20.7% use firewood for baking Injera. On the other hand, those households with either elementary level or non-educated are using electricity (19.7%) and firewood(48%).

The energy trend analysis shows that energy shifting trends from biomass-based energy to modern energy source, especially towards electricity is rising. In the meantime, it is an alarm for the government and other concerned bodies to give attention to modern energy expansion and supply of efficient appliances. A very important point is that where minimum energy efficiency standards are not considered by the community once the energy shift towards the modern energy source seems increasing. However, locally manufactured electric appliances are at very low efficiency. For instance, it has been reported that the thermal efficiency of the electric Mitad with different constructions is less than 50% in Ethiopian context [30].

In the study areas even though, there is access to electricity, which is relatively cheap and environmentally friendly, the power fluctuation is a very serious problem and the community is not confident enough to shift fully to electric energy for food cooking. Furthermore, the community does not have enough information concerning the cost and other merits of electric power utilization.

Generally, continuous education (awareness creation on energy) seems the key to green development programs the country is striving for. As can be seen, the energy preference is basically affected by education level and the type of residence in which both are related to awareness level. On the other hand, the major energy consuming sector in developing countries like Ethiopia is the household sector, which is accompanied by inefficient technology. Particularly, in Ethiopia, the cooking culture is very intensive, that is every household is usually cooking two to four times a day and the duration of cooking is also elongated. The inefficient technology and longer duration cooking of food in each household will affect the household economy and the country's economy.

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