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Comparative Analysis of Alternative Energy Adoption among Women in Rural and Urban Areas of Imo State: Implications for Women in Science and SDG 7

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ABSTRACT

This study investigated cooking fuel preferences among women in rural and urban sectors of Imo State, Nigeria. The aim of the study is to assess the use of cooking stove by women in the urban and rural areas of Imo state and to use the data obtained to check the progress toward Sustainable Development Goal (SDG) 7 in the state. Utilizing a survey research design, data were collected via questionnaires and oral interviews from 100 respondents, comprising of 50 women from World Bank Estate, Owerri (Urban) and 50 women from Ogbor Uvuru, Aboh Mbaise (Rural). The results indicated that in urban areas, 16% of respondents exclusively use Liquefied Petroleum Gas (LPG), while 12% rely on kerosene. Conversely, rural areas show a heavy dependence on biomass, with 14% using firewood exclusively, 15% employing a firewood-kerosene mix and 3% exclusively used gas in the rural area. From the findings, while urban women are transitioning toward cleaner fuels, rural women remain tethered to solid fuels due to availability, finance and cultural perceptions. The study recommends intensified environmental education from women in science and policy interventions from concerned quarters to reduce indoor air pollution and curb deforestation.

Keywords: SDG 7, Alternative Energy, Energy Stacking, Biomass, Women in Science, Indoor Air pollution

INTRODUCTION

Energy is one of the basic requirements on earth that without it, man's existence may be extinct (Alternative Energy, 2019). Energy is used in homes for numerous things among which lighting and cooking are included. Transition from traditional biomass to modern energy is one of the most significant challenges facing developing countries like Nigeria. Access to clean, reliable, and affordable cooking fuel is not merely a convenience; it is a critical determinant of public health, environmental sustainability, and economic productivity.

This study provides a comparative analysis of cooking fuel preferences between 50 rural and 50 urban households. It highlights a persistent "energy divide" which takes cognizance of the location of the respondents. This framework illustrates how households theoretically move from "low-grade" fuels like firewood to "high-grade" fuels like electricity or gas as their socio-economic status improves showing an energy ladder model.

The data obtained did not reveals straight transition rather it showed that households often engage in "Fuel Stacking" whereby they employed a simultaneous use of multiple fuels; for instance, using both Gas and Firewood to hedge against high costs of fuel and supply shortages (Masera et al., 2000).

The study revealed a dual challenge of Environmental and Economic challenges. It observed some outcomes which triggered off both the environmental impact like deforestation and emissions. It went further to observe the economic cost like household spending on cooking fuel and fuel stacking.

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With a lot of the total population still dependent on solid fuels (firewood and charcoal), there is pressure on local forest resources. The pressure remains dangerously high, accelerating deforestation and contributes to significant carbon emission. For rural households, reliance on firewood, which is often "free" in terms of cash but "expensive" in terms of time, spent gathering it, with the labour falling on women and children. This “time poverty” limits their economic and educational opportunities for the women and children respectively. Figures 1 and 2 show the hardship endured by women and their children in transporting firewood from the forest to their households.

Figure 1, African Women carrying Fire wood (Courtesy, Kahunzire, 2019

Women and children are exposed to different dangers ranging from bites from animals like snakes, and other dangerous exposures in finding the firewood in the forest and in transporting this firewood over long distances trekking to their homes. They can equally be exposed to gender-based violence (GBV) or animal attacks while in the bush (WHO, 2024; Premiere Times 2026).

Figure 2, School children in Northern Nigeria fetching firewood during school hours (Premium Times, 2013)

This energy poverty not only taxes their time, but exposes them to fatigue and other types of stress. World Bank (2025) opined that women in rural sub Saharan Africa can spend up to 20 hours a week trekking long distance to fetch firewood; a time that could have been used for more meaningful things. Not only does the women’s business suffer but their children education is equally affected.

The incomplete combustion of solid fuels creates a toxic indoor environment that disrupts respiratory homeostasis, leading to significant morbidity rates among women and children (Alzeer, 2024; World Health Organization, 2026). Recent assessments indicate that household air pollution is responsible for over 131,000 premature deaths annually in Nigeria, including approximately 76,000 children under five (Slater & Roche,

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2025). In Nigeria, particulate pollution (primarily from household smoke) is the third greatest external threat to life expectancy, trailing only malnutrition and malaria (AQLI, 2025).

The transition to modern renewable offers a dual-benefit: it helps mitigates anthropogenic climate forcing while liberating women from "time poverty" and the physical drudgery of fuel collection (Ember, 2026; Fischer-Kowalski & Schaffartzik, 2015). It ultimately aids in, achieving SDG 7 while providing the flexible energetic foundation necessary to ensure social equity and the long-term viability of the human species.

Despite Nigeria's geographic positioning as a tropical West African country with an abundance of solar irradiation, there is a significant disconnection between the potential thermal energy wealth and household reality. While solar and electricity represent clean, alternatives, the majority of the population remains tethered to carbon-intensive biomass. This is due to poverty, bad governance and limited infrastructure, approximately 72% of Nigerians depend on firewood for their primary cooking needs (Melah, 2015).

Statement of Problems

In Imo State of Nigeria several campaigns advocating better life and healthier environment are continually aired in our media houses. The fatality of inhaling smoke by the women is not left out. Women, as a major energy user in the home, need to be aware of trends and information around them to enable them adapt and improve their homes. There are many campaigns and enlightenments on global warming, climatic change, millennium development goals and sustainability development goals.

Alternative energy using cleaner cooking fuels in the home encourages cleaner environment. There has been some campaigns embarked on by many stakeholders. There must be genuine grassroots efforts to bring these campaigns home to have an impact on our women and their households. Most women still believe that using firewood brings out tastier food that other cooking fuels. Most of them are not aware of the danger they expose their households to by using firewood and fossil fuel, that are not environment friendly hence this study.

Nigeria, a vast land with changing weather and environmental conditions still experiences poor electricity supply. Most women in rural areas are not connected to electricity. Those connected have high electricity bills and cannot use electricity to cook; this makes it very difficult to rely on electricity as a source of cooking fuel.

Solar energy, is an environment friendly alternative energy that is in abundance in Nigeria. The use of solar energy is very expensive due to the solar panels being produced abroad. Everything about cooking with solar is expensive and might not be affordable for an average Nigerian woman.

Some women in Science carried out this research to find out the sources of energy used by women in cooking in their homes, the concept of alternative energy and the implications of their practices to the environment.

METHODOLOGY

This study was a survey work which was designed to inquire into the type of cooking fuel used by women in their homes. Survey research design was used for this study since it is seeking people's opinion, attitudes, behaviours and beliefs (Osuala, 2004). Questionnaires and oral interviews were used for collection of data. The interviewers sampled 100 respondents using multistage sampling technique.

In the first stage, 2 Local Government Areas (LGA) were purposively selected out of 27 LGA of Imo State, namely: World Bank Estate in Owerri West LGA and Ogbor Uvuru in Aboh Mbaise LGA.

The second stage involved the population use in this study. This constitutes of entire married women in Imo state while the sample consist of 100 women purposively taken from locations in World Bank in Owerri West and Ogbor Uvuru in Aboh Mbaise Local Government Area. The researchers used two groups of women for the study. The first group was 50 women from Ogbor Uvuru in Aboh Mbaise which stands for "Rural"; while the second group was 50 women at World Bank Estate Owerri designated as "Urban". The women were interviewed orally for duration of one month. The questionnaires were distributed by the researchers to avoid item mortality.

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Presentation of Data, Findings and Discussion

Age of Respondents

The data obtained from both the women living in Rural and Urban areas, was analysed and the table for the age of respondents is as shown in table 1.0

Table 1: Age of Respondents

Age	Residence		Percentage %
	Rural	Urban	
20-30 years	8	12	20
31-40 years	10	14	24
41-50 years	16	15	31
51-60 years	11	6	17
61-70 years	5	3	8
Total	50	50	100

Rural Area

From the data collected in table, a total of 8 women interviewed in the rural area were within the age of 20 -30 years. 10 respondents were within the age range of 31- 40 years, 16 women were within the age range of 41-50 years, 11 Women were within the age range of 51-60 years while 3 women were within the age of 60-70 years.

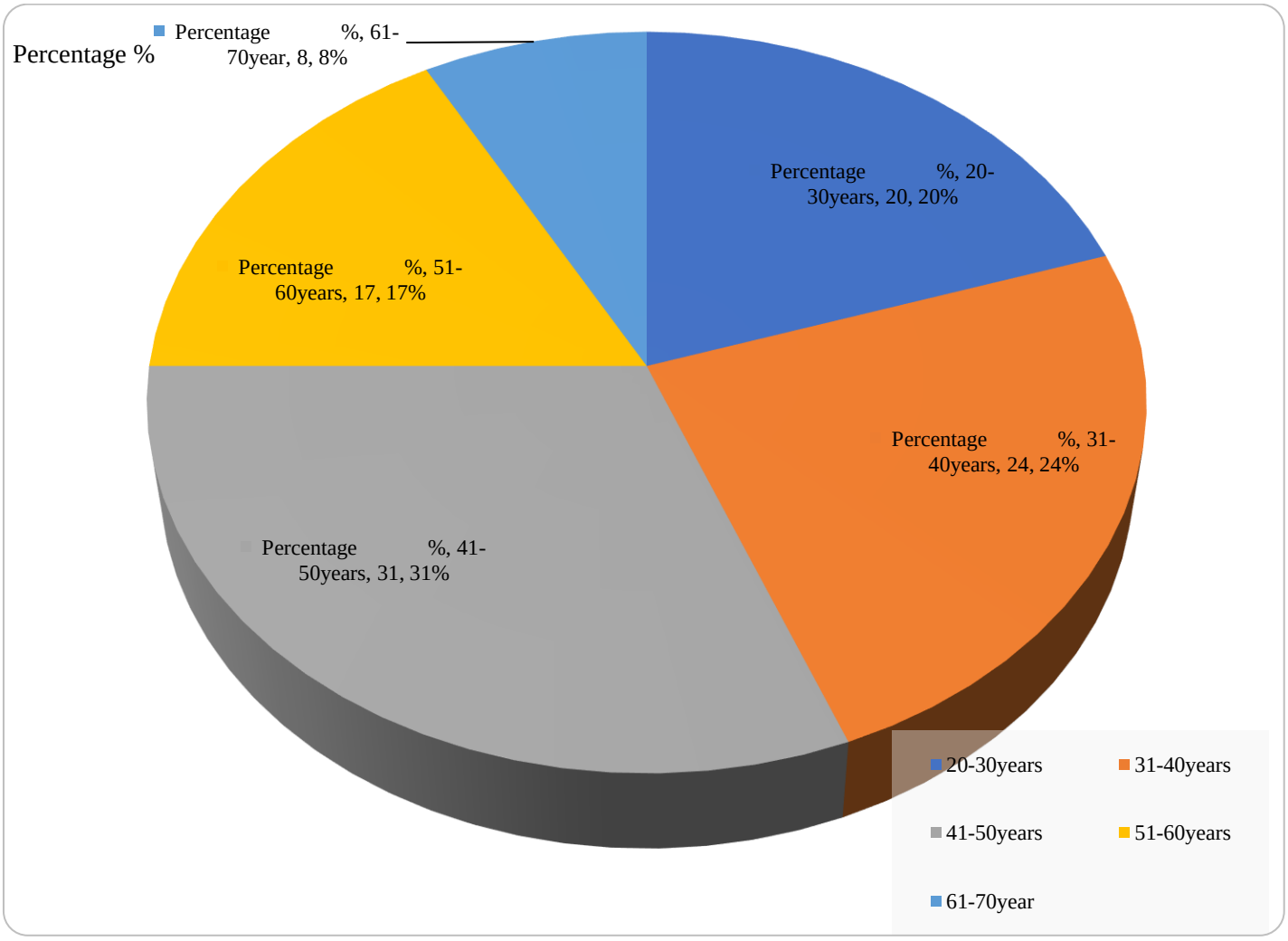

Figure 3: Age of Respondents

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Urban Area

For the women in urban areas, 12 respondents were within the range of 20-30 years, 14 women were within the range of 31- 40 years, 15 women were within the age 41-50 years,. Six women were within the age range of 51-60 years while 3 women interviewed in urban area were within the age range of 61-70 years. A figure showing the percentage age of the women is shown in figure 3.0.

Cooking Fuel used by Respondents

The cooking Fuel used by both the women in urban and rural areas is presented in Table 2.

Table 2: Cooking fuel used in Rural and Urban Area

Cooking Fuel	**Residence**		**Percentage %**
	Rural	**Urban**	
Firewood (F/W)	14	3	17
Firewood and kerosene (F/W and Kero)	15	5	20
Firewood and Gas (F/W and gas)	3	3	6
Firewood and Charcoal (F/W and Charcoal)	2	2	4
Kerosene (Kero)	10	12	22
Gas	3	16	19
Charcoal	1	0	1
Gas and Kerosene (Gas and Kero)	2	6	8
Firewood, Gas and Kerosene (F/W, Gas and Kero)	0	3	3
Total	50	50	100

Rural and Urban Area

Use of firewood

Firewood was the primary choice of respondents in rural area due to its availability and the cultural compatibility with traditional cooking methods (Ali et al., 2024).

14 respondents in the rural area used firewood only to cook. This makes it 28% of the total rural women sampled. Use of firewood as their sole fuel source, show that rural households exhibit a high reliance on solid fuels. Most of these brand of women admitted that food cooked over firewood has a special taste, and no other cooking source can produce food that tastes like food cooked with firewood. They cannot use another type of cooking source because it will not have the rich firewood flavour.

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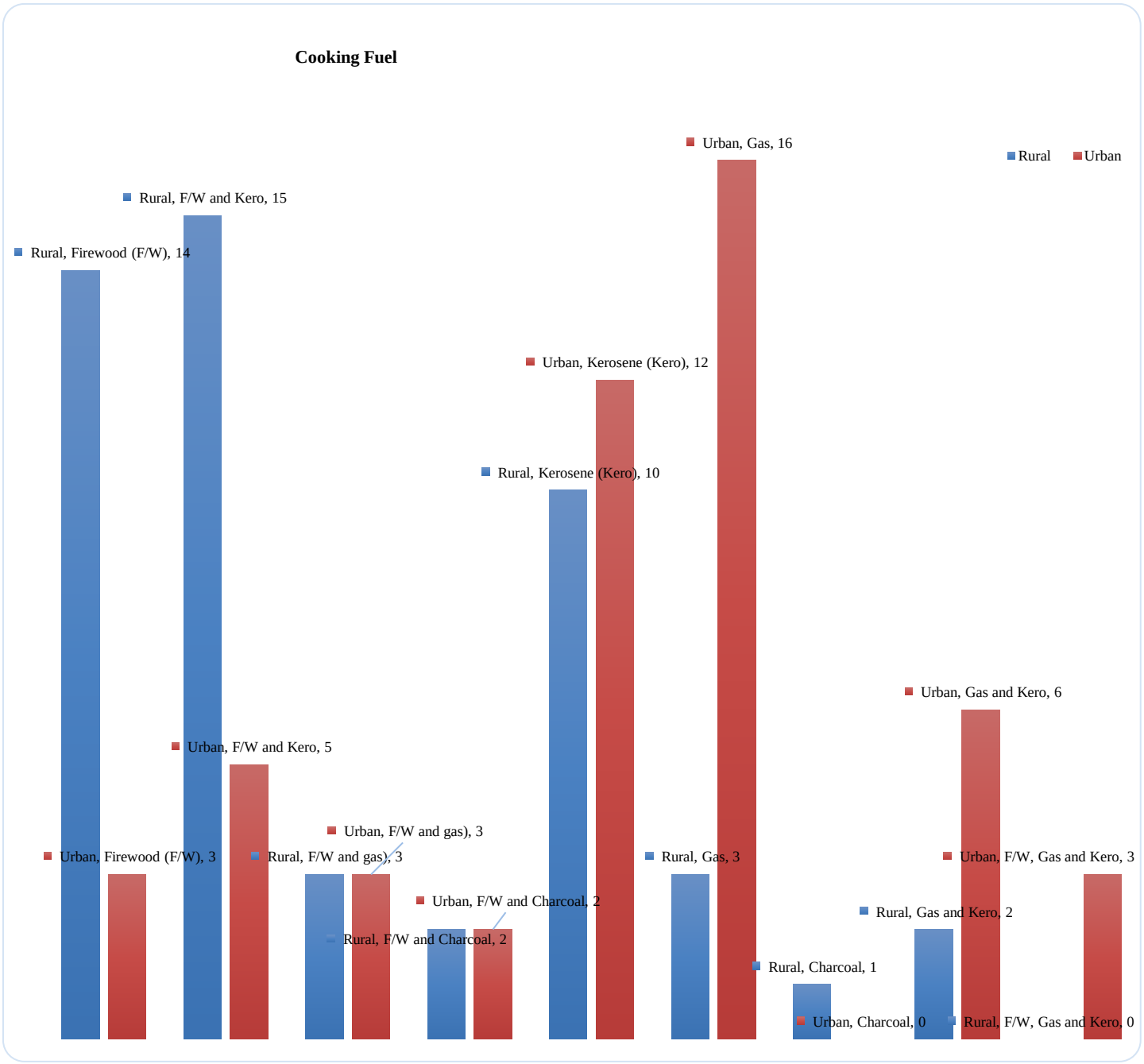

Figure 4, cooking fuel used by respondents in urban and rural area

When the residents in the rural area were asked how they procure the firewood, most of them admitted that they go into the bush to collect the firewood or they send their children to fetch firewood.

During the dry season, cooking with firewood is easy. Dry firewood is available in abundance unlike in the rainy season the firewood is wet and does not burn well. Due to the rains, cooking with firewood is done inside an enclosure. Wet firewood brings out a lot of smoke which affects the health of the women cooking and the children running errands around the kitchen. Even babies being carried on the back by the mothers while cooking inhale the smoke from the firewood.

Fuel stacking

During the rains, woods are wet and cooking outside because very difficult. Women use other fuel mix. This account for the percentage use of firewood and firewood mix to be 50%

The heavy reliance on firewood by rural women is often linked to the “free” nature of wood collection and the lack of modern energy infrastructure in remote areas

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Residents in urban areas do not usually have access to firewood. 3 respondents used firewood only in urban area. This may be due to the type of apartment they live in. For them to use firewood, they must have a space where they can cook with firewood. The landlord will not allow them to use firewood because it will mess up their apartment and the environment. This may account for the 6% of the total respondents in urban area using only firewood to cook.

Use of Kerosene

In the rural area, 10 respondents used Kerosene to cook while 12 respondents in urban area used Kerosene. 22% of total respondents used Kerosene to cook. This is so because the respondents switch over to cooking with kerosene stove during the rainy seasons. This accounts for the high number of women using kerosene to cook.

Kerosene remains a vital "transitional" fuel in urban areas, used by 24% of urban respondents, likely due to its portability and ease of purchase in small quantities (Aminu, 2024). Kerosene is easily accessible, stove can be bought at a cheap price, but in the long run, it might be more expensive due to its high price since fuel subsidy was removed.

Kerosene is readily available in filling stations. Occasionally when kerosene is scarce, people spend hours if not days in the gas/filling stations waiting to buy kerosene.

Respondents agreed that kerosene stoves bring out fumes which cause indoor pollution. Some women who use bad kerosene stoves have their kitchen painted with black soot.

Use of gas

Urban households demonstrate a significant move toward cleaner energy. 32% of urban respondents use Gas (LPG) exclusively, compared to only 6% in rural areas. The higher adoption of gas in urban centres is attributed to better distribution networks, higher income levels, and the prohibitive cost or unavailability of firewood in cities (Vo et al., 2024).

Cooking gas is refilled in gas plants. It is cheaper than kerosene. Most of the women agreed that gas is dangerous and there must be supervision for children to use it. Cooking with gas is clean; it burns well and is less stressful.

There is need for fuel stacking when use gas because it can finish abruptly. With availablity of a second gas cylinder or the use of fuel mix, one can conclude the cooking before refilling the gas.

Many households were found to be engaging in “fuel stacks,” often combining firewood and kerosene. The aim is to manage costs and protect against supply shortages of modern fuels (Azorliade et al., 2022). This strategy allows families to use firewood for long-duration tasks like boiling beans while saving gas for quicker needs (Vo et al., 2024).

Use of charcoal

1% of the respondent use charcoal. Charcoal is very expensive and takes a long time to catch fire. When it catches fire, it will burn to ashes, unless it is put off with water. Charcoal is usually used by food vendors and hawkers of roasted corn, roasted plantain and fish. Some food hawkers use charcoal to cook because once it catches fire, it can cook for a longer time.

Most often residents in urban areas live in flats. They do not have space for the use of firewood and may not have access to bushes and farms. They rely on kerosene and gas for cooking. Kerosene is not cheap to procure. Some kerosene cook stoves are not environment friendly as they release black smoke which burdens our atmosphere and environment.

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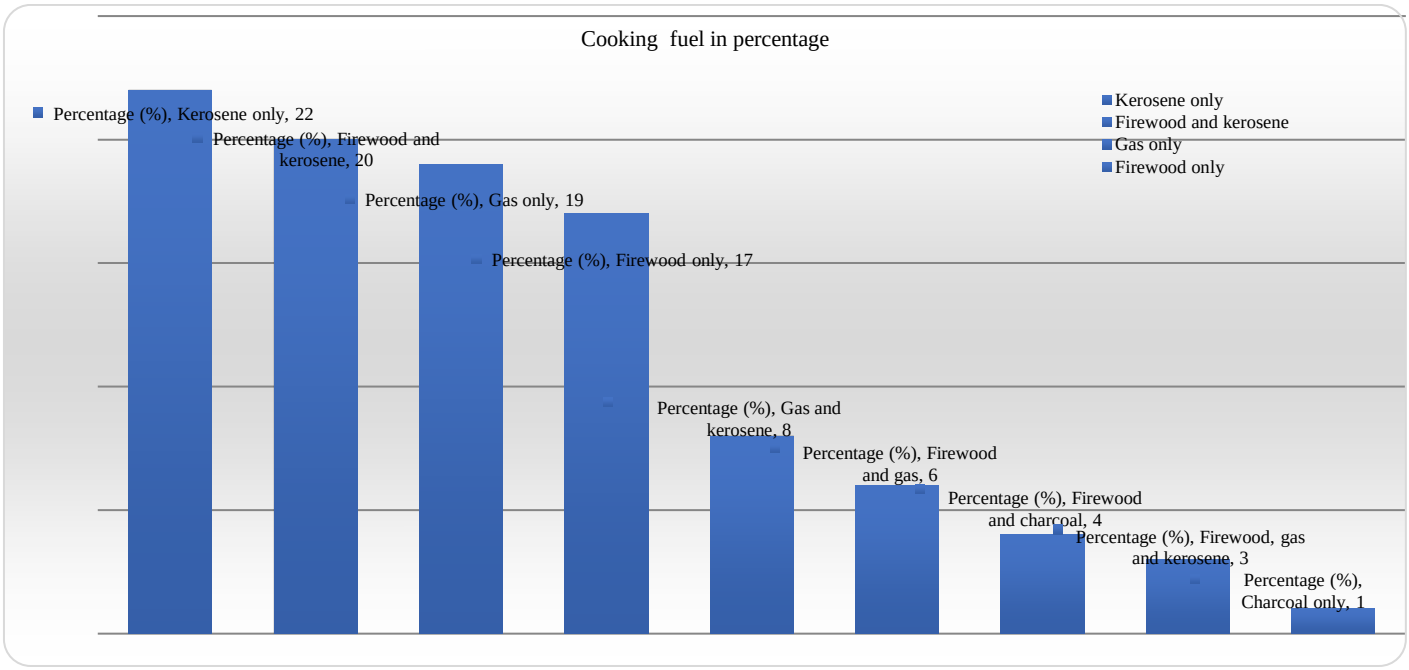

Figure 5, use of cooking fuel by both rural and urban residents

From figure 4, 22% of respondents used kerosene. Kerosene is the fuel used by the highest no of respondents in both Urban and rural areas. Kerosene is fossil fuel and aids indoor air pollution.

On health, 90% of all respondents accepted that firewood was not healthy. It affects their eyes, lungs and nose. 10% of the respondents agreed that cooking with firewood is okay, after all their parents and grandparents who use firewood had a longer life span than this present day generation.

Summary of Findings

Most Women in rural areas use firewood to cook

Heavy reliance on fossil fuel encourages deforestation.

Deforestation is a major driver of climate change and global warming. It equally increase the carbon footprint.

Women in urban area tend to embrace clean cooking fuel than those in the rural areas.

CONCLUSION

Most of the women in rural area rely on cooking with firewood this is not healthy for both human beings and the environment.

There was a stark contrast in cooking fuel preferences between rural and urban households. Those in urban areas have shifted toward modern, cleaner energy sources like Liquefied Petroleum Gas (LPG). This implies a broader trend in energy ladder transition. Women in rural areas remain heavily dependent on traditional biomass.

The reliance on biomass contributes to deforestation. Deforestation severely disrupts the global ecological balance like Climate Change. This is because the trees which act as a sink for carbon is turned into a source of carbon emissions which moves into the atmosphere. Deforestation accounts for roughly 10% to 15% of global greenhouse gas emissions by releasing stored carbon into the atmosphere.

From our findings, a lot of work needs to be done to educate the women especially the residents in rural areas on the need to use alternative and cleaner cookers to protect their family from indoor pollution.

Contribution to knowledge

The contribution to knowledge of this study is the awareness that our women need to be enlightened on the use of cleaner stoves for cooking. This will enhance their lives; give them a healthier life, save their time and those of their children. Above all they will live in a cleaner environment.

Declaration of interest

This manuscript is original and not sponsored by anyone. The women in Science came together to perform this project to help women as our contribution to knowledge.

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