

### 3] The Traditional Cook Stoves and the Achievement of Sustainable Development Goals in Kenya

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#### Abstract

The achievement of Sustainable Development Goals (SDG) is hampered by slow adoptions of new technologies. The Improved cook-stove has been designed to offer many benefits that lead to the achievement of food security, and the green, renewable and affordable fuel dimensions of the SDGs. However, there is low adoption of improved cook-stoves among the rural populations in Kenya. The rural population still rely on traditional cook-stoves. This study therefore sought to analyse how the traditional cook-stove is not fully contributing to the achievement of Sustainable Development Goals as it should. The Research Questions of the study were: What are the socio – economic realities of the communities in the use of cook stoves? What are the aspects in the traditional cook-stoves that do not allow it to fully contribute towards the achievement of Sustainable Development Goals in Uasin Gishu County? The study utilised Qualitative research approach and it is a case study of Uasin Gishu County in Kenya. There were 20 respondents for the study who were selected using purposive sampling technique. Both primary and secondary data were used for the study. Primary data was collected using interviews and observation data generation tools. The data was then analysed qualitatively using the thematic data analysis. The study reviewed the theoretical and empirical literature on the traditional cook-stoves. The secondary data was then analysed to determine how the traditional cook-stove is a barrier to the achievement of Sustainable Development Goals (SDG). From the study findings, the study concludes that to a large extent the traditional cook-stove is a barrier to the achievement of Sustainable Development Goals (SDG) especially in issues related to poverty, health, energy, climate change and sustainable forest management. It is anticipated that the study will be significant in emphasising the adoption of improved cook-stoves and the use of Biogas, liquefied petroleum gas (LPG) or other alternative cooking energy. The study will also have policy implications for energy and environment conservation in Kenya as well as promote the achievement of Sustainable Developments Goals.

*Keywords:* Sustainable Development Goals, cook-stoves, energy, environment

#### Introduction

##### Background of the Study

This study investigates how the traditional cook-stoves are barriers to the achievement of Sustainable Development Goals in Kenya on food sustainability and green, affordable

and renewable energy. According to World Bank (2018), over 38% of the world's population everyday cooking comes with an inherent risk. Household air pollution from the use of inefficient stoves and the burning of unclean fuel for cooking is responsible for around 4 million deaths a year, with women and children most at risk. The World Health Organization (2016) attributes deaths from pollution of household cook-stoves almost at par with that of HIV/AIDS, tuberculosis or even malaria, and contributes to a range of health risks such as lung cancer.

According to World Bank (2011), 90 per cent of the rural population in many countries depend on biomass energy as their main cooking and heating fuel. In Kenya, there is over reliance on biomass fuels as they are the cheapest source of energy to most people. Wood fuels are used for many purposes including heating and cooking and to support economic activities like beer brewing, tobacco curing, and brick-making (Mweu, 2019).

The impetus of improved stove is on conserving the environment and also socio-economic development. The improved stoves addresses development issues like improving health, safety, time saving, reduction of GHG emissions, and poverty alleviation (Ashley, 1993). In addition, household energy cuts across multiple sectors, including energy, forestry, gender, health, and climate change (World Bank, 2011)

### **Statement of the Problem**

This study investigates how the traditional cook-stove is hindering the attainment of Sustainable Development Goals. In Kenya, there is over dependency on biomass fuels (Ngigi, 2008) and traditional stoves as cooking energy. According to World Bank (2011) people will continue to use biomass fuel because switching to other cleaner fuel like liquefied petroleum gas (LPG) is expensive and affordable only with higher incomes. Dependence on biomass fuel has been associated with degradation of environment, hardship as a result of women collecting biomass and health issues (Reddy, 2012).

Wood fuel produces toxins similar to those found in tobacco smoke (World Vision Australia, 2011). A lot of attention has been given to the tobacco smoke in Kenya. It is now illegal to smoke in public places in Kenya. However, little attention has been given to the cook-stove smoke yet its consequences can be compared to tobacco smoking (Perez-Padilla, Schilmann, & Riojas-Rodriguez, 2010). In addition, rural communities are not aware about the health impacts of indoor air pollution (Rouse, 2004). The rural communities therefore continue exposing themselves to the harmful cook-stove smoke. This calls for research on effects of traditional cook-stoves.

### **Research Objective and Questions**

This study sought to investigate how the traditional cook-stove is a barrier to the achievement of Sustainable Development Goals. The research questions of the study are:

- (i) What are the socio-economic realities of the communities in the use of cook-stoves?
- (ii) How is the traditional cook-stove a barrier to the achievement of Sustainable Development Goals?

### **Significance of the Study**

This study highlight the significance of emphasising the adoption of improved cook-stoves and the use of biogas, liquefied petroleum gas (LPG) or an alternative cooking energy to reduce the overdependence of traditional cook-stoves. The study will also have policy implications for energy and environment conservation in Kenya as well as promote the achievement of Sustainable Developments Goals.

### **Literature Review**

After the expiry of the Millennium Development Goals (MDGs), there was an adoption of ‘Transforming our World: The 2030 Agenda for Sustainable Development’ document that contained the Sustainable Development Goals (SDGs). The SDG are a set of universal and transformative Goals and Targets. There are three dimensions of the SDGs which include economic, social and environments dimensions. It is envisaged that the 17 goals of the SDGs will be implemented by the year 2030 (United Nations, 2015).

Stoves determine the socio-economic and environmental impact of biomass use. These impacts are either internal or external to the households. Internally, the stove determines: how much time is needed for cooking food; how much wood is being used and the amount of pollutants emitted. External impacts are deforestation and greenhouse gas emissions (Kuhnhenh, 2003). Thus the nexus of cooking practices, household economics, health, forest and agricultural resource management, and global greenhouse gas (GHG) emissions has re-emerged as a transformative opportunity to improve individual lives, livelihoods, and the global environment (World Bank, 2011)

Traditional cook-stoves can range from three-stone open fires to substantial brick-and-mortar models and ones with chimneys (World Bank, 2011). They are not energy efficient and have poor combustion features (Overend, 2019). They have very low efficiency with about 85-90% of its energy getting lost in the atmosphere (Ngigi, 2008). A model of traditional stove consists of three stones that are positioned to form a triangular shape around a fire. The cooking pot or pan is normally placed on the stones, while fuel wood can be added between the stones (Jeuland, & Soo, 2019). The traditional three-stone stove is very common in the rural areas and it is estimated that 96 percent of the rural population use it (Ndegwa, Breuer & Hamhaber; 2011).

## **Health Issues**

Although both women and children are affected by IAP, children are the most vulnerable. Children equally spend long periods of time in polluted environments when in the company of their mothers (Budds et al., 2001). In addition, children inhale more air per kilogram of bodyweight than adults (Dyjack et al., 2005) and their breathing rate is faster. This means children absorb pollutants more than adults and retain them in their systems for longer periods (Banerjee, 2000).

When pregnant women are cooking, the foetus in their womb gets indirectly exposed to the indoor air pollution. Research indicates that indoor air pollution causes still births and low birth weight (LBW). The carbon monoxide from biomass combustion binds to haemoglobin to form carboxyhaemoglobin which reduces the oxygen-carrying capacity of blood. The shortage of oxygen supply causes a developing foetus to suffer intrauterine growth retardation and have a low birth weight. (Mishra et al, 2007). Low birth weight is a risk factor for pneumonia and other adverse health outcomes for infants in developing countries (WHO, 2007).

Apart from the effects Indoor Air Pollution caused by traditional cook-stoves, many women are also raped when looking for firewood (Reddy, 2012). Rape can result to death, sexually transmitted disease like HIV AIDS, unwanted pregnancy. In addition, rape victims can be affected psychologically and they can be traumatised.

## **Traditional Stoves versus Improved Stoves**

Jeuland and Soo (2019) give the following advantages of the traditional stoves: It is highly versatile for it burns all kinds of biomass; It can be adjusted to fit pots of any size; It can easily be controlled by adjusting the fuel wood; It can be used for heating and warming the room; Its fire can be used for lighting purposes and the smoke from the fire can be used to keep away insects and to preserve the thatch, food and timber. Despite the benefits, the authors outline the following setbacks of the traditional stoves: The traditional stoves has high consumption of wood; Cooking hours take longer; The stoves emit a lot of smoke and the openness of the stove can result in accidents, leading to injuries or damages to the house.

A number of countries including China, India, Rwanda, Ethiopia and Kenya have had national programs to promote the use of improved cook-stoves. There are also many organizations including Non-Governmental Organizations (NGO) that support the use of improved stoves at homes and institutions like schools in Kenya. The Improved stoves is constructed in such a way that it has capacity to mitigate harmful environmental impact as well as addresses climate change-related issues, like the reduction of greenhouse gases and black carbon (Reddy, 2012). In addition, the use of improved cook-stove leads to conservation, sustainable use of biomass, and reduced indoor air pollution (ibid).

Although many stove programmes have been launched in developing countries, it has been characterised with insufficient monitoring and evaluation efforts (Jeuland, & Soo, 2019). There is therefore need to monitor and evaluate stove projects more rigorously, particularly with respect to health benefits and usage patterns over time (World Vision Australia, 2011) and environmental impacts.

### **Research Methodology**

The Constructivist paradigm underpins the study because it offered an in-depth understanding of the use of traditional cook-stoves in Uasin Gishu County. The study analysed multiple construction of realities by respondents on the use of traditional cook-stoves. The study adopts a qualitative research approach. Taylor, Bogdan, and DeVault, (2016) describe qualitative methodology as research that produces descriptive data which consists of people's own written or spoken words and observable behavior. Data was collected in the participants' homestead which is their natural setting. The researcher was able to get knowledge about how people perceive, interpret and understand issues that underlie the use of traditional cook- stoves in their context.

The study utilised a case study design, which is an enquiry associated with an intensive investigation of a specific phenomenon in its natural context (Daymon & Holloway, 2011). This study did an in depth analysis of the use of cook-stoves in Uasin Gishu County while utilizing purposive sampling technique to select a sample size of 20 for the study from women in the rural communities in Uasin Gishu County.

The study was conducted in rural areas of Uasin Gishu County because the usage of solid fuel that is of interest to the study is higher compared to urban areas. Furthermore, Ndegwa *et al.* (2011) argue that rural communities are dependent on wood fuel with over 90 percent of rural households using firewood as their main household energy.

The study made use of multiple sources of data to ensure triangulation of data sources of research. The Primary data was collected using interview and observations research data collection tools. The primary data was then analysed using Thematic Data Analysis. This involved collecting, transcribing and coding data (Creswell, 2014). The coding process generated themes which was then analysed. The secondary data was collected from a number of documents reviewed. Data was collected on the traditional cook-stoves. The collected data was organized and analysed using the 17 documents Sustainable Development Goal and later compiled for interpretations using content analysis.

## Findings

### The Socio-economic Realities of the Communities in Uasin Gishu County in the Use of Cook-stoves

The study established there is over reliance on biomass fuels in the rural areas of Uasin Gishu County as they are the cheapest source of energy. This concurs with Mweu (2019) who asserts that in Kenya, there is over dependency on biomass fuels. The biomass fuels common in Uasin Gishu County include wood-fuel and agricultural residues. Welfle et al. (2020) concur that fuelwood (firewood) and charcoal are the most important wood-fuel in Kenya. The Agricultural Residues include maize cobs and dry maize stalks. Other sources of cooking energy found in households in Uasin Gishu County include Biogas and Liquefied Petroleum Gas (LPG). I did not come across any respondents using electricity, kerosene, ethanol or solar stoves.

The families with low income rely solely on the fuel wood (firewood) and agricultural residues as sources of cooking energy while the high income earners use firewood, charcoal, biogas and liquefied petroleum gas depending on their preferences. The firewood is sourced from the forests or cut from trees planted in farms. The study established that many women use the dried maize cobs since it is easily accessible, is very cheap and is easily stored in stores. A few households also use dry maize stalks as cooking energy. Maize cobs and maize stalks are easily accessible since Maize is the main food crop as well as cash crop in Uasin Gishu County.

### Preferred Cook Stoves

The traditional cook-stoves are the most preferred cooking stoves among the rural communities in Uasin Gishu County. The two types of traditional stoves that are common in Uasin Gishu County in Kenya include the open fire - made using three stones, and the cook-stove made using clay soil locally called *Chepkupe*.

The clay cook-stove, *Chepkupe* is the most preferred mode of cook-stoves in the rural areas of Uasin Gishu County. *Chepkube* cook-stove cooks faster and conserves firewood when compared to the three stones open fire. There are different sizes and designs of the *Chepkube* cook-stoves depending on the user preferences. *Chepkube* cook-stoves also can have an oven section to keep food warm especially for *ugali* which is the staple recipe made from maize (corn) flour in the region. Some women also design the clay cook-stoves in such a way that it can be used for cooking, as an oven as well as a chicken brooder. When one is cooking food the oven and the chicken brooder becomes warm. In addition, *Chepkupe* is safer when compared to the three stone cooking stove, because it is balanced and there is less open fire.

## **Emissions**

When one enters the traditional kitchen one can observe that the cook-stoves emit a considerable amount smoke especially when the maize cobs are used. The black soot which is caused by black carbon emissions discolours the walls and roof of the kitchen as well as the furniture found in the kitchen. The black soot also deposits on the utensils.

## **Pollution and Health Risks**

Most traditional kitchens are also poorly ventilated with one or two small windows which is insufficient and therefore there is considerable amount of indoor air pollution. Respondents in the study said that they cough and experience irritating eyes as a result of exposure to the smoke. Many women also complain of chest pain after exposing themselves to smoke as they cook food. Women who travel long distances to collect firewood often complain of back ache since they carry the firewood on their backs.

Women in the rural areas spend most of their time in the kitchen. Other family members also spend their time in the kitchen especially children in their formative years since they have to stay with their mother. Food is also served in the kitchen. This means children and other family members are exposed to indoor air pollution as much as the women.

The study established that women spend a lot of time collecting or splitting the firewood. They also spend a lot of time refilling the maize cobs into the fire since the maize cobs get depleted quickly. A lot of time is spent on collecting or splitting firewood instead of engaging in an economic activity.

Many households in the rural areas do not prefer using charcoal stoves because it is expensive to buy charcoal. The charcoal stove is also slow when compared to the traditional cook- stoves and it does to have an oven to keep *ugali* warm. On the other hand, Biogas is expensive to install and therefore it has remained a reserve for the high income earners households and those who through the help of Non-Governmental Organizations have the Biogas installed in their homes.

## **Traditional Cook-stove as a Barrier to the Attainment of Sustainable Development Goals**

The second Research Question of the study sought to investigate how the traditional cook- stove is hindering the attainment of Sustainable Development Goals (SDG) as discussed below.

## Poverty

The first goal of the 17 Sustainable Development Goals is to end poverty in all its form. This study established that the use of firewood in the traditional cook-stove is a setback in eradicating poverty. Many women in Uasin Gishu County spend a lot of time looking for firewood, splitting firewood or refilling the fire with maize cobs instead of engaging in economic activities and reducing poverty. Reddy (2012) agrees that the poor spend a lot of time sourcing for biomass fuel.

Health related problems associated to indoor air pollution also reduces women's, especially the poor, abilities to work and therefore exacerbating poverty among the rural communities. The dependence on wood fuel is also associated with poverty. The type of energy fuel used in household correlates with income and therefore solid fuel use is more prevalent in poor communities in Kenya (Masera *et. al.*, 2005). Poverty is also a constraint restraining communities from shifting from traditional biomass to modern energy use (Ngigi, 2008).

## Health Problems

The third goal of the Sustainable Development Goals Goal to ensure healthy lives and promote the wellbeing of all at all ages. The problem of emissions from traditional stove is a major health challenge. Factors that determine the extent to which Indoor air pollution (IAP) impacts health include: the degree of pollution from the cook-stoves, the degree of exposure of the smoke and personal susceptibility to the effects of IAP. The exposure to emissions from these stoves is responsible for many diseases. In addition, they also contribute to more than 2 million deaths each year in the developing countries (Nya, 2013) which is more than the deaths from malaria or tuberculosis.

## Access to Affordable Green Energy

The seventh goal of the 17 Sustainable Development Goals is to ensure accessibility to affordable, reliable, sustainable and modern energy for all. It is not possible to achieve this agenda when the rural communities still rely on traditional cook-stoves. The use of wood-fuel in the traditional cook-stoves is not sustainable. Our forest cover which is the source of the wood-fuel is depleting faster than the growth of trees. It is also not a modern source of cooking energy.

The twelfth goal of Sustainable Development Goals aims to ensure sustainable consumptions and production patterns. SDG (12.2) aims to ensure sustainable management and use of natural resources by 2030 which will not be realised when households continue to use the traditional cook-stoves and wood-fuel. The wood-fuel cook-stoves consumes firewood which is a natural resource at a faster rate than the amount of trees being planted.

The wood-fuel cook-stoves cause indoor air pollution which affects Air, an important natural resource. The incomplete combustion in fuel wood stoves releases smoke whose main components are: Suspended particles; Nitrogen oxides; Carbon monoxide; Sulphur oxides Carcinogens In addition, more than 18 percent of the black carbon (BC) emitted worldwide come from the toxic emissions produced by these stoves.

The traditional cook-stove exacerbates the climate change yet SGD 13 asserts that urgent action should be taken to combat climate change and its impact. The fuel wood stoves emit massive greenhouse gases (Ndegwa, Breuer & Hamhaber, 2011) due to inefficient combustion of the wood fuel. Greenhouse gases include methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), Carbon dioxide (CO<sub>2</sub>), black carbon (BC) and Fluorinated gases. These gases causes the planet to warm up (NRDC, 2011). When we use the wood fuels we also destroy the forests which help manage the green-house gases by absorb carbon dioxide (US EPA, 2013b).

SDG 15 aims to protect, restore and promote sustainable use of terrestrial ecosystem, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. However, this is not possible since the rural household rely on firewood and therefore in contrast, deforestation, land degradation and loss of biodiversity is bound to increase if no urgent intervention is not put in place to provide the rural livelihoods with alternative means of cooking energy.

The traditional cooking stove is characterised by higher consumption of firewood. This has contributed to deforestation (AAP Kenya, 2012), wood wastage (Ndegwa, Breuer & Hamhaber, 2011), reduction in carbon sinks (World Vision Australia, 2011) and soil erosion. The use of firewood also causes the clearance of vegetation and loss of plant species diversity (RoK., 2009)

## **Summary**

The study established that there is over reliance on biomass fuels in the rural areas of Uasin Gishu County as they are the cheapest source of energy. The use of the traditional cook-stoves is hindering the achievements of the following Sustainable Development Goals: The eradication of poverty (SDG 1); The attainment of healthy lives and wellbeing of all at all ages (SDG 3); Accessibility to affordable, reliable, sustainable and modern energy for all (SDG 7); Sustainable consumptions and production patterns (SDG 12); The management of climate change (SGD 13) and sustainable management of forests and does not combat desertification, and halt and reverse land degradation or halt biodiversity loss (SDG 15).

## Conclusion

The study concludes that the rural communities in Uasin Gishu County use the traditional cook-stove as the preferred cook-stove since it is a cheap source of energy and it can be used as an oven as well as the chicken brooder. However, to a large extent the Traditional cook stove is hindering the achievement of Sustainable Development Goals (SDG) especially in issues related to poverty, health, energy, climate change and sustainable forest management.

## Recommendations

The Energy policy makers should consider coming up with strategies of increasing access of cleaner energy solutions such as biogas or alternative source of cooking energy to reduce the over dependency of firewood.

Research on the effect of maize cobs as use of cooking energy should be investigated since it is used by the majority of households. Research should also be done on how the maize cobs can be converted to produce clean energy since maize cobs are easily available in large quantities.

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