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Assessment of the Use of Liquefied Petroleum Gas (LPG) as Cooking Energy Source Among Rural Households in Badagry Area of Lagos State

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Abstract

The need to promote the use of clean household cooking energy source as well as propagating safe and sustainable environment to cut down the number of human lives lost to the use of unsafe, inefficient and unhealthy cooking energy sources has informed the introduction of the Lagos LPG initiative. This study assessed the use of Liquefied Petroleum Gas (LPG) as cooking energy source among rural households in Badagry Local Government Area of Lagos state. A multistage sampling procedure was used to sample 140 respondents from seven rural communities of Badagry Area of Lagos state. A structured interview schedule was used to collect data from the respondents, these were analysed using descriptive (frequencies, percentages, means, and ranks) and inferential (Chi-square) statistics. The study revealed that the mean age of respondents was 34.18 years with majority being married (69.3%), Christians (60.0%), self-employed (83.9%), with average income of ₦14137.14 monthly and majority (91.4%) having household size of 1-8 persons. The use of LPG among respondents was low (38.6%) amidst high level of knowledge on the utilization of LPG (67.1%) and awareness of health risks associated with the use of alternative household cooking energy sources (70%).

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Major constraints limiting respondents' choice of LPG were lack of fund to purchase LPG ($\bar{x}$=1.31), scarcity of gas at skid plants (($\bar{x}$=1.29) and high cost of refilling gas (($\bar{x}$=1.15). Respondents' level of education (χ^2=9.05) and households' income (χ^2= 11.55) were significantly related to the use of LPG. Based on the findings of the study, it is recommended that efforts be made to reduce the incidence of poverty by introducing poverty alleviation programmes to improve the standard of living of the people, palliative measures to ensure the affordability of LPG should be considered and the government should also revisit the delivery system for LPG to ensure that availability is enhanced particularly at designated skid plants.

Keywords: Use; LPG; household; cooking energy sources.

1. Introduction

Energy is vital part of any nations' existence, it is the "life blood'' that drives economic and social development without which it becomes essentially difficult for an individual, community or even a nation to survive.

The household is responsible for about 15 to 25 percent of primary energy use in many developing countries. Average per capital household energy use in developed countries is about nine times higher than in developing countries, even though in developing countries a large share is provided by non-commercial fuels that are often not reflected in official statistics [1]. It is estimated that approximately 2.5 billion people in developing countries rely on biomass fuels to meet their cooking needs [1, 2]. Cooking in a household involve the use of solid fuel and nonsolid fuel [3]. The solid fuel consists of coal which is a fossil fuel and biomass fuel (BMF) like wood, charcoal, dung and crop residues. Worldwide, more than three billion people depend on solid fuels, including biomass (wood, dung and agricultural residues) and coal, to meet their most basic energy needs: cooking, boiling water and heating. The nonsolid fuel consists of kerosene, liquefied petroleum gas (LPG), gas and electricity [3].

According to [4], the use of biomass is not in itself a cause for concern. However, when resources are harvested unsustainably and energy conversion technologies are inefficient, there are serious adverse consequences for health, the environment and economic development. It further stated that about 1.3 million people –mostly women and children die prematurely every year because of exposure to indoor air pollution from biomass. Valuable time and effort is devoted to fuel collection instead of education or income generation, environmental damage can also result, such as land degradation and regional air pollution.

Literature has revealed that the rural people in low-income countries do not have access to sustainable energy needed such as electricity and gas. [5] Opined that rural energy occupies centre-stage in rural development issues and cooking energy has the major share in total household energy consumption. The author also posited that accessibility and availability of cooking fuels at affordable prices is becoming more difficult day by day for poor people, many of whom are outside the modern energy system.

To address some of the problems associated with energy use particularly those resulting from the use of traditional biomass, which of course include health and environmental issues [4] opined that vigorous and concerted government action is needed to achieve this target, together with increased funding from both public

and private sources. Policies to promote cleaner, more efficient fuels and technologies for cooking need to address barriers to access, affordability and supply, and to form a central component of broader development strategies.

As a strategic policy to move people away from the overreliance on biomass and curtailing its associated problems as well as problems resulting from poor electricity supply across Nigeria, the Lagos state government recently introduced the Liquefied Petroleum Gas (LPG) initiative (Eko gas scheme). Liquefied Petroleum Gas (LPG) is a product of the hydrocarbon refining process. It is possibly the cleanest and most efficient fuel available today. It is portable and convenient to use; with significant health, safety and environmental benefits compared to traditional fuels i.e. wood, coal, coconut husk, corn husk and charcoal [6].

The initiative is intended to ensure that through use of LPG by rural and low income households, Lagosians can have better health, a cleaner environment and more efficient/faster cooking time, thus, productive workforce will be enhanced. The LPG cylinders are affordable and portable and with the installation of skid plants, users can be ensured of a continued supply and ease of access. The LPG skid plants are expected to serve as refilling points for gas cylinders and also meeting the needs of the residents in the localities where they are sited. The scheme has been taken to Ikorodu LG, Isolo LCDA, Eredo LCDA, Badagry LG, Alimosho LG, Orile Agege, Ajeromilfelodun and Ojodu LCDA [6]. However, it has been observed that a significant proportion of households in these places where LPG has been introduced still make use of other forms of household energy sources outside LPG which is a major setback to the LPG initiative and thus ensuring that the overall objectives are not attained. Understanding the issues arising from the utilisation of LPG will help create a road map for the sustainability of this initiative (Eko gas scheme); it is against this backdrop that this research assesses the utilisation of LPG as household cooking energy source among rural households in Badagry area of Lagos state. The study therefore looked into the following objectives

1. identify the socio-economic characteristics of respondents in the study area;
2. determine the knowledge level of the respondents' on the utilisation of LPG in the study area;
3. ascertain if they are aware of the health risks associated to the use of alternative household's cooking energy sources to LPG
4. determine the level of use of LPG as cooking energy source by the respondents in the study area
5. identify constraints faced in the use of LPG over as household cooking energy sources in the study area

2. Materials and methods

2.1. Description of study area

The study was carried out in Badagry, one of the well-populated towns in Lagos State, South west Nigeria. Badagry is endowed with lagoon system, deltaic distributaries, floodplains and mangrove swamps. It is a bicultural and multilingual town harbouring the natives called the Aworis and immigrants from neighbouring Ghana, Benin Republic and Togo. It lies within longitude 2°42'E and 3°42'E and stretches between Latitude 6°22'N and 6°42'N, sharing boundary with Republic of Benin. It directly connects with Nigeria's 960 km of coastline bordering the Atlantic Ocean in the Gulf of Guinea, a maritime area of 46,500 km^2 with depth of up to

50 m and an Exclusive Economic Zone of 210,900 km^2. It is important for both artisanal and commercial fisheries, and as well as transportation, recreation and domestic purposes. It serves as a means of livelihood for many villagers, and fishermen and women. The creek separates the mainland sedimentary basin of South-west Nigeria from the Atlantic coastline. The creek exhibits relatively high species richness, which might possibly be due to succession of species temporarily using the environment for feeding, spawning and shelter. The population of the study involves all rural women from the households who are involved in cooking activities in the selected communities.

2.2. Study design

A multi-stage sampling procedure was adopted for this study. In the first stage, stratified sampling technique was used to break Badagry local government into strata i.e. stratum A - urban communities (Badagry, Topo and Idale Whedakoh), stratum B - peri-urban communities (Iworo, Ajido, Povita, Ilado, Aradagun and Aklakumo) and stratum C - rural communities (Okunmesan, Okun Kundun, Okun Kojo, Okun Ibrahim, Okun Idose, Poriso, Daddy Louis, Yafin Sitogbetome, Epeme, Okun Muba, Muba and Okun Tafi). Simple random sampling technique was used in second stage to select seven communities from stratum C - rural communities (Okun Muba, Okun Ibrahim, Okun Kojo, Epeme, Muba, Yafin and Sitogbetome). Thereafter, snowballing technique was used to identify rural households with women who are involved in cooking, from which 20 respondents where sampled from each of the seven rural community to give a total of 140 respondents.

Interview schedule was used to collect information on the respondents' socioeconomic characteristics, knowledge on the use of LPG, awareness of the health risks associated with the use of the alternatives to LPG, constraints to the use of LPG and level of use of LPG among respondents. Use was measured on a three point scale of always use, rarely use, and never use, scores of 2, 1 and 0 were awarded respectively, score were computed and the mean score was used to re-categorise into low and high level of use. Knowledge on the use of LPG was measured by responding yes or no to some statement items, scores of 1 and 0 were awarded accordingly. Level of awareness of the health risk associated with the use of the alternatives to LPG was measured on a two point scale of aware or not aware with a score of 2 and 1 respectively, the mean score was used to re-categorise into high and low awareness. Constraints to the use of LPG was measured on a three point scale of severe, mild and not a constraint scores of 2,1 and 0 were awarded accordingly, mean scores were computed and used to rank the constraints. Data were analysed using descriptive (frequencies, percentages, means, and ranks) and inferential (Chi-square) statistics.

3. Results and discussion

3.1. Socioeconomic characteristics

Result in Table 1 shows that larger proportions (76.4%) of the respondents were below 41 years of age with a mean age of 34.18. This implies that majority of the respondents were relatively young. Age of an individual can be of great importance or a factor in their preference for materials to be used for cooking. The taste and perceived benefits of cooking energy source to an individual can also be attributed partly to their age. The finding from this study is supported by [7] who posited that majority of work force falls within the ages of 20-40

years. This is the age in which individuals are very energetic and may be actively involved in livelihood activities that demand more of their time thus make the use of an efficient energy more likely. About 69.3% of the respondents were married while 21.4%, 3.6%, 5.0% and 0.7% were single, divorced, widowed and separated respectively. This implies that there were more respondents who were married, suggesting a high level of married individuals in the study area who are saddled with the responsibility of catering for their families. This result corroborates the findings of [8] and [9] who maintained that majority of rural households are married it. Furthermore, more than half (67.8%) of the respondents had one form of education or the order. A high level of education could influence the use of LPG. This assertion corroborates the view of [10] that the basic objective of any form of education is to impart knowledge which would influence a change in attitude, skill or knowledge. The results also shows that there were diverse livelihood activities among the respondents these include trading (32.9%), artisans (31.4%), fishing (17.9%), farming (7.9%), teaching (5.0%), cleaner (3.6%) and clerics (1.4%). The finding of this study negates the findings of [8] who opined that the largest percentages of rural dwellers are crop farmers. About half (49.5%) of the respondents earn between ₦1000 - ₦10999 monthly, with an average monthly income ₦14137.14. This suggests a very poor income profile when placed side by side the cost of living in the country. This corroborates [8] and [7] that majority of rural workforce earns 10,000 on the average in a month and it is also consistent with the findings of [11] that major problem facing women in rural area is poverty. An overwhelming majority (91.4%) of the respondents had household size between 1-8; the mean household size was 5. This implies that respondents have relatively large household size for which they are responsible and it is expected that they will seek a cost effective and efficient way of cooking.

3.2. Knowledge of the utilisation LPG

Table 2a shows the distribution of respondents based on knowledge of the utilisation of LPG**.** A sizeable proportion (65%) of the respondents agreed that lighting of LPG cooker should be done immediately it is turned on, 71.4% disagreed that water should be used in turning off the LPG cooker. Only 49.3% of the respondents agreed that LPG is cheaper compared to other sources of cooking energy. Also, 75.7% of the respondents disagreed with continuation of cooking whenever the LPG cylinder is leaking. Majority of the respondents (67.1%) disagreed with turning on of the LPG cooker when not in use as safe. However, only 35% agreed that the fume from LPG cooker blackens the wall of the house. Apparently, 70.7% agreed that cooking is faster when cooking with LPG cooker, 32.9% disagreed that a leaking cylinder must be repaired before used and 38.6% agreed that cooking with LPG cooker generate foul smell. Finally, 71.4% of the respondents disagreed that automatic ignition LPG cooker requires the use of matches.

The result on table 2b shows that 32.9% of the respondents had low level of knowledge about the utilisation of LPG while majority 67.1% had high knowledge.

The implication of this result is that significant numbers of the respondents had high knowledge of the utilisation of LPG. This may be due to the fact that most had one form of education or the other and might influence their knowledge of the utilisation of LPG.

Table 1: Socio-economic characteristics of respondents (n=140)

Variables	Frequency	%	Mean	SD
Age (years)				
Less than 20	16	11.4		
21-30	48	34.3		
31-40	43	30.7	34.18	11.68
41-50	23	16.4		
51-60	5	3.6		
Above 60	5	3.6		
Marital status				
Single	30	21		
Married	97	69		
Divorced	5	4		
Separated	1	1		
Widowed	7	5		
Level of education				
No formal	45	32.2		
Primary	50	35.7		
Secondary	36	25.7		
Tertiary	9	6.4		
Types of occupation				
Trading	46	32.9		
Fishing	25	17.9		
Teaching	7	5.0		
Farming	11	7.9		
Cleaner	5	3.6		
Cleric	2	1.4		
Artisans	44	31.4		
Monthly household income (₦)				
≥10,999	69	49.5		
11,000-20,999	49	34.9	14137.14	10,035.19
21,000-30,999	11	7.8		
31,000-40,999	9	6.4		
41,000 and above	2	1.4		
Household size				
1-4	69	49.3	5	

5-8	59	42.1
9-12	10	7.1
13-16	1	0.7
Above 16	1	0.7

Source: Field survey, 2015

Table 2a: Distribution of respondents based on knowledge of utilisation of LPG

Variables (N=140)	**Yes**		**No**	
	F	**%**	**F**	**%**
Do you know that you are to light your LPG/gas cooker immediately you turn it on?	91	65	49	35.0
Water is used in turning off LPG/gas cooker	40	28.6	100	71.4
It is cheaper to cook with LPG/gas cooker compare with other cooking energy sources	69	49.3	71	50.7
You can continue with your cooking even when your LPG/gas cylinder is leaking	34	24.3	106	75.7
It is safe to turn on your LPG/gas cooker without lighting it	46	32.9	94	67.1
The fumes from the LPG/gas cooker blackens the wall of the house	49	35.0	91	65.0
Cooking is faster when cooking with LPG/gas cooker	99	70.7	41	29.3
You have to refill your cylinder when it's empty	97	69.3	43	30.7
A leaking cylinder must be repaired before use	94	67.1	46	32.9
Does cooking with LPG/gas cooker generate a foul smell?	54	38.6	86	61.4
Automatic ignition LPG/gas cooker requires the use of matches	40	28.6	100	71.4

Source: Field Survey, 2015

Table 2b: Categorisation of respondents based on the level of knowledge on the utilisation of LPG

Level of knowledge	**Scores**	**Frequency**	**Percentages**
High	**7.34-11.0**	**94**	**67.1**
Low	**0.0-7.33**	**46**	**32.9**

Source: Field Survey, 2015 *mean=7.34

3.3. Respondents' awareness of health risks associated with the use of alternative household cooking energy sources

The result in Table 3a gives the description of responses to the awareness of health risks associated with the use of alternative household cooking energy sources. Most (89.9%) of the respondents were aware that kerosene stove fumes can lead to respiratory infection, 92.9% also agreed that eye irritation can be caused by wood

fumes, and 84.3% of the respondents were aware that coconut husk fumes when inhaled can lead to asthma. The respondents further indicated that they are aware that the inhalation of fumes when using sawdust in cooking can lead to lung cancer (71.4%). Accumulation of fumes inhaled when cooking fish with charcoal can cause acute respiratory infection (67.9%). Cooking of fish with coconut husk can cause discomfort to the eyes (89.3%). Frying or cooking with kerosene stove can cause eye disease (79.3%). Cooking with electric cooker can lead to electricity shock (84.3%), Excessive inhalation of carbon-monoxide produced from the incomplete combustion of coal can lead to death (65.7%). The sparks coming from wood when cooking can cause burns (100.0%).

This result implies that majority of the respondents were aware of the health risk associated with the use of alternative household cooking energy sources. Their awareness might influence their utilisation of LPG since it is an environmentally-friendly cooking energy source. the result also suggest that that the health effects of using solid fuels such as wood, charcoal, sawdust and animal dung have substantial negative impact in the health of rural dwellers especially the women. These diseases include; asthma, respiratory infection, lung cancer, acute respiratory infection and other diseases that can lead to death. This is consistent with the submission of [12]who posited that the World Health Organization (WHO) estimates that 1.5 million premature deaths per year are directly attributable to indoor air pollution from the use of solid fuels. Table 3b on the categorisation of the level of awareness of health risks associated with the use of alternative household cooking energy sources shows that 70% and 30% of the respondents had high and low awareness level respectively of health risks associated with the use of alternative households cooking energy sources .While the result on table 3a is impressive, the result on table 3b is an affirmation that majority of the respondent are aware of the impending implications from the continual used of the alternatives. It is expected that their awareness will favour attitudinal change towards the use of LPG.

3.4. Use of LPG energy sources for cooking

The result in Table 4a indicates that 13.6% of respondents utilised LPG, 25.0% use rarely, while 61.4% never use LPG. Table 4b on the categorization also indicated that the level of use LPG among respondents in the study area is still very low (38.6%) even with the high level of awareness of the palpable health risk associated with the use of the alternative energy sources thus implying that knowledge maybe a necessary condition for change in this instance but it is not in itself a sufficient condition. The result is also indicative of the fact that the use of the alternatives still dominates in the study area a situation characterized by rural areas in Nigeria. This is consistent with the argument of [13] that Nigeria, like other developing nations, derived more than one quarter of her energy from traditional fuel. These findings suggest that a lot still needs to be done in order to ensure that the objectives of the initiative are attainable and sustainable.

3.5. Constraints faced in the use of LPG over alternative sources

The result in Table 4 shows that Lack of fund to purchase gas ranked highest in terms of constraints faced in the use of LPG over alternative household cooking energy sources with a mean score of 1.31. This was closely followed by Scarcity of gas at skid plant ($\bar{x}$ =1.29), high cost of refilling LPG cylinder ($\bar{x}$ =1.15) and Fear of

house burning ($\bar{x}$ =1.04).

Table 3a: Distribution of respondents based on their awareness of health risks associated with the use of alternative household cooking energy sources.

Variables (N=140)	Not aware		Aware	
	F	%	F	%
Kerosene stove fumes can lead to respiratory infection	17	12.1	123	89.9
Eye irritation can be caused by wood fumes	10	7.1	130	92.9
Coconut husk fumes when inhaled can lead to asthma	22	15.7	118	84.3
The inhalation of fumes when using sawdust in cooking can lead to lung cancer	40	28.6	100	71.4
Accumulation of fumes inhaled when cooking fish with charcoal can cause acute respiratory infection	45	32.1	95	67.9
Cooking of fish with coconut husk can cause discomfort to the eyes	15	10.7	125	89.3
Frying or cooking with kerosene stove can cause eye disease	29	20.7	111	79.3
Cooking with electric cooker can lead to electricity shock	22	15.7	118	84.3
Excessive inhalation of carbon-monoxide produced from the incomplete combustion of coal can lead to death	48	34.3	92	65.7
The sparks coming from wood when cooking can cause burn.	0	0.0	140	100.0

Source: Field survey, 2015

Table 3b: Level of awareness of health risks associated with the use of alternative household cooking energy sources

Level of knowledge	Scores	Frequency	Percentages
High	8.23 – 10.00	98	70
Low	3.00 – 8.22	42	30

Source: Field survey, 2015 *mean=8.23

Table 4a: Distribution of respondents by their use of LPG energy source for cooking

Variables (N=140)	Never		Rarely use		Always use	
	F	%	F	%	F	%
LPG	86	61.4	35	25.0	19	13.6

Source: Field survey, 2015

Table 4b: Categorisation of the level of use of LPG energy source for cooking

Level of use	Scores	Frequency	Percentages
High	0.65– 2.00	54	38.6
Low	0.00– 0.64	86	61.4

Source: Field survey, 2015 *Mean = 0.65

The findings on the lack of fund to purchase LPG as major constraints is an indication that poverty still loom in the study areas, this findings is in line with the argument of [14] that poverty is particularly severe in rural areas, where up to 80 percent of the population live below the poverty line and with limited access to social services and infrastructures. It is also in agreement with the finding of [3] who posited that as regard the use of gas, high household income and wealth were also associated with the use of gas in both the urban and rural areas respectively. The findings is also a justification that choice of a particular cooking energy sources in the study area is dependent on a complex of factors, this is consistent with the submission of [13] that the choice of a particular cooking energy is influenced by some factors, among which price is considered to be a major factor, the availability and affordability of a particular cooking fuel, as well as the ease in getting these fuels, plays a major role in the choice of the energy in Nigerian homes. All of these put together may be responsible for the poor level of use of LPG among respondents in the study area. On the other hand, lack of technical knowhow ($\bar{x}$ =0.26) was the least constraint faced by respondents suggesting that expertise on the use of LPG was not responsible for the low level use of LPG in the study area.

3.6. Relationships between socioeconomic characteristics and use of LPG

Table 5 shows that the level of education (χ^2 = 9.05, P= 0.029) and income (χ^2 = 11.55, P= 0.021) were significant related to use of LPG in the study area. This implies that respondent's education and income influences the use of LPG. This result corroborates the submission of [3] that the level of education determines the household income, knowledge attributes and preference of a woman for cleaner fuel. Women who are highly educated are more likely to be engaged in white collar job in which there is limited time for sourcing of solid fuel for cooking. On the other hand, age household size and marital status were found not to be significant with the use of LPG in the study area (χ^2=7.11, 2.33, 3.24 and 5.60 respectively; P> 0.05). This implies that age, household size and marital status did not influence their decision to use LPG.

4. Conclusion and recommendation

The study concludes that use of LPG among women was low despite the general level of high awareness of the health risk associated with the use of the alternatives to LPG and the high knowledge level on the use of LPG in the study area. Lack of funds to purchase gas, scarcity of gas at skid plant and high cost of refilling gas were the major constraints that hinders the utilization of LPG. Efforts should be aimed at reducing poverty by introducing poverty alleviation programmes to improve the standard of living and other palliative measures to ensure affordability of LPG should be considered, the government should also revisit the delivery system for LPG to ensure that availability is enhanced particularly at designated skid plants.

Table 4: Distribution of respondents based on constraints faced in choosing LPG over other household energy sources

Variables (N=140)	Very severe		Severe		Not a constraint		Mean	Rank
	F	%	F	%	F	%		
High cost of refilling gas	62	44.3	37	26.4	41	29.3	1.15	3rd
Lack of fund to purchase gas	80	57.2	23	16.4	37	26.4	1.31	1st
Scarcity of gas at skid plant	73	52.1	34	24.3	33	23.6	1.29	2nd
Unavailability of skid plant to refill	34	24.3	52	37.1	54	38.6	0.86	6th
Limited number of cooking points	5	3.6	62	44.3	73	52.1	0.51	8th
Fear of house burning	56	40.0	33	23.6	51	36.4	1.04	4th
Scarcity of refilling station	36	25.7	51	36.4	53	37.9	0.88	5th
Distance of refilling	34	24.3	52	37.1	54	38.6	0.86	6th
Lack of space for cylinder safety	17	12.1	29	20.7	94	67.1	0.45	9th
Lack of technical knowhow	7	5.0	23	16.4	110	78.6	0.26	11th
Lack of preference for LPG	17	12.1	29	20.7	94	67.1	0.45	9th

Source: Field survey, 2015

Table 5: Relationships between socio economic characteristics and use of LPG

Variables	Df	χ^2 value	P-value	Decision
Age	5	7.11	0.212	NS
Household size	4	2.33	0.675	NS
Households Income	4	11.55	0.021	S
Level of education	3	9.05	0.029	S
Marital status	4	5.60	0.231	NS

Source: Field survey, 2015

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