

THE CONTRIBUTION OF COMMUNITY SENSITIZATION ON EFFICIENT USE OF WOODFUEL ENERGY IN ALEBTONG LOCAL GOVERNMENT

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Abstract: Community sensitisation influences not only public policy direction but the general behaviour of an individual or group or a community in a number of settings. This article examines how community sensitisation contributes to efficient use of wood fuel energy in a rural community in northern Uganda. We rely on primary data collected from Amugu Sub County, Alebtong district where majority of the members in the community relies heavily on wood fuel for household energy requirements. Our results reveal that community sensitisation through mass media, training and dialogue meetings has the potential to lead to efficient use of wood fuel energy in the area of study and beyond. However, the success of these strategies require frequent dialogue meeting with the local leaders and community members of Amugu Sub County on a monthly basis; training of the communities on efficient use of wood fuel energy as the majority reported having not participated in any training and the government to subsidise cost for radio talk shows on efficient use of wood fuel energy.

Keywords: Wood fuel, dialogue meetings, community sensitisation, mass media.

1. BACKGROUND OF THE STUDY

One of the greatest sectors which impacts a lot on the environment contributing to climate change worldwide is energy. According to the National Research Council (2010), energy is a dominant source of carbon dioxide emissions and several other releases which impact on climate change. Efforts to reduce the dangerous emissions into the atmosphere can be through efficient use of different sources of energy as well as economic subsidies as well as targeted decision making as factors that impact negatively on atmospheric pollution. Aware of the seventeen Sustainable Development Goals (SDGs) that envisage a future which would not only be free from poverty and hunger but be safe from the negative effects of climate change, this article is opportune.

Renewable and efficient energy offer a safe, reliable and affordable means to achieve massive de-carbonization consistent with keeping the rise in global temperatures below two degrees Celsius. The combination of renewable energy, efficient energy and increased electrification have the potential to achieve ninety percent of the reduction needed in energy-related emissions (IRENA's analysis, 2019). Basing on this analysis, climate change is a global concern, which necessitates the attention of everyone and everywhere. It requires focus on efficient use of every source of energy aimed to reduce carbon dioxide emissions without any discrimination and or politics. In order to achieve this transformation, communities need continuous sensitisation. According to Sahid (2012), environmental awareness among individuals, organizations, and firms is an indicator of how communities and individuals respond to the negative impact on their surrounding environment.

The International Energy Agency (2014) indicates that Sub Saharan Africa (SSA) remains the region with the lowest access rate to electricity, an issue which has increased the direct reliance on wood fuel. This inefficient source of energy continues to affect the ozone layer perpetuating climate change. While the supply of energy has had slow progress, its demand continues to increase as a result of rising economic growth and changes in demographic distribution. This disparity in demand and supply has created security issues in energy and caused adverse effects on the sustainability of industries and the global economies at large (Adom & Amuakwa-Mensah, 2016). The World Energy Assessment of 2000 reveals the need for community sensitisation on efficient use of different sources of energy so as to embrace modern ways such as biomass which aim to address climate change in rural areas where reliance on wood fuel is dominant.

Heavy reliance on traditional biomass (including but not limited to charcoal, dung and agricultural residues) is associated with positive socio-economic, health and environmental impacts. According to the World Health Organisation (2014), it is estimated that up to 4.3 million premature deaths have occurred worldwide as a result of exposure to household cooking fuels. Yet, unsustainable harvesting of biomass, referred to as non-renewable biomass, is concentrated in hotspots such as East Africa where population growth and lack of efficient access to energy are contributing to land degradation, deforestation and rapid climate change (Bailis et al., 2015). This corroborates the idea presented by United Nations Environmental Program (2011) noting that biomass combustion resulting from cooking and clearing of land for charcoal production contributes to dangerous emissions and short-lived climate pollutants.

The use of traditional biomass resources as a household fuel in SSA continues to increase despite efforts to search for alternatives. The high environmental and health burden of such dependence is a barrier to sustainable development (Masera et al., 2015). In rural SSA, the number of people relying on traditional biomass is estimated at 792 million, which is nearly ninety percent of the region's population. In Eastern Africa, dependence remains high due to the permissive nature of woody biomass, reaching ninety-eight percent in Rwanda, ninety-five percent in Ethiopia and eighty-five percent in Kenya. Few countries in Africa with large populations (Democratic Republic of Congo (DRC), Ethiopia, Nigeria, and Tanzania) account for majority of the wood fuel extraction in SSA (International Energy Agency, 2014). Due to high population growth, it is estimated that 1.8 billion people will still be dependent on traditional biomass resources in SSA in the future. This projection is enormous thus calling for increased community sensitisation on the efficient use of sources of energy so as to mitigate the impact of current and future climate change.

The first aspiration, seventh Goal of Africa Agenda 2063 gives emphasis to sustainable management of the continent's rich biodiversity, forests, land and waters as well as shifting to adaptive measures aimed to address the risk of climate change. This is especially so seeing that an estimated 2.74 billion people rely on traditional biomass and lack reliable access to modern fuels and 1.2 billion lack access to electricity (SE4All, 2017). To achieve this, it is necessary that local authorities embark on community sensitisation on the efficient use of energy (Murphy & Corbyn, 2013). No wonder, the East African Community Vision 2050 (Pillar 3.4) targets sustainable utilization of natural resources, environmental management and conservation. The problem of persistent use of inefficient energy sources is acute in SSA as the region is home to more than half of those who lack access to electricity worldwide and approximately 1 in 3 of those who rely on traditional biomass (Sustainable energy for All, 2017). In respect to this, communities have become more vulnerable and left with fewer options in adapting to climate change (Sumiya, 2016).

The Uganda Vision for 2040 calls for development of appropriate adaptation and mitigation strategies on Climate Change to ensure that the nation is adequately cushioned from any adverse impact resulting from climate change. In 2018, Uganda became the first country in Africa to sign the partnership plan for Nationally Determined Contributions (NDCs) to achieve national climate goals as part of its obligations to the Paris Agreement. Under the NDCs, the country committed itself to reducing national emissions and adapt to the impacts of climate change. However, UNHS (2012/2013) reveals that seventy-five percent of households in Uganda relied on firewood for cooking while twenty-one percent relied charcoal. Combined biomass fuels constituted the main fuel for cooking for ninety-six percent of the households. As a consequence, the government of Uganda in addition to civil society organizations are fostering clean cooking interventions such as clean cooking stoves.

A number of Asian countries have made positive progress, particularly china where approximately every household now has access to electricity leaving about a billion of the global population lacking access to electricity located in SSA, where reliance on traditional biomass is above eighty percent (IEA, 2016). This poses major challenges to sustainable development and exposes many to the impacts of climate change. The most vulnerable populations are faced with

multiple burdens that require comprehensive responses (Chevallier, 2006). The cost of electricity among domestic consumers in Uganda remains very high though the country is envisioned to bring it down to five United States cents per unit by 2040 thus making it a challenge in the current situation for the rural poor. Therefore, efficient use of energy in order to achieve sustainable use of affordable means of energy in a way that mitigate climate change is key.

A few obtainable studies fail to address the link between community sensitisation and efficient use of wood fuel among rural communities. A study by Egeru (2014) established that 98.8% of the households rely on fuelwood for food preparation with individual consumption going up to 542.32 kilograms. A similar study was conducted in Ghana regarding strategies to increase use of clean cooking fuels (Larsen, Dalaba & Wong, 2020). Nkwanga (2014) focused on use of waste to get energy as a way of conserving plant genetic resources as well as improving community livelihoods. Larson, Monterroso, Liswanti, Herawati, Banana, Cantuarias, Mwangi (2019) studied the models of formalising customary and community forest lands and found that it was necessary to integrate livelihoods into rights and conservation management goals. A close look at the above studies suggests that few have focussed on community sensitisation and efficient use of wood fuel and none of them addresses the problem at hand.

A study conducted by both Uganda Bureau of Statistics (UBOS) in 2012 reveals that only nine percent of households in Uganda have been sensitised on energy efficiency. Of these households, eighty percent adopted energy saving appliances such as wood saving stoves, air conditioners and refrigerators. This suggests that campaigns aimed at raising awareness among Ugandans combined with a dissemination program of energy saving appliances can be successful. As per cooking energy, household's annual biomass demand totals 20.9 million tons of fuelwood and 1.5 million tons of charcoal, accounting for seventy-four percent of delivered biomass energy. Rural households are the largest biomass consumers as a consequence of their low monthly income, which has a direct impact on their willingness to pay for the energy consumed (UBOS, 2012). This inefficient production and use of biomass energy in Uganda is having adverse effects on the environment and the health of users of biomass energy, especially rural households. There is low public awareness about the efficacy and potency of renewable energy technologies. Even if people are aware of these technologies, their potential and technical limits and constraints are underestimated (Energy issues in Uganda, 2011).

In northern Uganda, over ninety percent of the population relies on traditional biomass for cooking. The intervention aimed to promote increased energy efficiency as well as increased reliance on renewable energy, including but not limited to, the distribution of clean cook stoves, solar lantern lights and tree planting, has not achieved much (UNHCR Uganda Energy and community Assessment, 2015). The impact of climate change in Alebtong District has resulted into flooding which has destroyed crops and buildings leaving several households homeless with famine in the Sub Counties of Omoro and Abako; roads have become inaccessible to local businesses and school going children (Q FM news bulletin - 5th September, 2019; Unity FM news bulletin - 12th September, 2019). Trees in the villages of Amugu Sub County fell down except shrubs as a result of continuous reliance on wood fuel. The Census of 2014 reveals that more than ninety percent of the households in Amugu rely on firewood for cooking. The oral tradition likewise indicates that there were a number of swamps whose water used to dry up in March but are drying even earlier than mid-January.

2. STATEMENT OF THE PROBLEM

While several interventions have been put in place, the impact of climate change on human and natural systems have not been impressive and are projected to worsen. Current rainfall patterns in Lango sub-region have become unpredictable leaving many a farmer muddled over when to plant. Obtainable evidence suggests that many of the causes of climate change are anthropogenic in nature through lifestyles which increase atmospheric pollution and depletion of the ozone layer. Households have failed to adopt to any alternative source of energy for cooking. Results from UBOS census of 2014 demonstrates that over ninety percent of the households in Amugu Sub County rely on firewood as the major source of energy with only 3.7% in Ajuri County having access to electricity. Efforts by the government to educate masses about adaptation of efficient sources of energy have not executed due to several challenges such as the resource envelope on the side of those of community sensitisation. Therefore, this study aimed to assess the contribution of community sensitisation on efficient use of wood fuel energy in Alebtong district. Consequently, three research questions were answered, viz.; (a) to what extent does the level of awareness and community perception contributes to increased rate of efficient use of wood fuel energy? (b) What is the level of efficient use of wood fuel energy in Amugu Sub County, Alebtong District? And (c) How do effective means of information increase the efficient use of wood fuel energy?

3. METHODOLOGY

Our study adopted the qualitative description within the explanatory pattern where to Polit and Beck (2004) made an assumption that reality is multiple and subjective and mentally constructed by individuals. Data was gathered from Local council leaders, members of the community and other energy related service providers as key informants through semi-structured and closed ended questionnaire. Focused group discussion was not used due to COVID-19 pandemic but rather interview guides were used to solicit information from members of the selected energy service providers as a means of cross-validating the data obtained via the use of the questionnaire. These tools were used because of the constraint of time and other financial resources amidst the COVID-19 pandemic. Both women and men are involved in firewood collection and as users of wood fuel energy they were targeted for the study. These included women and men engaging in food and rural processing industry activities and those who do not belong to any group. This was done because women and men in groups would provide the researcher with factual information about their experience on the use of wood fuel energy and how they were bringing about efficient use of energy sources. Women and men who do not belong to any group were considered because; they would enlighten the researchers about some of the reasons why they don't engage in such activities and their challenges in trying to foster efficient use of wood fuel energy.

The sample size for this study was 48 respondents. This included the leaders of local councils and community members engaging in food and rural processing industries (five local council leaders and six community members engaging in food and rural processing industries, one community development officer, one senior assistant secretary, one production officer, six service providers in the energy sector, and twenty-eight community members) who were either purposely or randomly selected respectively. Those engaging in food and rural processing industries as well as stakeholders enlightened the researcher about the contributions of community sensitization on the efficient use of wood fuel energy. The six respondents who were engaged in food and rural processing industries were selected for the study because they were people who were actively involved in use of wood fuel energy. The researchers broke down 48 respondents engaged in food and rural processing industries and the 28 community members by taking equal representation of respondents from each of the four parishes of Amugu Sub County. A questionnaire composed of structured and semi-structured items with both open and close-ended questions was used. In addition, direct observation was used to acquire nonverbal information that was important in justifying the controversial circumstances. Finally, the interview was used to supplement and extend our understanding about individual thoughts, feelings and behaviours regarding wood fuel usage. Interviewing was done with the help of an interview guide and the researchers administered every interview with a purpose of obtaining information for this survey. This was used to capture data from the local council leaders and service providers.

The researchers were provided with an introductory letter from Lira University, Department of Public Administration to be presented to local authorities, who, in turn, introduced the researcher to the relevant people who assisted the researcher to get access to the staff list from which the sampling frame was drawn from service providers, community members and local leaders. Every respondent was informed about the purpose of the research and any other information such as expected duration of participation, procedures to be followed, any benefit to the respondent, extent of privacy, available options to the participant and expected risks that was required by them before being interviewed. And the respondents were informed that the information to be given was entirely for academic purposes only and not for any other purpose and their identities would not be exposed anywhere. Data from the field was analysed using both qualitative and quantitative methods. Qualitative data was coded to generate themes and sub-themes.

4. RESULTS OF THE STUDY

Demographic characteristics of the respondents

The findings show that the majority (52.1%) of the respondents were male while 49.9% were female. Most of the respondents 68.8% were married, 39.6% were within the age bracket of 25 –34 years and 39.6% completed secondary level of education. Although this findings show representation of both gender, the majority were male implying that male are responsible for the promotion of efficient use of wood fuel energy since they are in most cases decision makers in homes. Men carry purchased wood and where excess is produced women are rarely involved in selling it. Men have an exceptionally low involvement in gathering fallen wood and head loading can be related to gender ideology. Their involvement in this work which is conventionally done by women is considered disgraceful. Women and girls are primarily responsible for collecting fuel and cooking for their families. Many of the people who are involved in the wood

fuel trade or who work in rural industries or commercial enterprises that use wood fuels are women. Although this means that gender aspects play an important role in wood energy, this is rarely reflected in wood energy planning and programming. Generally, women are responsible for wood fuel collection by gathering from public sources or from private land, such as farmland and home gardens. Safe access to wood fuel is a direct benefit for their food security and overall health but depending on the context collecting wood fuel can be unsafe for the women involved. Planting and taking care of the trees means extra work for which women may not have time. When women do plant trees, they are able to use it for household consumption, or sell it for cash, but depending on the cultural and family context, they may not be involved in deciding how to spend that cash. The choice of tree species is also a subject where gender plays a role, because men generally prefer trees that can be sold as timber, while women may prefer fast-growing species that provide them with fuelwood.

Majority of the respondents are married 33(68.8%), 9(18.8%) were single, 1(2.1%) had separated, 2(4.2%) were divorced, 1(2.1%) cohabiting and 2(4.2%) widowed. This implies that majority of the respondents who were married had responsibilities to promote efficient use of wood fuel energy in their families. The implication is that efficient use of wood fuel energy is being interpreted differently where by what is efficient use of wood fuel energy for one person may be inefficient use of wood fuel energy for another, therefore, in this context community sensitization seems to glorify the process, implying the need for campaign and launch of the development, adoption and utilization of other modern fuels and technologies in order to achieve the objectives of emission reduction, protection of the environment and energy conservation and additionally promote Renewable Energy and Energy Efficiency Programs. As per the age bracket, majority of the respondents were in the age bracket of 25-34 years constituting to 19(39.6%), followed by respondents of age category 35-40 years 7(14.6%), others included those of 45-49 years constituting 5(10.4%), 18-24 years and 41-44 years were the same at 4(8.3%) and finally those of 55 years and above had no score. This suggests that the research was able to test the contribution of community sensitization on the efficient use of wood fuel energy on the factor of age category clearly showing that the beneficiaries of community sensitization on the efficient use of wood fuel energy are those ranging from 25-34 years of age because they are youngest generation and parents who need to be educated to be able to inspire their children and change the world to the most efficient use of wood fuel energy hence addressing the impact of climate change we are experiencing now.

The Contribution of dialogue meeting on the efficient use of wood fuel energy in Amugu Sub County.

Dialogue meeting is the most effective response to developments because, on the one hand, it allows people to span their differences and forge shared frames of reference and, on the other, it gives those formerly excluded from decision-making an opportunity to participate in the process of finding common ground and establishing priorities for action. The findings show that majority of the respondents (53.33%) did not participate in dialogue meeting on efficient use of wood fuel energy in Amugu Sub County while 46.67% participated. This implies that communities are not aware of important of efficient use of wood fuel energy in response to addressing the impact of climate change. Also, out of 48 of the respondents who participated in dialogue meeting on efficient use of wood fuel energy, very few (25.0%) had participated for 2 to 4 times and more than four times. The majority (50.0%) had participated once. In addition most of the meeting were organized by CBO/NGOs reported by 53.8% of the respondents, the majority of the respondents (92.9%) reported seeing the relevance of dialogue meeting and 67.9% of the respondents rated the contribution of dialogue meeting to promoting efficient use of wood fuel use at moderate level. This suggests that there is limited opportunity to engage community members in a process to enhance awareness raising, sensitization and collaborative problem solving in order to address issues of climate change with the responsibility of organizing dialogue meeting on the efficient use of wood fuel energy mainly left on NGOs whose scope of work is very narrow.

The contribution of media towards efficient use of wood fuel energy in Amugu sub county

The study revealed that majority of the respondents (73.33%) uses radios to access information on efficient use of wood fuel energy and 13.33% access information using phones and other types of media as presented in Figure 3 above. The implication is that radios is the most effective media to reach wider community and therefore information on the efficient use of wood fuel energy should be tailored in radio programs in the most attractive manner in order to not only promote efficient use of wood fuel energy but as well mitigate the impact of climate change. Majority of respondents (86.7%) were able to access information concerning efficient use of wood fuel energy using radios. While 60.0% of the respondents seldom access information on efficient use of wood fuel energy and they reported the information was not sufficient.

However 55.2% reported having no challenge in accessing information using their specific media while 44.3% said they faced challenges. Concerning the contribution of media toward efficient use of wood fuel energy in Amugu sub County, a number of respondents (42.9%) noted that it contributed moderately. This implies that radio is one of the best tools of media to spread awareness in the modern society and can be used to create awareness on the efficient use of wood fuel energy. However, the findings further implies that a number of challenges in accessing radio impacts a lot on the frequency which is being registered the lowest at 8% as very often which limits community of Amugu Sub County from obtaining a full benefit generated from the contribution of media on efficient use of wood fuel energy. The challenges such as loaded information, limited power, irregular network or signals, inability of community members to follow all the radio programs since they are not good at timing and the broadcast of verbal information do not provides practical aspect of efficient use of wood fuel energy probably could be the reasons for low attribution on the frequency to access information on efficient use of wood fuel energy through media (very often). Many campaigns aim to directly affect individual recipients by raising cognitive or emotional responses. Such programmes were intended to affect decision-making processes at the individual level. Anticipated outcomes include the removal or lowering of obstacles to change, helping people to adopt healthy or recognize unhealthy social norms and to associate valued emotions with achieving change. These changes strengthen intentions to alter and increase the likelihood of achieving new behaviours.

The contribution of training on efficient use of wood fuel energy in Amugu Sub County

The finding showed that majority of the respondents (56.7%) never had training on efficient use of wood fuel energy. Out of the 13 (43.3 %) who participated 46.7% said they were selected as a group and it was compulsory for the community, 30.8% reported they undergo training after every 6 months and after one year, 35.7% said the training method is discussion and 84.6% reported that the method used during the training had impact on their skills concerning efficient use of wood fuel energy. The data implies that training plays a cardinal role in as far as contribution of community sensitization on the efficient use of wood fuel energy is concerned therefore, the findings has shown that there is a gap in training with more than half of the respondents not benefiting from training on the efficient use of wood fuel energy. Group selection criteria provides a fair representation of community members within the entire sub county whereby group members can easily cascade the training to other new group members and community at large even if the training opportunity was given to a few representatives in various groups. This is one of the most effective way of ensuring sustainability since community groups are normally created to find solutions to issues affecting them that is self-help initiatives and once their capacity is being built they become able to integrate it into their usual activities thereby increasing chances for knowledge and experience sharing thus trickling down on attitudinal change that is very key for the adaptation of efficient use of wood fuel energy translating into climate change resilience.

5. DISCUSSION

The study corroborate with Bohm (1991) who noted that dialogue is the most effective response to developments because on one hand, it allows people to span their differences and forge shared frames of reference and on the other, it gives those formerly excluded from decision-making an opportunity to participate in the process of finding common ground and establishing priorities for action. Slovic and Peters (2006) suggested that people need to be inspired, engaged and have fun when receiving the message (how we feel about a given situation often has a potential influence on our decisions. These decisions strengthen intentions to alter and increase the likelihood of achieving new behaviours (Fishbein & Azjen, 2010). For example, media might emphasize risks of inefficient use of wood fuel energy and the benefits of shifting to more efficient use of wood fuel energy. The findings further support the earlier views raised by Bartle, (2012), who revealed that training is often assumed to be only the transfer of skills to trainees however, in community management training goes much further in its role of poverty reduction and capacity building which also includes mobilizing the group to take action and organizing to increase capacity and strength with the following elements; awareness raising, providing information, transferring skills, stimulation or encouragement, mobilizing and organizing.

6. CONCLUSION

While scholars have written about the role community participation on wood fuel utilisation, we still know less about it. This study fills the gap in obtainable literature by examining three aspects, namely the contribution of dialogue meeting on the efficient use of wood fuel energy, the contribution of media on the efficient use of wood fuel energy in which the radio is discovered to be one of the best tools of media to spread awareness in the modern society therefore it is a stringent opportunity that government and other development partner needs to explore to create awareness on the efficient use of

wood fuel energy. We find that following numerous challenges faced by community in accessing information through use of radio, our results reveal that it is equally important that government takes drastic measures to deal with these challenges for the safety and conservation of our environment. The third aspect in this study pertains to the contribution of training on the efficient use of wood fuel energy, which plays a cardinal role in as far as contribution of community sensitization on the efficient use of wood fuel energy is concerned therefore, our findings call for a more concerted effort in bridging the gaps so as to enable community members to attain skills and experience on the efficient use of wood fuel energy.

Our study calls for the need to conduct frequent dialogue meeting with the local leaders and community members of Amugu Sub County especially on a monthly basis; conduct training of the communities on efficient use of wood fuel energy as the majority reported having not participated in any training. The training may include how to make energy saving stove, entrepreneurship's skills among others that boost the livelihood of community members to generate income and avoid total dependency on natural resources. Our findings call on the government to subsidise cost for radio talk shows on efficient use of wood fuel energy. Due to the expensive cost attached to talk show, it limits the frequency level of sensitization conducted on efficient use of wood fuel. In addition, government needs to engage companies such as MTN and Airtel to keep sending messages on efficient use of wood fuel as well as collaborating the civil society so as to aid wide spread of information.

LIMITATIONS OF THE STUDY

1. COVID-19 pandemic that has caused not only delays in finalizing the research work vis-à-vis the schedules in the timeframe but also limited the use of focus group discussion.
2. Under budgeting since the initial budget allocation could not support fully the research process because of COVID-19 safety related items that became very key in the process of data collection for example, face mask, hand sanitizer among others.

Conflict of interest

The authors declare no conflict of interest.

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REFERENCES

- [1] Adom, P and Amuakwa-Mensah, F. (2016). What drives the energy saving role of FDI and Industrialization in East Africa? *Renewable and Sustainable Energy Reviews*, 65.
- [2] Attari S Z, DeKay M L, Davidson C I and Bruine de Bruin W 2010 Public perceptions of energy consumption and savings Proc. Natl Acad. Sci. USA 107: 16054–9.
- [3] Attari, S.Z. (2014). Perceptions of water use Proc. Natl Acad. Sci. USA.
- [4] Attari, S.Z., DeKay, M.L., Davidson, C.I., and Bruine de Bruin, W. (2010). Public perceptions of energy consumption and savings Proc. Natl Acad. Sci. USA.
- [5] Baird, J.C., and Brier, J.M. (1981). Perceptual awareness of energy requirements of familiar objects. *Journal of applied Psychology*, 66(90).
- [6] Bin, S., and Dowlatabadi, H. (2005). Consumer lifestyle approach to US energy use and the related CO₂ emissions Energy Policy, 33: 197–208.
- [7] Chen, V.L., Delmas, M.A., Kaiser, W.J., and Locke, S.L. (2015). What can we learn from high-frequency appliance-level energy metering? Results from a field experiment Energy Policy, 77: 164–75.
- [8] Chevallier R. (2006). Addressing mitigation of and adaptation to climate change in Sub-Saharan Africa while meeting Development Goals, South African Yearbook of International Affairs, 2008/9.
- [9] Crutzen, P.J., and Andreae, M.O. (1990). Biomass burning in the tropics: Impact on atmospheric chemistry and biogeochemical cycles. *Science*, 250 (4988).1669-1678.

- [10] DuPont, P. (1998). Communicating with whom? The efficiency of appliances energy in labels in the US and Thailand. In Proceedings of the 1998 ACEEE summer study energy efficiency in Building, American Council for an energy efficient economy, Washington D.C.
- [11] Easton L and Smith S 2010 Homesmart renovations—testing tools to promote sustainable renovation Proc. New Zealand Sustainable Building Conf., Wellington, New Zealand.
- [12] ECOWAS. (2012). *The ECOWAS energy efficiency policy*. Final version.
- [13] Egeru, A.S. (2014). Rural households' fuel wood demand determinants in dryland areas of eastern Uganda. *Energy sources. Part B: economics, planning, and policy*. 9(1). 39-45. 10.1080/15567241003716688.
- [14] Elvira, M. (2008). Choice determinants for (non)-adoption of energy efficient technologies in households. IIEE Reports.
- [15] Energy issues in Uganda (2011). <https://pubs.iied.org/pdfs/16030IIED.pdf> accessed on 14th December 2019.
- [16] Frederick, S.W., Meyer, A.B., and Machon, D. (2011). Characterizing perceptions of energy consumption (letter). Public perceptions of energy consumption and savings Proc. Natl Acad. Sci. 108 E23
- [17] IEA (2014). World energy outlook 2014. Paris: International Energy Agency.
- [18] IEA (2016c). World Energy Balances 2016, OECD/IEA, Paris.
- [19] IRENA (2015). Africa 2030: Roadmap for a Renewable Energy Future. IRENA, Abu Dhabi. www.irena.org/remap
- [20] IRENA's analysis (2019). Available at: <https://www.irena.org/publications/2019/jun/climate-change-and-renewable-energy>
- [21] Johnson, M., Edwards, R., Alatorre Frenk, C. & Masera, O., 2008. In-field greenhouse gas emissions from cookstoves in rural Mexican households. *Atmospheric Environment*, 42 (6), pp.1206-1222.
- [22] Kempton, W. (1986). Two theories of home heat control *Cognitive Science*, 10: 75–90.
- [23] Kempton, W., and Montgomery, L. (1982). Folk quantification of energy, 7: 817–27
- [24] Krishnamurti, T., Davis, A.L., Wong-Parodi, G., Wang, J., and Canfield, C. (2013). Creating an in-home display: experimental evidence and guidelines for design *Applied Energy*, 108: 448–58.
- [25] Krishnamurti, T., Schwartz, D., Davis, A., Fischhoff, B., De Bruin, W.B., Lave, L., and Wang, J. (2012). Preparing for smart grid technologies: a behavioral decision research approach to understanding consumer expectations about smart meters *Energy Policy*, 41: 790–7
- [26] Larsen, B., Dalaba, M., and Wong, B. (2020). *Cost-benefit analysis of interventions to increase the use of clean cooking fuels in Ghana* (pp.10-18, Rep.). Copenhagen consensus Center. Doi:10.2307/resrep23675.5
- [27] Larson, A., Monterroso, I., Liswanti, N., Herawati, T., Banana, A., Cantuarias, P.,...Mwangi, E. (2019). (Rep.). *Centre for an urban future*. Doi:10.2307/resrep22282
- [28] Makame, O.M. (2006). Adoption of improved charcoal stoves in urban Zanzibar and its impact on forests, *Management of environmental quality Journal*, 18(3). 353-365.
- [29] Masera, O. R., Drigo, R., Ghilardi, A., and Ruiz-Mercado, I. (2015). Environmental burden of traditional bioenergy use. *Annual Review of Environment and Resources*. 40, 121-150.
- [30] MEMD, UBOS, (2012). Uganda rural-urban electrification survey.
- [31] Mugo, F. (1999). The effect of fuelwood demand and supply characteristics, land factors and gender on tree planting and fuelwood availability in highly populated rural areas of Kenya. A PhD dissertation, Cornell University, New York.
- [32] Murphy, B., and Corbyn, D. (2013). Energy and Adaptation-Exploring how energy access can enable climate change adaptation. Practical Action consulting.

- [33] Nkwanga, D. (2014). Waste-to-energy: conserving plant genetic resources, improving livelihoods. *BG journal*, 11(1). 11-13. Retrieved Oct. 29, 2020 from: <https://www.jstor.org/stable/24811295>
- [34] Rasmussen, R.A., Smith, K.R., Khalil, M.A.K., Thorneloe, S.A., Manegdeg, F. and Apte, M. (1993). Greenhouse gases from biomass and fossil fuel stoves in developing countries: A Manila pilot study.
- [35] Sagar, A.D., 2005. Alleviating energy poverty for the world's poor. *Energy Policy*, 33 (11):1367-1372.
- [36] Sahid, Z. (2012). Climate Change Awareness and Adaptation by Local Planning in Punjab, Pakistan (Doctor of Philosophy). University of Western Sydney, Australia
- [37] Schley, D.R. and DeKay, M.L. (2015). Cognitive accessibility in judgments of household energy consumption *Journal of Environmental Psychology*, 43: 30–41
- [38] SE4ALL (2017). Progress toward sustainable energy: Global tracking framework.
- [39] Smith, K.R., Khalil, M.A.K., Rasmussen, R.A., Thorneloe, S.A., Manegdeg, F., and Apte, M. (1993). "Greenhouse gases from biomass and fossil fuel stoves in developing countries: A Manila pilot study". *Chemosphere*. 26 (1–4): 479–505.
- [40] Sumiya, B. (2016). Energy poverty in context of climate change: what are the possible impacts of improved modern energy access on adaptation capacity of communities? *International journal of environmental science and development*, 7(1), 73.
- [41] UBOS National Household Survey 2012/2013, Final report 2014
- [42] UNEP/WMO (2011). Integrated Assessment of Black Carbon and Tropospheric Ozone: Summary for Decision makers. United Nations Environment program (UNEP): Nairobi.
- [43] Vassileva, I., Wallin, F., and Dahlquist, E. (2012). Understanding energy consumption behavior for future demand response strategy development *Energy*, 46: 94–100.
- [44] Venkataraman, C., Habib, G., Eiguren-Fernandez, A., Miguel, A.H. and Friedlander, S.K. (2005). Residential biofuels in south Asia: Carbonaceous aerosol emissions and climate impacts. American Association for the Advancement of Science.
- [45] Wanjala, F., Obwoyere, G., and Eshiamwata, G. (2015). Wood fuel Utilization Patterns and Cooking Devices Efficiency, Analysis for Likia Residents, Njoro Kenya, pp 158- 162
- [46] WHO (2014). Burden of disease from household air pollution for 2012. World health organization. http://www.who.int/phe/health_topics/outdoorair/databases/FINAL_HAP_AAP_BoD_24march2014.pdf.
- [47] World watch Institute (2009). State of the World: Into a Warming World. 26th edn. Norton & Company, London.