

CLEAN AND IMPROVED COOKSTOVES AND END-
USER FINANCE SOLUTIONS FOR CLEAN ENERGY
SOLUTIONS IN ADAMAWA STATE, NIGERIA
HOUSEHOLD SURVEY ANALYSIS
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1. Background

1.1. General demographic information on Adamawa state

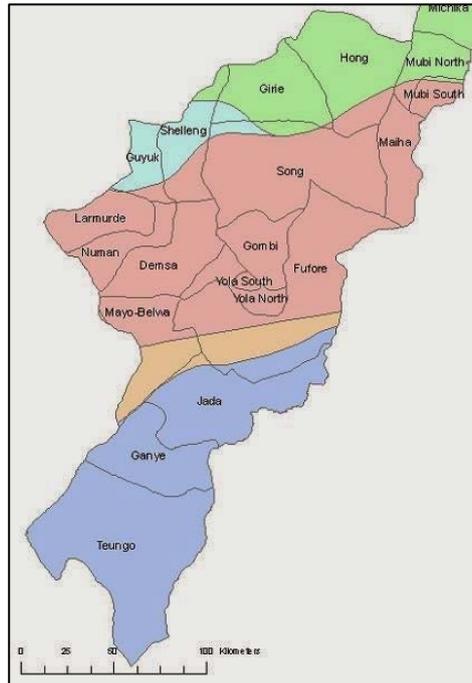


Image 1: Map of Adamawa

Adamawa state is located in northeast Nigeria, bordered to the east by Cameroon and to the north by Borno State (the epicentre of the Boko Haram insurgency since 2009). Nigeria conducted its last census in 2006. Since then, the National Population Commission (NPC) has provided periodic estimates for the country's total population as well as the population of states based on each state's share of Nigeria's population in 2006 and the estimated annual national population growth rate of 2.9 percent. In 2006, Adamawa's population was 2.24 percent of Nigeria's population and, at the estimated annual population growth rate of 2.94 percent, Adamawa's population would have grown to 3.67 million in 2011 and to 4.5 million by 2018. Adamawa's two largest towns are Yola, with an estimated population of 400,000 and Mubi with a population of approximately 150,000. The population density in Adamawa state is estimated to be 99.5 persons per km². While Nigeria's total fertility rate in 2011 was 5.7, the rate was significantly higher in Adamawa at 7.2.¹

Other than being a large and relatively remote state with a higher-than-average fertility rate, Adamawa is also a predominantly rural state and most residents depend on farming for the majority of their incomes. Adamawa ranks in the bottom half among Nigeria's states in income, quality of infrastructure, literacy, and health. A 2009 survey conducted by the Nigerian Bureau of Statistics, found that for 65.2 percent of respondents, farming was their most important source of income. The main cash crops are cotton and groundnuts. The adult literacy rate in Adamawa in 2006 was 49 percent in rural areas, 70 percent in urban areas, 67 percent among men, and 44.8 percent for women. When observations were conducted in 2011, 49 percent of children in Northeast Nigeria were found to be stunted.² In 2017, Adamawa state had an unemployment rate of 6% and an underemployment rate of 27.4%.³

¹ National Population Commission [Nigeria]. 2013. Nigeria Demographic and Health Survey 2013. Abuja: National Population Commission.

² Samuels *et al.*, 2011. <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/7359.pdf>

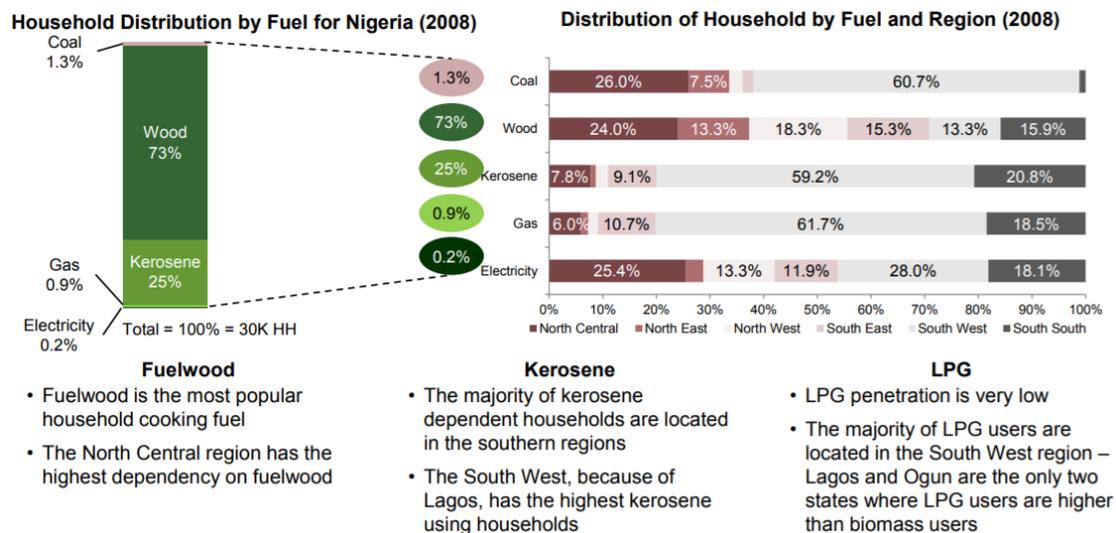
³ National Bureau of Statistics of Nigeria, 2017, www.nigerianstat.gov.ng/download/694

1.2. Brief energy profile of Nigeria

Nigeria is one of the largest oil producers with the second largest proven oil reserve in Africa. It is also the third largest bioenergy producer and possesses some of the largest gas reserves in the world. Inevitably, Nigeria's electricity production is heavily reliant on fossil fuel with 91.5% of electricity produced in 2015 coming from such sources.⁴ According to USAID, about 45% of the population have access to grid electricity, leaving 20 million without access mostly in rural areas (2018)⁵. Grid electricity supply in the country suffers from limited supply capacity and reliability issues. Most common alternatives to grid electricity in Nigeria include Pico devices, solar home systems (SHS), and mini-grids, for which access to financing has grown over the recent years.

With regards to energy for cooking, less than 10% of cooking in Nigeria qualifies as clean cooking. Reliance on woodfuel and kerosene for cooking and lighting is high in rural areas and even today, LPG penetration remains largely confined to urban and peri-urban areas in Nigeria. However, recent developments show a dramatic increase in LPG consumption from 5,000 metric tonnes in 2007 to about 600,000 in 2017⁶. Woodfuel in Nigeria is mostly sourced from wood, which contributes to severe deforestation; charcoal only represents 5% of the biomass used.⁷ According to a study conducted in 2016, kerosene and woodfuel were the main energy sources used for cooking in Adawama state while electricity was most used for lighting (followed by kerosene).⁸

The use of kerosene and solid fuels for cooking and lighting is the most significant source of household air pollution. Estimates by the Global Alliance for Clean Cookstoves show that solid fuel usage (especially with open or three stones fire) caused approximately 80,000 deaths annually, representing 3.8% of the national diseases burden.⁹



Source: Clean Cookstoves Alliance, 2011.

⁴ UNEP, 2017,

http://wedocs.unep.org/bitstream/handle/20.500.11822/20520/Energy_profile_Nigeria.pdf?sequence=1&isAllowed=y

⁵ USAID, Power Africa. (2018). Power Africa Fact Sheet. <https://www.usaid.gov/powerafrica/nigeria>

⁶ Banner Energy, 2018.

⁷ DHS (2013). Nigeria Demographic and Health Survey.

⁸ Akut & Adebayo, 2016,

https://www.researchgate.net/publication/325366407_THE_DETERMINANTS_OF_HOUSEHOLD_ENERGY_CONSUMPTION_IN_JIMETA_ADAMAWA_STATE

⁹ Global Alliance for Clean Cookstoves, 2011, http://cleancookstoves.org/resources_files/nigeria-market-assessment-mapping.pdf

1.3. Introduction to the survey and respondents

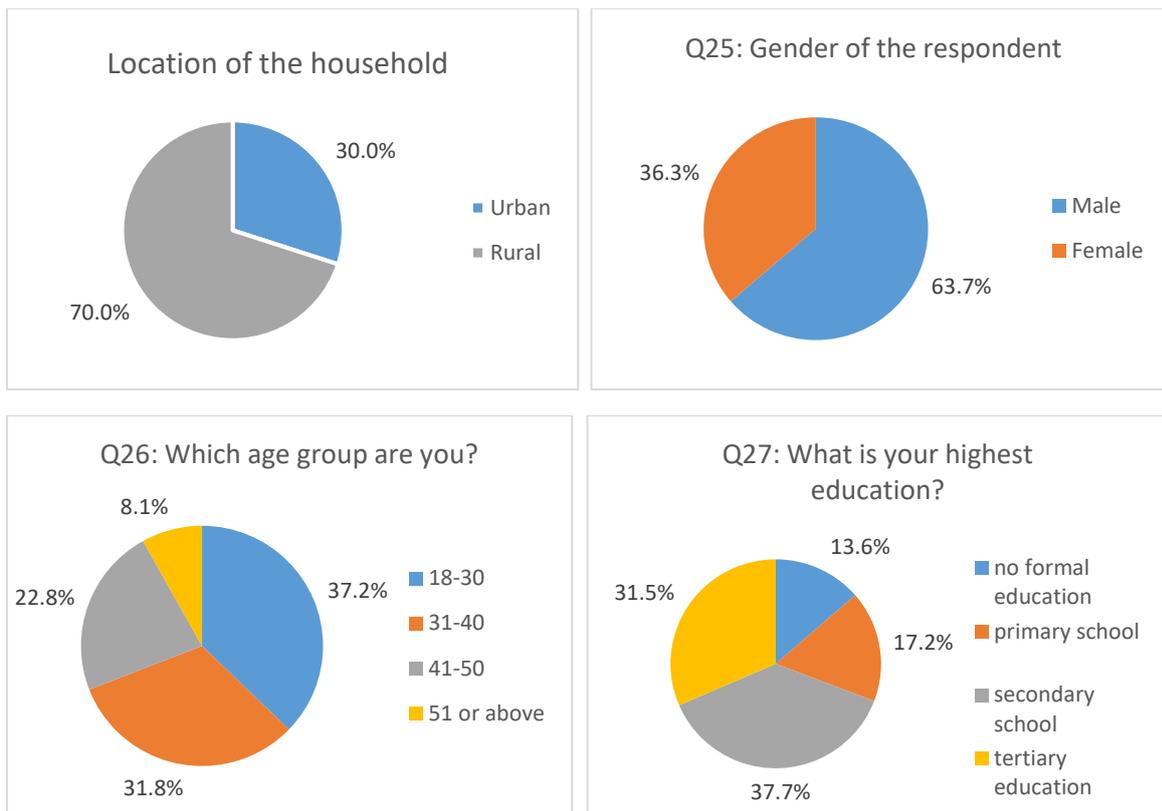
The data presented in this report was obtained through a survey conducted by a researcher during a field visit facilitated by Standard Microfinance Bank Ltd. (SMB), as partner of the project, in the state of Adawama in the northern part of Nigeria in 2018. The survey contained 34 questions relating to households' demographic characteristics, their cooking and lighting habits in general and the use of cook stoves and solar lamps in particular.

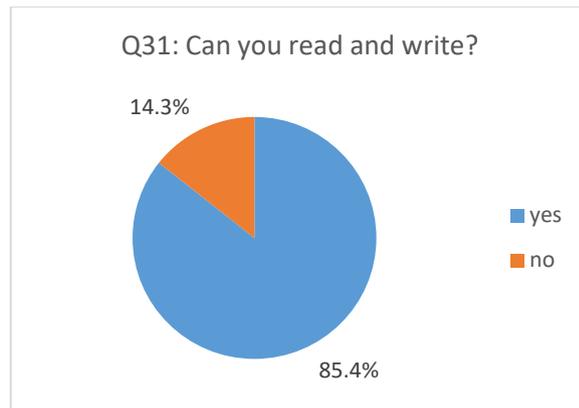
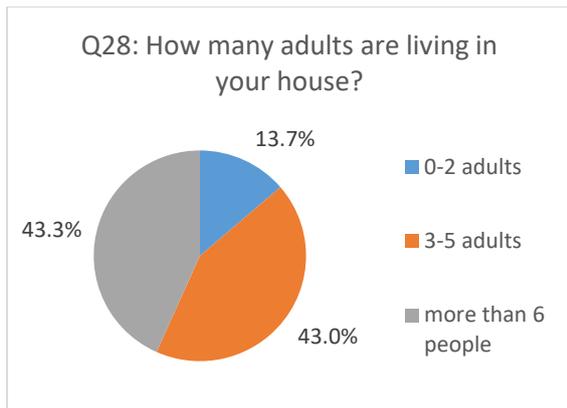
Objective of the survey

The objective of this survey was to explore the potential for introducing cleaner energy technologies such as improved cookstoves and solar lamps in Adawama, and inform the design of a suitable financial mechanism to enable communities to acquire them with the support of SMB.

Profile of respondents

There were 350 respondents to the survey, the majority of which were inhabitants of rural areas and aged 18 to 40 years old. Approximately 63% of the respondents were male, which can often be explained by the fact that traditionally the head of the household tends to answer questions relating to the household. The level of literacy of respondents reached 86.4%, with 69.2% being educated to secondary school level and higher. The size of the households varied with 43% having 3-5 adults living in the house to 43.3% having more than six adults.

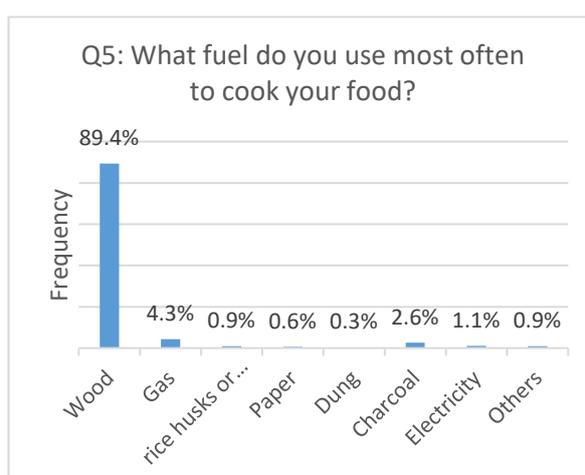
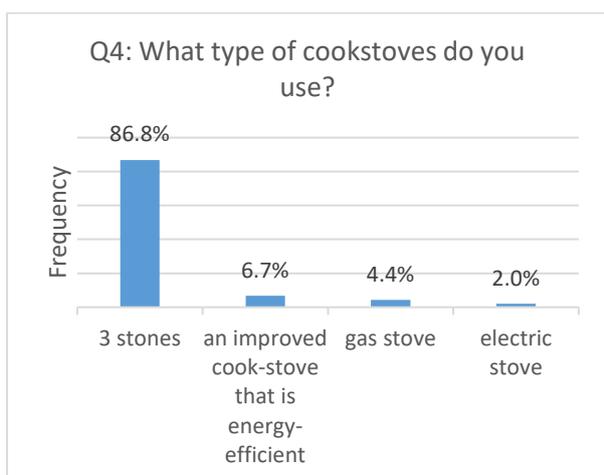
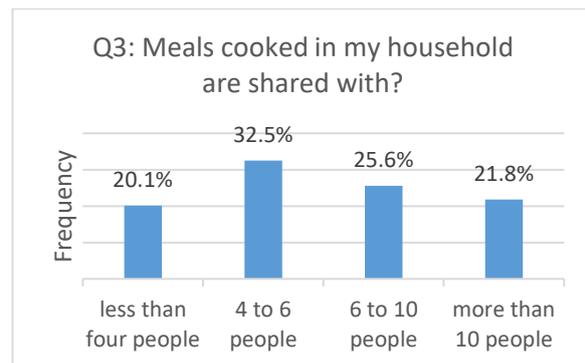
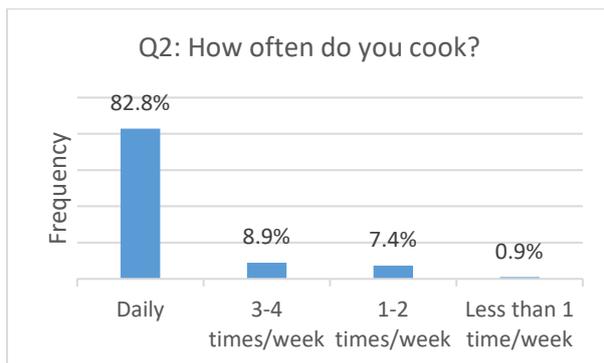




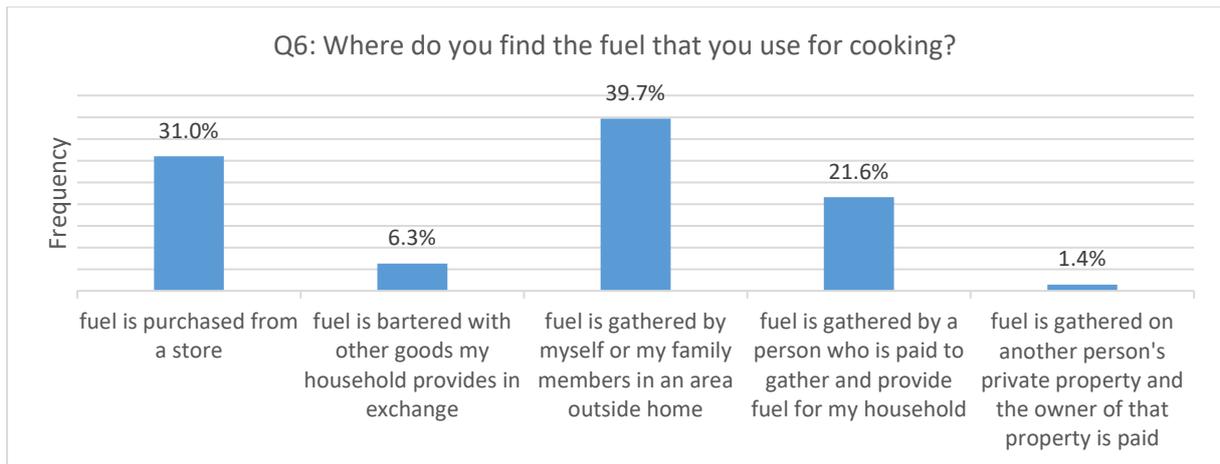
2. Energy use/practices in Adamawa

2.1. Energy for cooking: attitudes and behaviour (results of the survey)

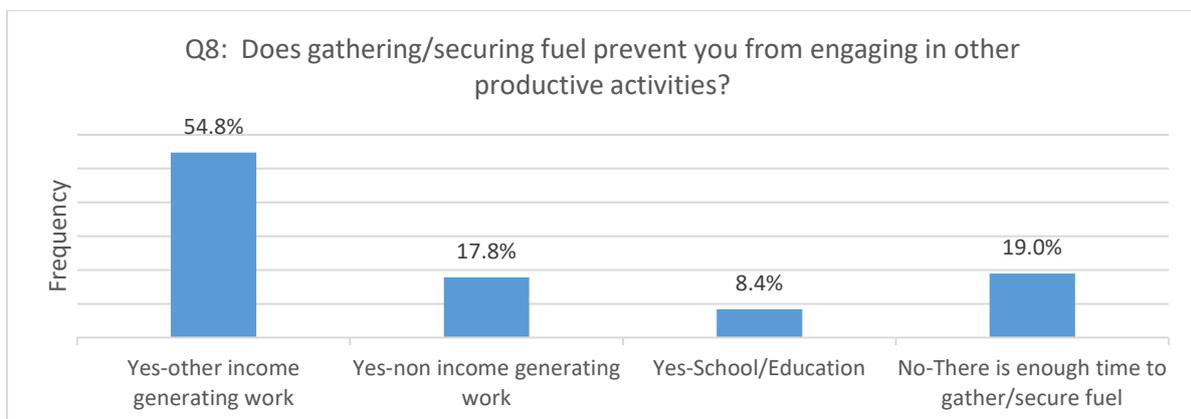
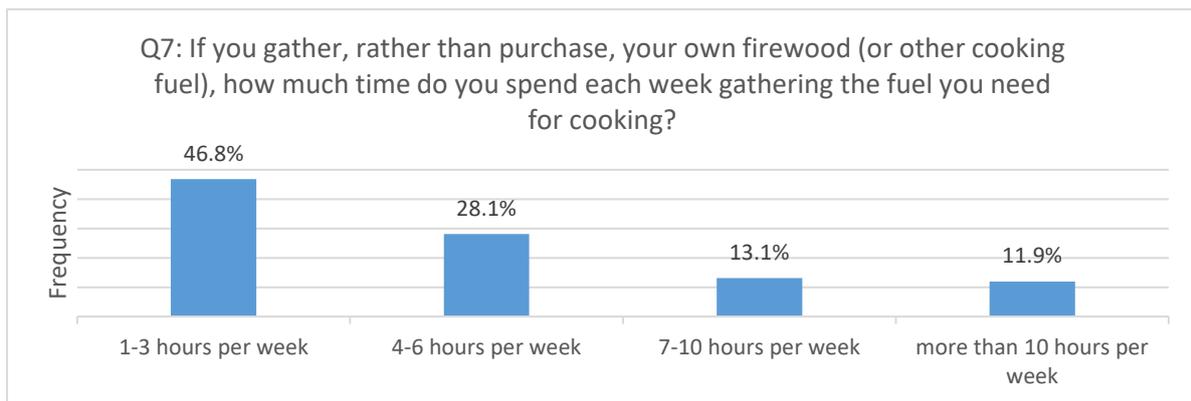
This section presents the results of the survey relating to cooking habits and behaviours. Approximately 80% of the respondents cook on a daily basis and share their meals with minimum 4 people (including 21% sharing their meals with more than 10 people). Almost 90% of the households use wood as their main fuel for cooking and just above 85% use the traditional 3-stones stove.



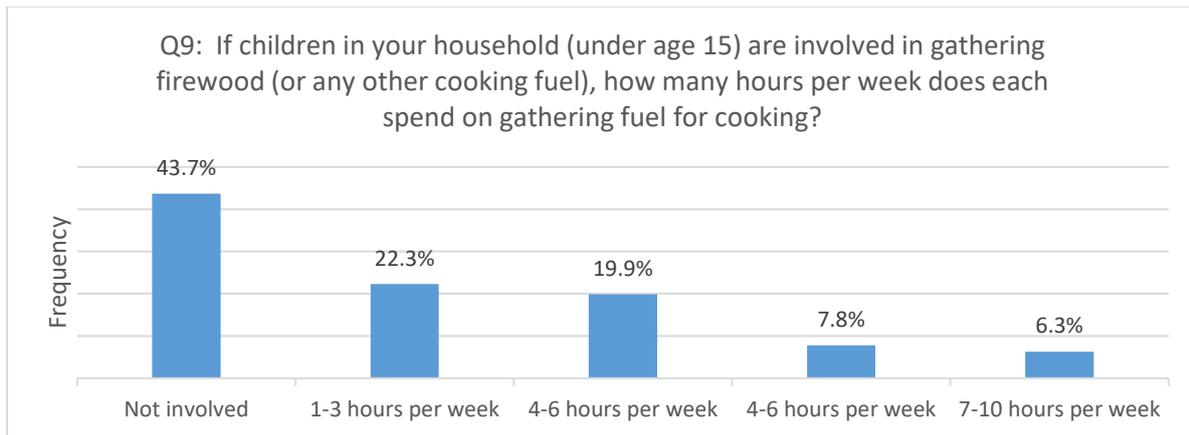
The households obtain their fuel from a variety of sources (i.e. store, bartered with other goods, collected) but the majority (52.6%) has to pay to obtain the fuel, either directly at a store or via someone who is paid to collect for the household.



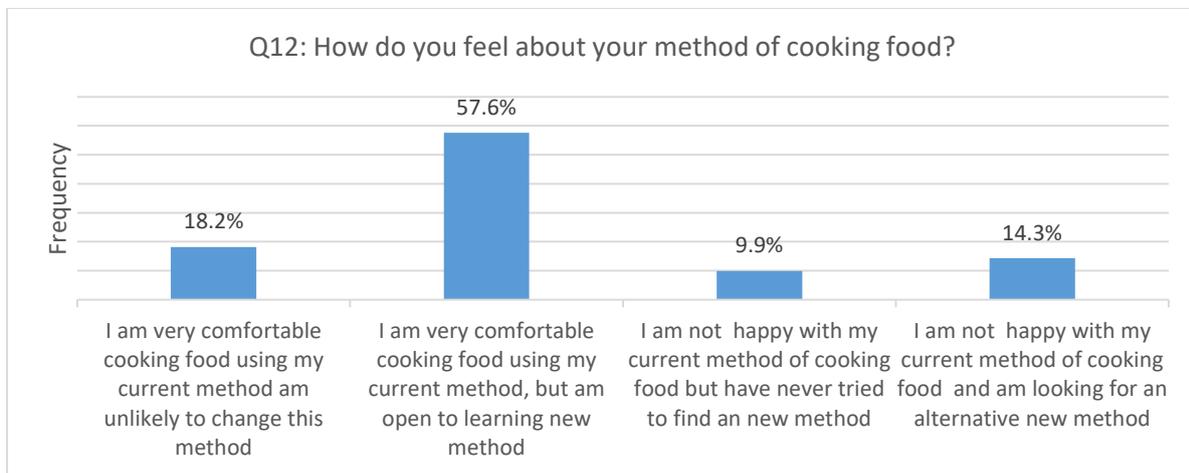
For the households who gather their fuel for cooking, about two thirds spend 1-6 hours per week on collecting. In relation to the time spent collecting cooking fuel, about 55% state that securing fuel prevents them from engaging in income generating activities and 17.8% from non-income generating activities. We could assume that a change of cooking practices that would reduce the quantity of wood needed would lead to an augmentation of time available to engage in income generating activities, thereby reinforcing the household's economic situation and purchasing power. However, the length of time spent weekly on collecting wood remains relatively low for a majority of respondents (1-3 hours).



About 8% of the respondents indicated that gathering fuel prevented them from engaging in activities related to school and education. When children are involved in gathering firewood or other cooking fuel (in about 66% of households), each of them spends several hours per week: with approximately 20% spending 4-6 hours and 6.3% spending 7-10 hours a week.

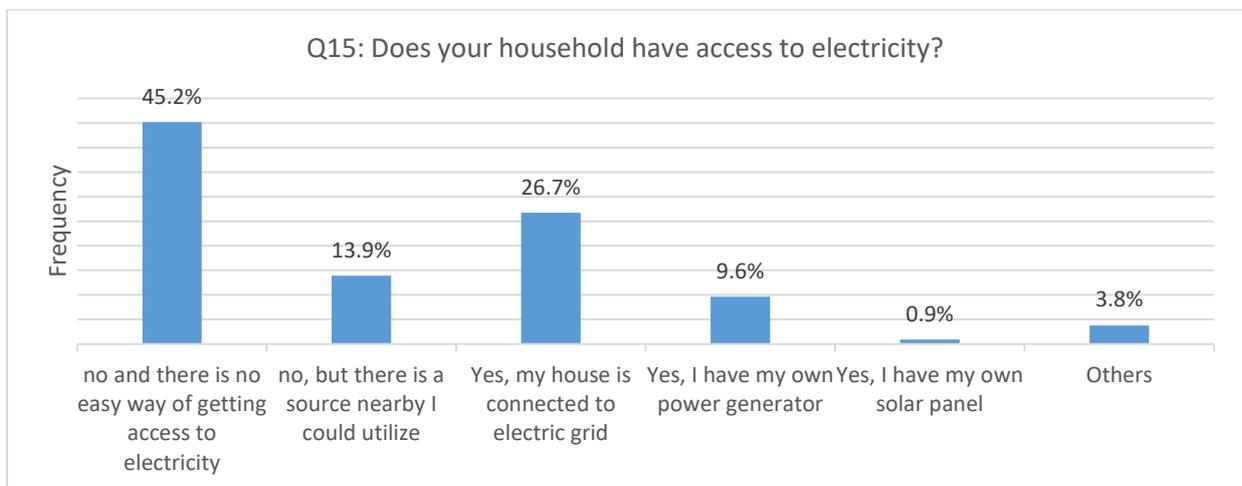
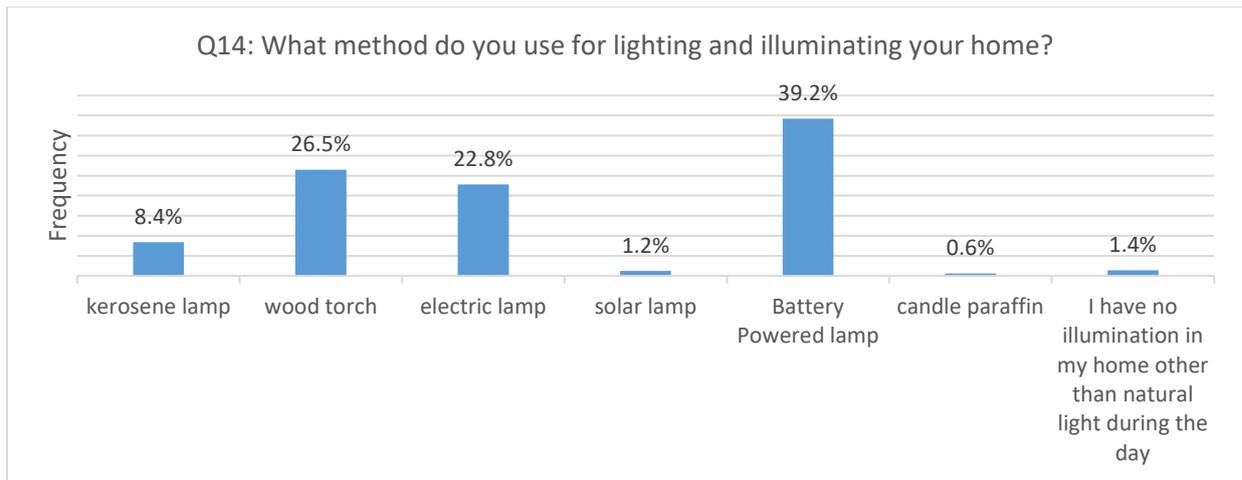


When asked about their cooking method, a vast majority (81.8%) of respondents indicate the willingness or potential to change to a new cooking method. While 57.6% express being comfortable with their current cooking method, they also state being open to learning a new method.

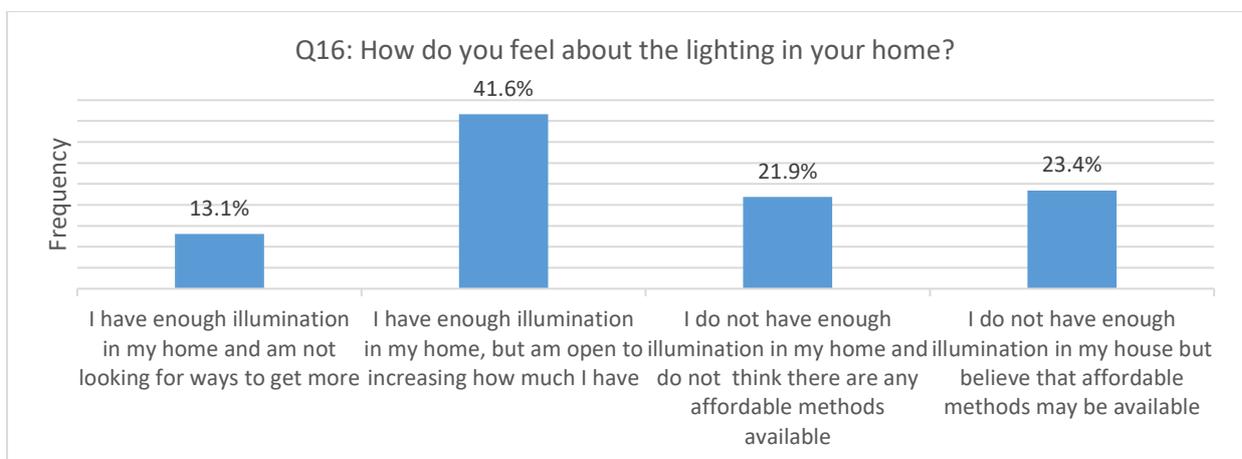


2.2. Energy for lighting: attitudes and behaviour (results of the survey)

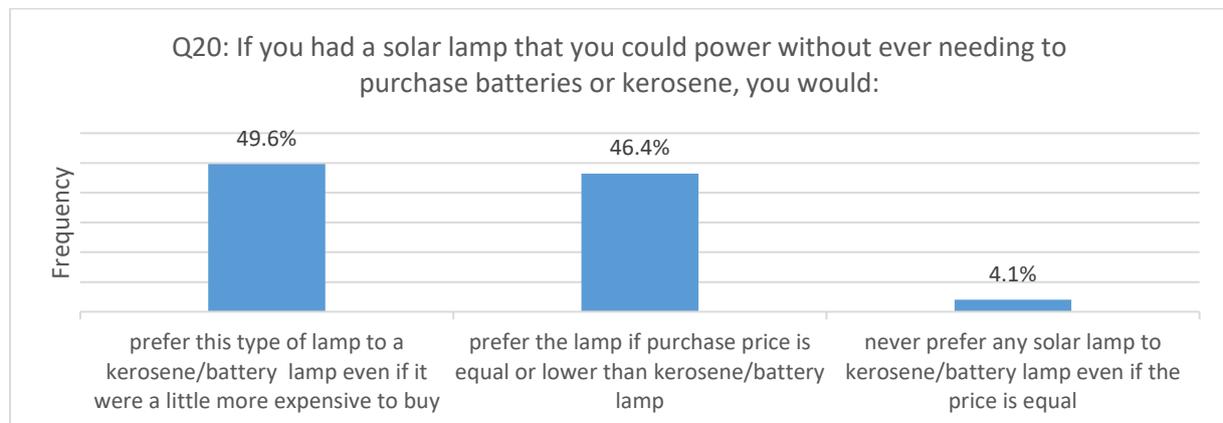
This section presents the results of the survey relating to lighting habits of the respondents. As shown in the figure below, almost all households have some form of lighting. The most common methods for illuminating the household were: battery power lamps (39.2%) and the wood torch (26.5%) and the electric lamp (22.8%). These results align with the level of access of electricity reported; about 45% of respondents stated not having access to electricity in their household.



When asked about their opinion on the lighting in their homes, 45% expressed not having sufficient illumination in their household, of which about half said that they do not think there are any other affordable methods out there. While a majority stated having sufficient illumination in their household, most of which were open to increasing their lighting. Overall, this signals that 86.9% of the households would potentially be interested in increasing their level of lighting in their house and evidently use an affordable method to do so.



Finally, regarding their preferences, almost all respondents would prefer a solar lamp provided that its price was lower, equal, or just a little bit more expensive (see figure below). This signals strong market potential for such products as long as the price and financing mechanisms are adequate.



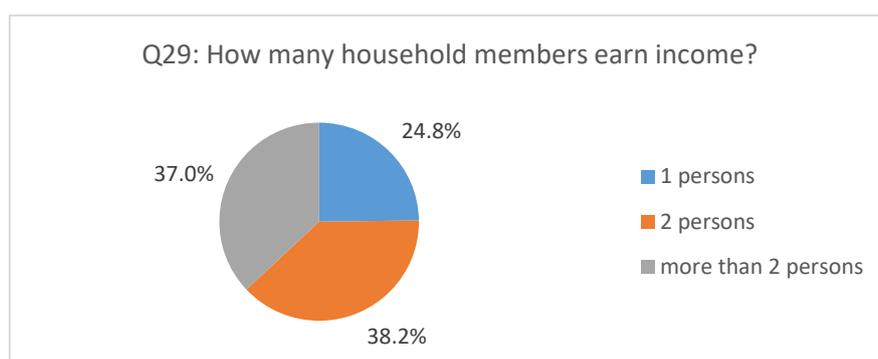
3. Assessment of market potential for clean energy solutions for households

3.1. Analysis of households' economics: an overview

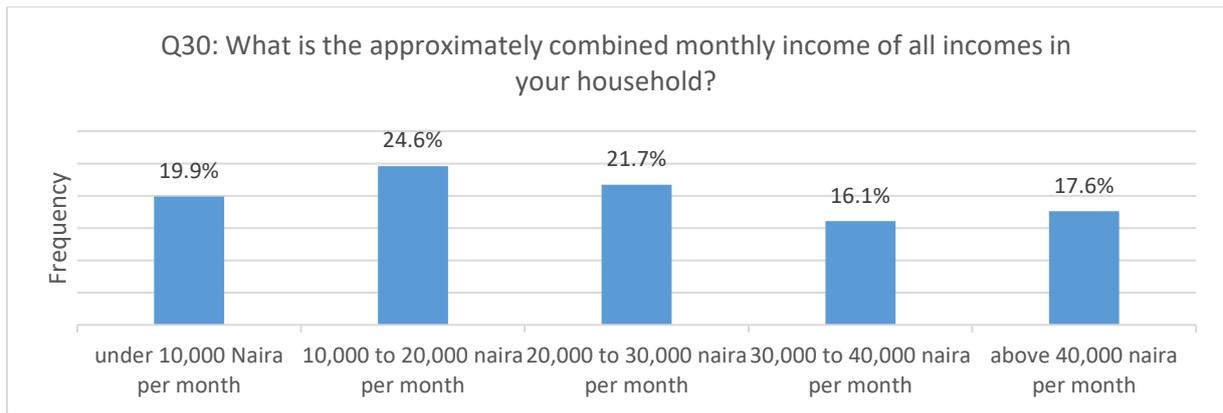
This section presents an overview of households' economics (e.g. income, costs, expenditures) related to lighting and cooking.

a) Existing household income

In 75.2% of the households, at least two persons earn an income. About a quarter of the households only has one person who earns an income (24.8%). But overall, it means that every household possesses an income indicating a good basis for repayment capacity. However, the survey did not cover the question of source of income and frequency in that regard. To evaluate repayment capacity, knowing where the income comes from and whether it is subject to seasonality would be necessary.



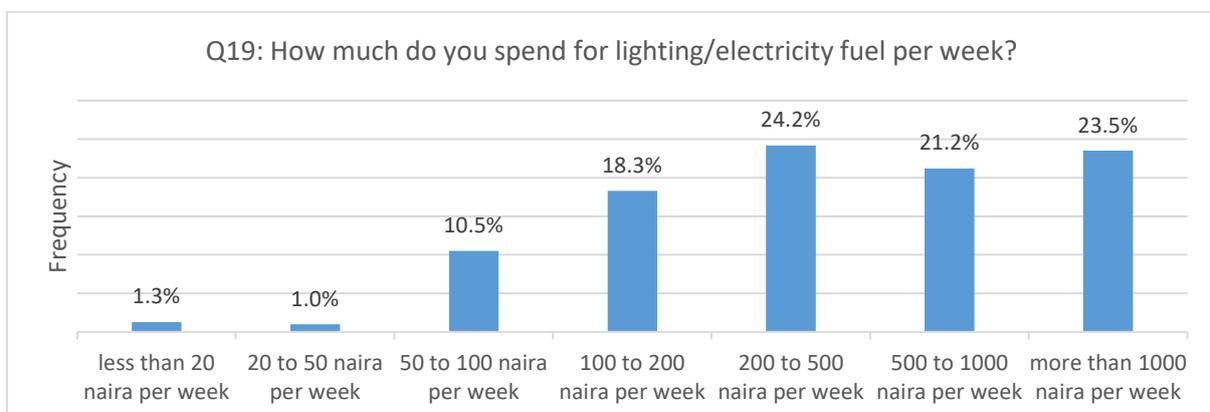
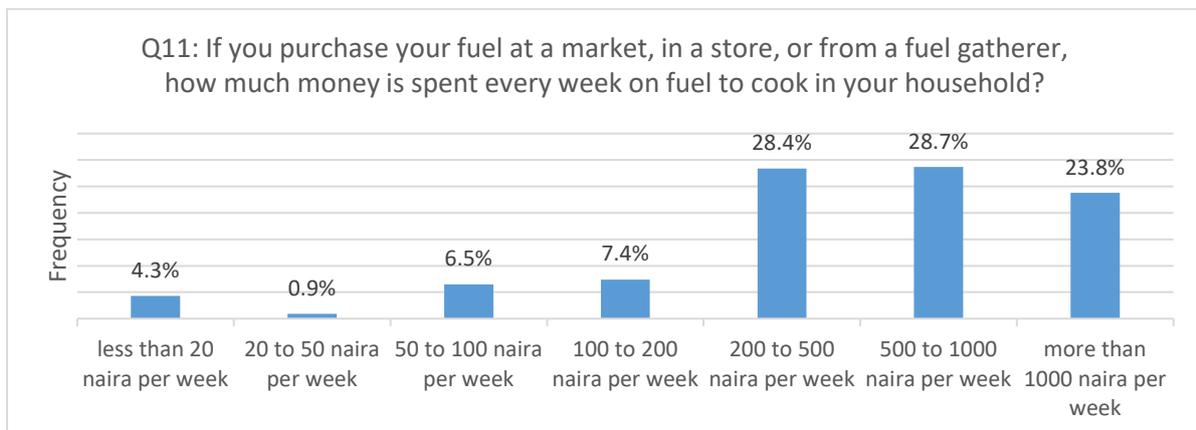
The combined income in the households is relatively well distributed as portrayed in the figure below with about a fifth of respondents earning an income situated in the five intervals presented. This shows that there is potential to develop a range of products adapted to each income level or segment of the market, including those with the lowest income and spread the risk across the financing scheme. Unfortunately, the ranges included in the survey do not include an upper limit, but we can assume that some households earn a lot more than NGN 40,000 (USD 112.68) per month. However, this segment is expected to be very small.



To further assess households' economic situation as well as consumer profile, an additional question could be integrated in future surveys such as "what would you spend your income on if your income was higher?". This could help us better understand the influence of income on the households' purchasing decision.

b) Existing household costs

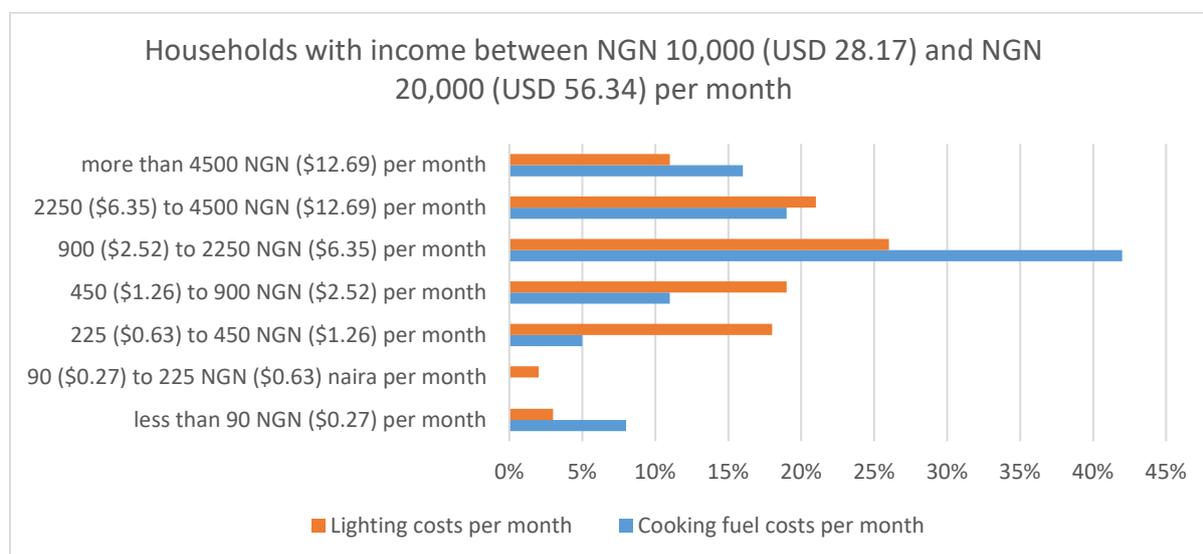
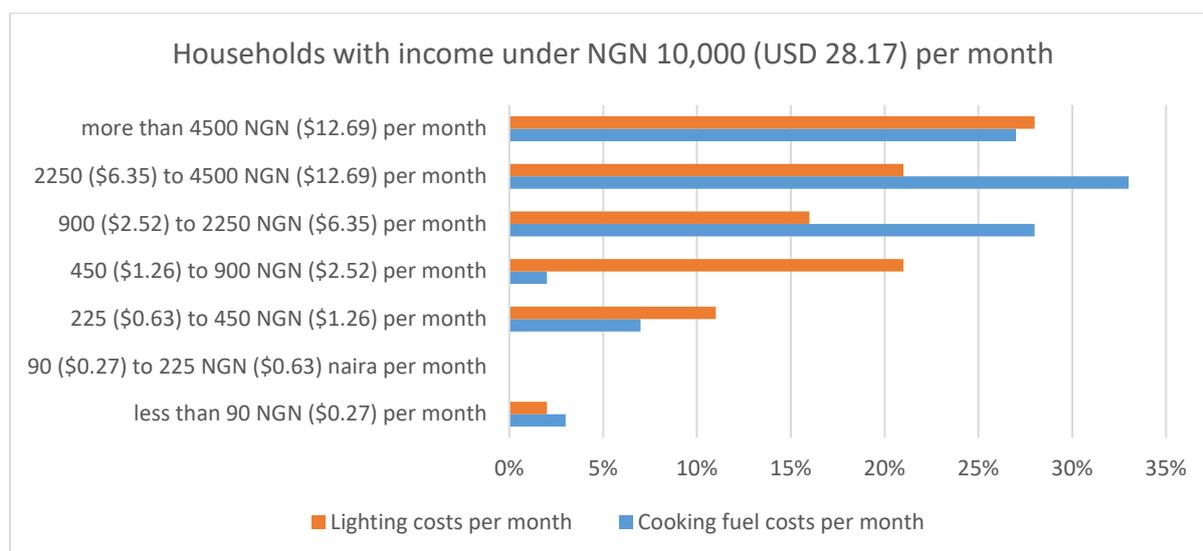
Overall, households have relatively high costs for lighting and cooking fuel, highlighting the potential for significant savings. A more detailed analysis of costs reported according to income level is presented in a series of graphs below.



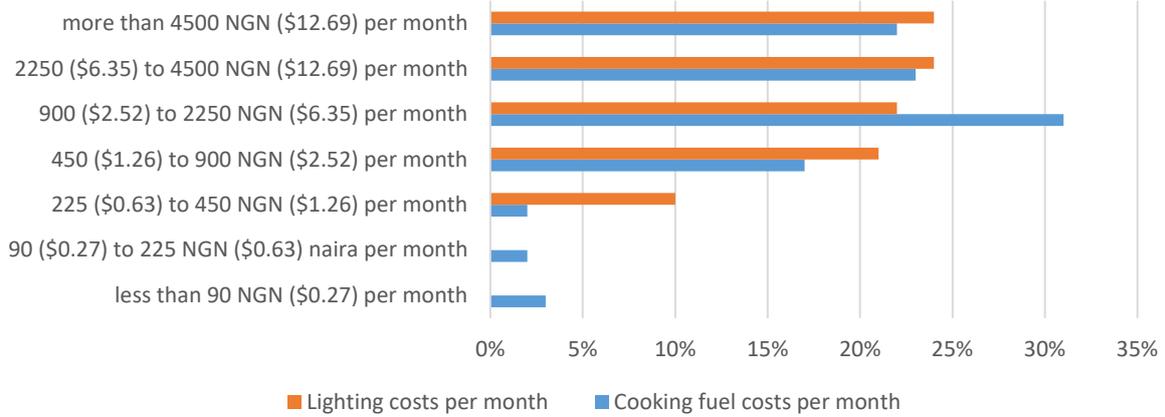
Detailed analysis by income level

Even in the more detailed analysis, it appears that regardless of their income, households have costs for lighting and cooking fuel that lie in the higher intervals. This is especially valid for households with the lowest income (under 10,000); for more than 50% of them, the combined lighting and cooking fuel cost that they have to bear represents at least 45% to 90% of their income (i.e. assuming their income is the maximum value of 10,000 Naira per month). This value is particularly high, and more information is necessary to determine the accuracy of the costs reported. One reason for these values could be linked to income levels being underreported by farming households: the value of their own produce that they consume is not included in the income stated. Fuel and lighting are therefore the main source of expenditure for those households.

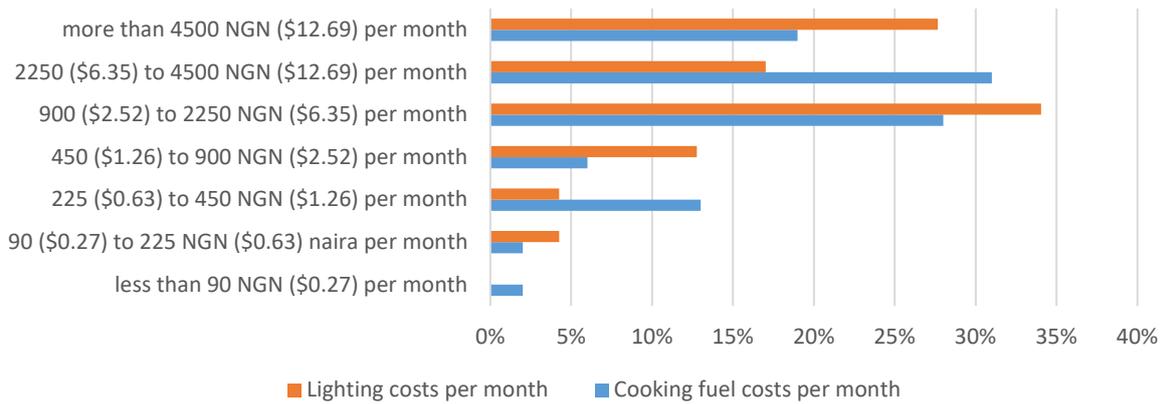
For higher income households, such costs (e.g. 4500-9000 per week on lighting and cooking fuel combined) would only represent 11%-22.5% of their income (assuming that their income equals the lowest value of 40,000 naira). To summarize, lower income households would experience a significantly high financial impact due to savings linked to switching to alternative lighting and/or cooking methods but not necessarily a sufficiently high purchasing power to be able to cover the upfront costs of the products. In the case of higher income households, the trend is reversed; their purchasing power is high but the financial impact is not as significant.



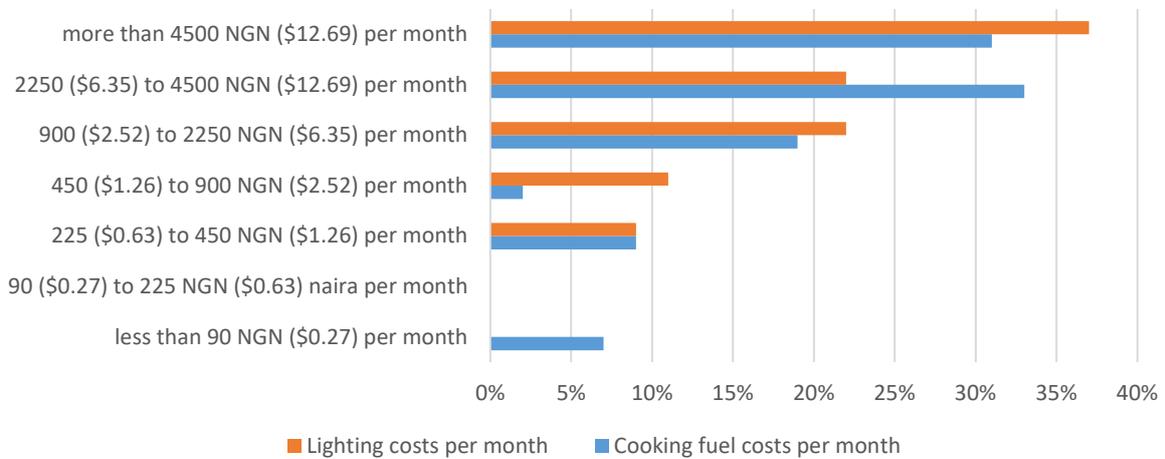
Households with income between NGN 20,000 (USD 56.34) and NGN 30,000 (USD 84.51) per month



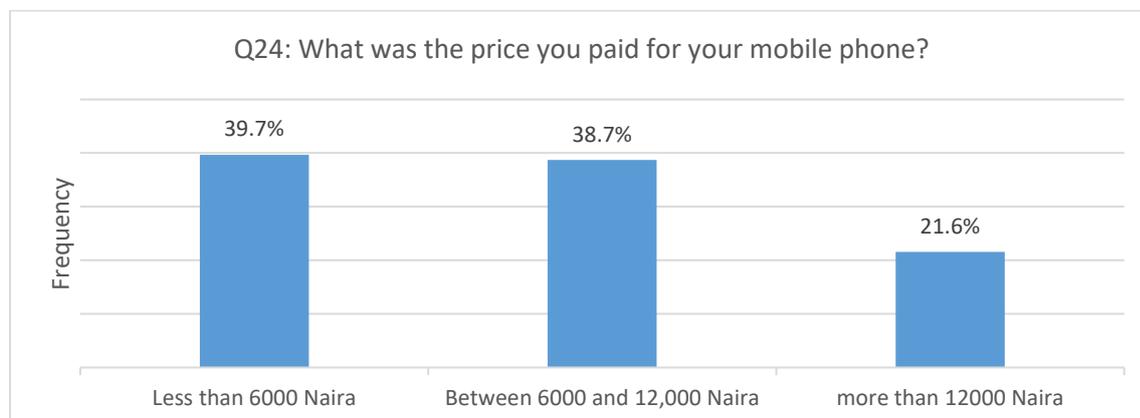
Households with income between NGN 30,000 (USD 84.51) and NGN 40,000 (USD 112.68) per month



Households with income above NGN 40,000 (USD 112.68) per month



The reported expenditure level for acquiring a phone presented below (more than 50% of respondents spend 6000 Naira [USD 17] and above) suggests a purchasing potential for goods priced at a similar level with an equally or sufficiently high level of utility.



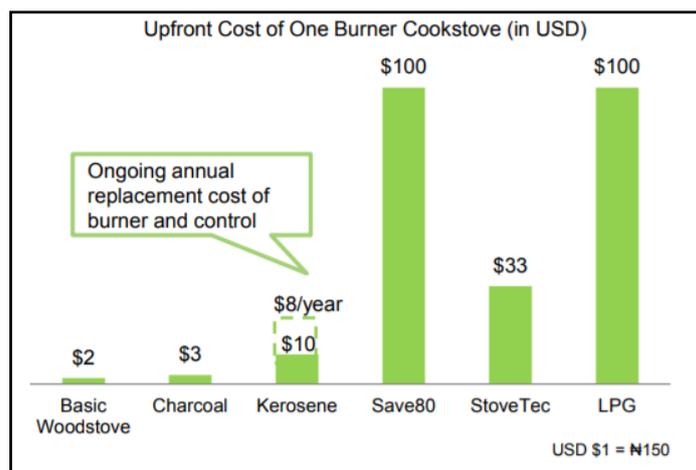
For further research, consideration should be given to gathering information on the monthly spending of households on phone related costs.

c) Cost of alternative measures

Below, we present a few alternative measures available in Nigeria for both lighting and cooking and their costs.

LIGHTING		
Company/Brand	Products	Costs
Above USD 30 USD – Solar Home Systems		
<i>BTS Energy</i>	Energy Solar Home Lighting System BTS-902. Weblink	USD 54 (NGN 19,500)
<i>D light</i>	Solar home systems for lighting. Weblink	USD 97 (NGN 35,000)
<i>Generic</i>	Generic Solar Home System 32" TV Appliance. Weblink	USD 972 (NGN 350,000)
Below USD 30 – Solar lamps and chargers		
<i>Sunking (Kenya)</i>	A wide range of solar lanterns and some that are also mobile phone charger. Weblink	~ USD 16 - 32 (NGN 2800 - 11,800)
<i>Awango by TOTAL</i>	Range of solar lamps and panels Weblink	Lowest USD 16 (NGN 6000)
<i>D light</i>	Solar lighting solutions. Largest distributed solar lighting brand for households and small businesses in off-grid communities	~ USD 8 – 27 (NGN 6000 – 9800)
<i>Solar</i>	Solar Power Bank 6000mAh With Fluorescent Light	USD 14 (NGN 5000)

COOKING			
Type	Descriptions and benefits	Benefits & disadvantages	Cost
<i>Basic wood and charcoal stoves</i>	Basic stove using solid fuels such as wood, charcoal, and animal dung	+ Zero/Low cost and can be manufactured by local community groups. - Produces smoke, air pollution affecting health of users; low efficiency	USD 2-3 (NGN 720-1080)
<i>Kerosene stove</i>	Cookstove using Kerosene as fuel	+ Cleaner, less smoke produced; time savings from not having to collect wood - Volatility and high level of kerosene price; safety concerns; health risks (exposure dangerous emissions)	USD 10 (NGN 3600) + USD 8/year (NGN 2890) per year)
<i>StoveTec</i>	Improved woodstove	+ Higher efficiency than a regular woodstove; less smoke produced; 2.5 years in use - Still relying on wood as fuel; still producing smoke	USD 33 (NGN 11,910)
<i>Save80 stove</i>	Stainless steel stove with high efficiency	+ Higher efficiency and lower level of smoke produced; 80% wood savings; estimated lifetime 15 years (manufacturer's information); can be assembled locally (parts sent from suppliers) - High cost of the stove; still relying on wood as fuel	USD 100 (NGN 36,100)
<i>LPG</i>	Higher end cookstove using LPG as fuel	+ Higher efficiency and no level of smoke produced - High cost of stove and LPG; safety concerns; availability and reliability of LPG supply	USD 100 (NGN 36,100)



Source: Global Alliance for Clean Cookstoves, 2011

These costs were part of a market study conducted by the Global Alliance for Clean Cookstoves in 2011. Although, this information is eight years old, it is still fairly representative of cookstoves prices today.

d) *Financial impact*

The financial impact calculations presented below represent the difference between remaining disposable income (income minus cooking/lighting costs) of households when using their current cooking/lighting method and their remaining disposable income if switching to one of the technologies over the course of the repayment period (includes repayment and interests rate). A detailed overview of the assumptions made in the calculations is presented in the table below:

Assumptions in the model	
Demographic characteristics	Assumption
Income	For the purpose of calculation, we make assumptions on the level of income of the households by taking an average of each range. For the upper and lower ranges, we apply a 20% decrease to the lowest value (Profile 1) and a 20% increase to the highest value (Profile 4)
Monthly expenses for cooking fuel (average)	The average of the highest three categories of expenses reported for each profile is used
Monthly expenses for lighting (average)	Average of highest three categories of expenses reported. Cost of mobile phone charging not included
Remaining disposable income	Cost of the original stove assumed to be 0
Stove and lighting options	
Option 1: Stove tec or other improved cookstove	Assumed efficiency for the stove is 30%; thus we assume a reduction of fuel costs by 30%
Option 2: Save80 stove	Assumed efficiency for the stove is 80% as communicated by manufacturer; thus we assume a reduction of fuel costs by 80%
Option 3: LPG stove	Here the cost of woodfuel is replaced by the costs of LPG (see below for fuel costs)
Option 1: Sinking solar lantern also charging station	Assumed a reduction of costs of 100% when using the technology
Option 2: D light Solar Home System	Assumed a reduction of costs of 100% when using the technology
Fuel costs	

LPG costs	Assuming a consumption of 5kg per month and 20% increase as income increases in the households (from one profile to next). See: http://nigeria.opendataforafrica.org/oieqsne/cooking-gas-price-watch-2018
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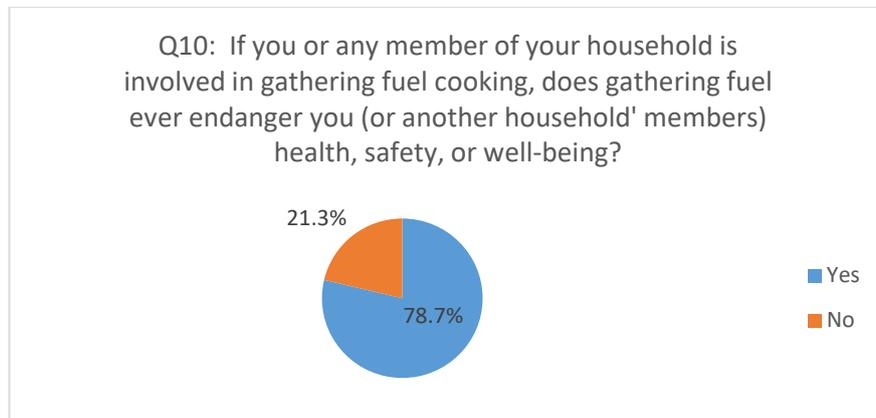
The calculations are for a loan tenure of 12 months with an interest rate of 32.5% as per current product range offered by SMB. For an overview of calculations and different repayment periods, see excel file.

Cooking solutions with 12 months repayment period									
Interest rate of 32.5%									
Households profile based on income level (assumed average)	Option 1: Stove tec			Option 2: Save80			Option 3: LPG stove		
	USD 33			USD 100			USD 100		
Monthly expenses for cooking fuel (average of highest three costs reported by households)	15	9	4	15	9	4	15	9	4
Profile 1: USD 22 - NGN 8,000	2	0	-1	5	0	-4	2	-4	-9
Profile 2: USD 41 - NGN 15,000	2	0	-1	5	0	-4	1	-5	-10
Profile 3: USD 69 - NGN 25,000	2	0	-1	5	0	-4	0	-6	-11
Profile 4: USD 96 - NGN 35,000	2	0	-1	5	0	-4	-2	-8	-13
Profile 5: USD 132 - NGN 48,000	2	0	-1	5	0	-4	-3	-9	-14

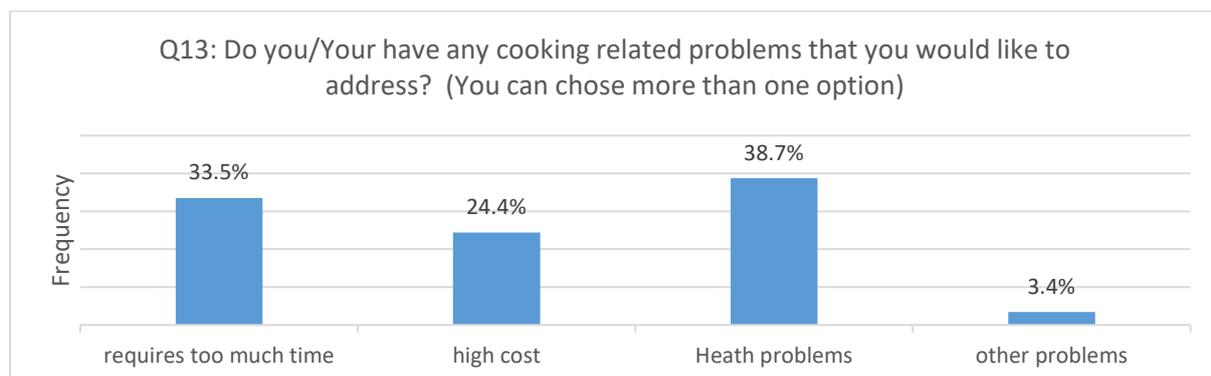
Lighting solutions with 12 months repayment period						
Interest rate 32.5%						
Households profile based on income level (assumed average)	Option 1: Sunking solar lantern			Option 2: D light Solar Home System		
	USD 33			USD 96		
Monthly expenses for lighting (average of highest three costs reported by households)	15	9	2	15	9	2
Profile 1: USD 22 - NGN 8,000	13	7	0	8	2	-5
Monthly expenses for lighting (average of highest three)	9	4	2	9	4	2
Profile 2: USD 41 - NGN 15,000	7	2	0	2	-3	-5
Monthly expenses for lighting (average of highest three)	15	9	4	15	9	4
Profile 3: USD 69 - NGN 25,000	13	7	2	8	2	-3
Profile 4: USD 96 - NGN 35,000	13	7	2	8	2	-3
Profile 5: USD 132 - NGN 48,000	13	7	2	8	2	-3

e) *Co-benefits including indirect financial impact*

Through the survey, a number of issues associated with current cooking and lighting methods used by the households were uncovered. Issues related to health, safety and time spent were predominant, closely followed by costs. A startling number of respondents (nearly 80%) expressed that gathering fuel endangered themselves or the member of their household who was involved in this process. However, we do not know the nature of the risks and dangers faced by respondents in this regard.



Almost 40% of the respondents stated having health problems related to their cooking that they would like to address. Although in this survey, health problems are not detailed, according to the WHO, the most common types of cooking related household air pollution causes diseases including chronic obstructive pulmonary disease (COPD), stroke, ischaemic heart disease, and lung cancer. These diseases linked to household air pollution, are identified as the cause of 3.8 million premature deaths annually and worldwide¹⁰. In Nigeria, where life expectancy is 53 years, solid fuel usage is estimated to cause ~80,000 deaths annually, representing 3.8% of the national disease burden.



The information presented above highlights a number of co-benefits that would derive from introducing cleaner energy technologies in the communities: improving health and reducing exposure to risks. From an economic point of view, an improvement in the health of respondents would have an effect on their ability to engage in productive activities that could lead to income generation, thereby reducing the risk of loan defaulting.

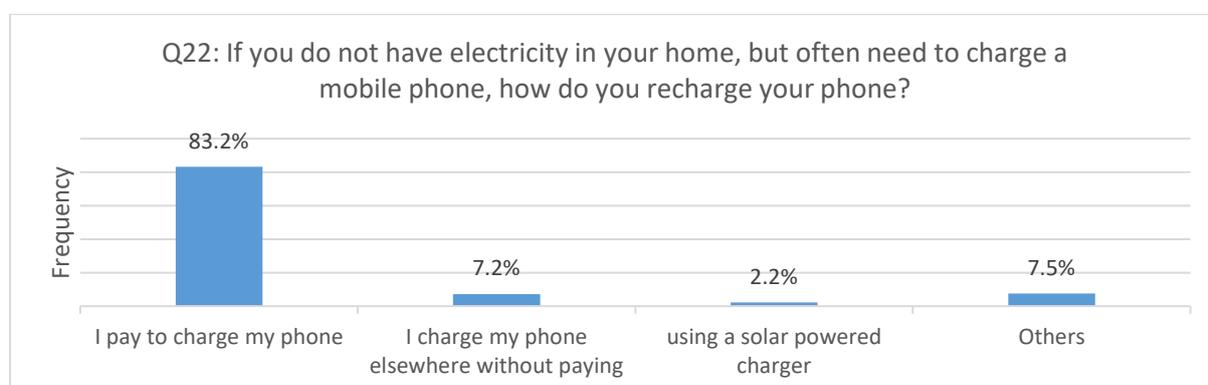
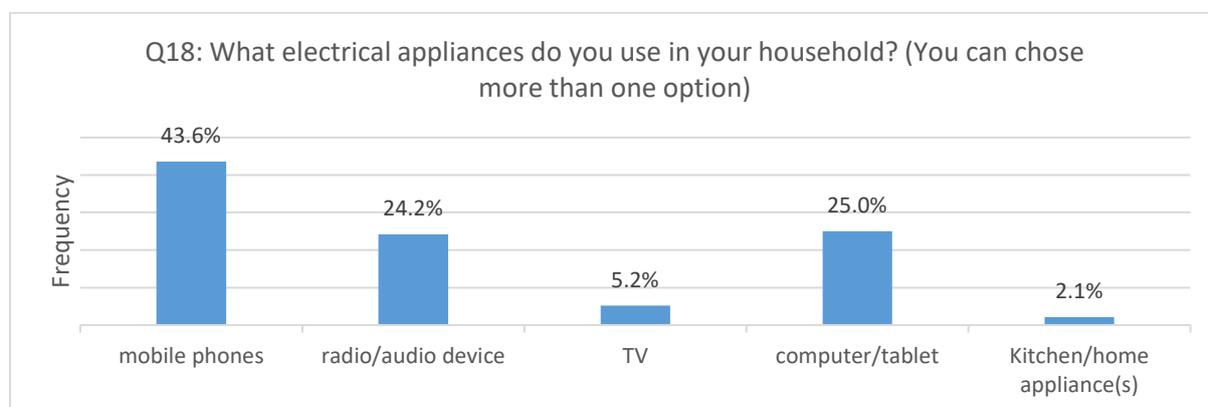
¹⁰ World Health Organisation, 2018, <http://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health>

f) Demand forecast

In this section, results of the survey that provide an overview of potential demand from households for improved lighting and cooking products are presented.

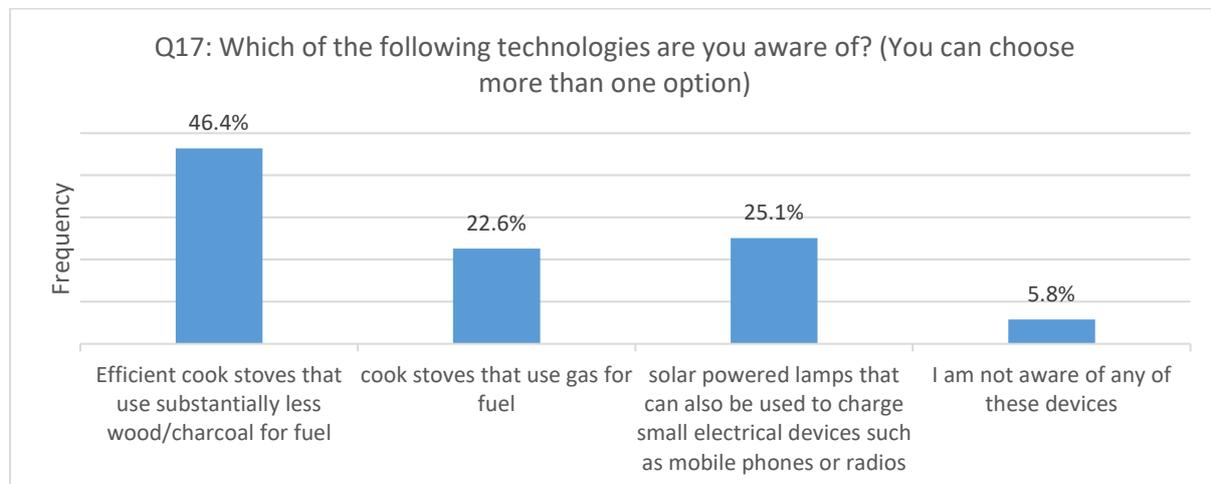
Characteristic	Percentage	Interpretation
Pay to charge their mobile phone	83%	Potential for cost savings with the use of combined solar light and charger
Are aware of either efficient wood cookstoves, solar power lamps or gas cookstoves	94%	Reduced need for awareness campaigns about the technologies
Would buy a lamp that would contribute to reducing their fuel expenses	84%	Willingness to buy provided that there are financial benefits
Willingness or potential to change to a new cooking method	82%	Lower risk of rejection of the technologies if openness to change is present
Interested in increasing the level of lighting in their home	87%	Clear interest in improved lighting and thereby potential willingness to buy such service

About 44% of the households use a mobile phone, of which 83% pay to charge it. This reflects an additional cost borne by the households without access to electricity. A cost that varies but is estimated at 50 naira (\$0.14) for a full charge¹¹. Interestingly, 25% of the households own a computer or a tablet, indicating a stronger purchasing power and potential for acquiring appliances with a relatively high price.

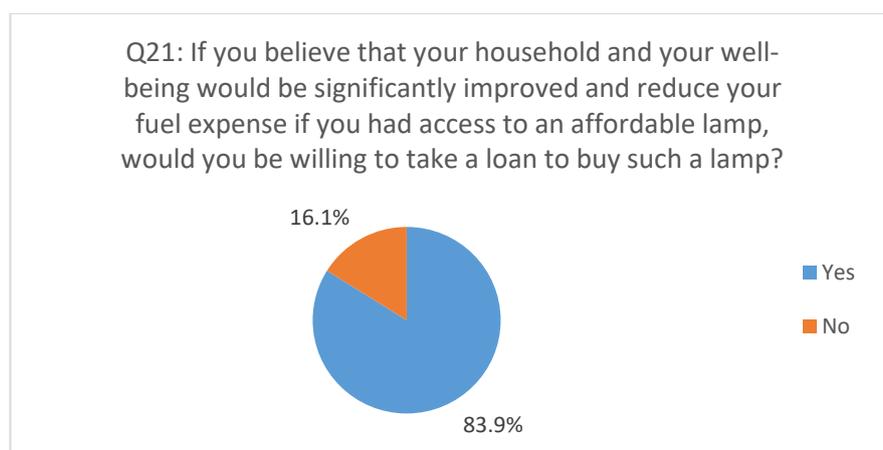


¹¹ Voa news, 2013, <https://www.voanews.com/a/for-10-cents-a-pop-nigerians-charge-phones-at-the-shop/1782892.html>

The level of awareness of respondents regarding cooking and lighting technologies is relatively high with 46% stating that they know efficient cookstoves, 22.6% for gas cookstoves, and 25.1% for solar powered lamp.

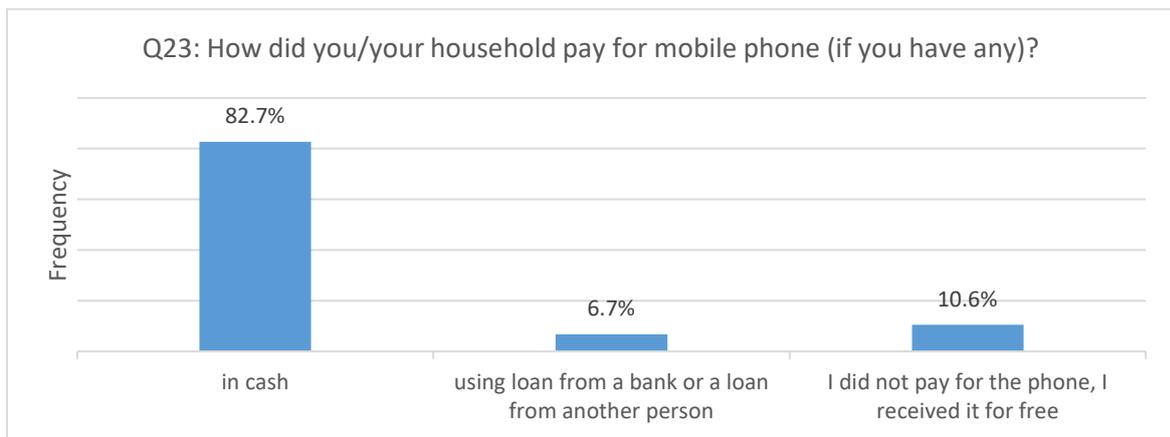
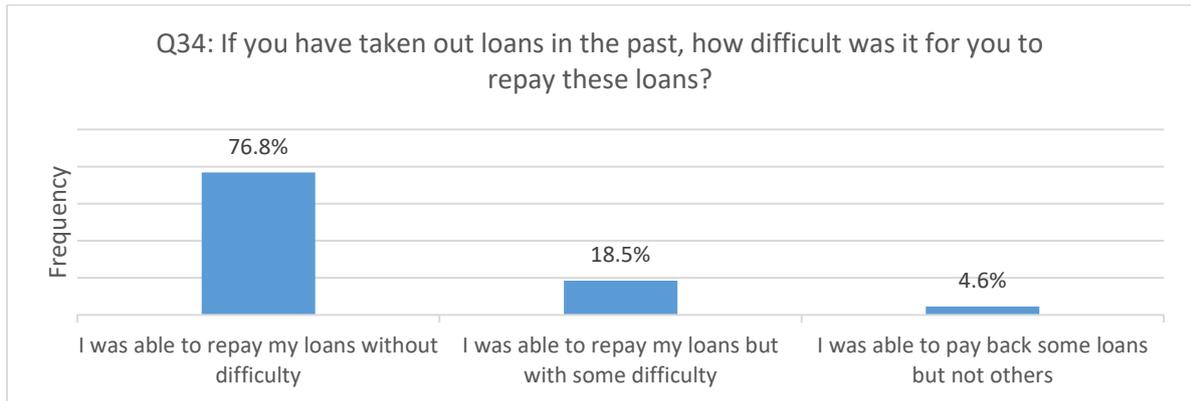
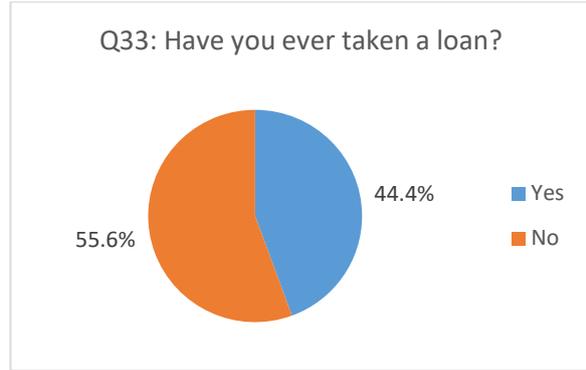
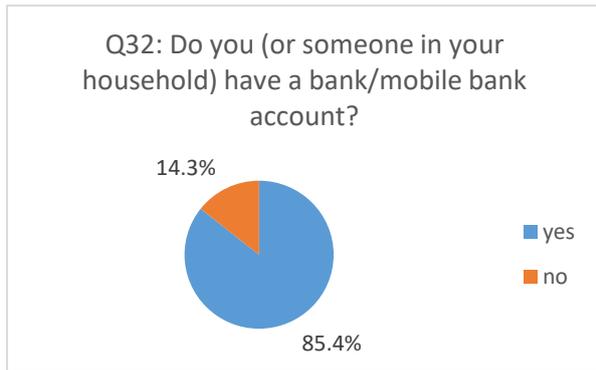


Respondents expressed a clear interest in alternative solutions for lighting with 84% stating that they would be willing to buy a lamp that would contribute to significantly reduce their fuel expenses, provided that such lamp was affordable.



Loan repayment capacity/experience: brief assessment

About 85% of the households surveyed declared having a bank or mobile bank account, this indicates relatively good access to financing services in the area. Slightly more than 55% already have experience with loans. Almost 77% of the respondents state that they were able to repay their loans without difficulty, indicating a low risk for defaulting on loans, which does not necessarily correspond to the reality observed by SMB. Further research is needed to understand the current state of the market for financial services in the state of Adawama.



g) Financial model

Based on the analysis of the survey, we extracted household profiles (based on income and expenditures) that could be used to determine the features of a potential micro loan offer and estimate sales and revenues in the first few years of the scheme. Please refer to excel file attached.

3.2. Availability of cooking/lighting solutions

The table below presents a non-exhaustive list of lighting solutions and cookstoves suppliers that supply solar lamps on the Nigerian market.

Company/Brand	Products	Costs	Availability
Lighting			
<i>Sunking (Kenya)</i>	A wide range of solar lanterns and some that are also mobile phone charger. Weblink	~ 16 - 32 USD (2800 - 11,800 NGN)	On Jumia (webshopping site)
<i>Awango by TOTAL</i>	Range of solar lamps and panels Weblink	Lowest USD 16 (NGN 6000)	Available at TOTAL Service stations
<i>D light</i>	Solar lighting solutions. Largest distributed solar lighting brand for households and small businesses in off-grid communities	~ USD 8 – 27 (NGN 6000 – 9800)	Available at distributors and on webshopping sites (Jumia weblink).
Cookstoves			
<i>Envirofit Nigeria</i>	Improved cookstoves	Not known	Distributor in Nigeria Weblink Telephone: +234-809-626-2541 Email: westafrica-sales@envirofit.org
Wise Ecostove Nigeria Limited	Clean cooking stoves (single and double burners)	Not known	Manufacturer based in Nigeria info@wiseecostove.com +44 7804643887/002348186497319

3.3. Availability, access, and cost of maintenance services and fuel

Maintenance

In general, maintenance can be provided by the manufacturer as part of a warranty system or service package for solar lamps and chargers. For cookstoves, local technicians or project implementers tend to be the ones providing service/maintenance in rural areas. To date, no precise data was found for the costs of maintenance for the different technologies.

Access to Kerosene fuel

Nigeria has a well-established market for Kerosene, which was initially supported through government subsidies that increased availability and affordability.¹² It is the second most used fuel by households nationwide after wood and most used fuel in urban areas. However, following the removal of the kerosene subsidy in 2016, the price per litre rose significantly and led to supply interruptions. In addition, recent research on the long-term health effects and fire hazards linked to kerosene use, attest to the need to support a transition to other fuels, such as LPG.¹³

Current average price paid by users for kerosene stands at **NGN 284 (USD 0.79) per litre**.⁶

Access to LPG fuel

Nigeria is one of the largest producers of LPG in the West African region, however consumption remains relatively low in comparison to other African countries. This can be explained by both issues of access and affordability for lower income households, and lack of infrastructure such as storage

¹² Obianuju *et al.*, 2018, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5923683/pdf/ijerph-15-00641.pdf>

¹³ Merem *et al.*, 2018, <http://article.sapub.org/10.5923.j.phr.20180801.02.html>

facilities.¹⁴ However, recent policy changes such as tax removal on locally produced LPG and support to transition from woodfuel and kerosene to LPG to mitigate health issues linked to household air pollution could lead to a boom in the sector.¹⁵

Current average price for a 5kg refill of LPG stands at NGN 2010 (USD 5.5) in January 2018, this equates to **NGN 402 (USD 1.11) per LPG kg.**¹⁶

4. Microfinance for clean energy solutions for households

4.1. Introduction to Standard Microfinance Bank Ltd.

Standard Microfinance Bank Ltd. (SMFB), formerly Jimeta Community Bank Ltd., started operations on November 30, 1992 as a Community Bank in Jimeta -Yola of Adamawa State. After successfully passing through a series of rigorous and comprehensive pre-licensing scrutiny and examination, the bank was granted a Microfinance Banking License by the Central Bank of Nigeria on 19/05/2009. The license allows us to collect deposits and do most of the usual banking activities.

In 2012, SMFB got a license to operate all over the State of Adamawa and now has 13 Branches and a customer base of over 50,000. Our network covers 15 Local Government and 2 Local Development Areas of the State. The Bank operates sustainably

In 2015, SMFB was a semi-finalist in European Micro Finance Awards. In 2016 Central Bank of Nigeria – IFAD consortium awarded SMFB for being the best rural MFB in Nigeria. In 2012, SMFB won a competitive grant from the EU for a financial inclusion and financial education programme which enabled the Bank to expand and to introduce new products.

SMFB's clientele is mainly small holder farmers, micro entrepreneurs, women and small businesses. SMFB has a major savings programme which has benefitted many clients. The Bank also has a financial education programme where members of the community are given free financial education. This has benefitted more than 12,000 people.

¹⁴ Nigeria's LPG Consumption In Focus, 2018, <https://www.youtube.com/watch?v=jrnjCkretLQ>

¹⁵ Leadership, 2018, <https://leadership.ng/2018/08/12/nigerias-lpg-market-set-to-boom/>

¹⁶ Nigeria Data Portal, 2018, <http://nigeria.opendataforafrica.org/oieqsne/cooking-gas-price-watch-2018>

4.2. Examples of successful microfinancing for clean energy solutions

Solar Sister – Cookstoves - Nigeria

Solar Sister is currently distributing cookstoves in three northern Nigerian states working with its local partner, Sosai Renewable Energies Company, to support and oversee the entrepreneurs. Solar Sister sources, distributes, and helps market the clean energy products, which are manufactured by international companies, while the SSEs serve as the primary marketers and sales agents. Each SSE is given a \$500 micro-investment seed capital loan in the form of an ENTREPRENEUR STARTER KIT (called a “business in a bag”) that includes:

- *Business training and product inventory.*
- *Marketing support: materials such as Solar Sister branded flyers, stickers, posters, tee shirt, sales record ledgers, a Solar Sister branded bag to carry products, and support for community launch events to showcase the products at high visibility locations.*

While the pilot program began with 48 women, there are now 62 women distributing cookstoves. Solar Sister Entrepreneurs (SSEs) are given an inventory comprised of six Envirofit rocket cookstoves with each inventory worth a total of \$124. The women make a down payment of ten percent of the total and pay the balance once the cookstoves have been sold and payments received from the customers. The SSEs call the State Coordinator to order additional inventory and again purchase the product at ten percent of the total, to pay the balance when the product has been sold at which point earning a small commission.

Distribution challenges

Cookstoves have posed unique distribution challenges. Long distances and undeveloped transportation linkages in Nigeria make transportation difficult for both customers who would like product, as well as distributors who wish to sell the cookstoves. Furthermore, the weight and bulkiness make it hard for distributors to take more than one or two from the warehouse located in Kaduna. In order to tackle these transportation and distribution challenges, Solar Sister has set up a central hub with three stock inventory locations. SSEs can access cookstove products from these hubs. SSEs are also finding new methods to overcome distribution challenges such as collectively renting a truck to pick up and deliver products.

Financing

In Nigeria, it has been challenging for SSEs to make the case to consumers that cookstoves are worth the upfront cost. Many people are paid at the end of the month, and therefore often have monthly debts that they then need to repay when they receive their monthly wage.

Several SSEs have been creative in overcoming payment challenges by becoming official vendors at schools and arranging payroll deductions as payment for the products.

Source: http://cleancookstoves.org/resources_files/womens-empowerment-gender-guide.pdf
Solar Sister’s website : <https://www.solarsister.org/about>

Lighting solutions – D.light and LAPO Microfinance Bank

LAPO Microfinance Bank in partnership with D.light designed a soft loan scheme to provide clients a more convenient and safe lighting (solar power lanterns) alternative that positively impacts their environment. D.light solar is a lightweight, durable and versatile lantern for every home.

- Facility amount: N6,200
- Methodology: Individual
- Duration: 3 months
- Grace period: 1 week

Benefits

- No collateral
- Flexible repayment structure
- Clean and renewable energy for a healthy environment
- Free replacement warranty
- Mobile charging
- Money saved everyday as you spend less on kerosene and mobile charging
- Expert financial advice available

Source: <http://www.lapo-nigeria.org/cleanenergy/dlight>

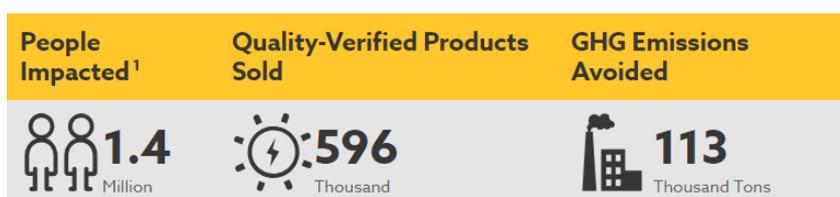
Lighting Africa – Nigeria – The World Bank & IFC

The Lighting Africa – Nigeria program was launched in March 2015 to increase access to better, cleaner and safer off-grid lighting and energy products to the rural and peri-urban populations with no access to the grid. The key objectives of the project are to help six million people gain access to clean, modern, affordable lighting products, while avoiding 120,000 metric tons of greenhouse gas emissions.

Lighting Africa is working to address issues including distribution and financing bottlenecks. Bottom of the Pyramid consumers typically spend more on the lifecycle cost of their current lighting sources (due to recurring fuel expenditures) than what they would spend on average for a solar lantern. Yet they often find it difficult to shoulder the initial upfront costs, which hampers their ability to switch to cleaner energy sources. To address this constraint, we are collaborating with five microfinance banks in Nigeria, offering basic knowledge training on products meeting our standards to MFI employees, who in turn introduce the products to their customers. This enables the MFIs to provide microloans to their customers to purchase solar lanterns. Retailers and distributors also face financing challenges and can benefit from these loans.

A robust distribution channel that reaches rural consumers is also lacking. Thus, Lighting Africa set up a retail channel development program to expand the distribution footprint of solar lanterns and SHS by training retailers in different areas of Nigeria. Support is also provided to these private sector actors by creating business-to-business linkages through events connecting manufacturers with distributors, and distributors with retailers.

Lighting Africa Nigeria plans to carry out market development work in 20 states of these States, using a combination of consumer education activities, retail channel development and consumer access to finance.



Source: <https://www.lightingafrica.org/country/nigeria/>

2.1 Recommendations

2.1. Identification of suitable financing instrument(s)

The identification of a suitable financing instrument will require further research on the state of the market for financial services in the area (see implementation plan below). The analysis of the household survey allowed us to draw up an initial financial scheme, which showed that there was potential for significant costs savings for households on both cooking fuel and lighting costs if they engaged in the transition to cleaner energy technologies. The level of cost savings is dependent on the type of technologies selected, especially in the case of cooking.

The provision of micro loans to individual households or group of households appears as a feasible option at this stage. The calculated savings can inform the optimal level for instalments and the period for the micro loans. However, the design of the scheme will have to take into account a number of factors peculiar to the Nigerian context as highlighted by SMB. These include: high level of trust deficit making the sale of new initiatives a little more difficult, poor social infra structure, a general sense of despondency and low level of literacy as well as financial literacy. Ultimately, discussions with stakeholders and assessment of supply chains for distribution for the technologies and fuels, and access to after sale services, will determine the pricing structure and overall product offer.

2.2. Design of an Implementation plan

Preparation

Further research is needed to better understand households' economic situation and evaluate their potential and ability to take on financial products to acquire the technologies. This will inform the design of the financial product offer. Similarly, information on the distribution network for the technologies and potential partners for the project are key success factors for the implementation.

- Market information
 - **Income** – information on seasonality/regularity of income is needed to determine length of loan period and establish a suitable payment plan; this would inform the choice of having individual loans or group loans
 - **Loan 'literacy'** – investigate current loan experience, the type of loans households have taken in the past, the level of installments, payment frequency;
 - **Competitor benchmarking** – review of current microfinance and banking services provided in Adawama state;
- Access to fuel and maintenance services
 - **Supply chains** – review current access to fuel supplies in the area and potential maintenance services providers to determine feasibility of the scheme and inform technology choice; based on results, set up agreements
- Distribution networks
 - **Distributors/Suppliers** – Identify potential distributors in the area or access points for retailing the technologies (e.g. local markets): define price and conditions of agreements
 - **Partnerships** - Identify partnership opportunities and design suitable incentive mechanisms for retailers; explore opportunities to support local groups to access loans for bulk purchase

Indicative timeline: between 3 to 6 months (depending on what is being done under the market information research component and the human resources allocated to the project)

Implementation

- Stakeholder consultations
 - **Engagement** - of relevant stakeholders and decision-makers in the areas to discuss the scheme, its relevance and potential impact
- Design product offer
 - **Product features** – determine features for the loans based on results of market research (e.g. flexible repayments, pay as you go) determine means for households to access information on their loan and pay their installments
 - **After sale services** – set up the adequate after sale services in partnership with the concerned suppliers
- Awareness and marketing campaigns
 - **Information campaign** – design adequate information campaigns that describe the technologies and their associated benefits, as well as conditions for the financial products offered; potentially include financial literacy training; identify best media for diffusion of campaigns
 - **Incentive mechanism** – identify suitable incentive mechanisms to disseminate the offer such as early bird offers

Indicative timeline: between 12 and 18 months until first launch (depending on the human resources allocated to the project)

- Launch
 - **Training/Product demos** – explore opportunities to organize trainings on the use of the technologies and financial services in partnership with relevant actors and authorities to support households during the transition. Potentially select some households to act start a “trainers of trainers” network
 - **Test the offer** – test launch and update the offer as necessary
 - **Official launch and feedback collection**
 - **Impact analysis** – first one conducted 6-12 months after the launch

2.3. Expected impact and project targets

The project targets both rural and urban areas of Adawama state with a diversified offer to cater to the (energy) needs of both low-income households and higher income households. Adawama state’s population is estimated at 4.5 million in 2018. With the assumption that average household size is 6 people, the estimated number of households in the target area is approximately 750,000. Based on this, it is possible to extrapolate potential impact for the project by assuming that a portion of the target population would benefit from the technologies and associated financial services provided by SMB. For instance, if 10% of the households were to acquire the technologies would mean that 450,000 people would be impacted by the project.

Socioeconomic impact for the project would include improved health by reducing indoor air pollution and fire hazards linked to kerosene use, and time and costs savings by reducing or eliminating the need to collect woodfuel. The time saved could be used for other activities such as income generation or education in the case of children involved in the collection of woodfuel. More broadly, the project would contribute to reducing deforestation in the area and CO2 emissions.

3.1 Conclusions

Factors such as access to maintenance/after sale services and fuel supply reliability play a key role in the selection of the technologies and design of product offer. While the household surveys and the analysis provided essential insights into the potential for households to transition to cleaner energy technologies, it is necessary to conduct further research on the market and the distribution networks in the area to design the most suitable product offer. Micro loans are an effective supportive mechanism for households to acquire technologies that they would otherwise not be able to afford but need to be combined with adequate information campaign to ensure that households have sufficient financial awareness to manage the debt. With a carefully designed product offer, SMB would provide key financing services that would contribute to significant positive impacts for the population of Adawama by enabling households to access cleaner energy technologies at a time where policy changes are favourable to a transition to cleaner energy sources.