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Adoption of Improved Cookstoves in the Peri-urban Areas of Nairobi: Case of Magina Area, Kiambu County, Kenya

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ABSTRACT

Concerted efforts have been made to enable communication and adoption of improved cookstoves by diverse development organizations in Kenya. However, their adoption remains low. This study sought to examine levels of adoption and use of improved cookstoves in Magina, Kiambu County and determine factors affecting their adoption and use. Results demonstrate that 93% of the households received the cookstoves from developmental programmes, among these 50% were making use of them but only 14% of the 50% had fully adopted them as main cookstoves. Efficiency and suitability, socio -cultural practices, economic capacity, limited capacity to appreciate the improved cookstoves concept and governance considerations were the cited limiting factors to adoption and use. There is need for an enabling policy and strategies to implement the bottom-up approach in the design and implementation of improved cookstoves to facilitate the upscaling of the adoption and use of improved cookstoves to conserve the forests in the country for sustainable development.

1.Introduction

Energy security, climate change and health concerns are some of the pressing issues globally and locally. The total world energy consumption is anticipated to increase by 33.5% between 2010 and 2030 (Saidur et al., 2011). Sustainability of the energy sector is therefore an issue of utmost importance because of the critical role played by energy in the socio-economic development of nations. This has been prioritized by sustainable development goals (SDGs) and also included in the climate change initiatives as well as in several conventions of the United Nations. The universal nature of the challenge posed by SDG number seven on energy means that the world will be faced with big decisions about how to best provide sustainable solutions to meet society's energy needs. The relationship between energy and environment is directly related to sustainable development and to attain the later, energy resources have to be used efficiently.

Approximately 2.5 billion people in developing countries and in particular rural areas rely on solid fuels including biomass (fuel wood, charcoal, agricultural waste, dung) to meet their cooking, lighting and heating needs (Bonjour et al., 2013; Sahoo et al., 2014; Kibria 2015). In many countries, these resources account for over 90% of household energy consumption. Several studies have predicted a "fuel wood crisis" coupled with increasing deforestation. A study by the United Nations Development Programme (UNDP) and the World Health Organization (WHO) in 2009 reported that 600 million people without access to modern energy live in sub-Saharan Africa where access to modern fuels is as low as 17% while 69% of the population rely on wood as their primary cooking fuel.

In Kenya, fuel wood and charcoal are the principle sources of energy among rural and poor urban households, and the informal sector (Situational Analysis of Energy Industry, Policy and Strategy for Kenya 2015). According to the Energy Regulatory Commission (2004) there is immense reliance on wood fuel and other biomass accounting for 68% of the total energy consumption while petroleum, electricity, and others account for 22%, 9% and 1%, respectively. The access to electricity is however, represented by less than 42% of the population in the country (World Bank 2015).

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Production, transformation, transportation and sale of wood and charcoal are critical sources of income for those engaged in these activities. It is estimated that about 13 million hectares of forest is lost every year with developing countries accounting for 99% of the losses (Amoah et al., 2015) thus contributing to global forest depletion and disease prevalence (Jan et al., 2017). Further exploitation and diminishing of woody biomass exacerbated by poor management and unsustainable utilization are inevitable. This is likely to have negative impacts on climate change through reduced carbon sequestration and increased greenhouse gas (GHG) emissions. Firewood collection is a time-consuming exercise with its use being associated with indoor air pollution while carrying bulk firewood can lead to physical injuries. Firewood and other forms of biomass are typically burnt in traditional inefficient stoves resulting to high levels of indoor air pollution considered to be higher than WHO recommended levels (Debbi et al., 2014). Indoor air pollution is a risk factor for chronic respiratory diseases, lung cancer, child pneumonia and adverse pregnancy outcomes (Bruce 2008; Eisner et al., 2010; Pope et al., 2010).

There exists a number of cleaner energy alternatives to traditional cooking practices and these include improved cooking stoves and cleaner fuels. Liquefied Petroleum Gas (LPG) is common among middle-income households in developing countries; however, it is relatively expensive compared to solid fuels while there is generally a lack of supply to many rural areas. Various practitioners and civil society organizations have started initiatives geared towards development and distribution of improved cooking and lighting technologies in rural areas (Honkalaskar et al., 2013). The improved cooking technologies are designed to improve combustion efficiency of biomass, consume less fuel, save cooking time, increase convenience in cooking processes and create a smokeless environment in the kitchen or generally lead to a reduction in the volume of smoke produced during cooking. Ethanol stoves, solar cookers and biogas also offer efficient and clean energy alternatives for households, however, they offer partial solutions and scaling them globally is likely to pose challenges. Improved cook stove programs have been launched in attempt to reduce the health problems caused by traditional cooking devices (Cooke et al., 2008). Such programs have been initiated in several countries Kenya included (Ochieng et al., 2013) with an estimated 53 million cook stoves distributed by the Global Alliance for Clean Cook stoves (GACC) from 2010 to 2015. Many institutions including Global Alliance for Clean Cookstoves led by the United Nations Foundation and Global Village Energy Partnership among others continue to remain at the forefront of cook stove development, marketing and distribution in the region (Winrock International 2011) yet there are still some failures in adoption and use of these technologies. The challenges and failures in adoption of clean cooking technologies imply that solid wood fuels are likely to continue being utilized among many households in developing countries (Debbi et al., 2014).

The objective of this study was therefore to assess the levels of adoption and use of improved cook stoves in Magina area located in Kiambu County, Kenya, in the context of the factors affecting the use of improved cook stoves. Consequently, suggest solutions in line with SDGs.

2. Materials and Methods

This study was conducted in Magina Location, one of the four locations in Kijabe Ward, Lari Constituency and in Kiambu County which lies within 1◦ 03' and 1◦ 09' South and 36 ◦ 49' East (figure 1). Lying adjacent to Kereita and Kinale forests, the Magina community depend largely on these forests for products such as wood fuel, timber, posts and poles for building and fencing, fodder, medicinal plants inter alia.

Figure 1: Map of Lari constituency county wards showing the Magina location

Source: Independent Electoral and Boundaries Commission (2012)

A blended methodology was deployed to collect both qualitative and quantitative data. A total of thirty questionnaires were administered to household heads in four sub-villages of Majengo, Bahati, Muthaiga and Site. These households were purposefully sampled. The household surveys were triangulated with participatory assessments, field observation, voice recording (where consent was given) and photography. Participatory assessments included two focus group discussions (FGD) of three hours each. The first focus group consisted of six women aged between 30-52 years old while the second group consisted of four women aged 53 years and above. Focus group participants were purposefully selected to inform the study objectives. The FGD checklist was informed by the information generated from the questionnaire survey. Key informant interviews were also conducted with experts from two development programs including Kijabe Environmental Volunteers (KENVO) and the CO2 Balance organization that had previously worked and distributed improved cook stoves in Magina area using a prior developed checklist.

These experts were also selected owing to their ability to inform the objectives of the study. The data collected was also based on participants' observations and experience and this included experiences on firewood collection where two participants one on household farm and Kinale forest were sampled. Secondary data was collected from both published and grey literature to triangulate the primary data.

To investigate the level of adoption, the factors contributing to adoption were identified from previous studies and included in the questionnaire and check list of question to key informants. The factors considered included Socio-economic, cultural, technological issues, and general awareness about energy solutions.

The qualitative data gathered through interviews, focus group discussions was transcribed and coded. Quantitative data was analyzed using thematic approach where different dataset was identified and integrated within different themes that had been identified to enable insight and generation of knowledge from the same. Descriptive statistics was used to analyze the quantitative data with the aid of charts.

3. Results and Discussions

Analysis of the demographics of the respondents indicated that majority of the respondents were female (93%) while 7% were male. Household tasks such as cooking are mainly carried out by females while males offer support to the main cook. Most respondents were above fifty-six years of age (43%), 38% were between the age brackets of 36-55 while only 19% were between 16-35 years. This is unsurprising because the proportion of young people in formal jobs begins to be visible at the age of 25 years while below that age majority are still in school (Zepeda et al., 2013). A majority of the respondents had attained primary level education (57%) while 10% had not attained any formal education. 9% and 1% had completed secondary and college education respectively. The respondents comprised mostly of farmers, business persons and housewives in that order. 60% had a household size of 3-6 members with 27% and 13% having 1-3 and 6-9 members respectively. The respondents practiced subsistence farming for their livelihood including livestock rearing and crop cultivation. The surrounding forests namely Kereita and Kinale serve as sources of firewood and pasture for their livestock.

3.1 Results of data analysis on level and reasons for choice of use of household energy technologies and adoption of new technologies are presented in the next sub-sections/Results and Discussions

3.2 Level of Adoption and Use of the improved Cookstoves

It was established that two developmental projects promoted the adoption and use of improved cookstoves in the study area. This included KENVO, a non-profit organization registered as a private limited company and the Aberdares Improved Cookstove project implemented by CO2 Balance. KENVO promoted improved firewood stove also known as the rocket stoves from 2009 to 2010. The program also had a biogas component that commenced in January 2014. CO2 on the other hand promoted the improved firewood stove, also known as MK2 from February 2011 to November 2011.

CO2 project distributed a total of 11,050 improved stoves in Lari Division while KENVO did more than 30 in Magina village. It was established that 28 households (93%) of the respondents received the improved stoves from these programmes. Further investigation was undertaken to establish the use of these improved stoves and it emerged that 50% of those who received the improved stoves were using them at some point. 36% of the respondents reported that the stoves they received broke within a period of one to two years of receiving them. The remaining 14% had a small outside kitchen or did not have an outside kitchen thus did not use their stoves since they were unable to install them especially so those who lived in rented houses. Of those who were using the stoves, only 14% used them as the main cooking stove. All households however were found to have a charcoal stove which was mainly used for space heating.

3.3 Factors affecting the Adoption of the Improved Stoves

The adoption of clean cooking technologies is expected to achieve great benefits in many aspects (Shen et al., 2015) environmental, social and economic in particular with more in-depth research evidence that can offer insights to policy makers. Sociological, demographical and cultural characteristics of households play an important role in influencing energy technology of households (Ouedraogo 2006; Wang et al., 2012). The design and deployment of cookstoves ought to therefore, consider such factors to ensure that there is convenience in real use.

3.3.1 Efficiency and Suitability of the Stove

Improved cook stoves in Magina area had not been adopted to the expected levels. Although 18% of the respondents, all whom had attained primary education indicated satisfaction with the stoves citing safety and less pollution, majority were dissatisfied and lacked interest for these cookstoves citing poor heat efficiency and suitability of the stove. This was largely related to the design of the ICS given the small inlet for firewood and the remittance of minimal heat. Much time was also spent in breaking firewood into smaller pieces and constantly pushing the pieces of firewood via the small inlets to sustain the burning as expressed by majority of the respondents. Magina often experience cold seasons and hence the charcoal cookstoves in particular, was used for space heating as indicated by over 50% of the respondents because of its portability. These respondents however, preferred the metallic charcoal stove which they indicated to heat the space better besides being more durable than the ICS. While the small inlet was not ideal, the portability of the ICS was deemed valuable in the design especially so for such areas where space heating is unavoidable. The incorporation of these user needs would therefore facilitate the adoption of ICS as also observed by systematic reviews which suggest that majority of the studies had confirmed that it was important for the user requirements to be incorporated in the design of the ICS to facilitate meet users expectations and sustain the ICS market (Rehfuess et al., 2014; SNV 2014).

3.3.2 Social and Cultural Practices

The social and cultural practices among the households in Magina played an important role in determining the choice and use of the cookstove. The community commonly cook githeri which was mentioned as a staple food. This food type takes a long period of time to cook and hence it is largely best cooked using firewood on a three stone stoves which is also said to make food more palatable hence the community's preference. Similarly, the community's traditional ceremonies such as the ruracio are also key in determining the type of stove and fuel. During such events, large pans are required to cook for many guests and therefore households are triggered to quickly assemble traditional three stone stoves. The respondents stated that the latter is ideal because it is fast with readily available firewood from the forest or and with less expense on firewood with flexibility of adjusting to hold the huge pans hence its use unlike in the case where charcoal stoves would be used. This highlights the need to have cookstoves design incorporate such communities cooking practices to improve on their performances and facilitate their adoption.

3.3.3 Economic Capacity

Majority (93%) of the respondents were receptive to improved cookstoves, which they indicated to had received either at no cost or minimal installation cost. Most of the respondents using the ICS were either practising farming for both consumption and commercial purposes or business persons with their spouses engaged in similar ventures with varied types of houses and kitchens. Many respondents on the other hand cited preference for the LPG gas stoves citing its advantages of being clean and fast however, they indicated that the stoves were expensive and the fuel was also more expensive compared to firewood.

Although women are key in purchasing decisions, the purchasing power is endowed among men as also observed by (Price, 2017). Women in the study area were unable to purchase both the traditional and ceramic charcoal stove whose prices ranged from KShs. 250-450 following lack of purchasing power hence the use of the traditional three stone. While the cost of charcoal was a concern, some respondents indicated that they often picked up the small pieces of converted charcoal from the three stone stoves and used in the charcoal stoves for space heating. The respondents also expressed their dissatisfaction with the durability of ICS which they stated to be fragile with a short life span requiring a household to often dig deeper into their pockets to buy another at the expense of other competing basic needs. The assembling and use of the three stone cookstove on the other hand had no cost implication and was deemed durable hence the preference for the same. Value for money was important in choice and use of stove among most respondents and hence this needs to be considered when designing the cookstoves.

3.3.4 Limited capacity to appreciate the improved cookstoves concept

According to the CO2 Balance, (2014), the fuel-efficient nature of improved cook stoves means that, as well as carbon saving, it halves the amount of smoke thus providing potentially lifesaving impact in the household. Besides, when wood is used as a primary fuel, with inefficient cooking methods, it leads to large-scale deforestation, soil erosion, desertification and emissions of greenhouse gases. The 93% who received the improved cookstoves had no clear understanding of the main concept behind improved cookstoves. They reported that they were called to Kago Primary School where they registered and were issued with the cookstoves. It is a clear demonstration of the hitch in awareness creation and capacity building hence the low levels (14%) of adoption. This may have also been compounded by the low levels of education where only 9% and 1% of the respondents had attained secondary and tertiary education respectively, yet it would be expected that in these levels of study, a clear articulation of improved cookstoves functionality are done. The low level of education may have also contributed to low level of adoption of the cookstoves as also observed by Shen et al., 2015, s study that links higher chances of clean fuel adoption with increase in education.

3.5.5 Governance considerations

While political support in terms of existing renewable energy policies that facilitates the promotion and adoption of the ICS, prevailing enabling conditions for private investment, collaborations between government and private sector to meet the policy targets and participation of development partners and stakeholders in the ICS sector are some of the common potential barriers to adoption of the ICS (SNV, 2014; Price, 2017). An interview with an expert from one of the development programme in Magina indicated that some members of the community linked the promotion and distribution of improved cookstoves to key political figures who were out to buy their votes given that the dissemination occurred during the electioneering period. This was however, disputed during the FGDs where it was deemed that there was no or insignificant influence from politicians and participants were willing to accept cookstoves irrespective of which political party or political leader offered it as long as there was no cost implication. Governance considerations should however, not be ignored. There is a likelihood that the FGDs participants may have been hesitant to clearly point out political factors for fear of retaliation. The timing for initiation of a particular project should also be observed to avoid possible misinterpretation of the goals of the project which is likely to affect its success.

3.4 Types of Fuels and Stoves used in Magina Location

3.4.1 Fuels

The sampled households use a variety of modern and traditional fuels for cooking, heating and lighting purposes.

Firewood and charcoal were the most used fuels while kerosene and biogas are also used in considerable amounts (figure 2). Middle income households also use LPG and electricity from the grid to meet part of their energy needs while sawdust and maize cobs are used for cooking among the poor. Most of the households cited preference for firewood stating that it cooks faster, it is affordable and easily available.

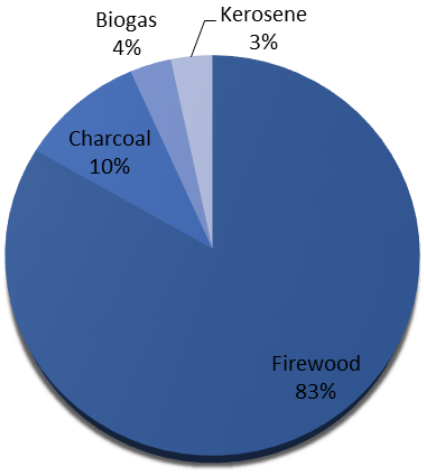

Figure 2: Main types of household fuels

Firewood collection activities averagely take 3-4 hours daily and this is usually the responsibility of women who carry loads of upto 40Kgs of mainly cyprus wood. Kireita forest is preferred for firewood fetching bacause Kinale forest has a rough terrain. Residents are levied a sum of Kshs. 100 at the beginning of every month as forest access fee. For those who find it difficult to fetch firewood from the forest, firewood vendors distribute firewood at an average cost of Kshs.1150 per heap of donkey cart. For a household of 3-6 members, a cart of firewood lasts for an average of 8 weeks (2 months) with the woman making at least two trips to the forest every week. Other fuels such as charcoal and kerosene are available at the shopping centre. Charcoal costs an average of Kshs. 1300.00 per sack and Kshs. 60.00 per 2kg tin. Biogas was available in only two households which had livestock and a digestor.

3.5 Types of Stoves Used

It was observed that the type of fuel chosen ultimately determined the stove used. The respondents in Magina own a wide variety of cooking stoves including traditional three stones, improved firewood stoves such as MK2 and kuni mbili, traditional charcoal stove, ceramic charcoal stove, kerosene stove, biogas stove, LPG stove, gasifier stove and electric microwave ovens. These stoves are used for cooking, space heating and heating of bathing water. 52% of respondents indicated that the traditional three stone stove was their main cooking stove, the traditional charcoal stove (7%) while 6% cited the ceramic charcoal stove (figure 3) as their main stove especially for respondents who lived in rental houses. Kerosene, LPG and the electric microwave oven were common in the middle to upper income households while biogas stoves were found in households that kept livestock. These stoves were used in the preparation of at least two meals a day and heating of bathing water. The charcoal stoves were common in all the households and were mainly used for space heating. All respondents using the three stone stoves assembled their own stove and a few added a tripod stand. The traditional charcoal stoves were bought at a price of Kshs.250-300 whereas the ceramic charcoal stoves ranged from Kshs. 350 to 450. The improved stoves from the development programmes were issued free of charge although KENVO had initially expected the beneficiaries to meet the cost of installation. CO2 Balance on the other had supplied the energy efficient stoves to the beneficiaries in exchange for all carbon rights for the emissions saved. The decision to procure a stove was generally left to the woman unless in very special circumstances where a substantial amount of money was involved for instance in the case of LPG, biogas and electric stoves.

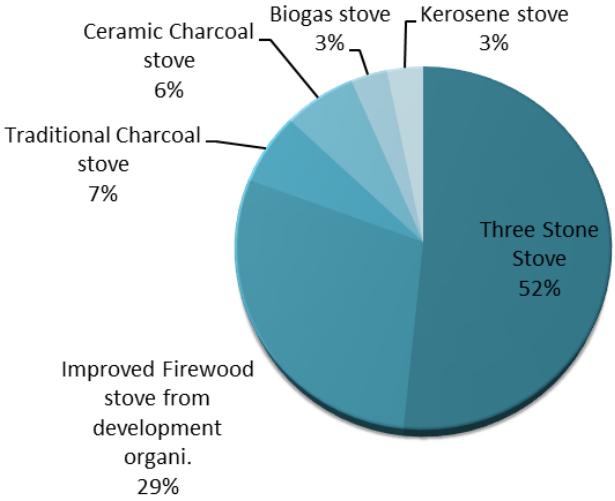

Figure 3: Main Types of Stoves in Magina Location

Conclusions

The developmental organizations, KENVO and the CO2 Balance made some great strides in the distribution and promotion of the adoption of ICS in Magina village yet the adoption of these ICS remains low (14%). Inefficiency and unsuitability of the cookstoves related to their designs hinders the adoption of the cookstoves in such areas where space heating is a necessity because of the cold. Foods like githeri take longer time to cook and tastes more palatable when cooked on three stone cookstoves and firewood hence the preference for the same. The latter is also preferable during social events like ruracio where food has to be well cooked and served in good time to the many guests with ease. The cost of the cookstoves also matters to a household which already has other competing interests hence affordability and durability would influence the adoption of a particular ICS. Understanding the ICS concept among different groups of people facilitates the appreciation and adoption of the ICS. Governance issues are often sensitive and are likely to negatively affect the success of the project, in particular the distribution and adoption of ICS if not well managed. Further research on harmonization and development of improved cookstoves that meets user needs in Magina Location and in similar other areas is therefore a necessity.

Upscaling awareness creation about ICS concept, bottom-up approach and involvement of communities in the prioritization and design of projects, review of the firewood collection permit policy to regulate on the number of trips to forests, livelihood diversification via empowerment programmes are vital in the facilitation of adoption of ICs in the Peri-urban areas of Nairobi to enable conservation of forests in these areas and in the country for sustainable development.

REFERENCES

Amoah, Martin, Oduro Marfo, and Michael Ohene. 2015. "Firewood Consumption Pattern, Availability and Coping Strategies Adopted to Mitigate Firewood Scarcity: A Case of Rural Households in Ghana." Forests, Trees and Livelihoods 24(3): 202–18.

Bonjour, Sophie et al. 2013. "Solid Fuel Use for Household Cooking: Country and Regional Estimates for 1980–2010." Environmental Health Perspectives 121(7): 784–90.

Bruce, Nigel. 2008. "Indoor Air Pollution from Unprocessed Solid Fuel Use and Pneumonia Risk in Children Aged under Five Years: A Systematic Review and Meta-Analysis." Bulletin of the World Health Organization 86(5): 390–98.

Cooke, Priscilla, Gunnar Kohlin, and William F. Hyde. 2008. "Fuelwood, Forests and Community Management – Evidence from Household Studies." Environment and Development Economics 13 (01). http://www.journals.cambridge.org/abstract_S1355770X0700397X (January 21, 2019).

Debbi, Stanistreet et al. 2014. "Factors Influencing Household Uptake of Improved Solid Fuel Stoves in Low- and Middle-Income Countries: A Qualitative Systematic Review." International Journal of Environmental Research and Public Health 11(8): 8228–50.

Eisner, Mark D. et al. 2010. "An Official American Thoracic Society Public Policy Statement: Novel Risk Factors and the Global Burden of Chronic Obstructive Pulmonary Disease." American Journal of Respiratory and Critical Care Medicine 182(5): 693–718.

Honkalaskar, Vijay H, Upendra V Bhandarkar, and Milind Sohoni. 2013. "Development of a Fuel Efficient Cookstove through a Participatory Bottom-up Approach." Energy, Sustainability and Society 3(1): 16.

Jan, Inayatullah et al. 2017. "Adoption of Improved Cookstoves in Pakistan: A Logit Analysis." Biomass and Bioenergy 103: 55–62.

Kibria, Golam. 2015. "Sustainable Energy for Rural Development in Developing Countries- Economic, Social, and Environmental Benefits of Renewable Energy- A Case Study." : 1–8.

Lusambo, Lp. 2016. "Household Energy Consumption Patterns in Tanzania." Journal of Ecosystem & Ecography 01(s5). https://www.omicsonline.org/open-access/household-energy-consumption-patterns-in-tanzania-2157-7625-S5-007.php?aid=72902 (January 19, 2019).

Ochieng, C. A., S. Vardoulakis, and C. Tonne. 2013. "Are Rocket Mud Stoves Associated with Lower Indoor Carbon Monoxide and Personal Exposure in Rural Kenya?: Kitchen and Personal CO from Traditional and Rocket Stoves." Indoor Air 23(1): 14–24.

Ouedraogo, Boukary. 2006. "Household Energy Preferences for Cooking in Urban Ouagadougou, Burkina Faso." Energy Policy 34 (18): 3787–95.

Pope, D. P. et al. 2010. "Risk of Low Birth Weight and Stillbirth Associated With Indoor Air Pollution From Solid Fuel Use in Developing Countries." Epidemiologic Reviews 32(1): 70–81.

Price, Roz. 2017. "Clean" Cooking Energy in Uganda – Technologies, Impacts, and Key Barriers and Enablers to Market Acceleration. Institute of Development Studies.

Rehfuess, Eva A. et al. 2014. "Enablers and Barriers to Large-Scale Uptake of Improved Solid Fuel Stoves: A Systematic Review." Environmental Health Perspectives 122(2): 120–30.

Sahoo, U.K., J. Lalremruata, and H. Lalramnghinglova. 2014. "Assessment of Fuelwood Based on Community Preference and Wood Constituent Properties of Tree Species in Mizoram, North-East India." Forests, Trees and Livelihoods 23(4): 280–88.

Saidur, R., A.E. Atabani, and S. Mekhilef. 2011. "A Review on Electrical and Thermal Energy for Industries." Renewable and Sustainable Energy Reviews 15(4): 2073–86.

Shen, Guofeng et al. 2015. "Factors Influencing the Adoption and Sustainable Use of Clean Fuels and Cookstoves in China -a Chinese Literature Review." Renewable and Sustainable Energy Reviews 51: 741–50.

Situational Analysis of Energy Industry, Policy and Strategy for Kenya. 2015. Nairobi, Kenya: Institute of Economic Affairs.

SNV. 2014. Grassroots Solutions for Scaling up Improved Cookstove Access in Uganda: A Last- Mile Community Market Intelligence Report, SNV Uganda. Netherlands Development Organization. https://stoves.bioenergylists.org/files/snv_market_intelligence_study_report_for_mail.pdf (January 27, 2019).

Wang, Rong et al. 2012. "Black Carbon Emissions in China from 1949 to 2050." Environmental Science & Technology 46(14): 7595–7603.

Winrock International. 2011. The Kenyan Household Cookstove Sector: Current State and Future Opportunities. Washington DC.

World Bank. 2015. "Access to Electricity (% of Population)." https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=KE.

Zepeda, Eduardo, Fatou Leigh, Lydia Ndirangu, and Jacob Omolo. 2013. The Youth Employment Challenge: The Insertion of Kenya's Youth into Formal and Informal Jobs.