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FINAL REPORT

BASELINE ASSESSMENT FOR MARKET-BASED ENERGY ACCESS FOR SCALE UP PROJECTS IN REFUGEE SETTLEMENTS

IN UGANDA

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EXECUTIVE SUMMARY

The cooking energy situation in refugee hosting areas is under severe threat due to heavy dependence on biomass. Biomass is the most important source of energy for 97% of the population, providing for 90% of the total primary energy consumption, in form of firewood, charcoal or crop residues. A lack of energy for lighting, phone charging and productive uses limits opportunities of education, communication and income generation activities. Currently, people use torches (27%), dry cell batteries (5%), phone lights or improvised lighting devices (54%) at high risks and costs. Phone charging is a thriving business mostly operated outside the home and charged at an average unit cost of UGX 500 /- .

With the increasingly challenging situation of access to clean sustainable energy supply in the humanitarian areas, GIZ through the Energy Solutions for Displacement Settings (ESDS) program selected CREEC to conduct a baseline survey to assess the energy market supply and demand situation in four (4) refugee settlements and host communities in Uganda. The study was designed to prioritize the settlements and host communities for their appropriateness to implement market-based energy access interventions.

The findings revealed that Nakivale and Kiryandongo are the most willing and appropriate settlements to adopt market-based approaches. In Maaji and Palabek, the incomes of the residents are lower as well as a slower uptake and appreciation of ICS was noted. However, it's important to note that all the respondents have a high appreciation for improved lighting technologies.

Markets are complex systems, which are driven by multiple players and influencing agents, in humanitarian settings the energy market is underpinned by three factors; availability, accessibility and cost. Solving these three is the key to a sustainable market system. The study has therefore given recommendations in the four components of a market system i.e. demand, supply, supporting functions and market rules.

Appropriate interventions: The demand gaps in all the four settlements and hosts present opportunities to increase the coverage of *one stop energy kiosks* with local operators skilled in basic business and technical knowledge required to operate and maintain the kiosks. These kiosks should be set up in the trading centres and can be managed by specially set up groups.

Appropriate models: Due to the low incomes of the survey respondents as well as the unsteady nature, hire purchase system is preferred for both cooking and lighting technologies for increased adoption.

Awareness: Adoption of improved cook stoves (ICS) is low mainly due to the lack of awareness of the benefits of these technologies by the communities. Thus for continuous sustainability there is a need to invest in *intensive* and *continuous* sensitization of the beneficiaries that helps people visualize the benefits of green technologies.

Solar is the only available and acceptable lighting option present in the settlements. However, in Palabek for example it is limited in supply. There is therefore a need to involve more entrepreneurs in and around the settlement in energy businesses.

Partnerships were found lacking in the supply chain. These partnerships can be created and built further by building linkages of the suppliers to these current and potential retailers. This we suggest can be done through match making events in the settlements that help to link

suppliers of quality products to these retailers. We also recommend a bulk warehousing solution in order to reduce the costs and the delay time reported in waiting for suppliers.

Building of associations – VSLA's have had great success not only in the refugee settlements but also in the host communities. This method has greatly aided the distribution of energy products such as the solar in the past and can now be expanded to also cater for clean cooking solutions. This method is greatly enhanced when the refugees are provided with avenues such as "cash for work" programs as here they are able to get money to contribute to these groups.

Incentive schemes: Despite the high willingness to pay for the clean technologies, a hamper has been on the ability to pay, thus subsidies on the products for **a period of time** that are **well communicated** can help increase demand and improve entire business in these areas.

From these identified gaps and recommendations a sustainable energy market can be developed that breaks the barriers of accessibility, affordability, and availability of products/services.

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AAH	Action Africa Help
ADRA	Adventist Development and Relief Agency
Cesvi	Cooperazione e sviluppo (Cooperation and development)
CREEC	Centre for Research in Energy and Energy Conservation
CRRF	Comprehensive Refugee Response Framework
DRC	Danish Refugee Council
EnDev	Energizing Development
ESDS	Energy Solutions for Displacement Settings
ESMAP	Energy Sector Management Assistance Program
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussion
FH	Food for the Hungry
FRC	Finnish Refugee Council
GCR	Global Compact on Refugees
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
ICS	Improved Cook Stove
IP	Implementing Partner
KII	Key Informant Interview
LWF	Lutheran World Federation
NSAMIZI	Nsamizi Training Institute of Social Development
NRC	Norwegian Refugee Council
NURI	Northern Uganda Resilience Initiative
ODK	Open Data Kit
OP	Operating Partners
OPM	Office of the Prime Minister
RMF	Real Medicine Foundation
SCI	Save the Children International
SME	Small and medium enterprise
URCS	Uganda Red Cross Society
UNHCR	United Nations High Commissioner for Refugees
WPDI	Whitaker Peace and Development Initiative

1 PROJECT BACKGROUND

The cooking energy situation in refugee hosting areas is under severe threat due to heavy dependence on biomass. Biomass is the most important source of energy for 97% of the population, providing for 90% of the total primary energy consumption, in form of firewood, charcoal or crop residues. This is compounded by the increasing number of displaced persons that has exacerbated rapid depletion and overuse of forests, leading to fuel scarcity in rural areas and an increase in price levels of charcoal and fuel wood in urban areas (MEMD, 2017) It has also resulted in undercooking of meals, while some households sell food rations to buy firewood thereby affecting their nutritional status. Firewood is mostly collected by women and girls, who are often exposed to sexual and gender based violence. In addition, cooking is done in poorly ventilated kitchens causing indoor air pollution that may lead to respiratory infections.

A lack of energy for lighting, phone charging and productive uses limits opportunities of education, protection, communication and income generation activities. Currently, people use torches, dry cell batteries, phone lights or improvised lighting devices at high costs and risks of causing fires. Phone charging is mostly done outside the home and paid for on a regular basis, productive use applications are also quite scarce with the few existing ones powered by diesel generators. Considering protracted crisis' and insufficient humanitarian funding, access to sustainable energy becomes increasingly challenging and calls for innovative and sustainable solutions to protect the environment, safety and health and create livelihood opportunities for both, refugees and hosts.

Despite the significant efforts from various development partners, there are several barriers to the access of modern energy services more particularly in the refugee areas.

These include; lack of organizational structure in energy markets in terms of the flow of structures of retailers, wholesalers and suppliers; weak energy business skills among local entrepreneurs; lack of access to key services such as credit, weak business advisory for the energy sector and unstable business environment perpetuated by the un-certainty in the stay or migratory patterns of refugees in the hosting country (EnDev, 2018).

Funded by BMZ, the global programme on *"Support in the Implementation of the UN Comprehensive Refugee Response Framework"* which is implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) seeks to support UNHCR as the facilitator of the Global Compact on Refugees (GCR) in the Humanitarian-Development-Peace-Nexus. The GCR seeks to establish a "multi-stakeholder and partnership approach in the humanitarian space. The programme is part of the German Special Initiative "Tackling the Root Causes of Displacement, (Re-) integrating Refugees". In Uganda, the project; Energy Solutions for Displacement Settings (ESDS), seeks to address the lack of a sustainable energy supply in refugee hosting areas through advisory services and the implementation of measures in displacement settings in three main areas as follows;

I. Improving the Enabling Environment for Sustainable Access to Energy

The project provides advisory services to the Ugandan Ministry for Energy and Mineral Development (MEMD) and UNHCR with regards to strategic energy planning promoting the inclusion of refugees into national service delivery systems. GIZ supports the development of the Sustainable Energy Refugee Response Plan (SERRP) under the CRRF and the establishment of the respective task force.

II. GREENING Base Camps

ESDS Uganda seeks to develop sustainable and cost-effective models that can be adopted by private sector actors and serve UNHCR to replace or hybridize diesel generators in base camps and social institutions. ESDS conducts the assessments and develops guidelines for UNHCR to implement the solutions on basis of private sector energy delivery models.

III. Increasing SUSTAINABLE Energy Access for Households, Small and Medium Enterprises (SMEs) and social institutions

ESDS pilots and promotes market-based solutions for access to sustainable cooking energy and electricity for households, social institutions and small businesses, benefitting both refugees and host communities. This involves stimulating demand through awareness raising campaigns and product marketing, developing financing schemes for end customers and promoting the supply of energy through de-risking mechanisms that encourage private sector involvement in the spirit of the CRRF. For example, through the establishment of energy kiosks, phone charging and secretarial services are provided and energy-efficient products like improved cook stoves (ICS) and quality solar products sold.

This market-based assessment was conducted in four refugee hosting districts in Uganda, namely; Adjumani, Lamwo, Isingiro, and Kiryandongo. The study was conducted to provide information on the energy market supply and demand situation in the four refugee settlements.

1.1 Objectives of the Study

The overall objective of the baseline survey was to assess the energy market supply and demand situation in four (4) refugee settlements and host communities in Uganda and prioritize the settlements and host communities for their appropriateness to implement market-based energy access interventions.

The specific objectives were;

- To conduct stakeholder mapping of key actors on the sector.
- To carry out a market analysis on supply of cooking and electricity technologies.
- To identify demand gaps for energy products for household use, productive use and public use

2 SITUATION ASSESSMENT IN UGANDA

Uganda's regulatory framework and settlement approach - the 2006 Refugee Act and 2010 Refugee regulations - which emphasize the integration of refugees within the host communities, with access to the same services as nationals, is widely regarded as an exemplary model (GoU, 2006) (GoU, 2010).

The framework ensures refugees have access to the main social services in the settlements, i.e. health, education, water, sanitation, community services and land for settlement. By doing so, Uganda closely follows the paradigm of the GCR, the adoption of the New York Declaration and its CRRF and focuses on: Easing the pressure on host countries, enhancing refugee self-reliance, expanding access to third-country solutions and supporting conditions in countries of origin for return in safety and dignity (United Nations Development Programme, 2018). Applauded as one of the most progressive in the world, Uganda's refugee policy profoundly commits to enabling refugees to pursue self-reliance and a dignified life while in exile, not only because of compassion, but also empower them to contribute to their new host communities, as workers, tax payers and consumers. Uganda is currently host to over one million refugees who fled from famine, conflict and insecurity in the neighbouring countries of South Sudan, Burundi and the Democratic Republic of Congo. This continued influx has underscored several critical interventions to sustain Uganda's ecological integrity.

Establishing systems to protect and sustain the livelihoods of refugees presents challenges at the global, continental, regional and national levels. Most refugee protection and livelihoods programs are heavily dependent on humanitarian aid yet this is a short-term solution for people temporarily displaced by conflict or natural disaster. According to UNHCR 2003, this temporary situation averages 17 years for the typical person residing in a camp. This problem is often acute in Sub Saharan Africa where refugees living in relatively small and resource scarce areas, contribute to damaging the ecological sustainability of the surrounding land (Nielsen, 2014). Given the landscape of humanitarian response, host governments and development partners are beginning to shift the philosophy of refugee assistance to durable solutions for addressing humanitarian and development needs of refugees and their host communities (United Nations Development Programme, 2018). These approaches focus on both the consumers and producers to seek solutions that make the market more independent, competitive and inclusive.

Energy is an important driver for social and economic development. Until very recently, ensuring access to modern energy solutions using sustainably sourced resources was rarely a priority when providing for displaced populations, as this imperative was set against more pressing needs to secure foods and shelter. Displaced people were left to source their own energy resources for meeting their cooking and lighting energy needs. As such, this approach yielded an unprecedented energy crisis among refugees and hosts making the eco system the main source of livelihoods opportunities. Due to environment related concerns, the various partners implementing energy, environment and livelihood programs in the settlements are now endeavouring to increase environment protection and restoration models to improve energy access among refugees and host communities. However, these models have registered low impact indices as they are measured focusing on number of disseminated products rather than adoption. To stir a fast-growing and sustainable energy market in refugee settlements in Uganda a market-based approach is proposed with an intention of including refugees and host in a competitive energy market.

2.1 Market system models in humanitarian settings

A market can be defined as a physical or abstract place where forces of demand and supply operate to allocate resources in the most efficient way possible. Demand describes the desire of people to acquire a certain product or service, ruled by the ability and willingness to pay of the market participants. Supply is the ability of producers to provide these products and services, ruled by access to information and resources. All markets have the following common elements: m*arket participants*, g*oods and services*, *rules of trade*, s*upporting functions* and *exogenous factors* depending on the market in focus. (Buss, 2013)

Markets are, thus, complex systems, which are driven by multiple players and influencing agents. The figure below provides a simplified model of a market system. The core of the market consists of the transactions between demand (consumers) and supply (producers) sides whose aim is to maximize their own benefit. The efficiency of what happens in the core depends on the rules, supporting functions and exogenous factors impinging on it.

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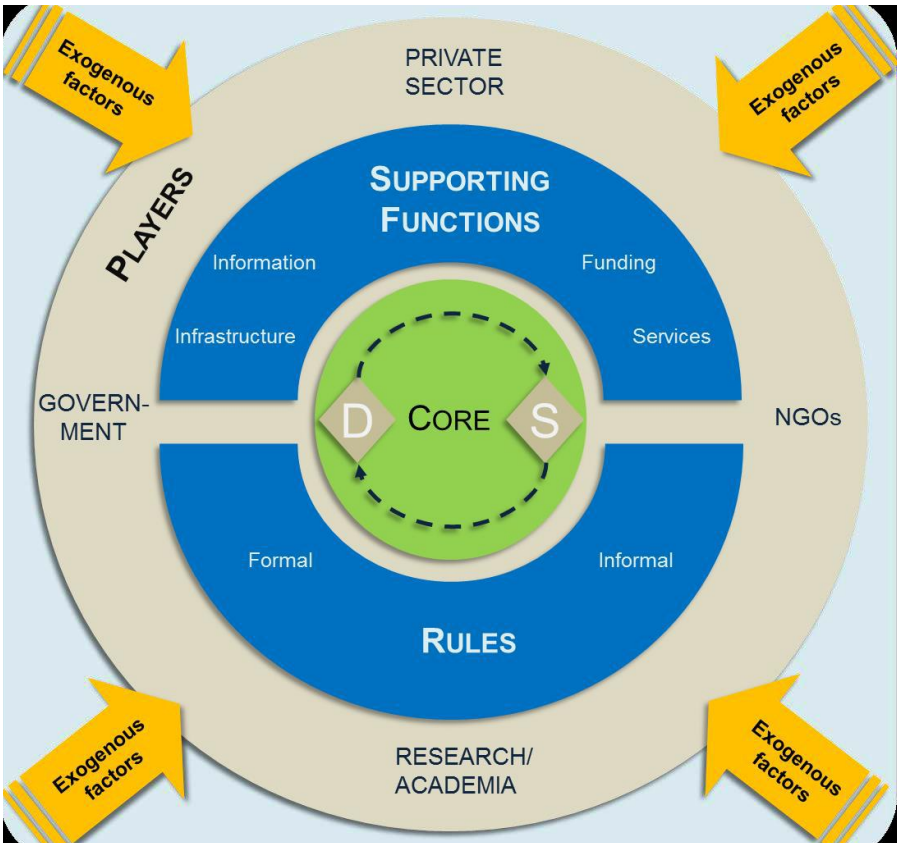


Figure 1; Market system (adapted from *(Gibson, 2012)*)

Market-based energy access

The sole purpose of a market-based approach is to work within market systems during a crisis to support access to affordable, quality goods and services that are critical to the survival of vulnerable populations. The Humanitarian-development-peace nexus promotes durable solutions to improve access to sustainable cooking energy and electricity for households, social institutions and small businesses, benefitting both refugees and host communities. Not only does this reduce the risk of undermining local recovery but it can also be more cost-

efficient and better targeted than traditional humanitarian programming meeting individual needs.

This involves stimulating demand through awareness raising campaigns and product marketing, developing financing schemes for end users and promoting the supply of energy through de-risking mechanisms that encourage private sector involvement in the spirit of the CRRF.

The provision of energy through a market-based approach offers an alternative that challenges perceptions of market viability within displaced populations and the role of humanitarian actors in providing energy goods and services within settlement environments. It facilitates the inclusion and empowerment of refugee and host communities to develop markets and deliver tailored solutions to meet local needs. This approach also provides the opportunity to investigate the efficiency and practicability of strategies developed for delivering assistance to remote displaced and host populations.

The responsiveness of energy demand and supplies to various economic variables are important inputs into energy planning and policy design (Owens, 2009). For instance, if fuel consumption is responsive to income growth, then high income growth areas will have needs for fuel production and infrastructure that accompanies fuel growth. This presents an opportunity for energy enterprises in humanitarian settings.

2.2 Energy situation in the settlements

Energy is the bedrock of social and economic wellbeing of mankind. In the context of humanitarian settings implementation of emergency energy supply measures have proven to be an expensive, unreliable and unsustainable provision for those in protracted crises. This is because provision is based on time bound humanitarian aid and donor support in form of "in-kind distribution" of energy equipment. This calls for a need to develop a long-term energy solution following a market intervention.

For this baseline study energy demand in the four refugee settlements was categorised as energy for: public use, household use and productive use.

Table 1: Categories of energy demand by consumers in refugee settlements;

Energy demand	Use
Public use	Generation and distribution of energy for shared facilities such as electricity for street lighting, back office administration, schools, communication services, healthcare services and clean water provision.
Household	Energy catering to household lighting, phone charging, cooking and cooling needs through service-based off-grid solutions or energy products (e.g. solar lanterns, SHS, LPG fuel and firewood).
Productive use	Energy requirements for income-generating activities such as cooking by street-food venders, mobile phone charging, hairdressers, metal workers, kiosks, etc.

To date, the energy requirements in the refugee environments have largely been deprioritized relative to other necessities, such as shelter, water, food and livelihoods. Although some progress has been made in putting energy on the agenda in displacement contexts, the topic is still often 'lost' as a cross-cutting theme running through multiple humanitarian clusters. Traditionally, energy goods and services have been delivered directly by aid agencies to refugees through in-kind distributions or service provision. In general, the energy options provided in refugee settlements for most refugees globally meet only tier 1 level which is just

the lighting and phone charging needs. According to ESMAP, the multi-tier energy framework looks at the multiple dimensions of access to capture detailed and accurate information about the quantity and quality of energy services. It also captures the multiple modes of delivering energy access from grid to off-grid and to the range of cooking methods and fuels people use. (Bhatia & Angelou, 2015) Under this framework, energy access was subdivided into five tiers. This leaves four more levels to reach tier 5.

The influx of refugees has placed overwhelming demands on already strained capacities and resources of the Government of Uganda, IPCC reports show and overall decreasing trend in rainfall amounts across the world. A study conducted by CREEC in 2018 revealed a decrease of tree cover and woodlands, showing that we are already in crisis stage and sustainable interventions should be put in place and closely monitored. Therefore, right after shelter and food, sustainable energy provision with a holistic approach to energy efficiency should be at the centre of all refugee crisis interventions given that refugees stay in the settlements for a long period of time. (CREEC, 2018)

2.3 Settlement profiles

Kiryandongo Refugee Settlement [GPS location; Coordinates: 1.957°N 32.181°E]

The Kiryandongo area was first used for resettling refugees in 1954 when the British colonial administration asked the Bunyoro Native Government to give the Colonial Government of the Governor to move Kenyan refugees to Kigumba in what was then Masindi District. In 1990 the Ugandan government gazette the virtually uninhabited land around Kiryandongo for refugee resettlement.

Kiryandongo is relatively hosted in a plateau land having an altitude of 1,295 meters above sea level. The climatic conditions within the area are favorable with a bi-modal rainfall pattern which is providing good conditions for agriculture.

Kiryandongo is strategically located business wise given that it is in the mid-western part of Uganda bordering Nwoya district in the North, Apac in the East, Masindi in the south and south west and Buliisa in the north west hence making it a transit area for bulk goods from the western, central and southern districts towards the northern districts, Southern Sudan and D.R.C. Bweyale is a town that has greatly benefited from this given that it is along the highway making it a strategically located trading centre for the bulk goods transit community and business persons. Kiryandongo is supplied with electricity from the main national grid however the distribution lines have not been extended much into the refugee settlements. Additionally, it has an estimated population 98,000 people making one of the highest populated town councils in the country with a mixture of about 50 ethnicities. Among the features close to the settlement include Murchison Falls and National park that spreads to the inland shores of Lake Albert, the 600 MW Karuma dam.

The district of Kiryandongo in which the settlement is hosted has a land area of 3,624.1 Sq. Km with the settlement covering an area of 70 Sq. Km. According to the UNHCR factsheet as of December 2019, the total district has an estimated population of 313,800 people and 65,459 are refugees as of February 2020.

Additionally, the settlement hosts many refugees from neighboring countries with the biggest percentage from South Sudan comprising of a diverse ethnicity for example the Masaba, Kenyan Luo's, Congolese, Rwandese, Burundians, South Sudanese Dinkas, Kuku, Nuer, Kakwa, Madi, Siluk etc. According to the profile by the Uganda Investment Authority for

Kiryandongo, the district also hosts internally displaced persons (IDP) mainly the Acholi who were victims of the Kony LRA rebel activities during the 1990's and persons displaced by the Eastern region's Budduda land slide in 2010.
A detailed info-diagram below provides summarized profile information.

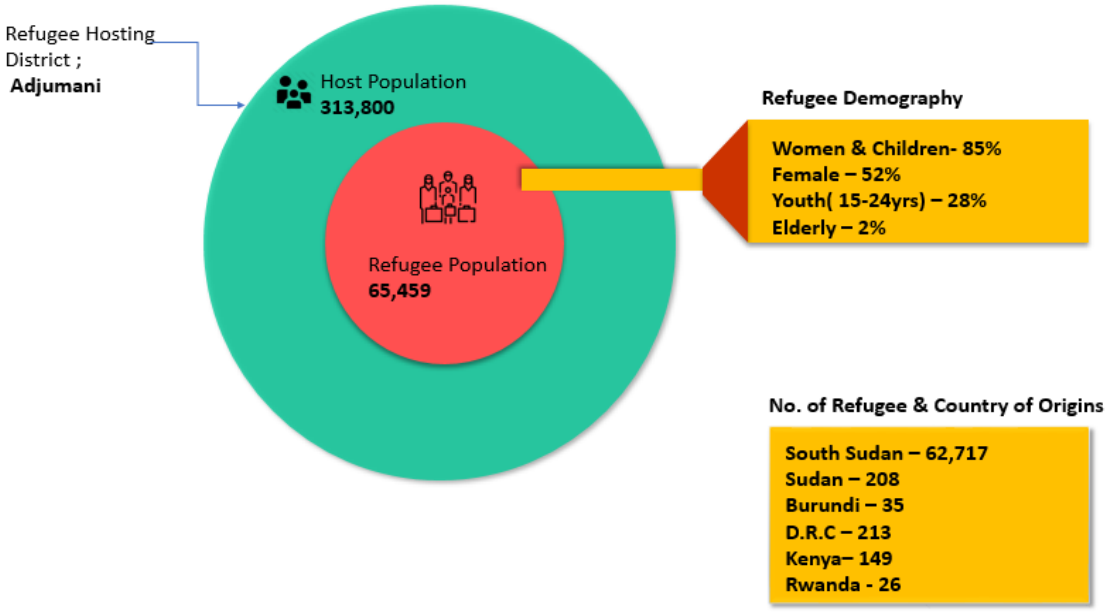


Figure 2; info-diagram for Kiryandongo refugee settlement

Source: UNHCR website www.unhcr.org (Population stats are as of Dec 2019, Demography and country of origin stats are as of Oct 2019)

Majority of the population in the district both the host and refugees engage in farming for both crops and animals as the main economic activity. The main crops grown include cassava, sweet potatoes, maize, beans and groundnuts. The cash crops include cotton, sunflower, and tobacco.

According to the UNHCR Kiryandongo data sheet as of October 2019, the top seven occupations undertaken by the refugees in the age bracket 18-59 years are as the breakdown below;

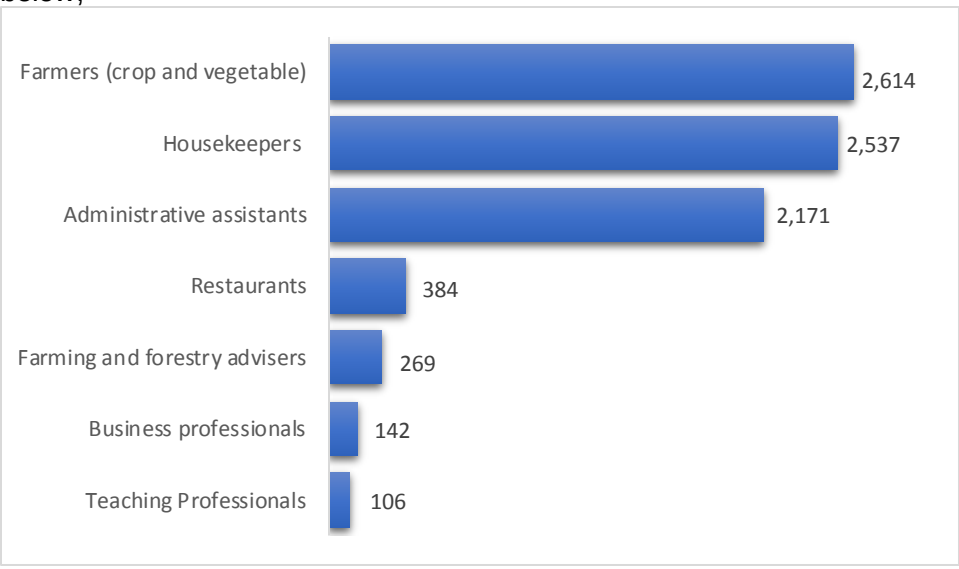


Figure 3; Top seven refugee occupations in Kiryandongo settlement

Nakivale Refugee Settlement [Coordinates: 0.8°S 30.9°E]

Nakivale refugee settlement was established in 1958 and officially recognized as a refugee settlement in 1960 through the Uganda Gazette General Notice No. 19. It is located within Isingiro district in the southwestern part of Uganda bordered by Kiruhura district in the North, Ntungamo in the west and Mbarara district to the northwest. The nearest country to country border is in the south with the Republic of Tanzania.

The settlements hosts refugees from Democratic Republic of Congo, Rwanda, Eritrea, Somalia and Burundi. Currently, most refugees in the settlement are Congolese with an ethnicity mainly comprising of the Hutu, Hema, Tutsi, Shi, Mashi Alur etc.

The topography of the area partly consists of steep hills and valleys (mainly in the sub counties of Nyakitunda, Kabingo, Kabuyanda, Ngarama and Kashumba) as well as gentle slopes and low land areas mostly found in the sub counties of Mbaare, Endiinzi, Masha and partly Birere.

According to the UNHCR factsheet as of December 2019, the total district population has an estimated host population of 596,400 people and 130,462 refugees.

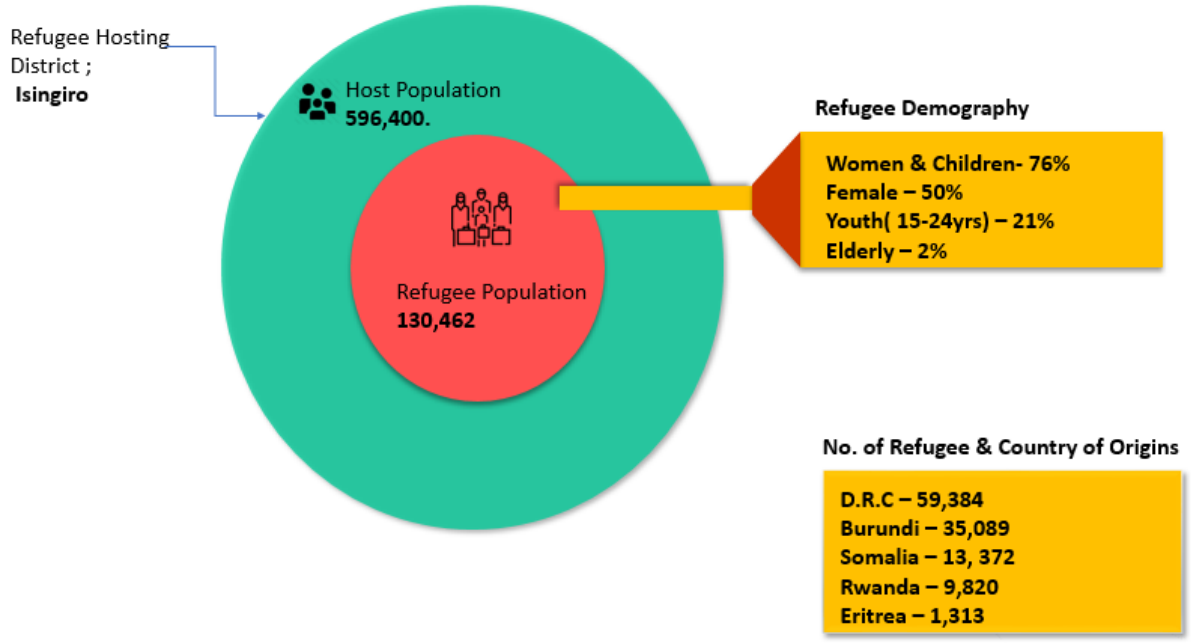


Figure 4; Info-diagram for Nakivale refugee settlement See detailed info- diagram (as of Oct. 2019).

The biggest percentage both host and refugees are engaged with farming activities. Major crops grown include bananas and beans. The refugees are also engaged in small scale business such as printing, retail shops, saloons etc. Fishing is also another activity carried out in lakes such as Lake Nakivale, Rwamurunga and Rivers Kagera and Rwizi. The power line mostly transects within the base camp zone of the settlement.

According to the UNHCR factsheet for Nakivale, the main occupations undertaken by the refugees is as below (*as of Oct 2019*).

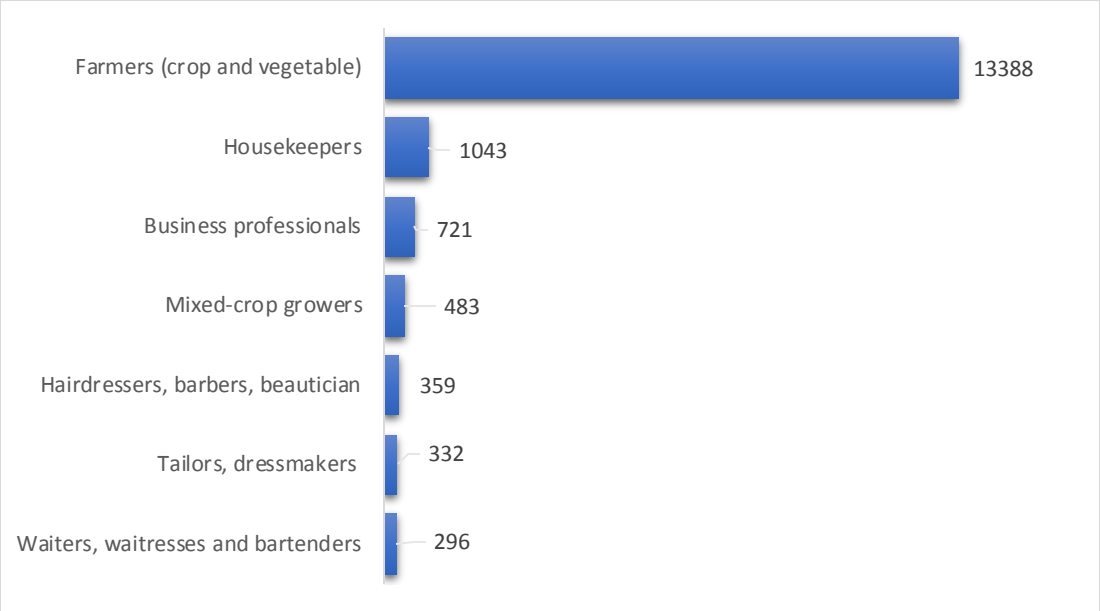


Figure 5 ; Top seven refugee occupations in Nakivale settlement.

Palabek Refugee Settlement [Lat. 3.38045283 Long. 32.53257751]

Palabek refugee settlement was established in April 2017 in Lamwo district that has a land area of 5,588.3 Sq. Km. The settlement sits on 50 sq. km total surface area of land in Palabek Ogil Sub County in Lamwo district northern Uganda. Palabek borders South Sudan to the north, Amuru district in the west, Gulu district in the south and Kitgum in the east. Ogili Sub County is located about 77 km from Lamwo district headquarters and 15 km from the nearest national electricity grid line located at Palabek Kal.

The hosting district, Lamwo has two rainy seasons from March to June and August to November hence fostering crop growing. The hosting community has English and Acholi as the common dialects.

According to the UNHCR factsheet as of December 2019, the estimated host population is 143,800 and 52,079 refugees as shown in the info- diagram below.

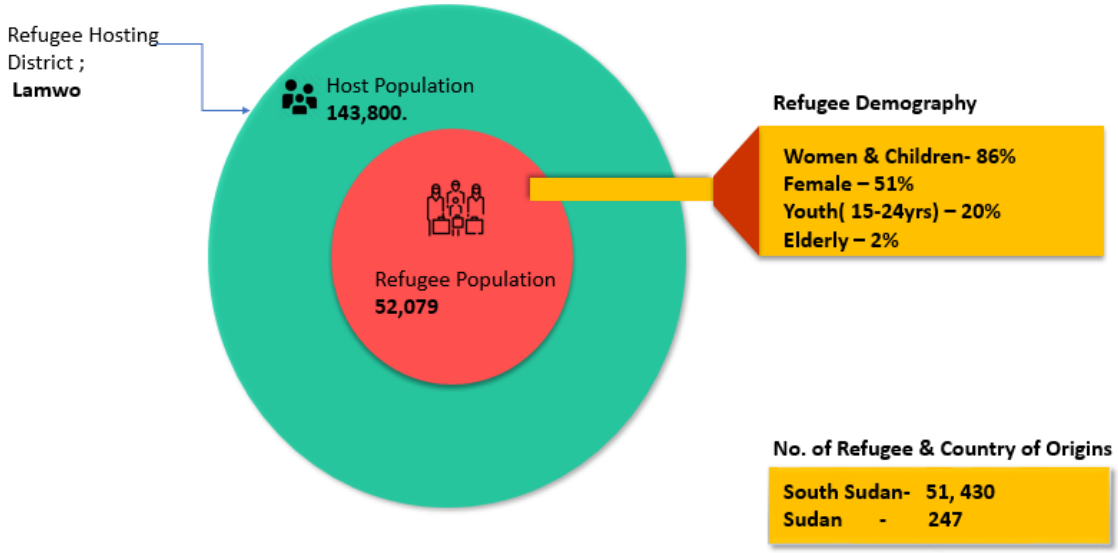


Figure 6; info-diagram for Palabek refugee settlement

Source: UNHCR website www.unhcr.org (Oct.2019)

Crop farming is the main source of livelihood for both host and refugees. Some of the cash crops include sunflower, simsim, millet, sorghum, ground nuts etc. The top seven occupations engaged in by the refugees is as below (*as of Oct 2019*).

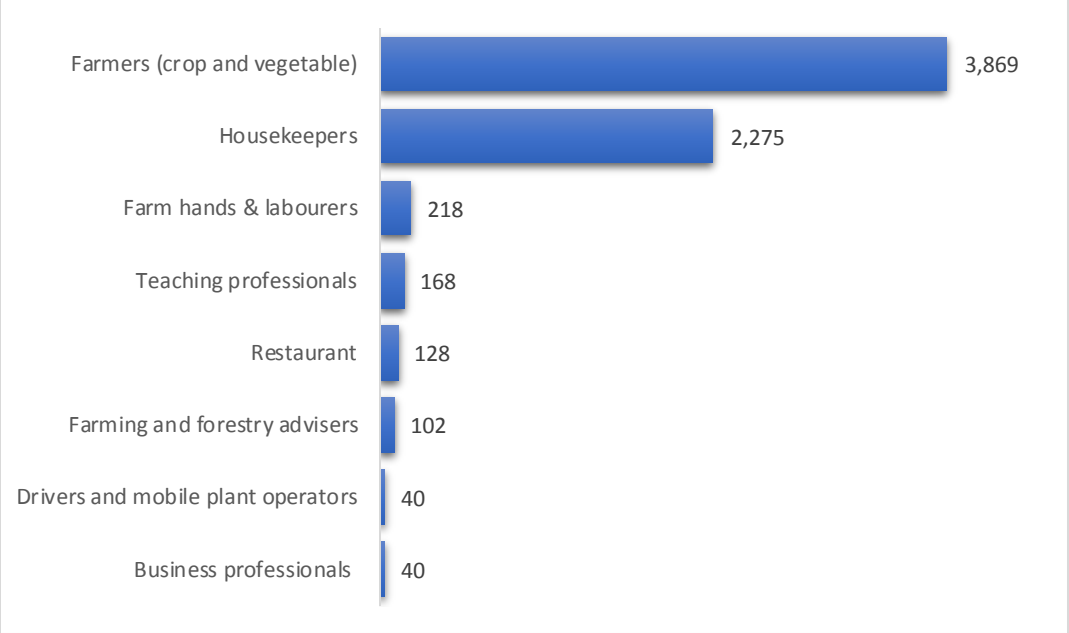


Figure 7; Top seven refugee occupations in Palabek settlement

Maaji Refugee Settlement [Coordinates; 3°11'58.3"N 31°39'08.1"E]

Originally established in 1997, Maaji refugee settlement was established in Adjumani district to host refugees fleeing the second Sudanese civil war. Maaji refugee settlement is currently divided into 3 zones namely, Maaji I, Maaji II and Maaji III. Of the 3 zones, Maaji 1 is the oldest and it hosted the very first refugees in the settlement. Maaji II and III were later reopened in

2015 to host new refugee arrivals from South Sudan after the resurgence of the civil war. The settlement is hosted in Ukusijoni sub-county which is over 20 km from Adjumani town center. Adjumani has an average altitude of 1,200 meter above sea level and a total area of about 3,128 Sq. Km.
The grid is at an estimated distance of over 20 km from the hosting sub county to Adjumani town.

Adjumani district is one of the few host districts whose refugee population for Maaji is 31,376 and that of the host community as 235,900. While the settlement is no longer receiving refugees, humanitarian partners continue to support and uplift the standards of living in the settlement.

The host community is largely comprised of the Madi tribe as well as Acholi, Kuku, and Lugbara. These share a closely similar ethnicity with the south Sudanese Refugees that includes Dinkas, Kuku, Nuer, Kakwa, Madi, and Siluk with farming being a major source of livelihood.

The info-diagram below provides a summarized profile of the settlement. The refugee demography is based on this survey that was sampled out of 428 households.

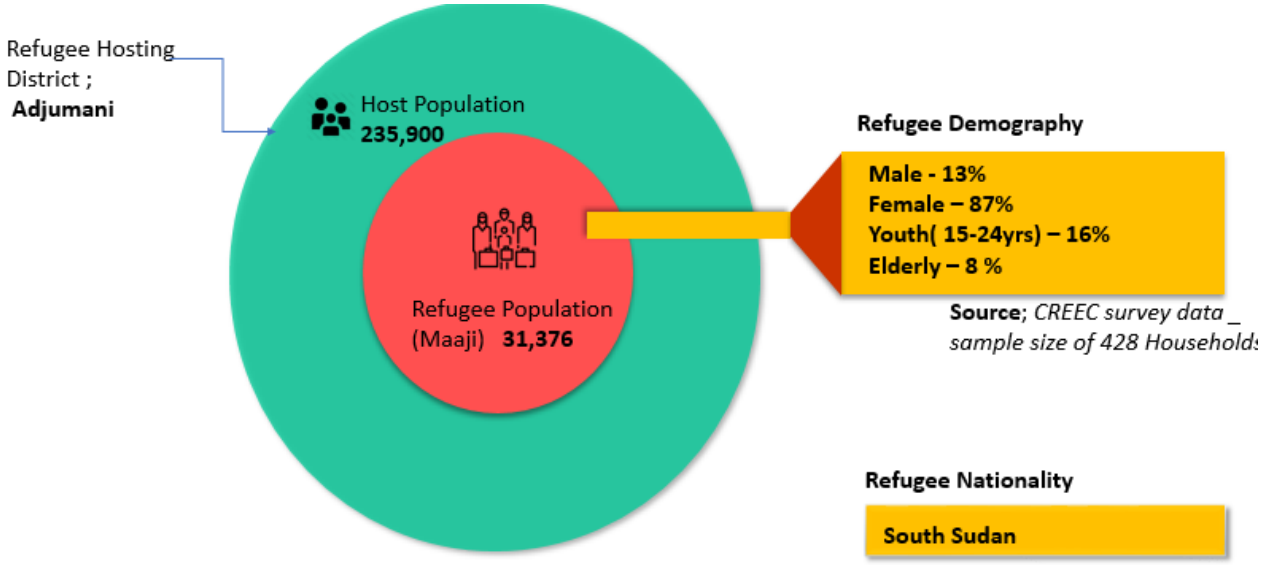


Figure 8 ; info-diagram for Maaji refugee settlement

Majority of the host population and partially refugees is engaged in peasant farming that includes both crop and livestock farming. Some of the cash crops include sweet potatoes, maize, beans, simsim, cassava etc. Housekeeping, teaching and restaurants are among the other major occupations undertaken by the refugees. The top seven occupations engaged in by the refugee community inclusive Maaji is as below (*as of Oct 2019*).

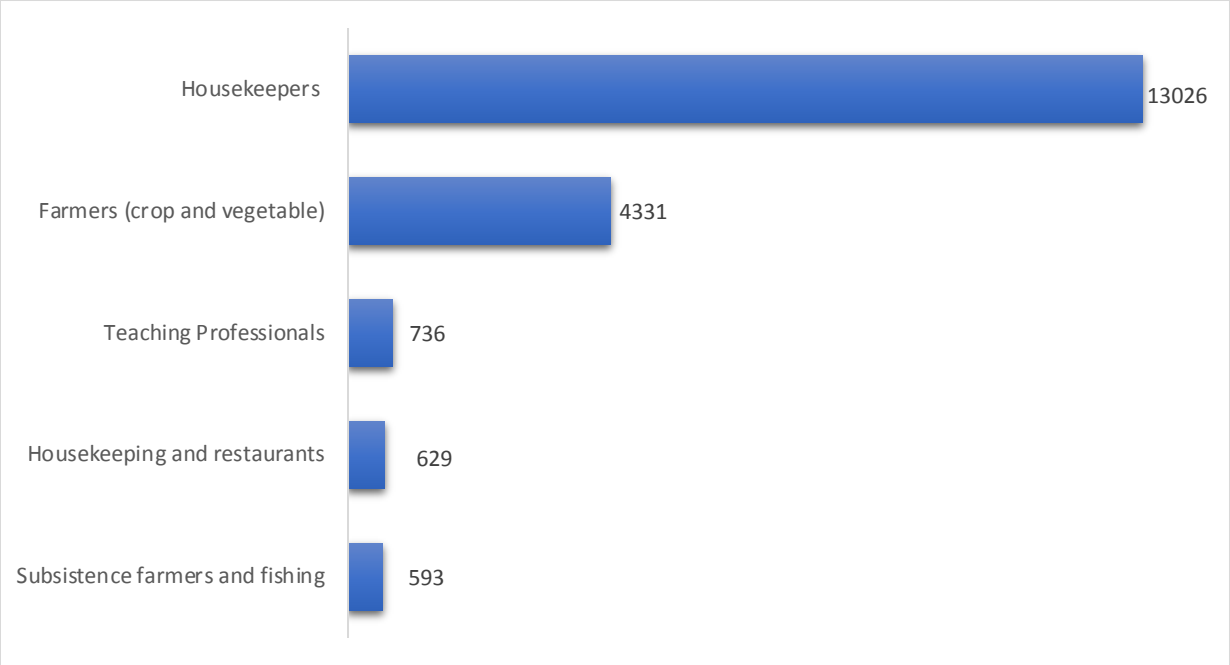


Figure 9: Top occupations in Maaji

3 METHODOLOGY

A quasi cross-sectional research design was adopted for the baseline energy market supply and demand survey. Data collection techniques used considered both qualitative and

quantitative methodologies in both refugees and host communities. The quantitative and qualitative methods employed different techniques/methods including but not limited to observation walks; Key Informant Interviews; Focus Group Discussions and household surveys. Given that the sample frame of households and institutions using energy appliances was not available, multistage sampling approach was used. The enumeration area was stratified using systematic random sampling approach following UNHCR/OPM developed stratums such as zones, blocks and houses.

3.1 Sampling of respondents

Sampling procedures of stratified random sampling and judgmental sampling were used to eliminate the possibility of omitting certain sub-group of samples, sample size was determined using the standard formula as shown below;

$$n = \frac{\frac{Z^2 * p * (1 - 0.5)}{e^2}}{1 + \frac{Z^2 * p * (1 - 0.5)}{e^2 * N}}$$

Where,
e is the desired margin of error at 5%
Z is the Z-score i.e. 1.96 for a 95% confidence interval,
p is the prior judgment of the correct value of p, 0.5
n is the sample size (to be found)
N is the overall sample size as reported

The sample size for the four districts from the formula above are;

Table 2: Sample size for each district.

District (name of settlement if different)	No. of KIIs	HH interviews (refugees and hosts)	No. of vendor surveys	No. of FGDs
Kiryandongo	7	385	13	3 (each 10-12 participants)
Lamwo (Palabek)	10	382	10	3
Isingiro (Nakivale)	9	353	10	3
Adjumani (Maaji I, II, III)	12	428	11	3

3.2 Target population

The target population for the household survey and focus group discussions included both refugee and host households, while the key informant interviews targeted staff of institutions (health centres and schools) and line partners implementing energy, livelihoods and environment related programs in the four refugee settlements.

3.3 Data Collection Methods

3.3.1 Observation walks

The observation walks were conducted in areas that had prospects for implementation of energy businesses. This activity was conducted in and around the trading centres in the refugee settlements and surrounding host community. This involved a straight walk through the target niche making observations guided by a checklist developed in line with the study

objectives. The purpose of this was to understand the community trade practices, market practices and to determine on – demand products.

3.3.2 Market surveillance survey

Price surveys were conducted in the markets or neighborhoods most frequently accessed by the study population. Market prices for charcoal, wood and solar products were recorded and crosschecked with prices which households and institutions claimed to pay for. The quantity of fuels such as charcoal and fuel wood was estimated using their local quantification and pricing criteria such as basins, kavera (polythene bag) for charcoal and bundles for wood fuel.

3.3.3 Vendor interviews

The vendor interviews were conducted to determine the supply and demand chain of energy products. This was focused on key actors in the market supply and demand. In both the settlement and host there were dedicated dealers in energy products such as solar products and accessories, kiosk businesses and bioenergy products.

3.3.4 Household interviews

Household interviews were conducted in households from the different zones of the settlement and villages of the host communities to determine the level of household energy access and challenges faced in the transition from traditional energy technologies to modern and efficient energy technologies.

Host Community Household Numbers: Given that the host community did not have identifiable household numbers, a unique naming format was developed which was comprised of; host, the number of the respondent being interviewed and the enumerator ID code.

3.3.5 Key Informant Interviews

Key Informant Interviews were conducted with knowledgeable persons and key players in the energy sector consisting mainly of vendors, institutions, NGOs, CBOs and other fuel consuming enterprises such as schools and health centres. Specifically, key informant interviews were conducted in line with the energy supply and demand situation in the enumeration area. Key informants were selected using a purposive sampling technique.

Three categories of key informants were engaged which were categorized as follows; **enabling bodies, implementing organizations** and **influential persons**.

3.3.6 Focus group discussion (FGD)

Focus Group Discussions (FGDs) were held per settlement with two gender sensitive groups for refugees i.e. female only and male only, while for the hosts, a mixed group FGD including both the male and female was done; thus a total of three FGDs were conducted per settlement. The purpose of the FGDs was to bring together a section of the community to discuss issues affecting them regarding energy market supply and demand.

3.3. 7 Stakeholder analysis

Stakeholder analysis can be defined as a methodology for gaining an understanding of a system, and for assessing the impact of change to that system, by means of identifying the key stakeholders and assessing their respective interests (Grimble, 1998; Grimble & Wellard, 1997). For this study, the stakeholder analysis was built on a pragmatic approach supported by an exploratory study design based on desk review of existing literature and multi

stakeholder engagements in humanitarian settings using questionnaires to fill information gaps. Questionnaires were used to conduct forty key informant interviews, forty-four vendor interviews and twelve focus group discussions in the four refugee settlements.

3.3.8 Data Quality Control and Analysis

The enumerators were purposively recruited based on local languages pertaining to the host districts for easy communication. They received prior training to the data collection exercise to ensure that they understood the questions within the questionnaire and had a good grasp on how to navigate through the questionnaire while using the Open Data Kit (ODK) survey tool.

Additionally, a field supervisor was assigned to each of the four settlements. Some of the responsibilities included data quality control by carrying out spot checks, daily review of all questionnaires to minimise errors and ensure consistency of the data collected.

4 FINDINGS

4.1 OVERVIEW OF SURVEY POPULATION

4.1.1. Demographic and socio-economic characteristics

Total No. of respondents: A total of 1,548 household interviews were conducted across the four refugee hosting areas; 28% (428 respondents) from Adjumani (Maaji), 25% (385 respondents) from Kiryandongo, 25% (382 respondents) from Palabek and 23% (353 respondents) from Nakivale.

Of the total respondents 31% were hosts (480) and 69% were refugees (1068);.while 79% (1228) were female and 21% (320) were male. The graph below shows a gender representation of the respondents per settlement.

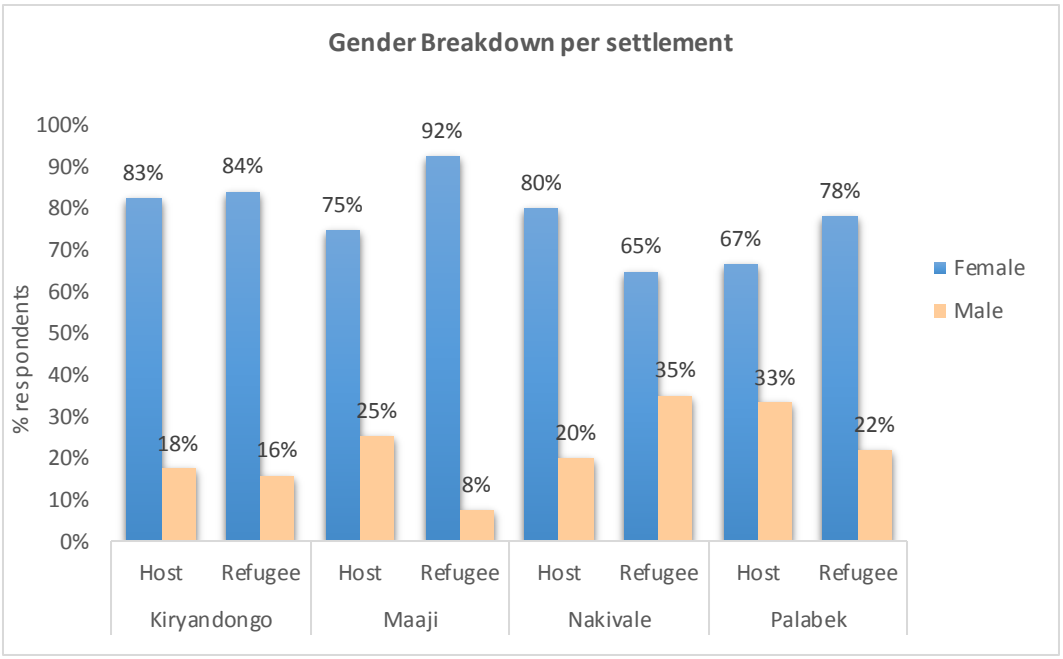


Figure 10: Respondent gender breakdown per settlement

As seen in the graph above, majority of the respondents were female as compared to male respondents across all settlements. An analysis on the household head revealed that 72% of the total respondents were household heads, of which **76% were female** and 24% were male. The graph below shows the detailed breakdown of household head versus gender for both the refugees and hosts.

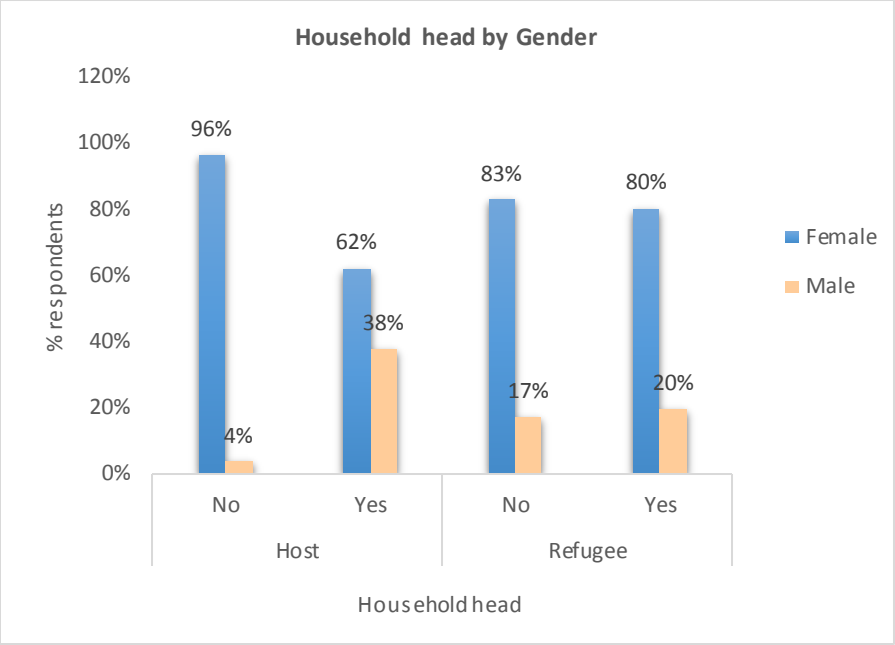


Figure 11: Household head versus gender

As seen above, for respondents that were household heads 62% in the host community were female as compared to 38% male, while for the refugee community, 80% were female and 20% were male. This gives an indication that females are mostly the key decision makers for the majority of households in the settlements. Traditionally this would not have been the case but in situations of displacement they have to take on this new role.

It is important to also note that where men were the respondents, majority of them were the household heads. However, for both refugee and host communities, the women were significantly more often the household heads.

Origin of the respondents: Of the household respondents, 54% were from South Sudan, 31% were Ugandan (host community), 4% were from Burundi, 6% from the Democratic Republic of Congo (DRC), 3% from Rwanda, 1% from Somalia and a few from Tanzania and Kenya.

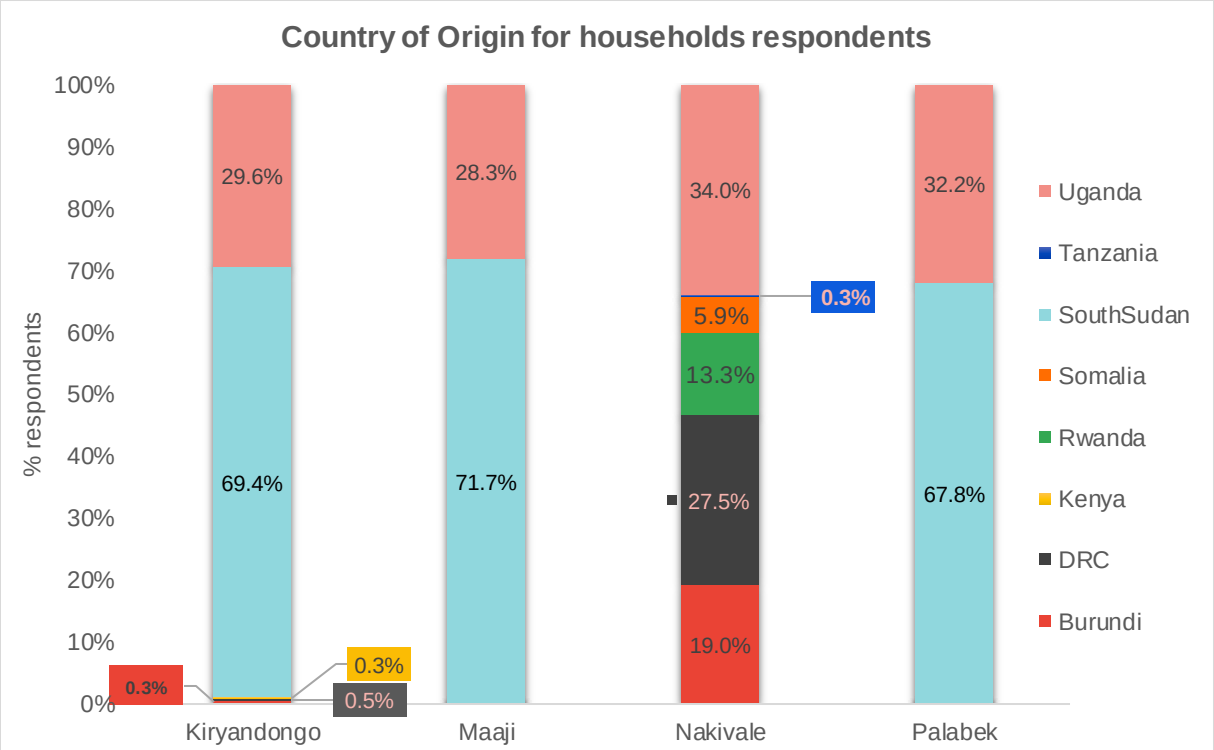


Figure 12; Respondent countries of origin per settlement (Host and Refugees)

The settlements of Palabek, Maaji and Kiryandongo were mostly hosting South Sudanese refugees while Nakivale was mostly hosting refugees from the Democratic Republic of Congo (DRC) and Burundi.

For the vendor respondents interviewed, majority i.e. 21 were from South Sudan, 15 were Ugandan, 3 from Democratic Republic of Congo (DRC), 2 from Burundi, 2 from Rwanda and 1 from Kenya.

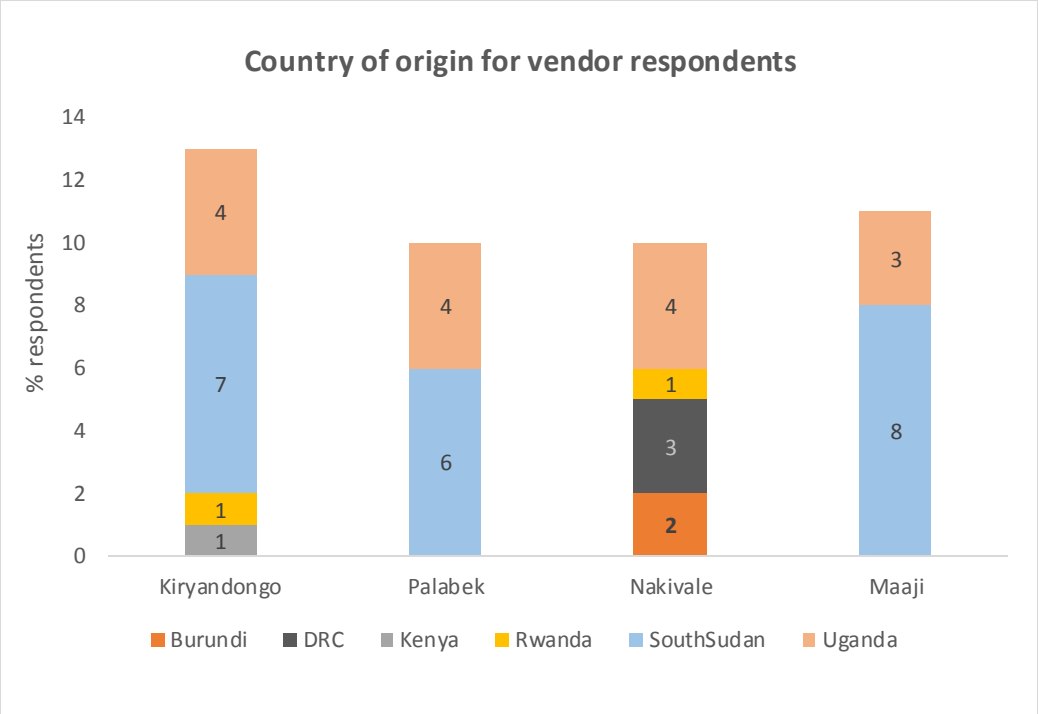


Figure 13: Country of origin for the vendor respondents per settlement

Similar to the household respondents, majority of the vendor respondents in the settlements of Maaji, Palabek and Kiryandongo were refugees from South Sudan, while the refugee respondents in Nakivale were mostly from DRC. Of the 44 vendors surveyed, 18 were female and 26 were male.

In addition, majority of the vendor respondents (31) were youth in the age bracket of 18 – 35 years, 6 were aged 36-45 years, 3 were 46-55 years, 2 were aged over 55 years and 2 respondents did not respond to this question.

Income sources: Of the total household respondents, 60% had one source of income while 21% reported two sources of income, 17% had no source of income and 2% had three sources of income. The graph below shows a breakdown of the number of sources of income and respective percentages per number of income source per settlement.

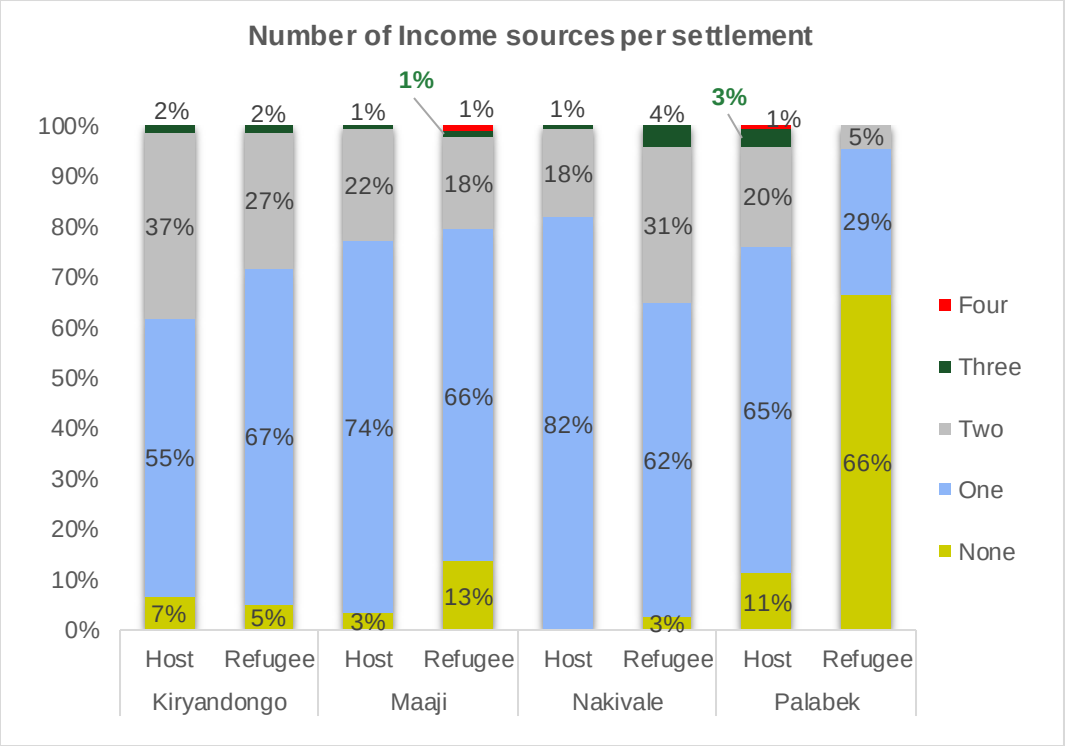


Figure 14: Number of income sources per settlement

Whereas the majority of household respondents in Kiryandongo, Nakivale and Maaji had one source of income which was mostly agriculture, the majority of respondents in Palabek (66% refugees, 11% hosts) had no source of income.

Nakivale (2%) and Kiryandongo (7%) had the lowest number of respondents who reported having no source of income, while Maaji had an average 8% respondents with no source of income. Kiryandongo (34%) and Nakivale (27%) still had the highest number of respondents reporting two sources of income and three sources of income, followed by Maaji at an average of 22%.

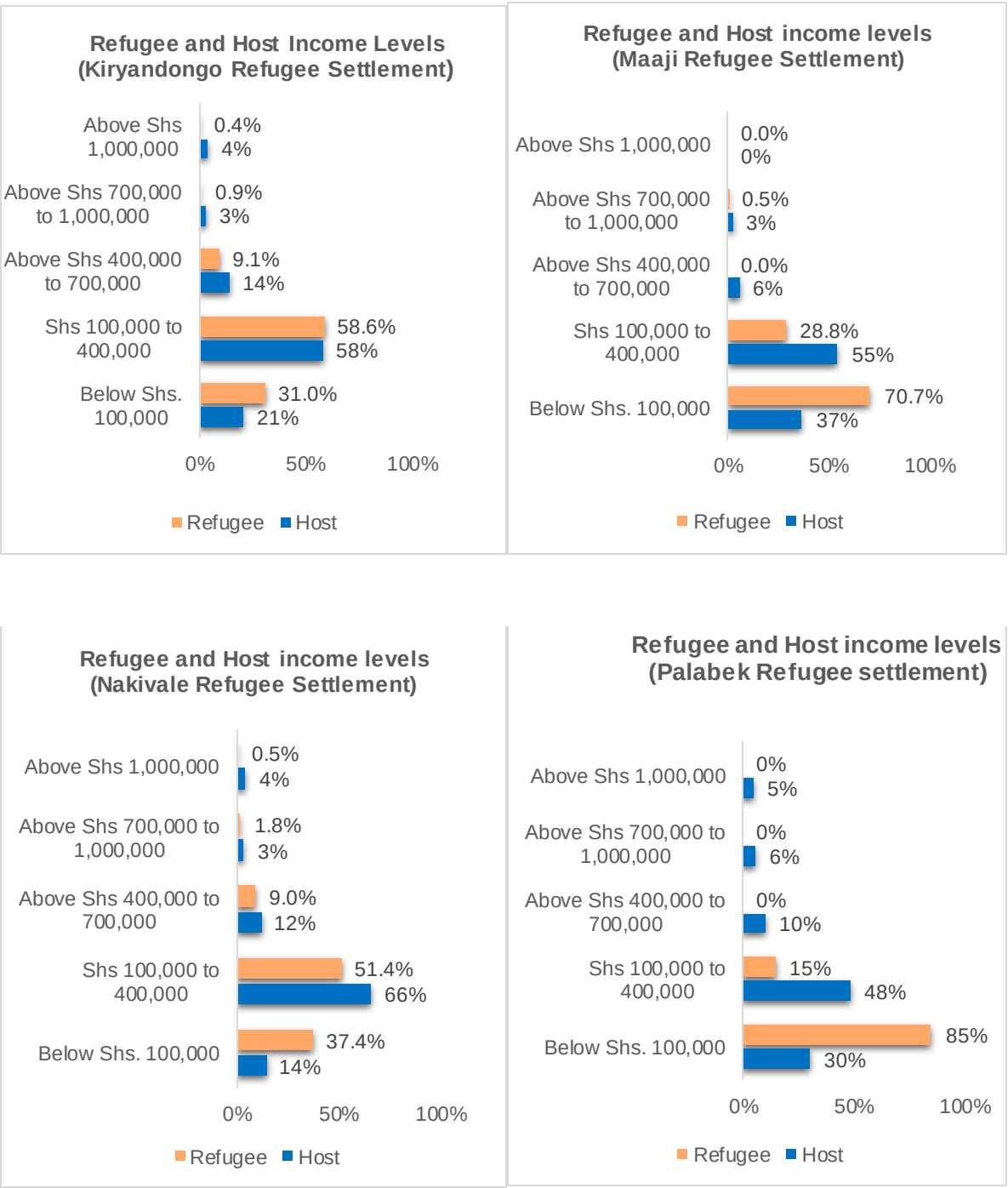


Figure 15: Income levels per settlement

From the analysis of the income levels per settlement, it was found that the majority of the respondents (58%) of both the refugee and host population respectively have between UGX 100,000 and 400,000 in Kiryandongo.

In Nakivale, 51.4% of the refugees and 66% of the hosts reported to earn between UGX 100,000 and 400,000. In Maaji 28.8% of the refugees and 55% of the hosts earn between UGX 100,000 and 400,000. While 70.7% of the refugees earn below UGX 100,000. In Palabek, 15% of the refugees and 48% of the hosts earn between UGX 100,000 and 400,000 while 85% of the refugees in Palabek earn below UGX 100,000. From these findings we realize that the respondents in Nakivale had the highest income levels followed by those in Kiryandongo and the lowest earning respondents were in Palabek. The average income for

the female household heads is UGX 101,000 while that of the male household heads is UGX 186,000.

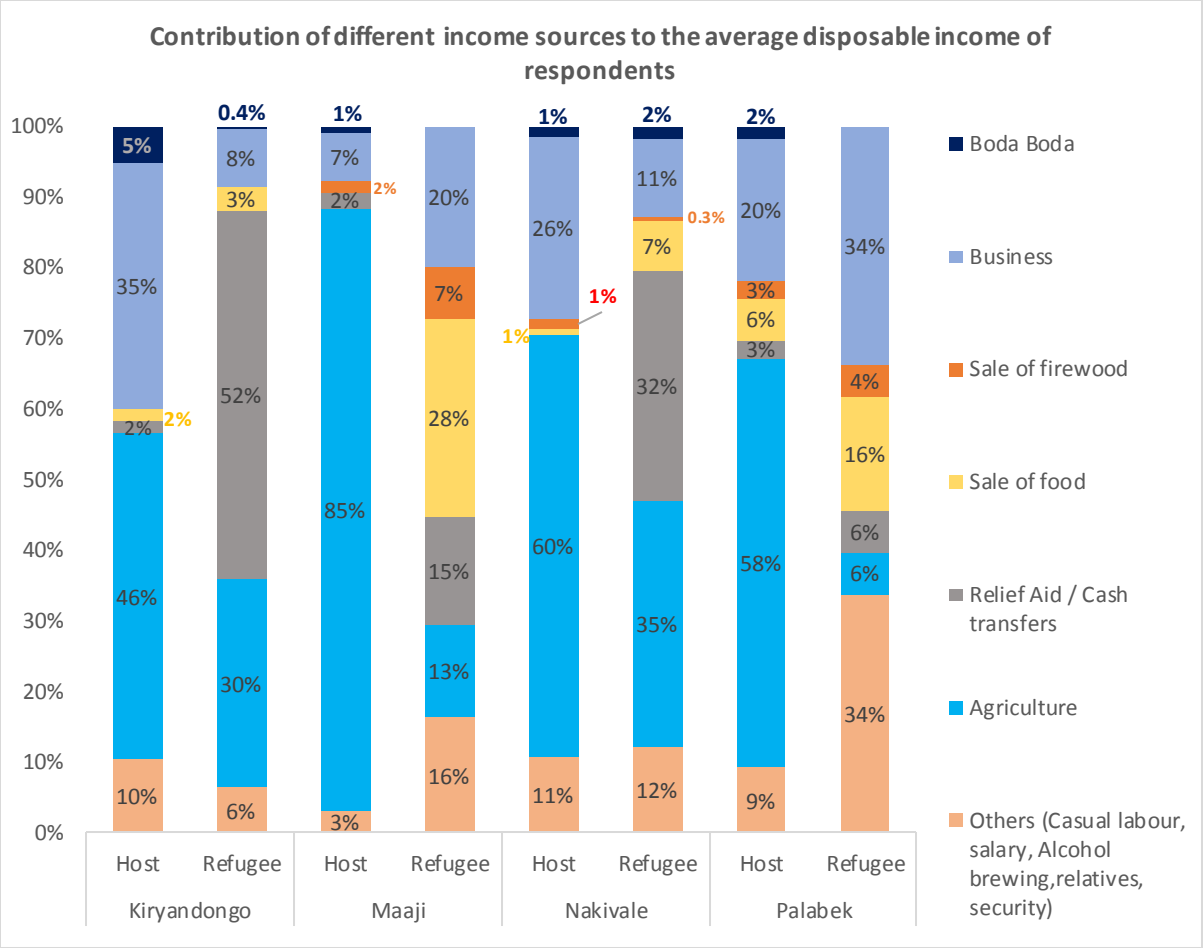


Figure 16: Income contribution per settlement

From the findings of the income sources when the data is disaggregated amongst hosts and refugees across the four settlements, it was noted that; for Kiryandongo, only an average of 3% of the refugees and hosts depend on sale of firewood for income, the greatest income source for the hosts is agriculture (46%) and for the refugees, it is relief aid with 52% reporting aid as their source of income.

In Maaji, 28% depend on the sale of relief food and 7% of the refugees depend on the sale of firewood for income. For the hosts, the greatest source of income is agriculture with 85% earning from it.

In Nakivale, the main source of income is agriculture followed by relief aid at 35% and 32% respectively, 7% of the `refugees earn from the sale of food (restaurant business). Agriculture is more widely practiced by the refugees in Nakivale than in all the other settlements this is attributed to their length of stay in the settlement in the host community of Nakivale the main source of income was agriculture practiced by 60%.

In Palabek, the highest number of refugees earn from business (34%) and other sources such as casual labour, alcohol brewing etc (34%). The hosts in this community mainly earn from agriculture (58%).

We observe that agriculture is the main source of income across all the settlements except for Kiryandongo where relief aid /cash transfers takes a higher percentage, with 52% of the refugee respondents receiving their earnings from aid. The amount of disposable income could not be calculated in this study however from literature; multiple studies in Uganda find the estimates of monthly household energy expenditures between US$2.37 and US$3.13. Refugee families report household incomes between US$.37 to US$.74 per day. The average potential monthly disposable household income is **US$2.16** for farmers (both host and refugee communities of any gender) (Mercy Corps, 2019)

4.1.2 Refugees' duration of stay in the settlements

In line with the period of establishment of each settlement, refugees have stayed different time periods in these settlements. Nakivale which was established in 1960 had the highest number of refugees (73%) who had stayed for over five years in the settlement. Whilst Palabek which is one of the newest settlements that started receiving refugees in April 2017 had the most number of refugees (53%) who had stayed for less than two years and 47% had stayed for two to five years.

Kiryandongo which was opened in 2014 had 78% of the refugees living in the settlement for two to five years and Maaji which was reopened in 2015 had 86% of the refugees reporting to have lived in the settlement for the past two to five years.

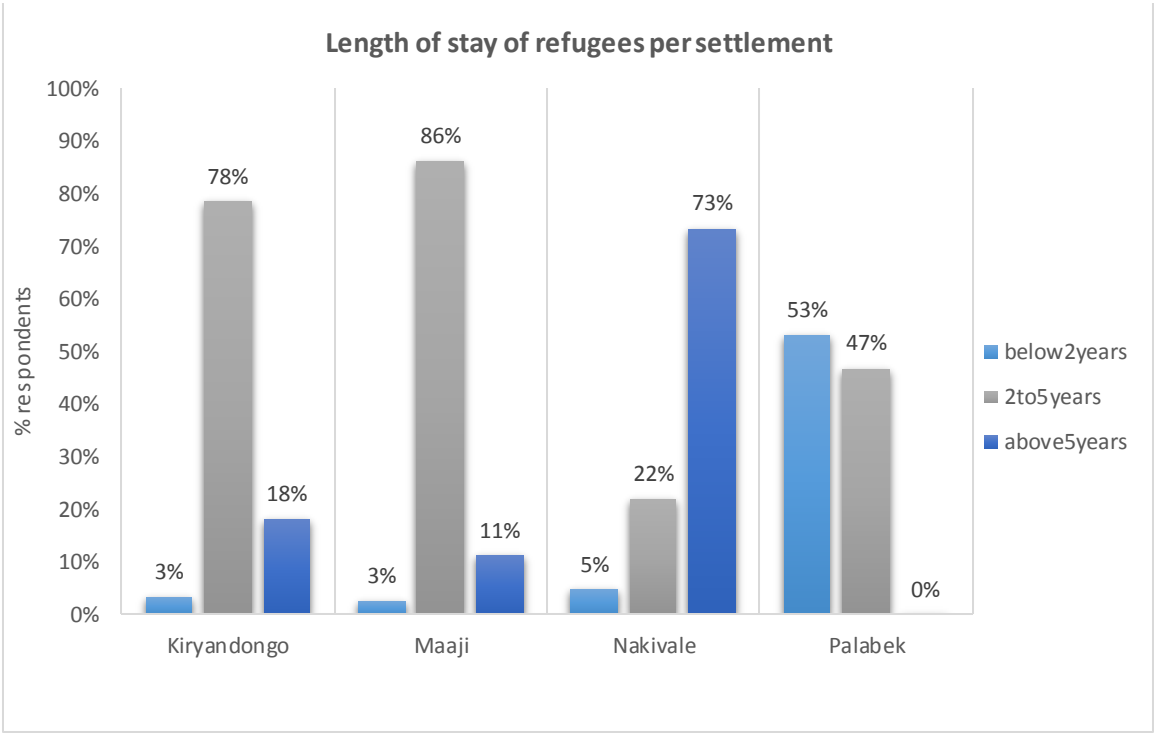


Figure 17 ; Length of stay of refugees per settlement

4.2 STAKEHOLDER MAPPING

Energy is one of the most important drivers of social and economic development for most developing countries of which Uganda is among. Though applauded as the top refugee hosting country in Africa, Uganda is largely immersed in energy poverty. Biomass is a major contributor to the national energy mix, meeting over 95% of the national primary energy demand. With the continued consumption rates of the natural forest cover, there is a definite threat on Uganda's bio economy where natural resources are a reliable safety net for meeting energy and livelihood short falls for both the host and refugee community. Currently Uganda is hosting over one million refugees from neighbouring countries including Democratic Republic of Congo (DRC), South Sudan, Burundi, Rwanda, Somalia, and Tanzania. This has increased pressures on the already dwindling natural resources further exacerbating an imbalance in demand which has overwhelmed the natural regeneration rates of the available biomass resources in the country despite the efforts by various development partners towards improved access to modern energy for cooking and lighting. Stakeholder challenges manifest as a major setback in most development initiatives involving a multi stakeholder involvement despite detailed planning and technically sound processes. Many times stakeholders may not be cognisant of each other's activities leading to duplication of roles. This notion is the motivation for his identification and classification of key stakeholders relevant for project success and avoiding duplication.

4.2.1 Objective

The aim of the stakeholder mapping was to identify key stakeholders relevant in the energy space (cooking and lighting) currently operational in the four settlements in question in the refugee sector. This analysis was designed to provide information on stakeholder types and their roles, needs for increased inter-stakeholder relations and investment opportunities and to identify implementable action plans for market-based energy access interventions in humanitarian settings.

4.2.3 Identification of stakeholders in the energy access market

Stakeholder identification was conducted in the four refugee settlements considered from the viewpoint of market-based energy access in regard to electricity and cooking needs, this involved the sectors of education, energy and environment and livelihoods. The concept of aggregation and hierarchy was used to refine the initial list by classifying stakeholders into smaller groups based on their functions within the stakeholder network. From this we grouped the stakeholders into NGO's, Development partners, financiers and research and academia[1].

4.2.4 Categorization of stakeholders

Information used for selection of potential key stakeholders with prospects of supporting market-based energy access was obtained from a comprehensive literature search on; the Refugee Response plan and existing literature on the various humanitarian support organisations based in the scoped study sites. A snowball sampling criterion was deployed to obtain expert opinion of the relevant key informants with a vision to promote and or implement market-based energy access in refugee settlements and host communities. Underpinned by expert opinions, three sectors were eye marked for survey including; Energy and environment,

[1] The enumeration area considered for this study included the area in the selected refugee hosting area and the immediate hosting community. With this definition of host community, no private sector was found as they were located in the major trading centers of the host community.

livelihoods and the education sector due their interdependencies and complementary flow of activities during program implementation.

1. Palabek Settlement

Table 3: Stakeholder categorization in Palabek

	What they do	Sphere of Influence	Approach / Strategies used
Category: Government of Uganda			
1. OPM (Office of the Prime Minister) 2. Local Government Uganda Police	○ Receive and grant asylum to refugees in accordance with both international and national legal instruments ○ Advise government and other stakeholders on refugee matters ○ Provide physical protection to refugees ○ Improve on the physical infrastructure of the Refugee settlements, such as roads, staff accommodation, offices, reception centres etc ○ Enhance the Refugee livelihoods by provision of Income Generating Activities (IGAs)	○ Host community and refugee settlement	○ Granting refugees, the right to cultivate and till land in Uganda, setup and establish their own livelihoods and businesses. ○ Establishing a police post in the settlement for peace and protection. ○ Establishing a refugee welfare council solely representing refugees on the OPM panel.
Category: **Humanitarian**			
UNHCR United Nations High Commissioner for Refugees	○ Provides protection and assistance to refugees. ○ Pursue durable solutions for refugees through project funding	○ Refugee settlement & host community	○ Forging sustainable partnerships with the Uganda government ○ Operation through development and implementation partners

	What they do	Sphere of Influence	Approach / Strategies used
World Food Programme (WFP)	○ WFP provides food to the refugees. in some areas they give cash for the food	○	○ Cash for food as per household request ○ Food to all the zones
Category: NGO's / CSO			
Lutheran World Federation (LWF)	○ Livelihood ○ Energy and Environment	○ Agriculture ○ Business management ○ Records keeping ○ Financial management ○ Sales of energy equipment ○ Forest restoration ○ Artisanal skills development on energy technologies ○ Business support ○ Financial linkages ○ VSLA, groups for business ○ Cash grant for business ○ Agriculture sport through group, farming tool, financial support for land, seeds, value addition ○ Small irrigation scheme ○ Water resources management	○ Distribution of planting material. ○ Training on agronomic practices ○ Formation of saving groups ○ Training on booking keeping and financial management ○ Group loan scheme ○ Training on artisanal construction of improved cook stoves ○ Establishment of nursery beds ○ Marking endangered tree species ○ Establishment of environment protection teams ○ Training on production of alternative energy efficient fuels (briquettes) ○ Energy business incubation through identifying interested individuals in energy stoves.
CARITAS	○ Livelihood	○ Economic empowerment ○ Food security	○ Supports group farmers with tools and startup capital

	What they do	Sphere of Influence	Approach / Strategies used
			○ Trains farmers on agronomic practice, provide tools and seeds based on the identified need ○ Use the existing structure comprising of participants from sub counties, RWCs, in identifying participants for training
Food for the Hungry	○ Livelihood and Energy through partner	○ Kitchen gardening ○ VSLA ○ Briquette making	○ Train members in VSLA on Stove making and Briquette
War child	○ Energy and Environment	○ Tree planting	○ Buy seedlings from private nursery operators and provide to interested households in the settlement and also give seedlings to water committee to restore degraded areas of land
Don Bosco	○ Energy and Environment ○ Livelihood	○ Tree planting and eco-clubs ○ Training	○ Gets the service from LWF for seedlings and ○ Provides trainings (solar, motor repair, tailoring, agriculture) in its vocational centre
Refugee Law Project (RLP)	○ Energy and Environment	○ Tree planting ○ Dialogue	○ Lobby land from community, enter MOUs, plant and manage the plantation for a period of 1year and hand it over to the land owner ○ Engage refugees and host through dialogue to manage the environment
Soroti Rural Development Agency (SORUDA)	○ Energy and Environment	○ Construction of Rocket Lorena stoves in host and settlement communities ○ Tree planting	○ Training Trainers on rocket lorena construction who later train and construct for others in their communities ○ Buy tree seedlings
Finnish Refugee Council (FRC)	○ Education	○ Primary and secondary education	○ Practical skills development ○ Business skills training

	What they do	Sphere of Influence	Approach / Strategies used
		○ Formal and non-formal vocation education	○ Internship and apprenticeship attachments
Action Africa Help (AAH)	○ Livelihoods ○ Energy and Environment	○ Tree planting	○ Distribution of seedlings
Category: **Research / Academia**			
CREEC, Makerere University Gulu University	○ Research ○ Capacity building	○ Research on energy access ○ Technical support energy technologies	○ Investigative survey ○ Interventionist survey ○ Development of implementable practical models (business, marketing)

2. Kiryandongo Settlement

Table 4: Stakeholder categorization in Kiryandongo

Name of agency	What they do	Scope of Influence *(Activity/Target coverage)*	Approach / Strategies used
Category: **Government of Uganda**			
OPM Local Government Uganda Police	○ Receive and grant asylum to refugees in accordance with both international and national legal instruments ○ Advise government and other stakeholders on refugee matters ○ Provide physical protection to refugees ○ Improve on the physical infrastructure of the Refugee settlements, such as roads, staff accommodation, offices, reception centres etc ○ Enhance the Refugee livelihoods by provision of Income Generating Activities (IGAs)	○ Host community and refugee settlement	○ Granting refugees, the right to cultivate and till land in Uganda, setup and establish their own livelihoods and businesses. ○ Establishing a police post in the settlement for peace and protection. ○ Establishing a refugee welfare council solely representing refugees on the OPM panel.
Category: **Humanitarian**			
UNHCR	○ Provides protection and assistance to refugees. ○ Pursue durable solutions for refugees through project funding	○ Refugee settlement & host community	○ Forging sustainable partnerships with the Uganda government ○ Operation through development and implementation partners
World Food Programme (WFP)	○ WFP provides food to the refugees. in some areas they give cash for the food	○	○ Cash for food as per household request ○ Food to all the zones

Name of agency	What they do	Scope of Influence *(Activity/Target coverage)*	Approach / Strategies used
Category: **NGO's / CSO**			
Real Medicine Foundation (RMF)	○ Supporting the refugee and host communities with health care ○ Supported refugees and host communities by setting up vocational training i.e. Panyadoli Vocational Training Institute which offers courses in hairdressing, tailoring, bricklaying, carpentry and solar technologies. ○ Education	○ RMF supports vocational training and sports programs in Uganda, nursing and midwifery programs.	○ Works with the community to conduct their programs
Danish Refugee Council (DRC)	○ Facilitating groups that make briquettes ○ Planting trees alongside roads and in Health Centres. ○ Training refugees and host communities on agro based activities ○ Wood harvest (Sustainable fuels) ○ Trainings on Energy saving stoves on Household level.	DRC works within the areas of: Livelihoods Environment Water, Sanitation and Hygiene Shelter & Infrastructure Armed Violence Reduction and Conflict Management Protection and Community Services ○	○ Involving communities at all levels. ○ Stakeholders meeting. ○ Extension workers. ○ Local structures that have got skills. ○ They involve Office of the Prime Minister in all the strategies. ○ District Local Government ○
BRAC	○ Emergency preparedness ○ Empowerment in livelihood for adolescents ○ Research on Livelihood ○ Skills development	○ BRAC uses a holistic approach to development engaging a wide range of tools to promote inclusion such as microfinance, health and nutrition, education, youth, agriculture and food security, research, community empowerment, disaster	○ BRAC has created clubs for girls. The girls meet every day in their clubs. They have been trained on financial literacy and family planning ○ They have created over 36 groups of VSLA in the settlement apart from the girls clubs formed ○

		management and climate change, targeting ultra-poor, social enterprises, water, sanitation and hygiene, poultry and livestock.	
Windle international Uganda	○ lead IP for Education ○ Provision of lighting technologies in schools both settlement and host communities.	○ Windle International Uganda is a registered NGO whose primary mission is to equip refugees and others affected by conflict in Africa to meet the challenges of development through providing access to education, training, and employment opportunities by advocacy and direct programme activity.	○ Joint missions (They work together with the parents, teachers and students and other interested organisations to achieve a common goal) ○ Meetings ○ Classroom Observation ○ Code of conduct training ○ Captures data of enrollment of refugees into educational programs ○ Curriculum development and disbursement

3. Nakivale Settlement

Table 5: Stakeholder categorization in Nakivale

Who they are	**What they do**	**Scope of Influence** *(Activity/Target coverage)*	**Approach / Strategies used**
Category: **Government of Uganda**			
OPM	○ Managerial overview of the settlement through playing a supervisory and monitoring role with other key stakeholders within the settlement.	○ Range of activities from coordinating partners that ensure equality, welfare and harmony such as security personnel. ○ Scope; Settlement community	○ Joint monitoring with other government entities / partners such as UNHCR, RWCs.

Who they are	**What they do**	**Scope of Influence** *(Activity/Target coverage)*	**Approach / Strategies used**
Category: **Humanitarian**			
UNHCR	○ Support and promote Refugee livelihood through services such as education, health and nutrition, cooking and lighting needs.	○ Provision of training and promotion of initiatives such as clean energy through funding of its implementing partners. ○ Targeted beneficiaries are both refugees and hosts	○ Implementation of initiative through collaborations with implementing partners. ○ Use of field monitoring teams to supervise and report on promoted initiatives
World Food Programme (WFP)	○ WFP provides food to the refugees. in some areas they give cash for the food	○	○ Cash for food as per household request ○ Food to all the zones
Category: **NGO's / CSO**			
War child	○ Energy and Environment	○ Tree planting	○ Buy seedling from private nursery operators and provide to interested households in the settlement and also give seedling to water committee to restore degraded areas of land
FRC	○ Provision of Adult Education ○ Livelihood and business training ○ Support for young people and civil society.	○ Services are provided to Refugees and partly local communities to avoid conflicts.	○ FRC offers functional literacy courses in refugees' first languages as well as in English ○ Supporting refugees' own organizations
Category: **Research / Academia**			
Nsamizi Training Institute of Social Development	○ Training on clean cooking technology. ○ Provision of clean energy fuels i.e. briquettes ○ Installation and maintenance of solar streetlights within the settlement	○ Training ○ Installation ○ Maintenance ○ Collaboration with funding partners	○ Household visits by the company team ○ Working with community workers within the households who are responsible for quality checks and providing weekly reports on feedback. ○ Training of trainers on ICS and briquette production within the settlement ○

4. Maaji Refugee Settlement

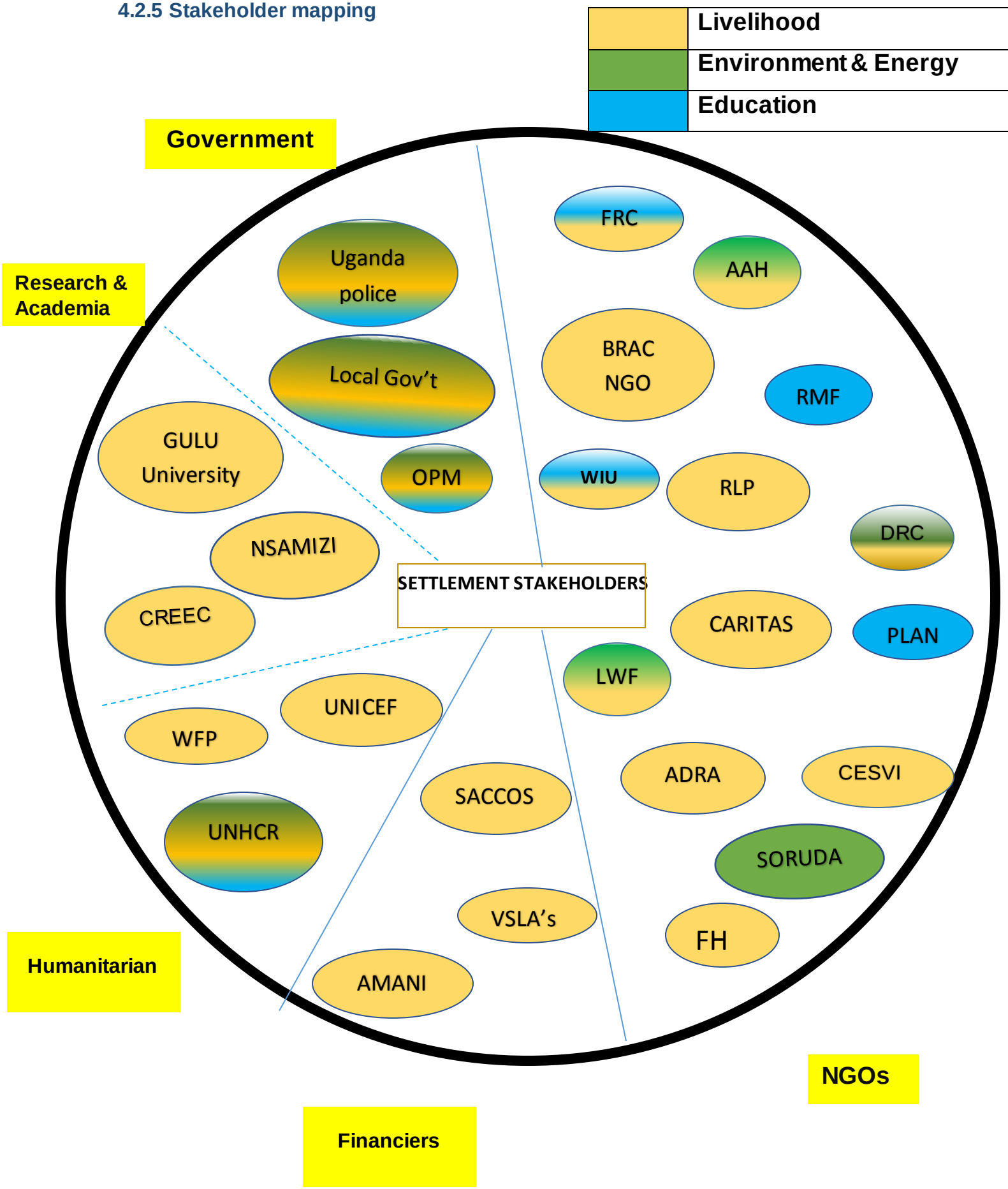
Table 6: Stakeholder categorization in Maaji

Who they are	**What they do**	**Scope of Influence** *(Activity/Target coverage)*	**Approach / Strategies used**
Category: **Government of Uganda**			
3. OPM 4. Local Government 5. Uganda Police	○ Receive and grant asylum to refugees in accordance with both international and national legal instruments ○ Advise government and other stakeholders on refugee matters ○ Provide physical protection to refugees ○ Improve on the physical infrastructure of the Refugee settlements, such as roads, staff accommodation, offices, reception centres etc ○ Enhance the Refugee livelihoods by provision of Income Generating Activities (IGAs)	○ Host community and refugee settlement	○ Granting refugees, the right to cultivate and till land in Uganda, setup and establish their own livelihoods and businesses. ○ Establishing a police post in the settlement for peace and protection. ○ Establishing a refugee welfare council solely representing refugees on the OPM panel.
Category: **Humanitarian**			
UNHCR	○ Provides protection and assistance to refugees. ○ Pursue durable solutions for refugees through project funding	○ Refugee settlement & host community	○ Forging sustainable partnerships with the Uganda government ○ Operation through development and implementation partners
World Food Programme (WFP)	○ WFP provides food to the refugees. in some areas they give cash for the food	○	○ Cash for food as per household request ○ Food to all the zones

Who they are	What they do	Scope of Influence *(Activity/Target coverage)*	Approach / Strategies used
Category: **NGO's / CSO**			
Danish Refugee Council	○ Community infrastructure construction ○ Facilitation and training of infrastructure management groups at community level ○ Access to clean energy cooking and lighting	○ Refugee settlement & host community	○ Training energy artisans and disseminating them into society as community workers and advocates. ○ Community dialogue to troubleshoot most prevalent problems and create everlasting solutions ○ Participating in national and international fora to influence and advocate for policies that empower displaced persons ○ Engaging both host community and refugees to provide integrated and inclusive solutions. ○ Cross organization cooperation to create quality cohesive solutions
Adventist Development and Relief Agency (ADRA)	○ Water and sanitation ○ Food and security ○ Improved health through Primary Health Care	○ ADRA Uganda works closely with local leaders, community-based groups, and civil society organizations to best promote sustainable livelihoods for people in displaced settings.	○ Community self-reliance through engaging the community in identifying its own needs. ○ Farmer groups' capacity building in agronomic practices, nutrition, appropriate technologies and supply of quality agricultural inputs ○ Extending support and trainings to VSLAs and SACCOs ○ Implementing community projects on maternal and child health. ○ Training health workers. ○ Advocacy and community awareness for environmental protection through afforestation, energy saving technologies ○ Skills improvement for teachers and school managers.
PLAN International	○ Supporting young people through skilling ○ Preventing and fighting against child abuse	○ Supporting young people to learn skills and get good jobs ○ Giving young children the best possible start in life through early childhood care and primary education	○ Using success stories from their skilling programs to champion/facilitate change. ○ Use of media houses to advocate for girls' rights and call upon community leaders.

Who they are	**What they do**	**Scope of Influence** *(Activity/Target coverage)*	**Approach / Strategies used**
	○ Promoting childcare and primary education ○ Promoting equal rights for girls and women.	○ Keeping children safe from all forms of abuse ○ Improving maternal, neonatal and child health as well as the sexual and reproductive health of young people ○ Responding to disasters and the influx of refugees into the country	○ Campaigns and activism programs to create awareness for human rights. ○ Young people driving change ○ Early childhood development
Windle International Uganda (WIU)	○ Education management in the settlement	Early childhood education for both refuges and host community ○ Primary education for both refugees and host community ○ Secondary education for both refugees and host community.	○ Enrollment of refugees into educational programs ○ Curriculum development and dissemination ○ Partnerships with other Ugandan tertiary institutions for further skilling and education of their graduate students.
Category: **Financers**			
AMANI Savings Corporative Society	○ Financial services to farmers	○	○ Organizing farmers into groups ○ Disseminating quality agricultural inputs to improve farmers' production capacity.

4.2.5 Stakeholder mapping



4.3 MARKET ANALYSIS ON SUPPLY OF COOKING AND ELECTRICITY TECHNOLOGIES

The markets have been analyzed basing on the following market system characteristics as per the EnDev Framework on Measuring Market Development 2013;

- Supply-side
- Demand-side
- Support Functions
- Market Rules

4.3.1 Supplier /Vendor Market

4.3.1.1 Vendor selection

The vendor selection was conducted in a three stage process; firstly after the visit to the settlement, key informants were interviewed to gain a full understanding of the settlement, data was collected on the number of markets, size of the markets and their respective market days. After this information was collected, basing on the interviews and field visits, the markets with the highest population was chosen and those with closest proximity to the respondents being surveyed. After the market selection, vendors dealing in energy products were interviewed,

4.3.1.2 Vendor characteristics

Note: *For this study, an energy retail shop was defined as a shop that sold energy products such as cook stoves and solar lamps; while an* ***energy service kiosk*** *was defined as a shop that provided services such as phone charging. The surveys in the respective settlements revealed that most vendors used either one of the models and only few kiosks that were usually of a larger size employed both models however these were dealing in general merchandise and not specifically only energy products.*

Of the 44 surveyed vendors, 23 were operating energy service kiosks while 21 were operating energy retail shops. Majority of the businesses surveyed (27) were operated by refugees. Of the surveyed refugee vendors, only 8 had other sources of income which were agriculture and cash transfers.

The graph below shows a breakdown of the type of businesses per settlement per category.

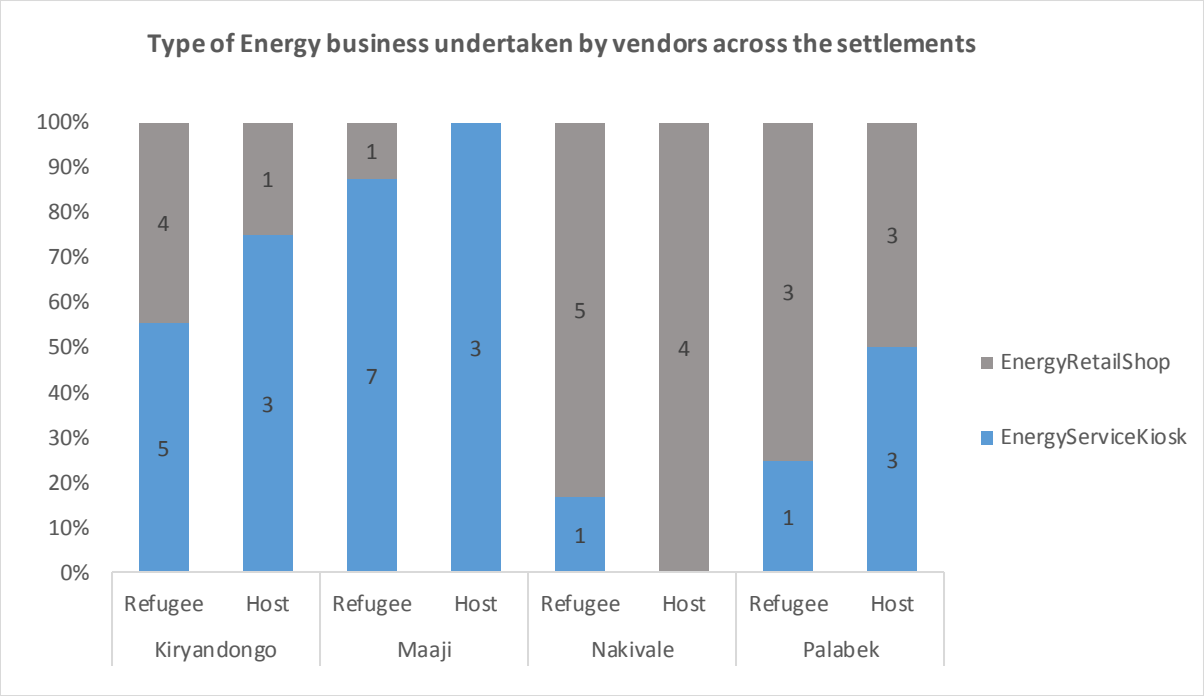


Figure 18; Type of business

Of the vendors interviewed, Maaji settlement vendors were mostly providing energy services, Most common among these services offered included, phone charging kiosks (which were most common, followed by saloons and entertainment halls which were more common in Maaji III than in Maaji II. Photocopying and printing service stations were also popular in the settlement although not more than 3 shops were found per centre. Opening hours for majority of the service centres was between 8 am to 9 pm except for entertainment halls which were reported to go past midnight on occasions of late-night European football. Entertainment halls were made from mostly semi-permanent materials such as iron-sheets and timber whereas the other service stations such as saloons, charging and printing kiosks were made from permanent structures.

Whilst in Nakivale, there were mostly energy retail shops; owned by refugees and others by the hosts, the service range mainly constituted of barber saloons. The central business area is located in the base camp zone and small non energy retail shops are located in different zones. Majority of energy retailers in the base camp are opened as early as 8:00 am and run into the night as late as 9:00 pm. The housing units observed were both of permanent structures (cement) and temporary structures (wooden structures). The make-shift markets which cover more than half an acre of land are held on Tuesday and Friday, on Tuesday the market is at Kityaza a host community that welcomes both nationals and refugees and on Friday it's at the New Congo market – the name derived from the large presence of Congolese refugees in the area.

In Kiryandongo, more vendors were operating energy service kiosks, the shops are open from 6 am to 10 pm though some open up to midnight. The services were found mostly in Bweyale town, in Kiryandongo some refugees are very near to the trading centers where they can easily walk for any service, but others are very far from those services and they need transport means to access the trading centers for example the respondents in cluster H and N.

In Palabek, there were more energy retail shops as compared to energy service kiosks, 6 out of 10. Within the settlement, each zone has a centrally positioned market to maximize access. The energy services found in the settlement included phone charging, saloon operations, bars, batteries were also found charging in the host community markets. Energy retail shops in

Palabek were mainly selling items such as torches, dry cells, candles. This was mainly because the high demand for such products. ICS were institutionalized and run by LWF through trained hawkers and these were sold also during the weekly market days. Most markets were gazetted with a radius of half an acre, and made of wooden kiosks and wooden frame stalls with shades made out of plastic bags. At Palabek there is one general market day convening all persons from refugee settlement and host.

The main **motivation** to start these businesses was found to be majorly due to the need to generate income coupled with the high demand for these products and services in the respective areas.

4.3.1.3 Products and Prices

The following were the energy products sold by the vendors who were interviewed;

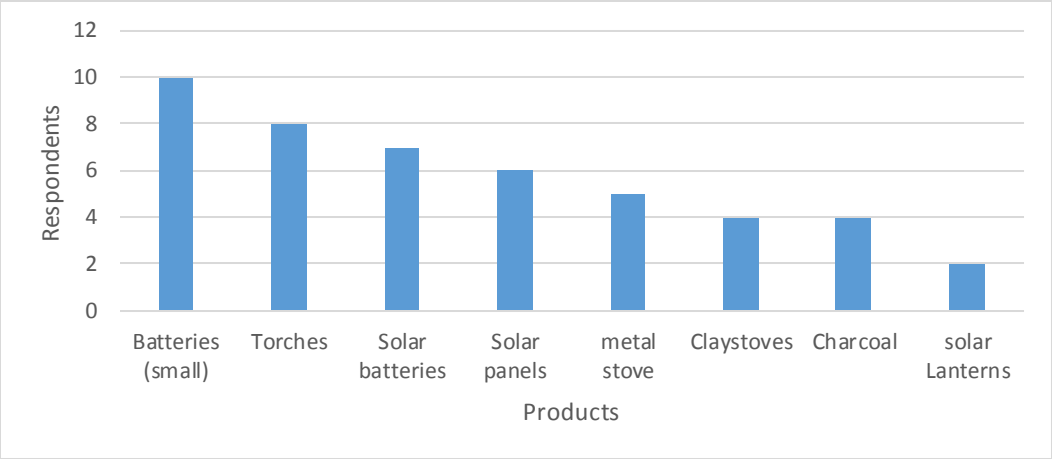


Figure 19; Energy products sold in the settlements

Majority of the vendor respondents were selling lighting devices i.e. small batteries and torches, this was closely followed by solar products, especially solar batteries and solar panels and lastly solar lanterns. Cooking devices such as metal stoves and clay stoves were also on sale. In terms of quality, for the various settlements different observations were made; In Palabek, where modern energy trade is institutionalized under LWF, the quality of solar lanterns was guaranteed since the products were supplied by certified dealers such as Greenlight plant/ Sunking. However, during the open market days, there were a range of products sold some of which were counterfeits and often very cheap in comparison to their genuine counterparts. In the other settlements, feedback for the quality of the products was obtained with vendor interactions mainly on product performance with the help of customer feedback, with many reporting poor quality products with short failure time. The different energy devices are discussed in more detail in the proceeding sections.

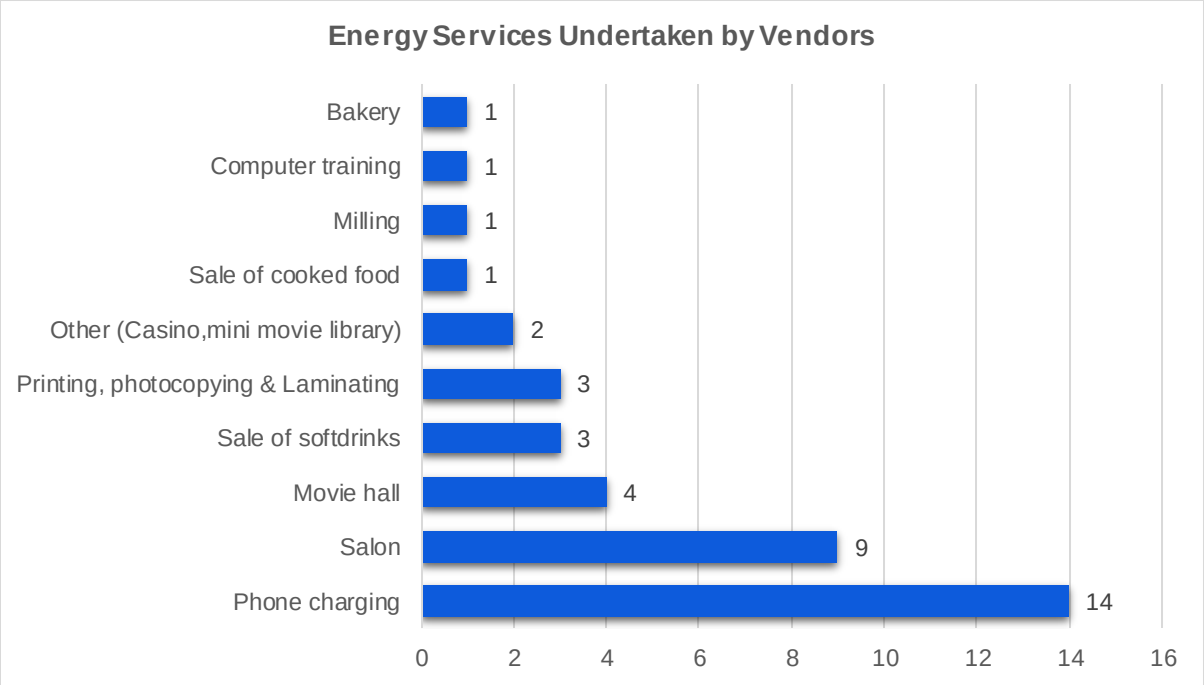


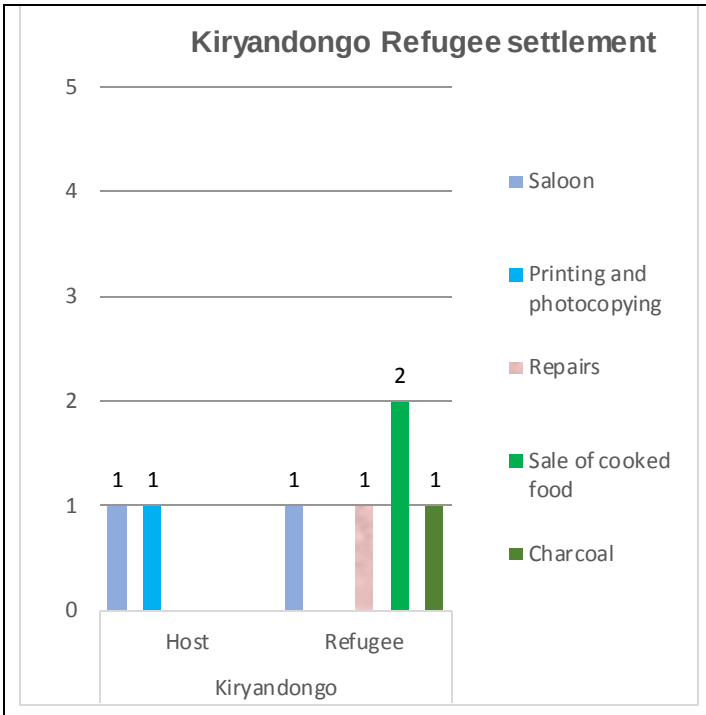
Figure 20; The categories of energy services provided

Phone charging was the commonest service provided by 14 of the 39 respondents followed salon services (9), entertainment services i.e. movie halls or sports (4) sale of soft/cold drinks (3) and computer services i.e. printing and photocopying (3).Other services were

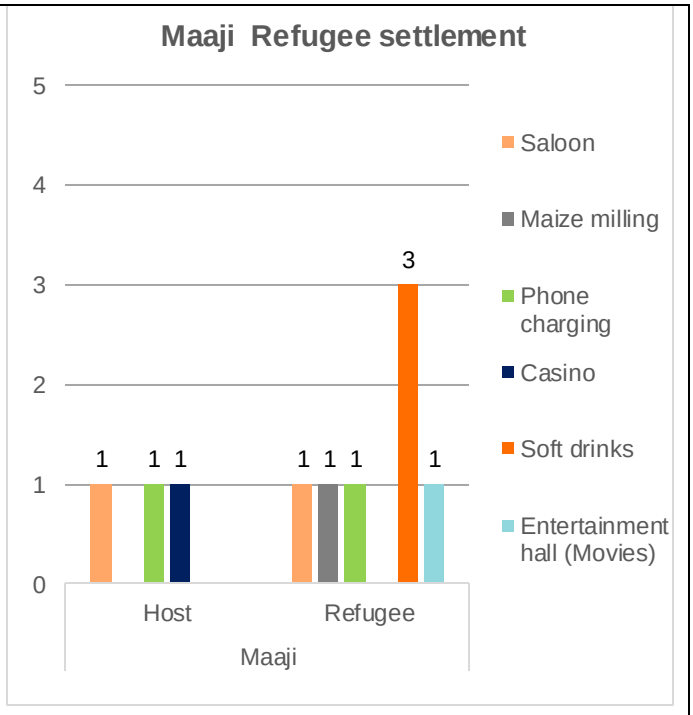
- Sale of cooked food
- Maize, sorghum, cassava milling
- Bakery
- Laminating, Computer training, Mini library

In the settlements, there was no one stop facility found in either the settlement or host community with more than two options for either lighting or cooking. Most were stand-alone business such as milling services were running on diesel generators and charcoal sellers.

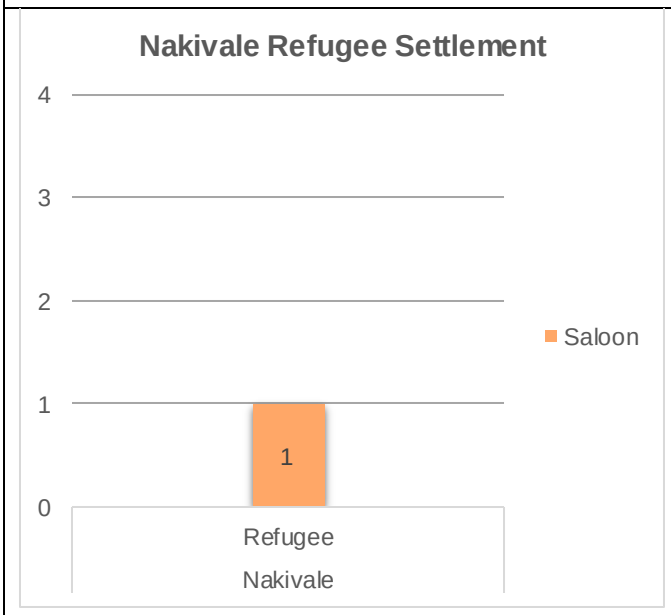
First most undertaken Service by Vendor Respondents per settlement



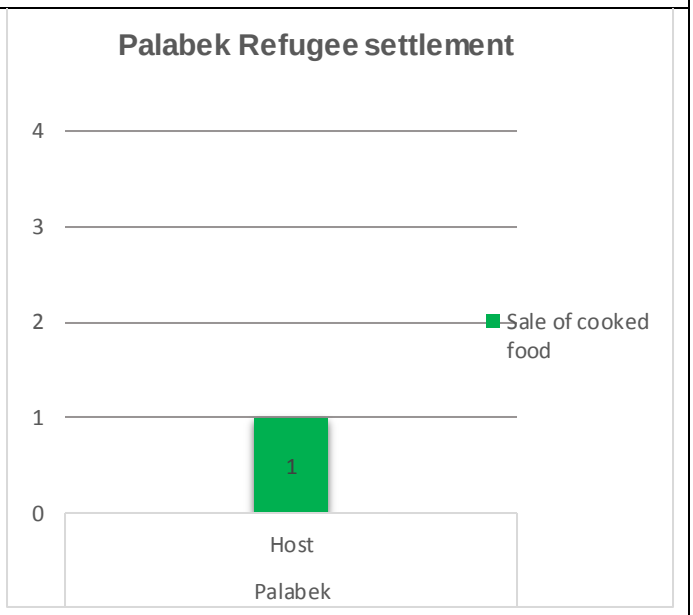
In Kiryandongo, sale of food is the most prominent service for 2 refugee vendors, while salon and printing and photocopy services standout for the host vendors



In Maaji, sale of soft drinks is the most prominent service for refugee vendors, while saloon, phone charging and casino standout for the host vendors.



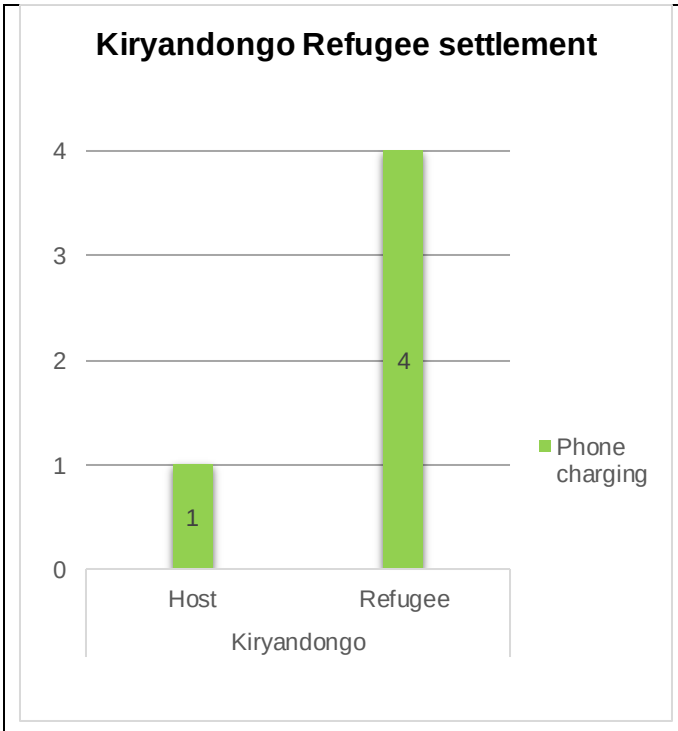
In Nakivale, refugee vendors were mostly operating salons; host vendors did not operate any energy service kiosks



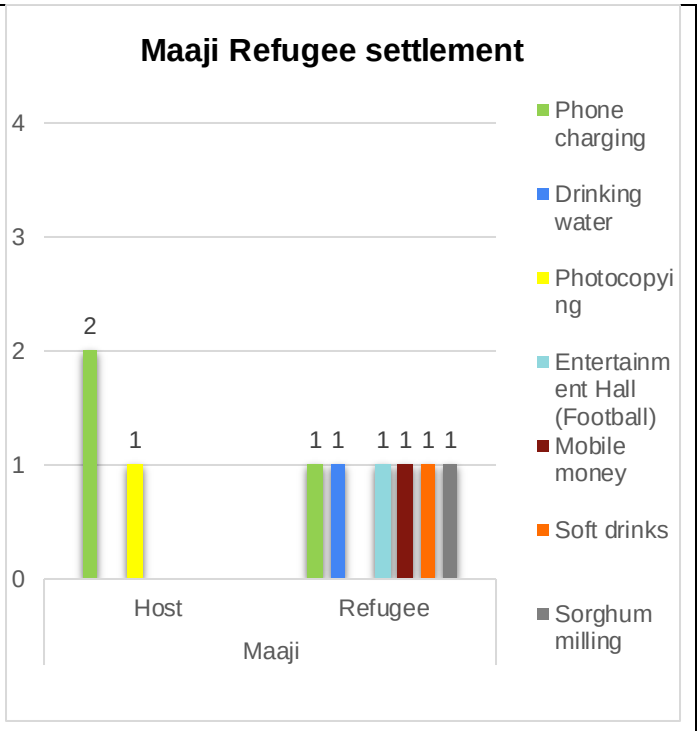
In Palabek, only the host vendors reported providing services; these were sale of food.

Figure 21; Energy service most undertaken (First)

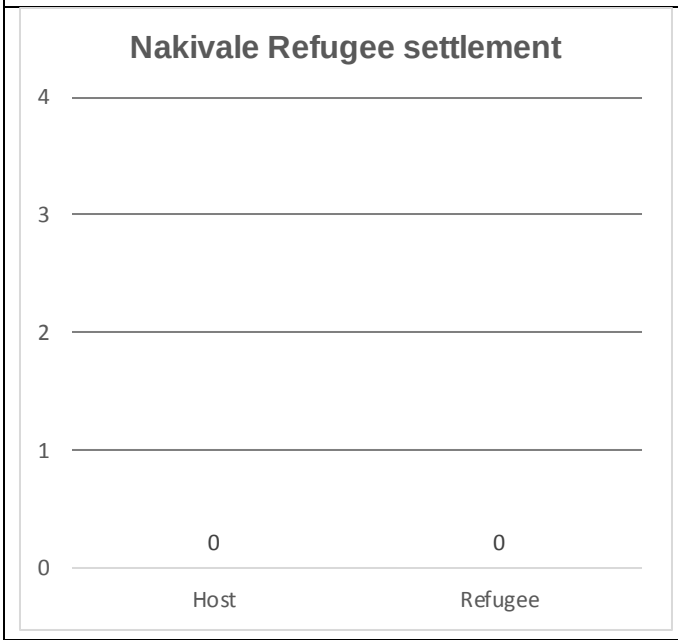
2nd Most undertaken service by Vendor respondents per settlement



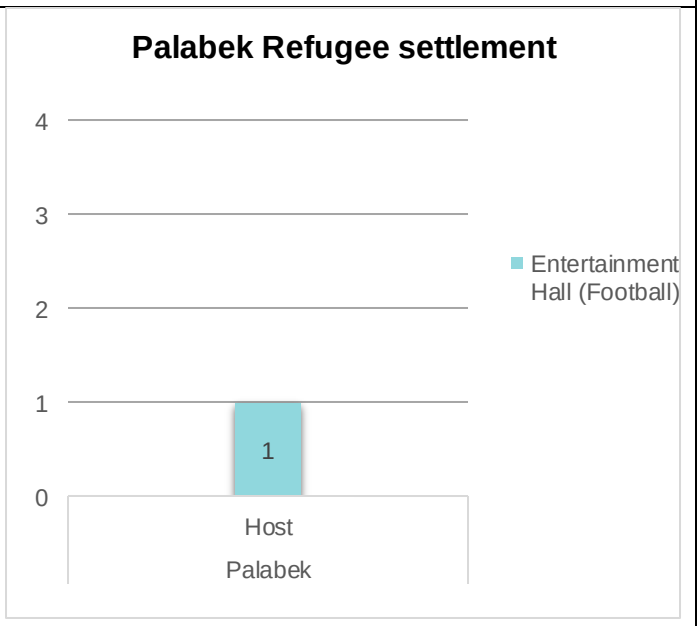
Phone charging was the second most undertaken service in Kiryandongo



In Maaji, Phone charging still stands out as the second most undertaken service, followed by photocopying



No other service was reported in Nakivale



In Palabek, entertainment halls showing football or sports activities were the second most undertaken service

Figure 22; Energy service most undertaken (second)

4.3.1.4 Product brands/

The most common stove brands sold by the vendors were smart home (a clay lined metal clad stove), metallic charcoal stove and locally made stoves; while for the solar products, the most popular brands on the market were Sunshine Solar, Fenix, Phoenix, and ADH batteries. Other brands of solar batteries were also found in the markets, namely;

- Uganda Batteries Limited (UBL)
- Exide chloride 26 Ah – 150 Ah
- J&L

4.3.1.5 Product and service prices

The price for the different energy services and energy products offered were as tabulated below.

Table 7: Cost of energy services across the settlements

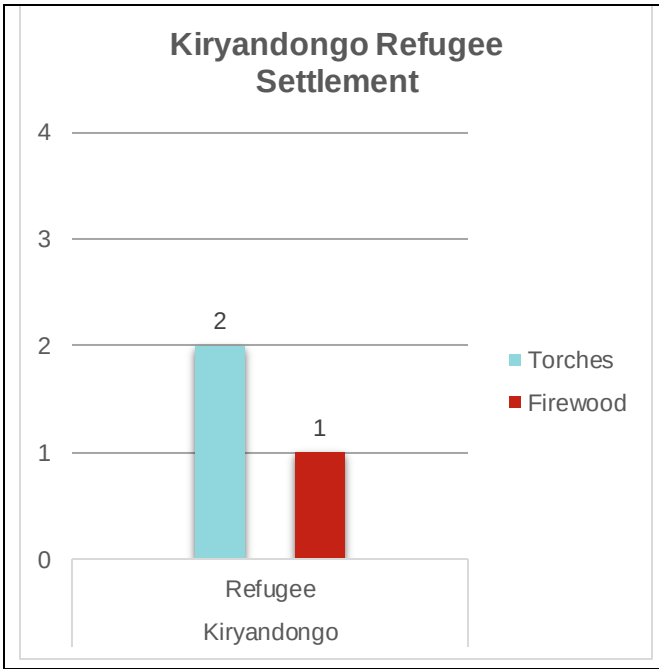
Energy service	Average price /UGX	Price range /UGX
Phone charging	500	500
Charcoal	1,000	1,000
Sale of food	4,500	2,000 to 7,000
Cold drinks	2,000	2,000
Movie/casino/sports	350	300-400
Photocopy	200	200
Mini video library	300	200 to 500
Saloon	2,000	500 to 3,500

Table 8: Cost of energy products across the settlements

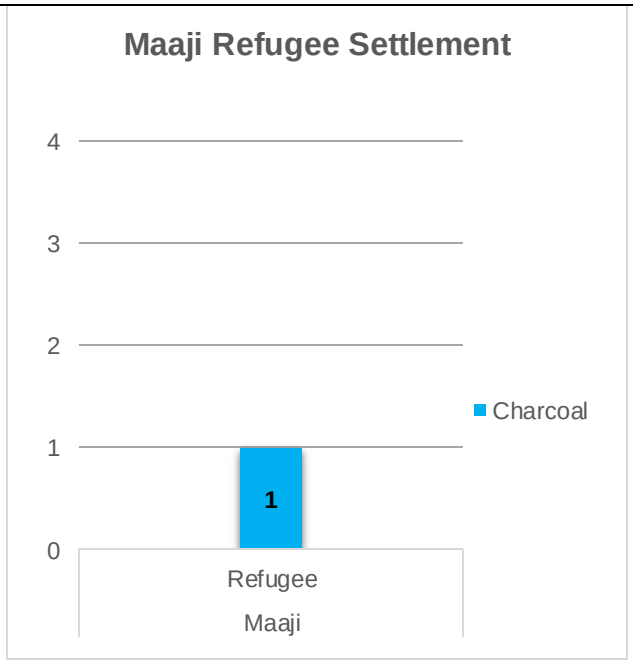
Energy product	Average price / UGX	Price range /UGX
Firewood	3,500	3,500
Charcoal	2,667	1,000 - 5,000
Clay stove	9,800	5,000 - 15,000
Metal stove	9,833	4,000 - 20,000
Solar panel[2]	205,714	150,000 (20 W) - 240,000 (120 W)
Solar lantern	35,000	35,000
Solar battery	275,000	55,000 (9 Ah) - 450,000 (150 Ah)
Torch	4,625	1,000 - 15,000
Dry cell battery	1,977	250 - 4,500

[2] Solar panel average price per Watt was UGX 2,757

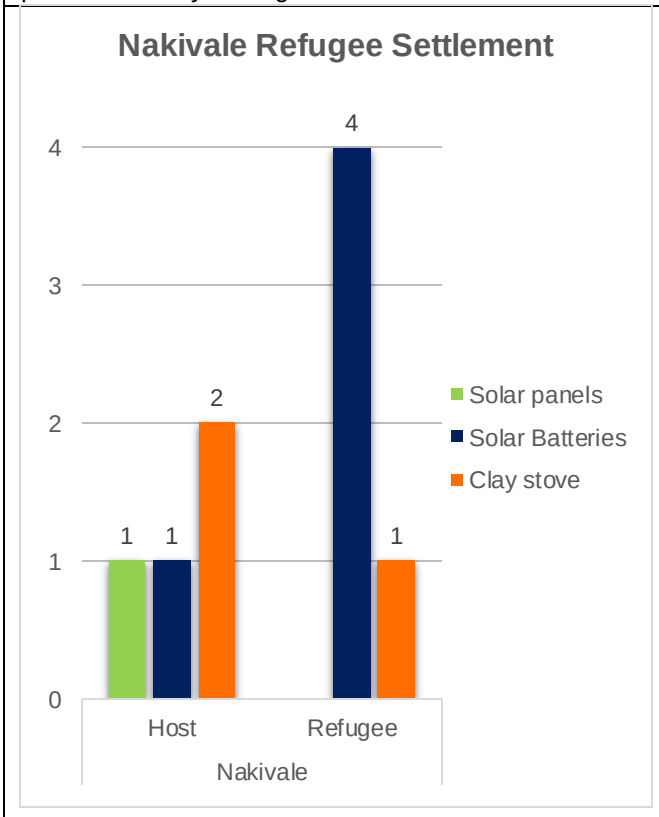
1st Most Selling products by Respondents



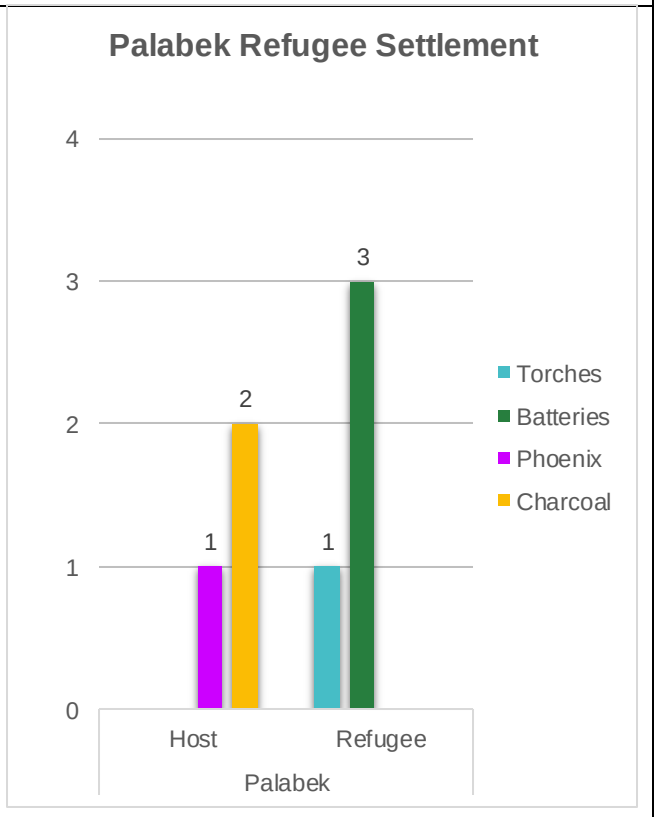
Torches (2) and firewood (1) were the most selling products in Kiryandongo



In Maaji, the selling product was charcoal



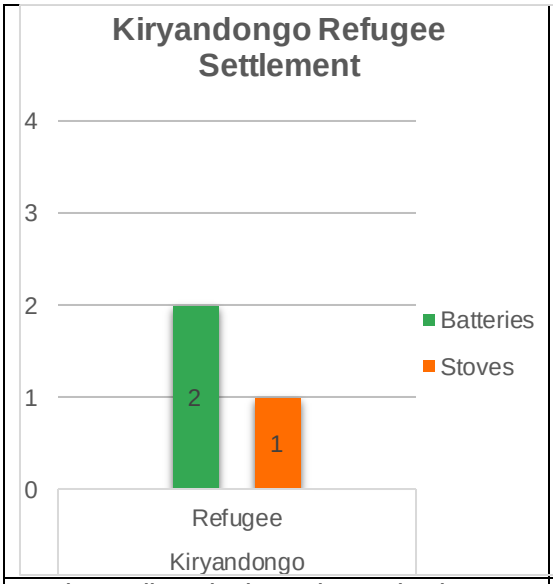
In Nakivale, 4 refugee vendors reported solar batteries as the most selling product this was mainly purchased by those far from the grid, while for 1 it was the clay stove. For the host vendors, for 2 of them, it was the clay stove, and then solar batteries and solar panels.



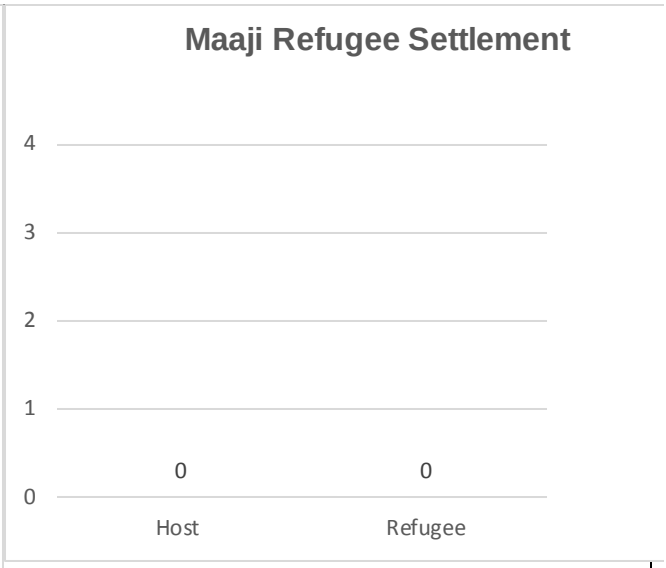
In Palabek, 3 of the refugee vendors said batteries was the most selling product while 1 said torches. For the host vendors, 2 sold charcoal whilst 1 sold Phoenix panels.

Figure 23; Most selling product per settlement

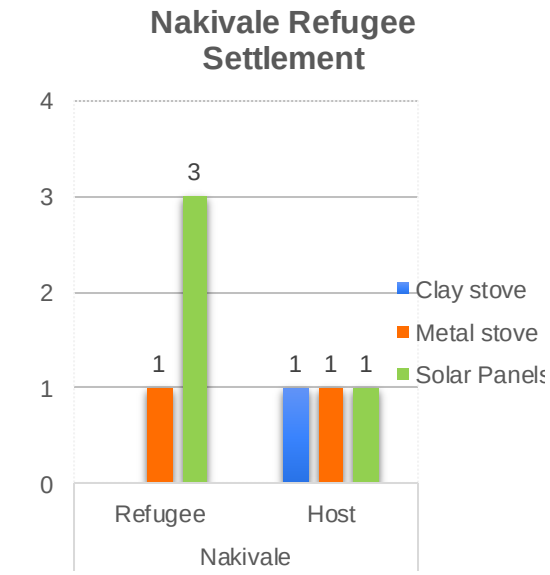
2nd Most Selling products by Respondents



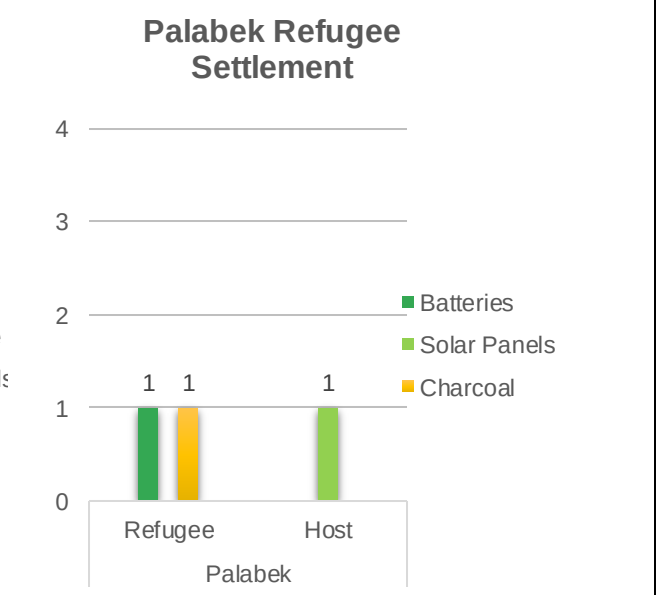
Both Maaji and Kiryandongo had no hosts selling, the respondents in these areas were mostly involved in energy services rather than product selling in the sampled areas.



In Maaji, energy products were not common in supply. However, the vendors were using solar to provide electricity for their shops.



In Nakivale, the 2nd most purchased product by the refugees was the solar panels.



In Palabek, the second most purchased product was the solar panels by the hosts and the batteries and charcoal by the refugees.

Figure 24; Second most selling product per settlement

4.3.1.6 Energy sources

Of the 44 surveyed vendors, 82% had electrified shops; of these 72% were using a solar system while 25% and 3% were using grid power and generator respectively. Below is a graphical presentation of vendors' source of electricity per settlement;

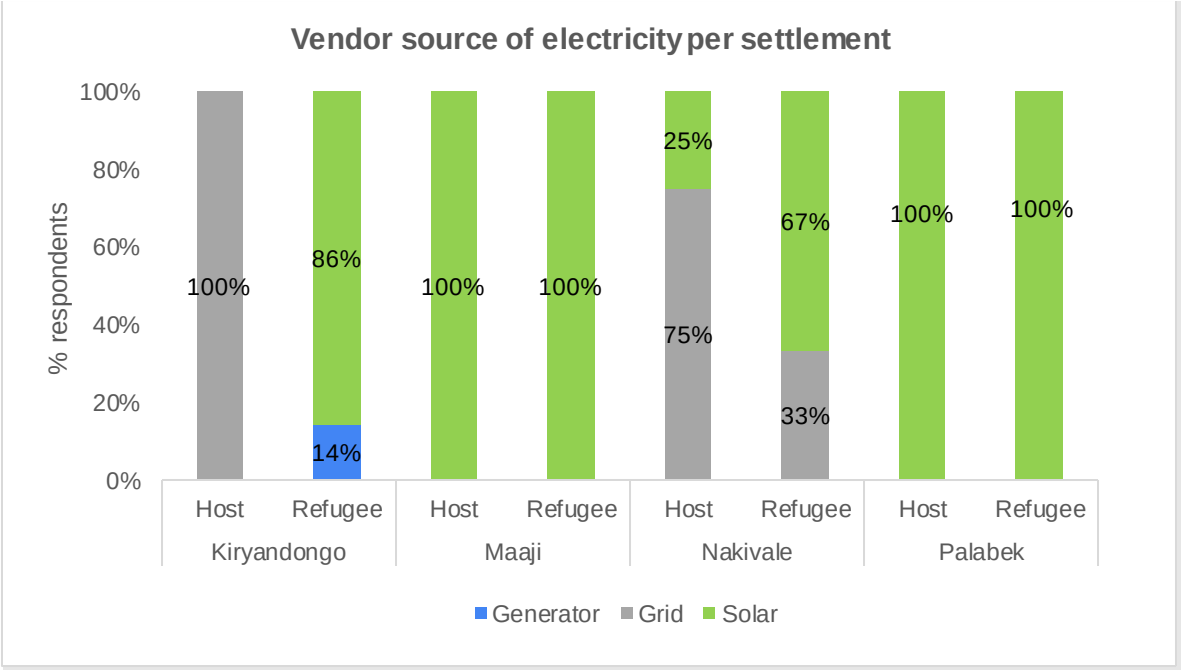


Figure 25; Source of electricity per settlement

In Kiryandongo, all the interviewed host vendors were using grid electricity, while 86% of the refugee vendors had solar powered shops and 14% were using a generator. These hosts were located in the villages of bweyale sub county namely; Adagwoo village, Bweyale town, kichwabugingo village, and Nyakadoti village.

In both Maaji and Palabek, all interviewed vendors both host and refugee were using solar to power their shops. While in Nakivale, 75% of the host vendors were using grid electricity with only 25% using solar, while the refugee vendors 67% were using solar and only 33% were suing grid electricity to power their shops.

4.3.1.7 Supply Chain / Distribution

1. NAKIVALE SETTLEMENT

Most of the trade items for energy found in the refugee and host markets are brought in mainly from Mbarara Central Market. The most common solar products traded are the solar panels and batteries. For the cook stoves, the main products are the clay stoves, metal cladded ceramic stoves as well as the metal stoves.
Most of the charcoal and some of the firewood that is present in some areas of the host community and refugee settlement is brought in from a town called *Ndinze* which has some existing forests. The proximity to the Tanzanian border allows both refugees and Ugandan nationals to buy charcoal and firewood from the border towns and communities of Tanzania.

Base camp.
The base camp is the largest trading center within the settlement, and one of the few places with access to grid electricity. There were approximately ten energy shops that were trading cook stoves and solar products, and providing productive uses of solar energy such as salon business and phone charging. This is the main market destination for traders and customers

on the market day which is designated as Friday. On such a day, traders from as far as Mbarara and neighboring host communities come to the settlement to trade.

Kityaza (Host Community)
This is a host community village which is a common trading area as well. It is a very active trading town especially on its market day-Tuesday. There were three established traders dealing in cook stoves that were identified as the popular destination for cook stoves.

Rugaga (Host Community)
This is a distant sub-county that also was found to have four energy retail shops especially for solar products. The only disadvantage with the town is its distance from the base camp which is close to 25 km. Their main source of supply of cook stove and solar products is from Mbarara, and Masaka Districts. There is a shorter connection from this town to Masaka which acts a source mostly for cook stove traders.

Energy Fuels
The energy fuels present include charcoal, briquettes and largely scarce firewood. Given the high fuel prices, residents in the settlement resort to the use of crop remains (bean pods) and shrubs as an alternative source of fuel. Nsamizi organisation, which is the energy implementer for UNHCR, trains people on making briquettes as well freely providing these briquettes only to Extremely Vulnerable Individuals (EVI's). Originally, they were selling these at Shs. 300 per kg, however, with the recent reduction in funding, they no longer sell but only provide to this group of people.
Their main source of supply of these briquettes is the portico and Uganda Green Fire. They supply to Nsamizi Organization which is supported by UNHCR to buy from these suppliers for People with Special Needs (PSNs). The Portico was started in 2013 but started operations in Nakivale in February 2017 and gets its raw materials from *Kabingo* a host community in Mbarara as well as from the refugees themselves. These briquettes are made from agricultural residues and charcoal dust

Palabek
Palabek Refugee Settlement was mapped in an area that was original gazetted for provision ecosystem services such as hunting, fruit gathering, and firewood collection. Due to its strategic location, refugees were in placed in a good position in benefiting from the already existing natural resources to meet their energy needs.

The availability of cheap and often free firewood and cheap charcoal has been part of the reason why biomass has prevailed as the dominant source for energy at Palabek Refugee Settlement. However, the rate of depletion of biomass resources is overwhelming. This has triggered concerns and unrest among the various key actors in energy operating within the settlement namely; LWF, OPM, LG and FH. As a result, energy and livelihoods programs were designed and are in place to promote access to clean and efficient energy to the refugees and host such as cookstoves and solar products.

The energy market at Palabek Refugee Settlement is characterised by a demand-driven supply chain. From the household survey conducted, demand indicators suggest need for energy efficient stoves and solar lighting appliances. However, the supply network is solely controlled by LWF who are the only UNHCR energy implementing partner in the settlement. ..

LWF's approach involves the use of energy champions who are members of the community trained in solar sales and ICS construction. The products are sold to both hosts and refugees under a “cash on delivery” model. The deliveries and marketing are conducted by the LWF trained person (energy champion) who in turn benefits by getting a commission for each sale, however, the percentage was not revealed. This model is not preferred by the community who from the FGDs would prefer a more flexible payment model.

Supply network of energy efficient stoves and solar appliances

At the time of reception, all refugee households were handed a solar lantern. However, the household survey revealed that most of the solar lamps had gotten damaged and there were no programs to replace or repair them. And therefore, most households resorted to use torches bought from retail shops within the settlement.

Other than the traditional wood fuel supply chain. The supply model in Palabek involves LWF as the supplier and the energy champions as the distributors and commission agents. The agents were dealing in solar lamps of two sizes sold at UGX 20,000 and UGX 30,000 and the Lorena stoves constructed at UGX 20,000. The final recipient pays the cost for construction/purchase of the product.
Five of the ten surveyed retailers were selling torches and batteries; and only one shop surveyed was dealing in solar in the settlement.
The settlement also hosts weekly market days and during which vendors from the host communities sell solar products such as solar lamps, panels and light bulbs.

OPM highlighted a foreseen energy crisis that requires immediate sustainable action. Energy is the main driver of economic development. However, energy access in Palabek is primitive and transition is slow because of a low lack of awareness and appreciation of improved cooking methods.

For the other categories of users namely the schools and health centres, there is inadequate capacity for the supply of energy products. For instance, most training centers and health centers have solar electricity mainly for lighting and are unable to run three phase machines. This has encouraged adoption of standalone generator sets, for supplementary electricity generation.

However, in both the settlement and host there were no dedicated dealers in energy products such as solar products and accessories and bioenergy products. Bioenergy products such as charcoal was mainly sold in the base camp market for employed staff working at the settlement.

Kiryandongo

Kiryandongo Refugee Settlement has the grid line running through the settlement but refugees are not connected to the grid line due to their reported inability to afford the monthly electricity bills. Only two schools, the base camp where all the NGOs, UNHCR and OPM are based and one market near the reception centre have grid access. As a result, options such as solar and bioenergy are the most preferred energy alternatives among refugees. The solar lamps are generally preffered by both the host and refugee communities as the most preferred lighting technology to use, however limitations come in on affordability. Thus we realize that once the lamps given at the reception centre get a fault the users go back to their traditional technologies. For the case of the stoves, In Kiryandongo the portable stoves and rocket lorena

are the stoves being marketed currently as improved technologies, however due to family size constraints the portable cook stove is not able to meet the demand of the large households leaving the rocket lorena as the winning solution for their cooking needs. Thus under Household energy use the Rocket Lorena stove is most popular and is made by local artisans at a small fee, starting from UGX 15,000/=.

Energy for productivity use was majorly sustained using diesel generator sets for instances grain milling points. Solar energy was observed to be the main lighting source in over 95% business premises in the trading center and public institutions in the settlement. Some of these places include; shops, saloons, restaurant, schools.

All the schools surveyed in the settlement that is Arnold primary school, Bidong primary school and Panyadoli vocational training institute use three stone and improved wood fuel cook stoves to meet their cooking energy needs. Four institutions were found to have abandoned the Rocket Lorena stove and the reason given was that it cooks slowly.

Other than the traditional wood fuel supply chain, DRC is the lead line partner at Kiryandongo refugee settlement spearheading livelihoods, energy and environment programs at the settlement. Several models have been tested to ensure sustainable supply of energy products among the refugees and host. These models include; dissemination of solar lamps and sustainable wood fuel, and training local artisans on construction of rocket Lorena stoves.

Maaji

Maaji Refugee Settlement is a market yet to be penetrated with energy interventions. In all its 3 trading centers, there was no vendor selling improved cook stoves, alternative cooking fuels, solar lanterns or pico-solar lighting kits that can easily be adopted in households for improved lighting.

Majority of the vendors whose businesses require power are using solar as the primary source of electricity to meet their energy needs. These commonly included; salons, phone charging kiosks, printing and photocopying stations, entertainment halls and cold drinks and beverage shops.

The two most commonly used cooking technologies found in the settlement were the 3 stone fire and mud stoves with firewood being the most commonly used cooking fuel although charcoal also has its fair share of adoption in both the refugees and host community. Alternative cooking fuels like briquettes are yet to penetrate the market as there was no sign of their adoption either in the households or at the markets.

In the households, different technologies are adopted for lighting. Although majority i.e. 200 of the households interviewed used solar to power 1 or 2 lights, 96 of the households interviewed used single-use torches sold in the settlement's trading centers.. These torches are UGX 500/= and can only be used once or even for a few hours.
Many expressed their discontentment at this technology but then without the ability to afford solar lamps in one single payment, these torches are their best option for lighting. It is also important to note that 2 of the interviewed households used tadooba or a kerosene lamp, 10 were found to use either firewood or grass for lighting, 12 households were found to rely on their cell-phones' torches for lighting and a rather large number of 39 households were found to rely on make-shift dry-cells to small bulb technology for lighting

Maaji is a very lively settlement with prospects of morphing into a self-sustained community. With the need to bring services closer to the community, energy plays a central role and so most businesses at the settlement use solar to power their systems. Such businesses include;

Salons, Phone charging kiosks, Printing and photocopying stations, Entertainment halls and Cold drinks and beverage

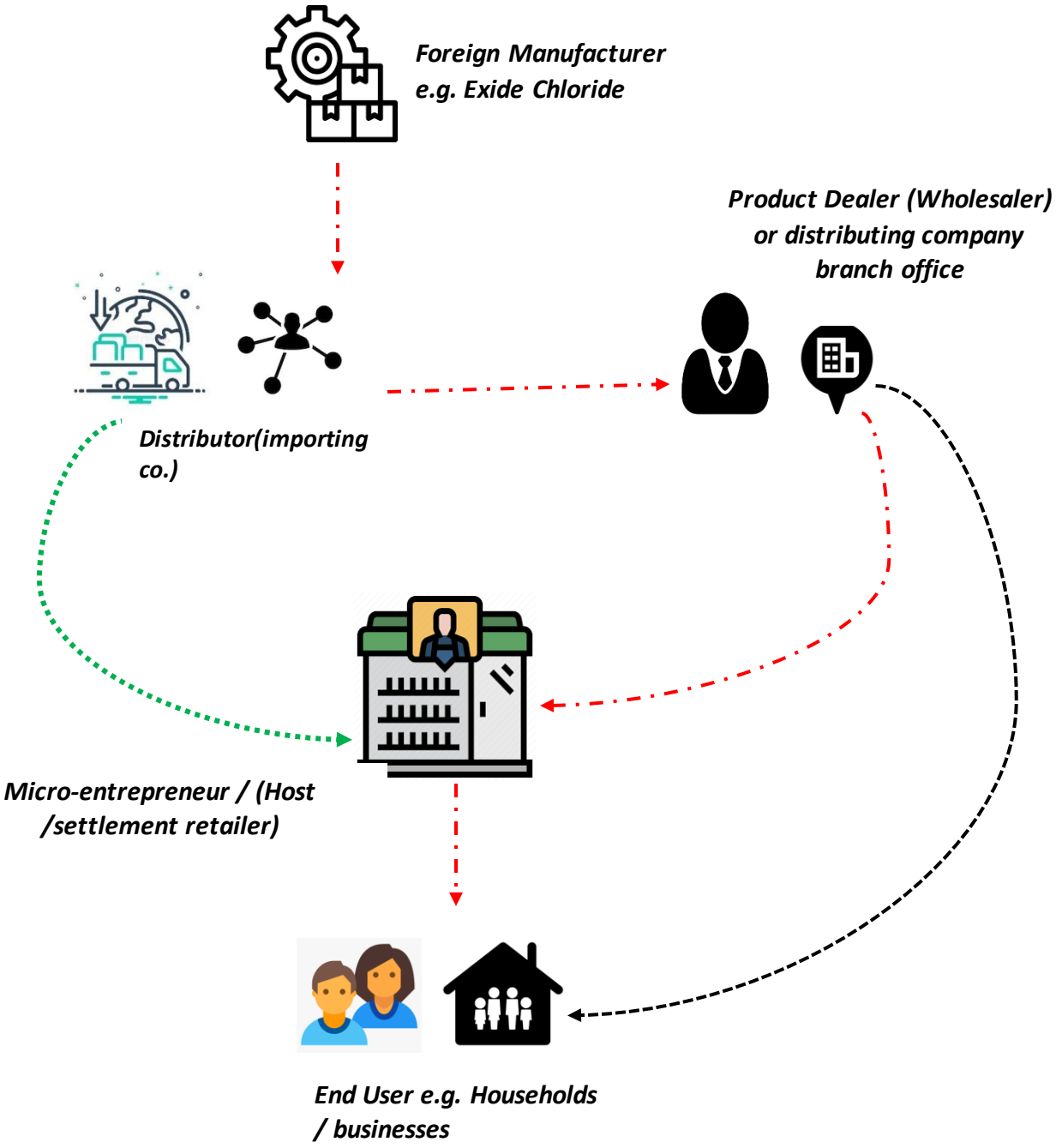
	
Single use torch	Makeshift dry cells to bulb lighting technology

Figure 26: Lighting technologies in Maaji (1, II, III)

SOLAR PRODUCTS SUPPLY CHAIN

Nakivale:

The supply chain for Nakivale settlement was evident from Exide Chloride Battery Company which has some vendors within the host and refugee markets. The manufacturer provides the products which are then sold through distributor and retail agents and then to the final user. Other products are sold straight from the distributor to the retailer without an agent. The products were normally gotten from Mbarara market and then taken to the various shops in Nakivale host community.



	Traditional distribution channels – Distributors/ importers sell their products to dealers. The dealer generally has a network of sub-dealers or micro-entrepreneurs depending on the remoteness of the areas
	Micro-franchising – Distributors/ importers identify micro-entrepreneurs at a village level, work closely with them on distribution, marketing and servicing
	Direct sales distribution channel- Company directly sales to the end user.

Figure 27: Supply chain for solar products in Nakivale

2. Kiryandongo and Palabek.

The supply chain graphic presented below is applicable to both settlements – Kiryandongo and Palabek. This was mostly evident with Fenix solar kits products in Kiryandongo. The company directly distributes its own product to the end user through an approach that involves the use of field teams to market and sell the products. Below is a graphical design of the supply chain.

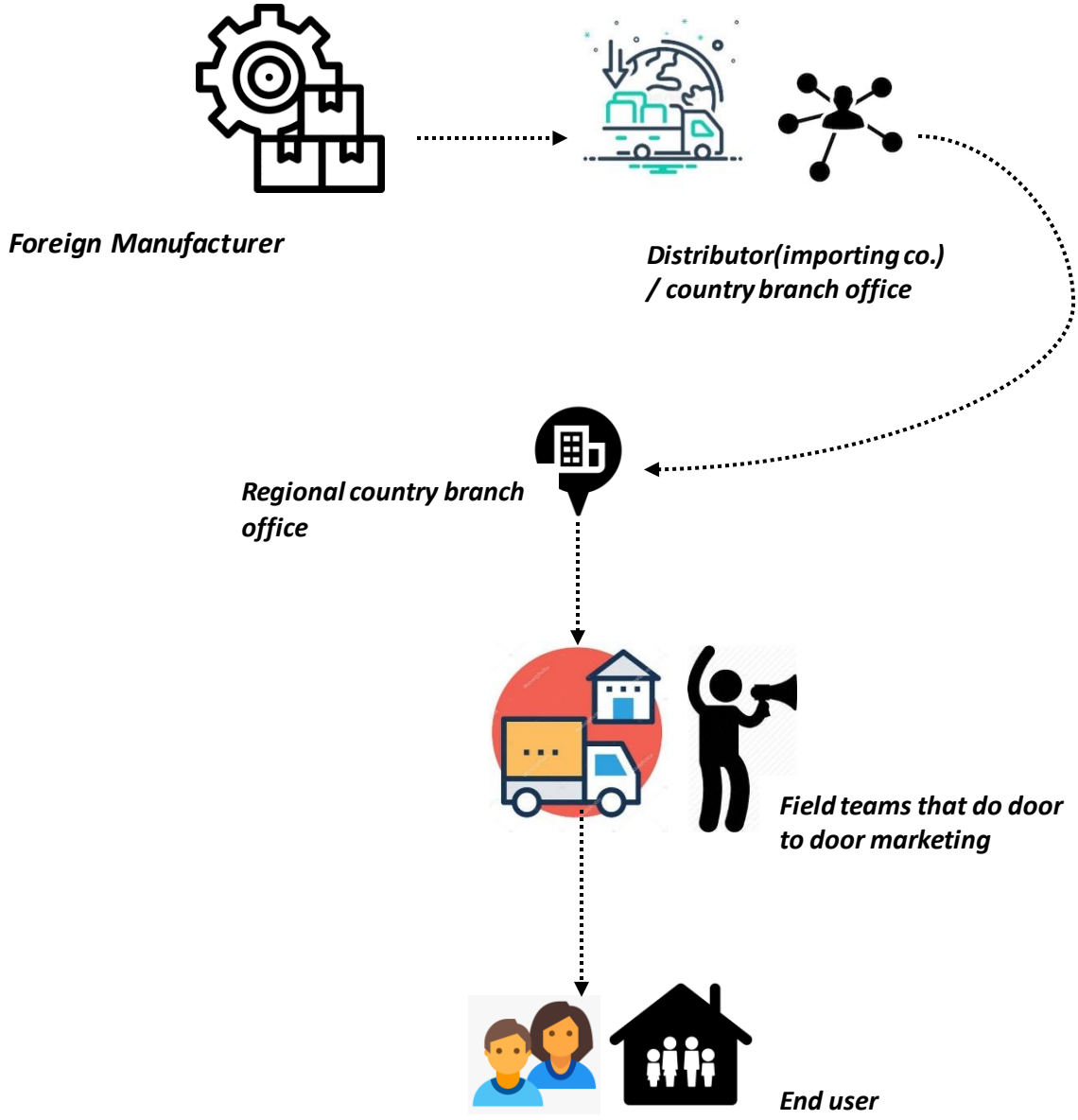


Figure 28: Supply chain for solar systems as found in Kiryandongo and Palabek

For Kiryandongo, the solar appliances are mainly purchased from the local market, the type of customer is determined by the ability of one to afford these products. Most of these market products were also found to have no warranty except for MTN Solar product "*readypay*" which is very expensive for the common refugee though it also offers flexible payment plans where a customer pays daily UGX 500 for the product till the complete product amount is paid.

NB: In Maaji, no solar energy products were found to be sold thus there was no supply chain to be studied

COOK STOVE DISTRIBUTION

This is evident for smart home cook stoves that were found in Kiryandongo and Nakivale refugee settlements. In Kiryandongo, the local manufacturer from Kampala delivers the stoves to vendors in Kiryandongo who later resell to the end user.

In Nakivale settlement, the observable stoves were delivered from Kampala to Mbarara market from which some of the host/ settlement retailers obtain for stocking and resale.

Another model that was common was a local artisan producing the stoves for the end user. This is common with the mud stove which are commonly used in the settlements and the host communities.

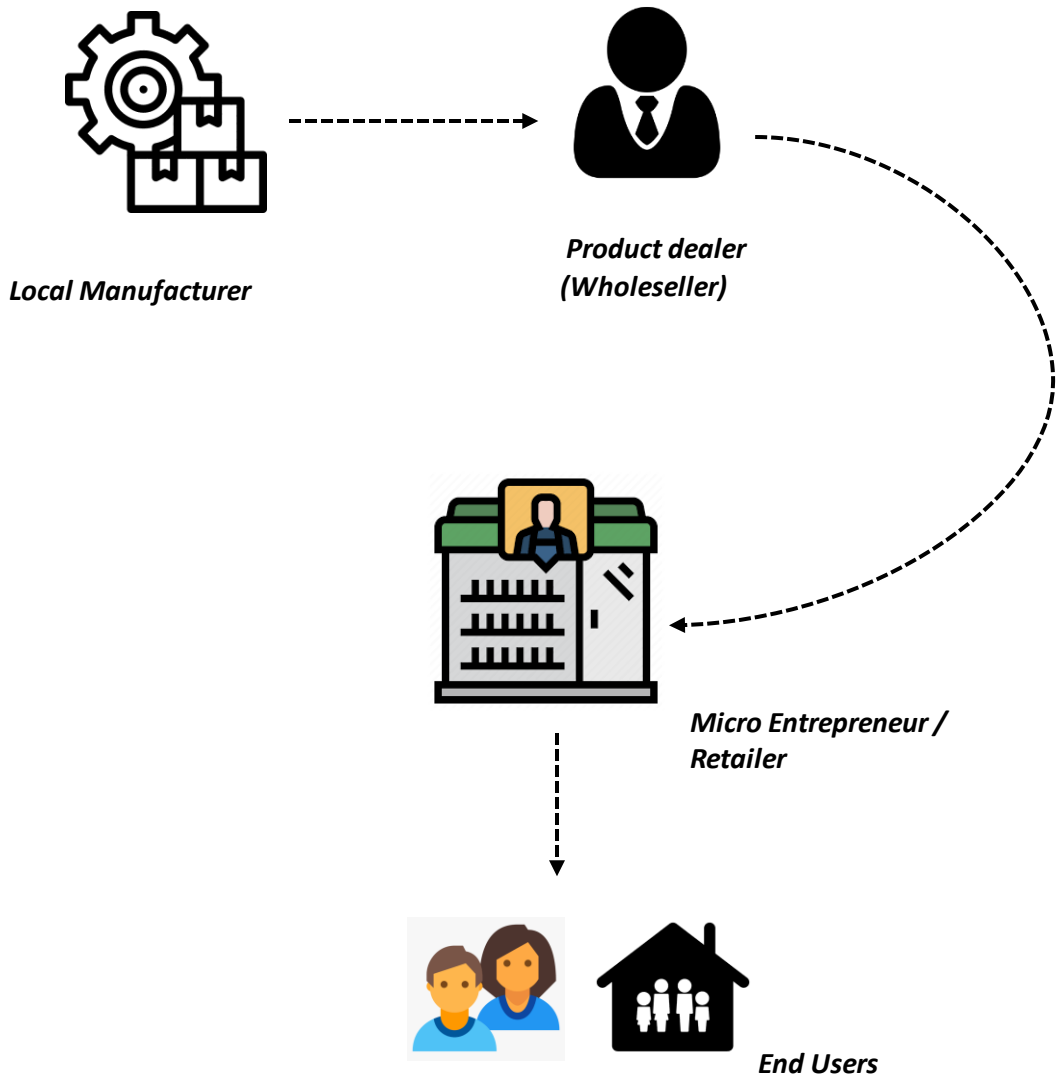


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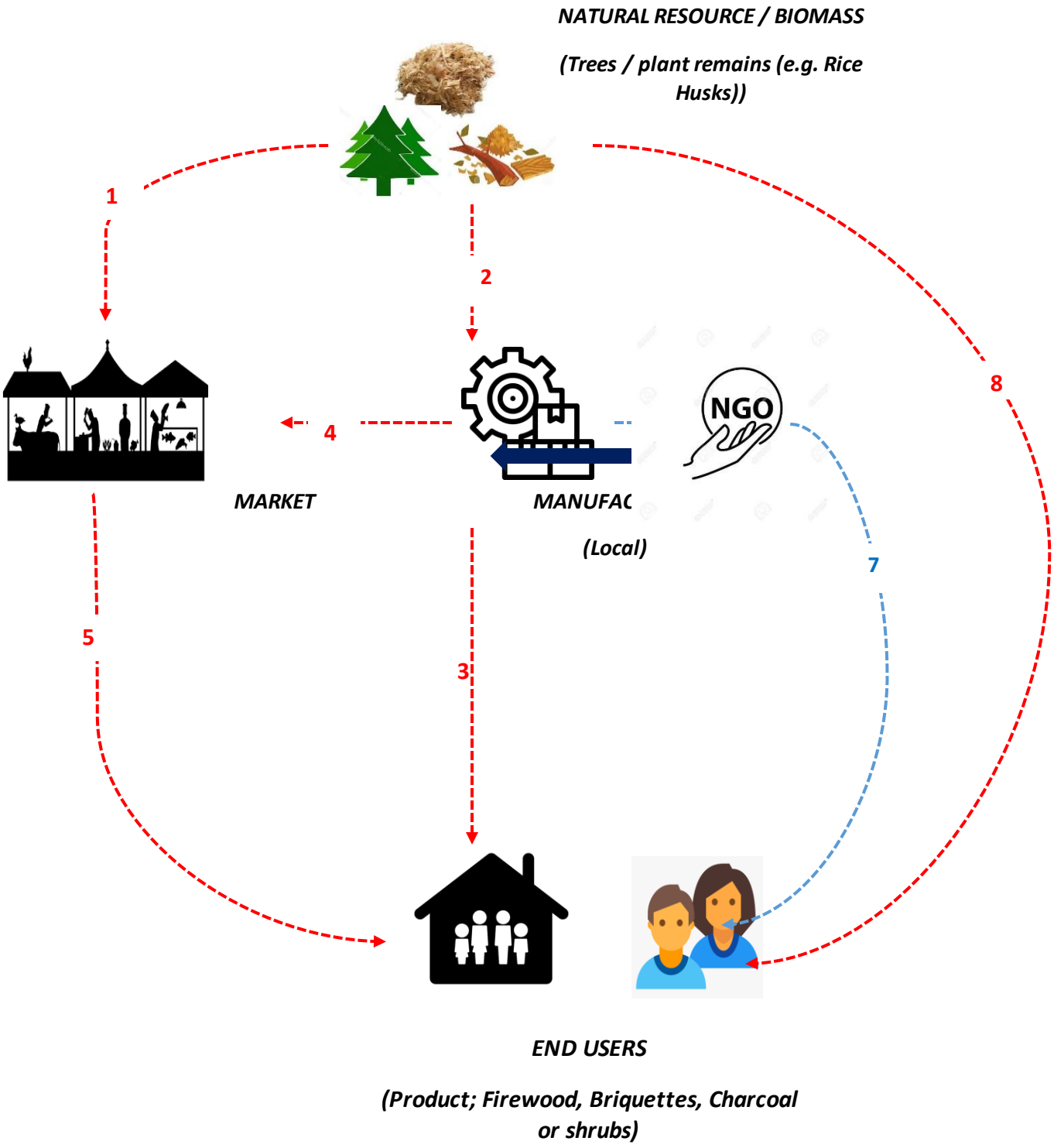
Figure 29: Supply chain for cooking technologies across the four settlements

SUPPLY CHAIN FOR ENERGY FUELS

The supply chain for the various energy fuels was studied – This included charcoal, briquettes, crop residues and firewood. Below is the graphical design as found for all the settlements.



1	Direct transfer of harvested natural resources to the market for sale
2	Processing of harvested resources or biomass for firewood, charcoal, or briquettes.
3	Own Processing (The end user with the processing skills and knowledge can turn biomass into the final product for respective uses e.g. briquettes.
4	Transfer of firewood, charcoal and briquettes to market for sale by the producer/manufacturer
5	Purchase of end products by the user
6&7	An NGO e.g. Nsamizi purchases from the local manufacturer and provides to the end user i.e. refugees
8	Direct collection and use of energy fuels from their habitat e.g. firewood

Figure 30: Supply chain for energy fuels across all the four settlements

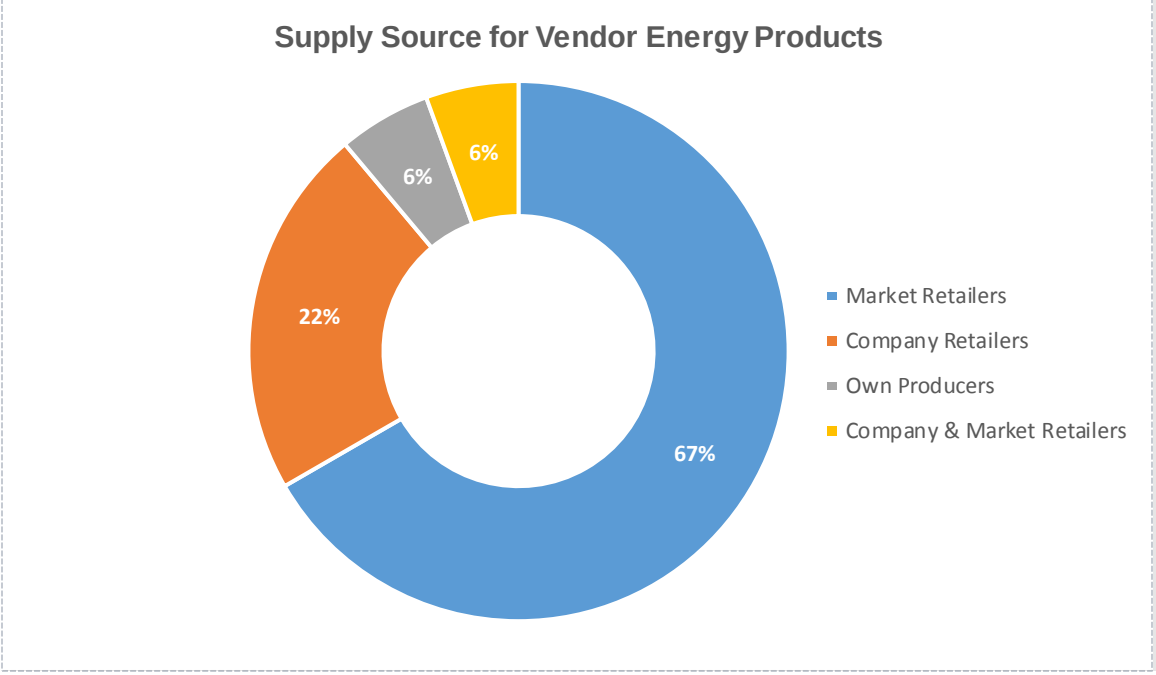


Figure 31; Suppliers for the energy products in the settlements

Market retailers: These are vendors who sell different types of products in the market.

Company retailers: These are vendors who also act as agents dealing in branded products from specific companies such as D.light or Sunking.

4.3.1.8 Partnerships and Business Network

The businesses that were surveyed were engaged in different partnerships at different levels. Of the vendors, 27% had received some kind of training while majority had not received any training. The trainings received were through partnerships with different NGOs, Institutions and private companies such as Solar Now. The trainings done covered the following topics with finance and bookkeeping topping the list, followed by saloon skills, product installation and business training.

- Finance and bookkeeping (39% count of mention)

- Marketing - 6%
- Saloon skills – 11%
- Product installation – 11%
- Electronic skills – 6%
- Stove building skills – 6%
- Computer training – 6%
- Aftersales maintenance service – 6%
- Business training – 11%

4.3.1.9 Challenges and Opportunities

The majority (64%) of the vendors reported facing challenges in their energy businesses. The biggest challenges faced were;

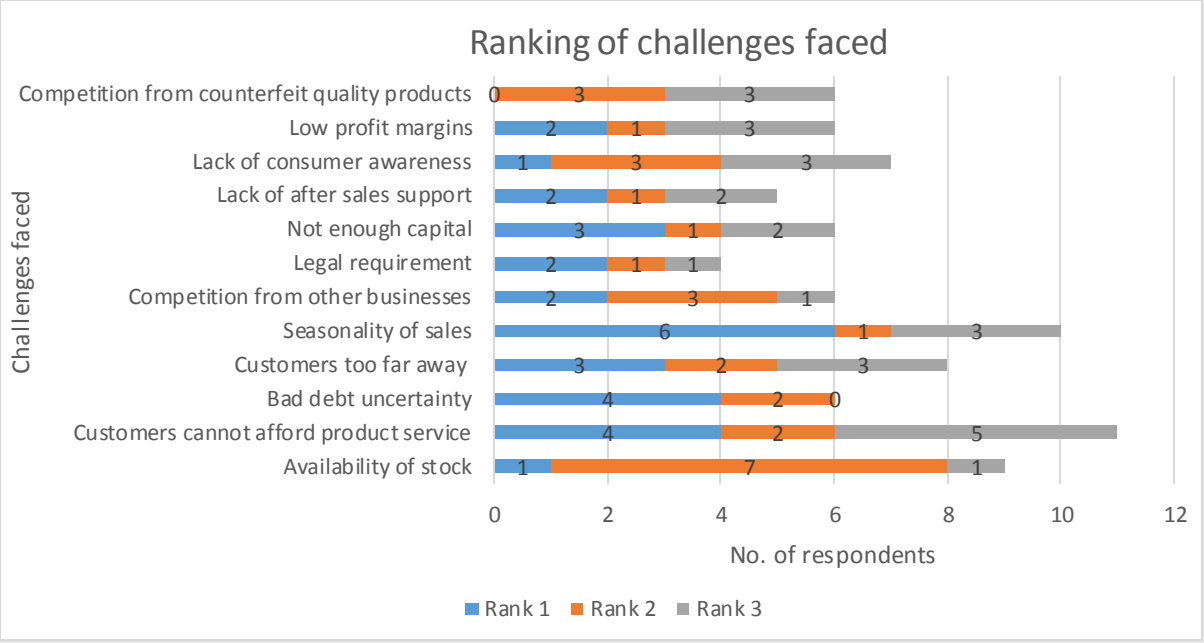


Figure 32: Ranking of challenges faced

Overall, customers' inability in affording products or services was the biggest challenge, followed by seasonality of sales and then the availability of stock.

Seasonality of sales was mostly a result of change in seasons; It was said that during the rainy seasons, sales were low. For example, for Maaji where the source of electricity was majorly solar energy, rainy or cloudy days affected business sales as vendors registered fewer sales. *This presents a need to introduce an energy mix to compliment solar technologies.*

Also, seasonality of sales was affected by the availability of income of buyers. Buyers had better income especially during the harvesting season and when refugees had received relief aid or cash transfers; then they were able to buy what they needed. Nonetheless, it should be noted that the starting of energy businesses was majorly due to a high demand for such products and services.

Of the vendor respondents, 41% wished to improve their businesses as stated below.

- More capital
- Sale of solar fridges
- More charging stations
- More power by getting another generator
- Better and stronger battery
- Use a generator since solar is affected by weather
- Add a fridge
- Stock more products
- Quality products
- Add more solar panels
- Better quality phone charging
- Having a closer source of stock for both the stoves and solar products.

4.3.2 Demand Assessment

4.3.1.10 ENERGY FOR LIGHTING

In the households, different technologies are adopted for lighting. Although some households use solar to power 1 or 2 lights, majority of the population use single use torches sold in the settlement's trading centers. These torches are UGX 500 /=[3] and can only be used once or even for a few hours. Many expressed their discontent with this technology but then without the ability to afford solar lamps in one single payment, these torches are their best option for lighting. It is also important to note that there is a good number of people who are using grass for lighting or do not have any lighting device at all in the settlements.

Lighting in public places is still a big challenge in Maaji most especially on the streets and water points. Majority of the installed solar street lamps were not operational mostly due to lack of maintenance which is a result of ineffective monitoring mechanisms. This was evident from the transect walks done in Maaji settlement and from the focus group discussions. In Palabek, however there was no problem reported with the street lighting and in Kiryandongo, the street lights are in the trading centres and others in isolated areas, however there is a problem of theft and many lights get stolen especially those in isolated points. In Kiryandongo as well, aneed was also reported for lighting in the market area which currently does not have street lights making them close business early.

[3] These torches were not found in the vendor markets however they were being sold in the consider shops which had other products such as utensils/

Below are pictorials of the different lighting sources used in the settlements;

Candle

Kerosene lamp

Phone torch

Tadooba

Torch

Solar system

Dry cells and bulb

Firewood

Grid electricity

Grass

Figure 33: Lighting technologies in use across the settlements

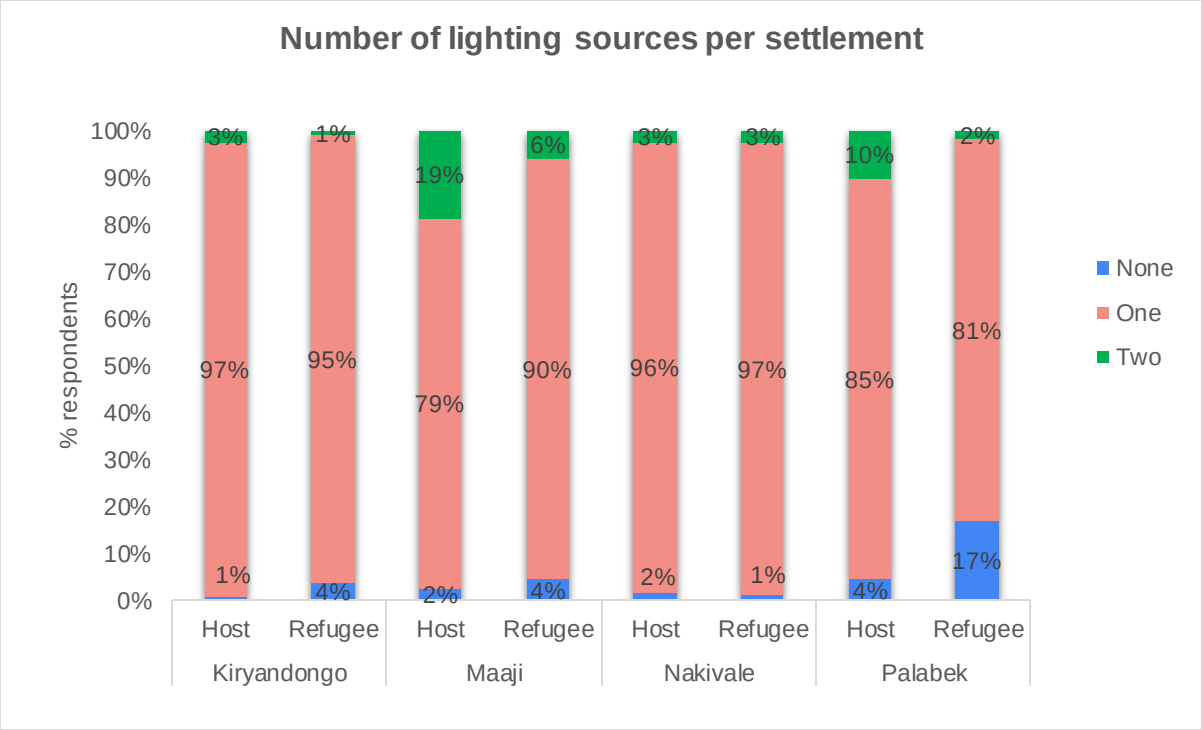


Figure 34; Number of lighting sources used per household in four settlements

Majority of the respondents in the different settlements were using one lighting source. Maaji had the highest percentage of respondents reporting using two lighting sources especially in the host community, while Palabek had the highest percentage of respondents without any lighting source especially in the refugee community.

Lighting sources for the refugee community;

For the refugee community in Kiryandongo, the most used lighting devices were solar system (55%) followed by the torch (23%) and phone torch 15%, while in Maaji, the most used lighting devices were solar system (51%) followed by torch (40%).In Nakivale, 59% were using a solar system and 31% used a torch. It is also the only settlement were refugee respondents reported using grid electricity and generator for lighting. In Palabek, majority (52%) used a solar system for lighting followed by torch at 29%, while a significant percentage (16%) reported using grass for lighting.

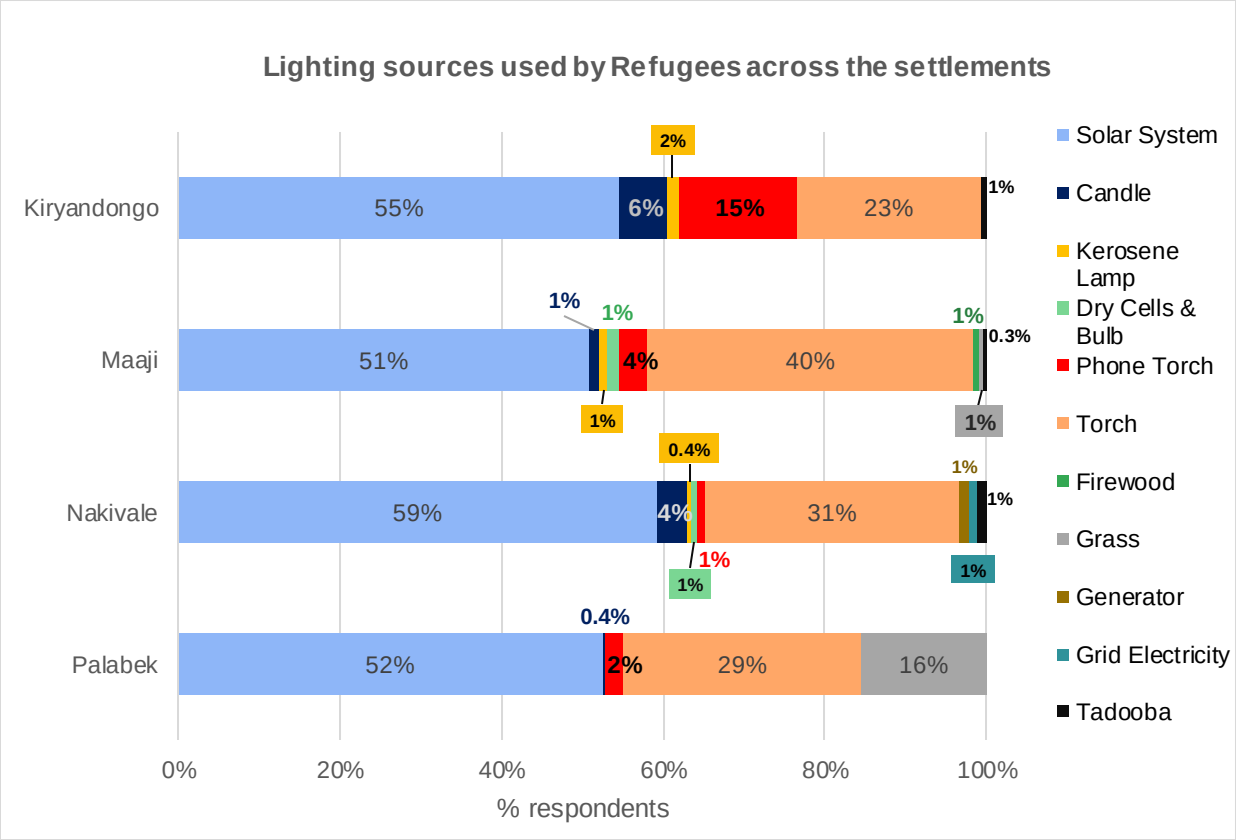


Figure 35: Different lighting devices used by the refugees across the settlements

Lighting sources for the host community;

For the host community in Kiryandongo, the most used lighting devices were solar system (61%) followed by the torch (14%), while in Maaji, the most used lighting devices were solar system (46%) followed by torch (30%) and 16% reported using dry cells and bulb. In Nakivale, 59% were using a solar system, 12% used a torch and 11% reported using tadooba. It is also the only settlement were host respondents reported using grid electricity (12%). In Palabek, majority (48%) used a solar system for lighting followed by torch at 34%.

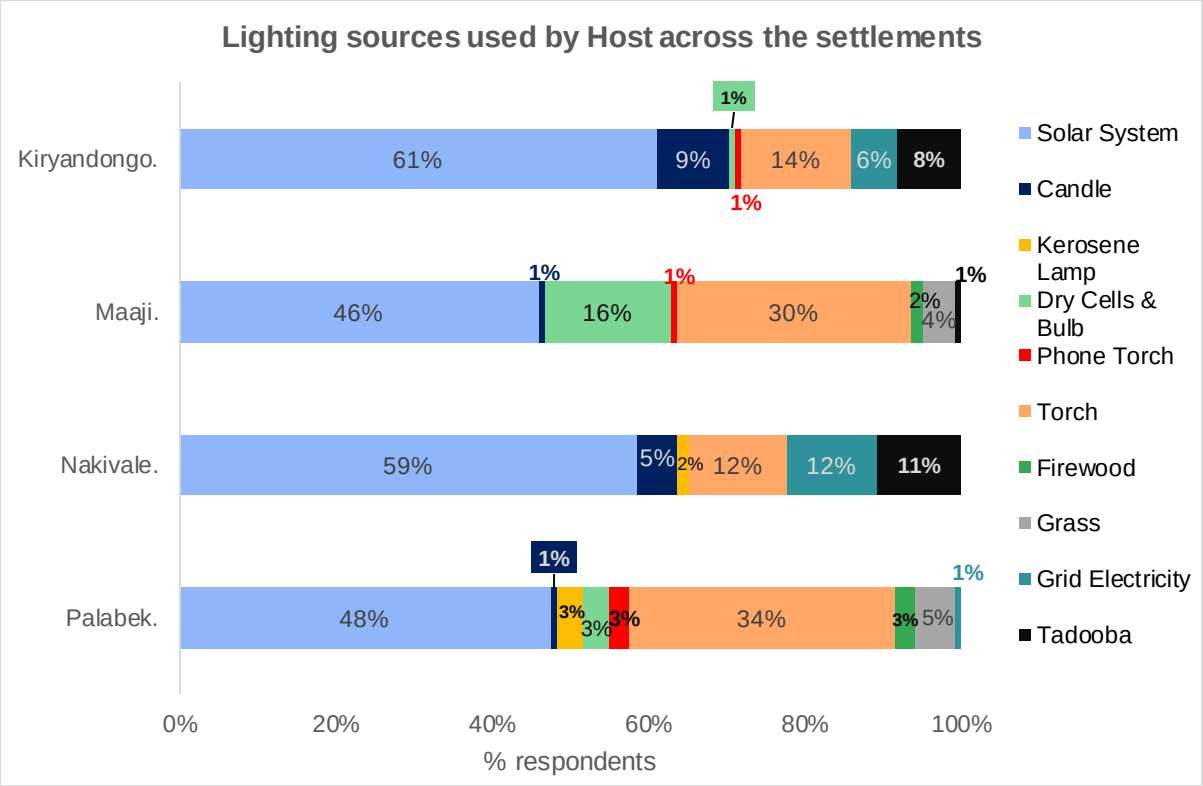


Figure 36: Different lighting devices used by the hosts across the settlements

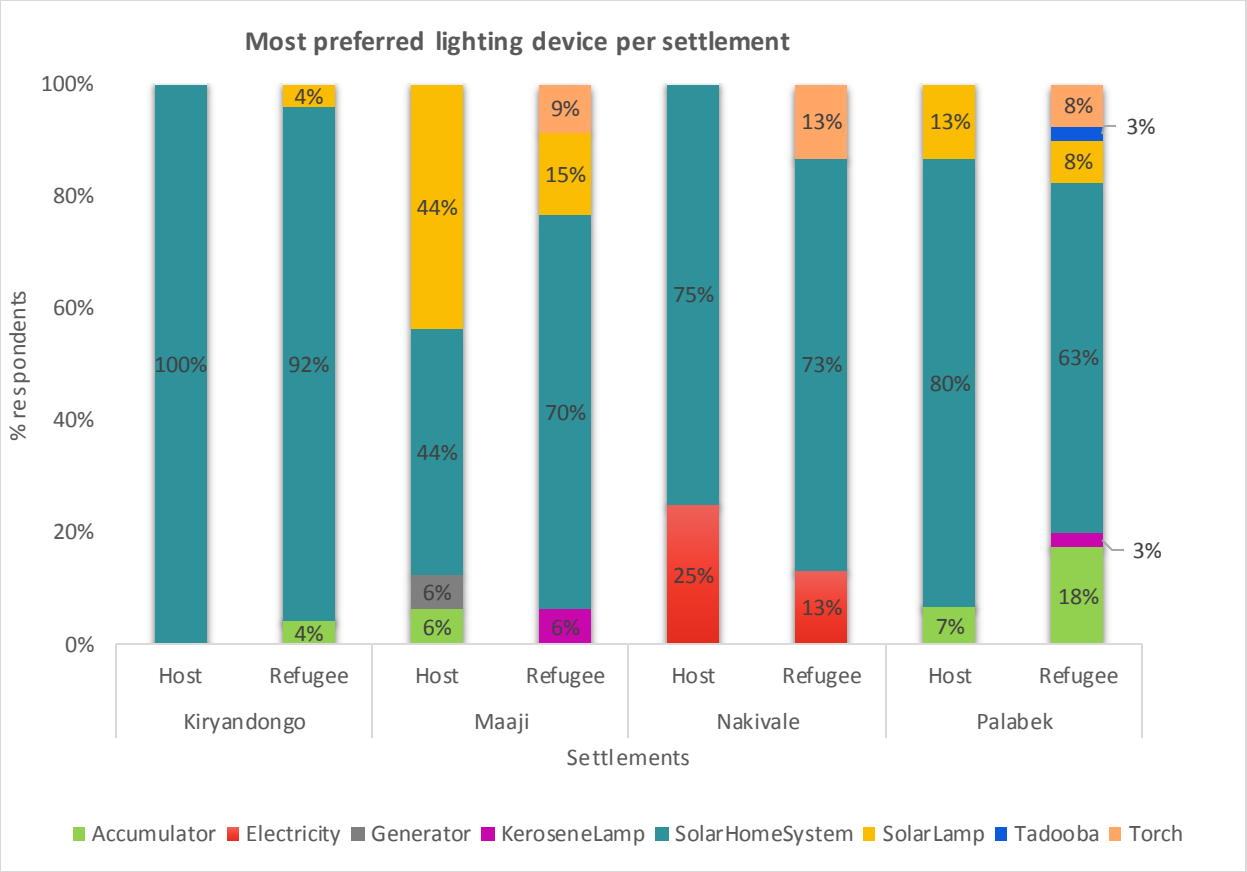


Figure 37; Preferred source of lighting per settlement

As seen above, the most preferred system across all settlements for both refugee was the solar home system. Only Nakivale had respondents preferring grid electricity which could be attributed to the fact that the grid is more established in Nakivale given it is one of the oldest settlements. Maaji had a 44% respondents preferring solar lamps.

Willingness and Ability

As popularly known in Economics *"Demand is the desire backed by willingness and ability to pay for a good or service".* This technically means for there to be demand there must be an equal willingness and ability to purchase a product. This was studied with two questions whose results have been discussed below.

Willingness to pay:

Though there was a high level of consensus in preference of the solar home systems, only 56% of the respondents across all the settlements were willing to pay for these systems. Nakivale and Kiryandongo again had the highest willingness to purchase with percentage figures of 61% and 52% respectively. The respondents in Palabek again expressed the least willingness to purchase these technologies with 77% saying No, while in Maaji, 60% were unwilling to pay.
The graph below shows the detail of respondents' willingness to pay per settlement.

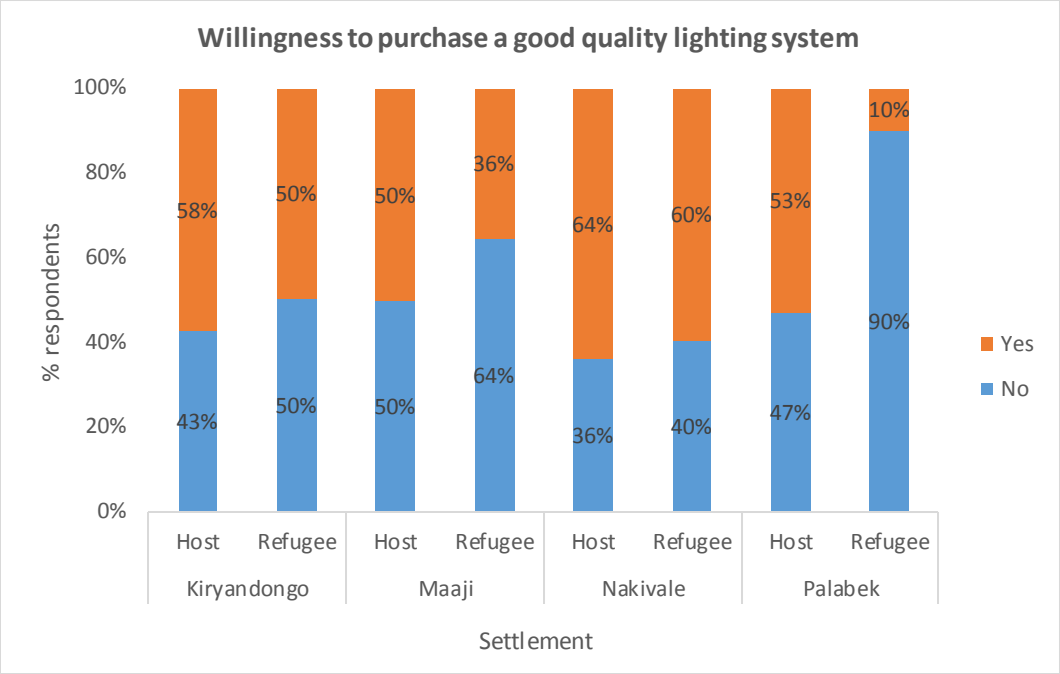


Figure 38; Willingness to purchase good quality lighting

In Palabek, only 10% of the refugees were willing to purchase a good quality lighting system while 53% of the host community was willing to purchase. In Maaji 36% of the refugees were willing to purchase as compared to 50% of the host community.

In Nakivaale, 60% of the refugees were willing to purchase as compared to 64% of the host community. In Kiryandongo, 50% of the refugees were willing to purchase as compared to 58% of the host community.

Again, generally, the host community across all settlements was more willing to purchase an improved cookstove as compared to the refugee community.

The overall findings on willingness to pay could be related to respondent awareness to the benefits of improved lighting devices as Palabek had the lowest awareness levels at 25% and Nakivale reported the highest awareness levels at 75%. The graph below shows the awareness level per settlement.

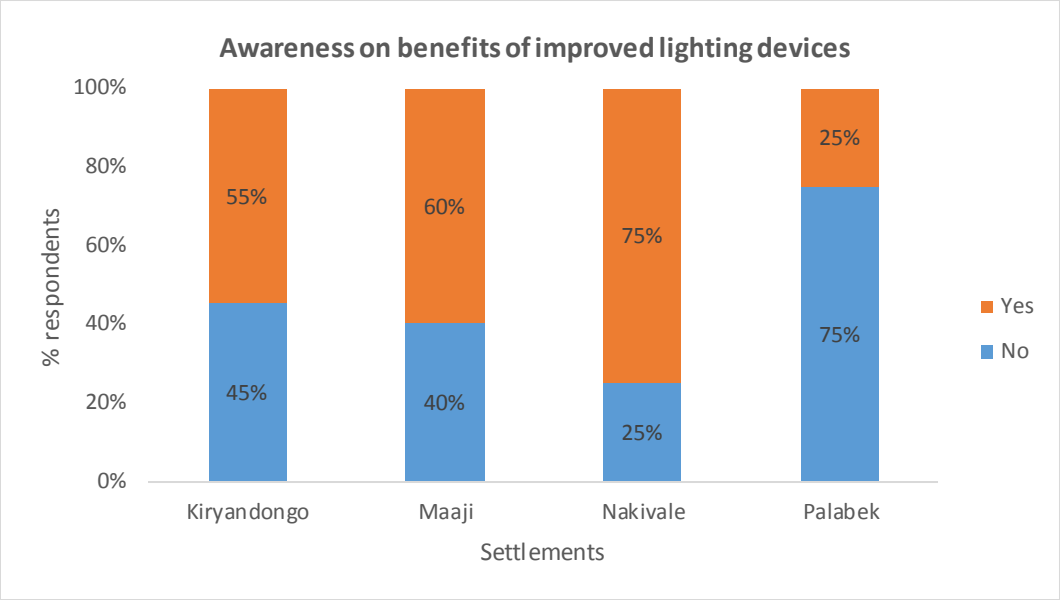


Figure 39: Awareness on benefits of improved lighting

In Palabek, only 25% of the respondents were aware about the benefits of improved lighting devices while in Nakivale 75% of the respondents were aware. In Maaji, 60% were aware and in Kiryandongo, 55% were aware.

Overall, across all settlements, 46% of the respondents were aware about the benefits of improved lighting devices and 54% were not aware. Most awareness on improved lighting was through traders and the neighbors or relatives who had purchased systems.

Desired purchase price:

After the assessment of the willingness to pay, assessment was done on the desired amounts that the respondents would be willing to pay for a good quality lighting device. Of the settlements with the highest willingness to pay that is Nakivale and Kiryandongo, majority (35%) of the respondents in Nakivale were willing to pay above UGX 100,000 for an improved lighting system, while in Kiryandongo majority (27%) were willing to pay between UGX 20,000 and UGX 50,000 with another 21% willing to pay between UGX 50,000 - 80,000. The graph below shows a breakdown at settlement level of desired amount to pay for a good quality lighting device.

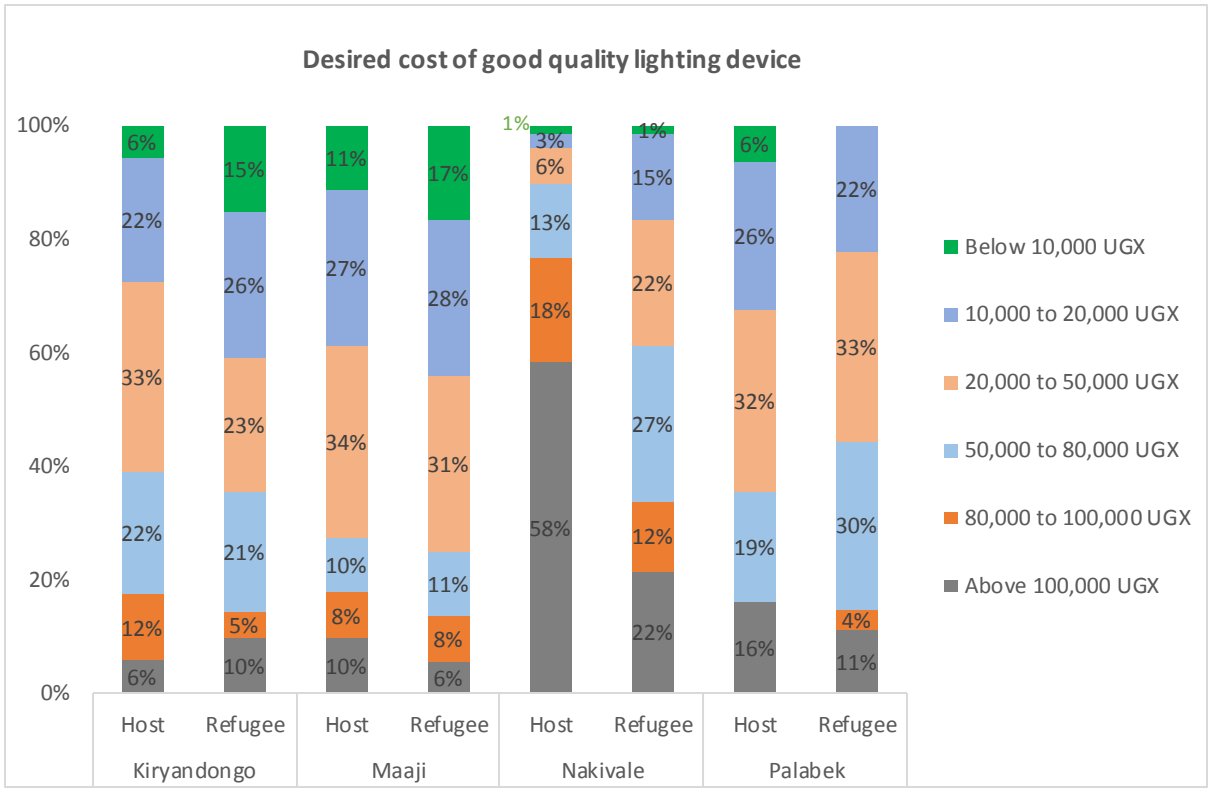


Figure 40; Desired cost of lighting

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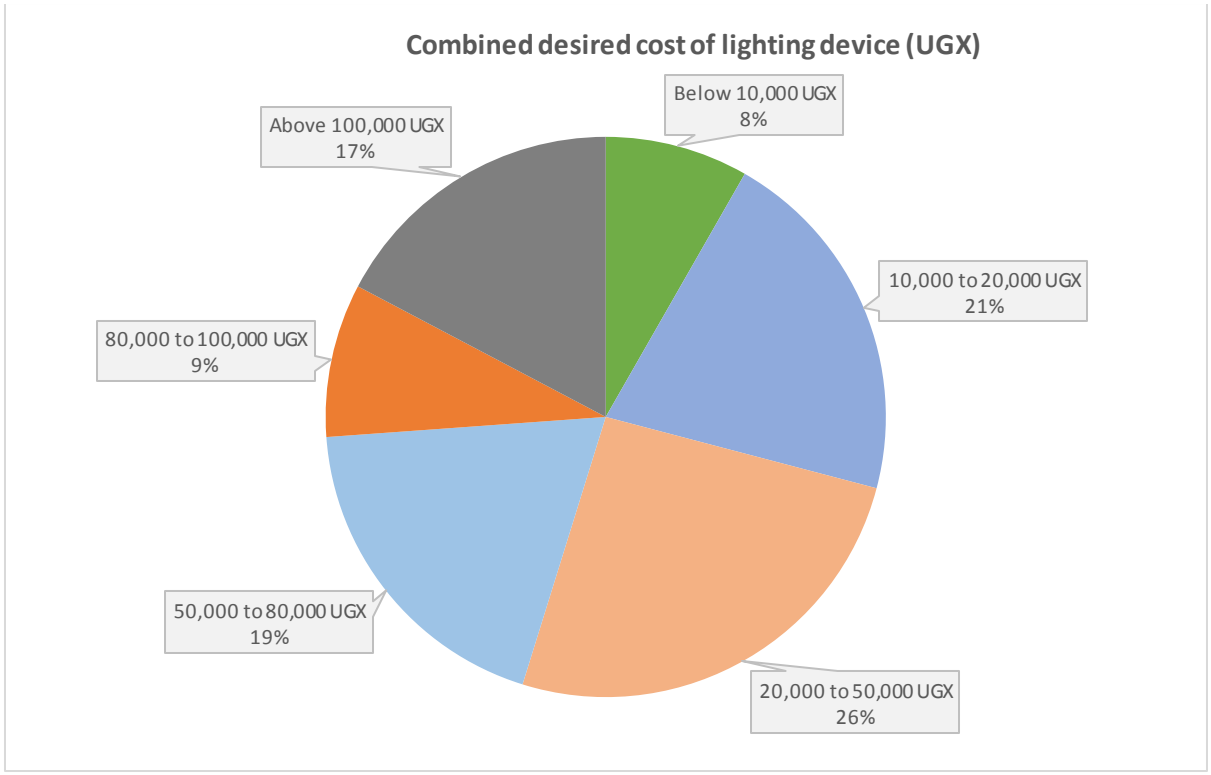


Figure 41; Desired cost of the improved lighting system across the settlements

Overall, majority of the respondents, 26%, were willing to pay between UGX 20,000 to 50,000. About 45% of the respondents were willing to pay above UGX 50,000 for a good quality lighting system. Basing on the price of improved lighting which starts from UGX 30,000, about 70% of the respondents can afford the small lighting systems; however, only 17% can invest in any system above UGX 100,000. If combined with installment purchase methods, the high willingness to adopt improved lighting systems is an indicator that is a potential demand for the system.

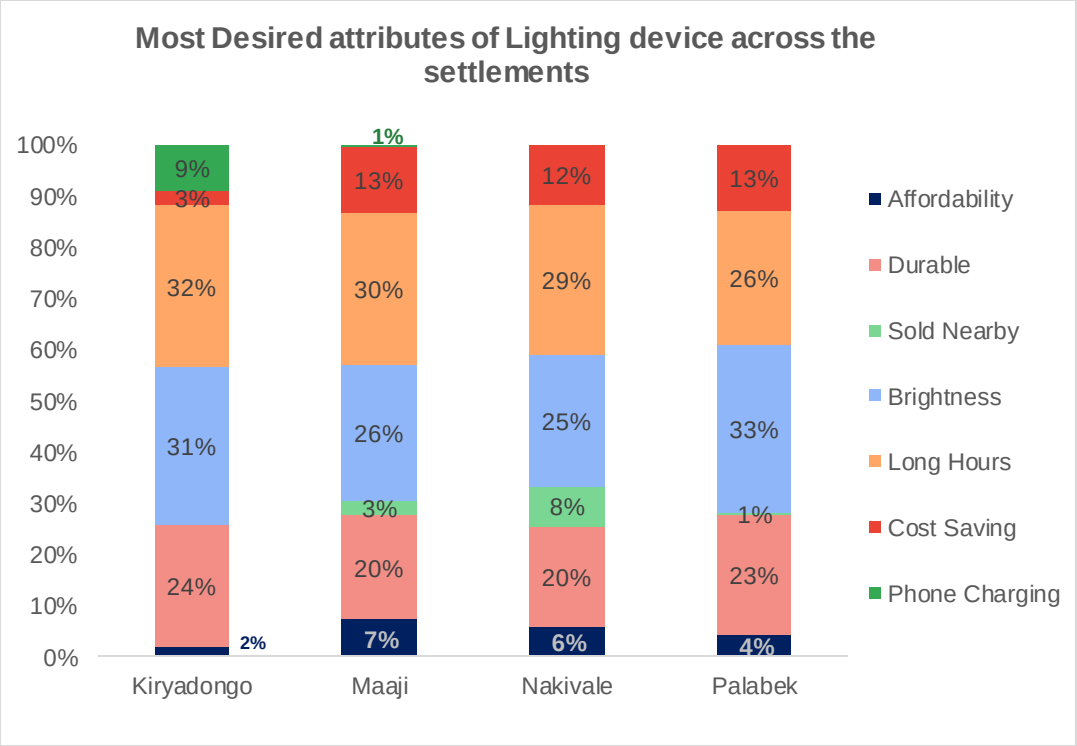


Figure 42; Most desired attributes of lighting devices across the settlements

ENERGY FOR COOKING

4.3.1.10.1 Consumer Characteristics / behavior

To fully understand the consumer characteristics of our respondents, several queries were asked namely, who usually cooks, the number of meals eaten, number that skip meals, reasons for skipping meals, and the cooking place. The findings revealed the following.

Gender involved in cooking: Of the total household respondents, 94.5 % of the cooking is done by women and only 5.5% of the men cook. For both the host and refugee communities, women were the primary cooks.

Number of meals eaten: It was found that for the refugees 65% ate two meals per day, 20% had three meals a day, and 15% had one meal per day. For the hosts, 56% had two meals a day and 35% had three meals a day, and 9% had one meal per day.

Overall, 62% of both the refugee and host community responded to having two meals a day, 25% had three meals a day and 13% had one meal a day. Furthermore, 61% of all respondents reported skipping meals and the two main reasons given for skipping meals were

food shortage (58%) followed by cooking fuel shortage (33%). The graph below shows the meals taken by respondents per settlement.

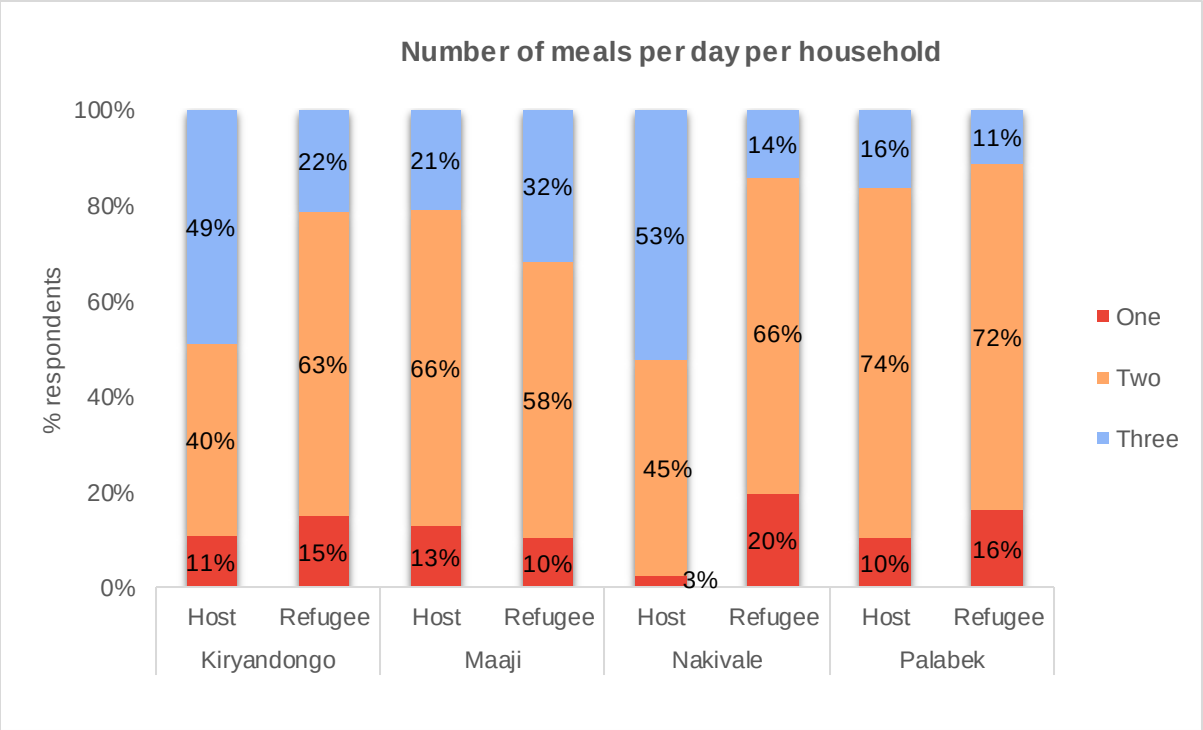


Figure 43; No. of meals per day per household

From the graph above, it is evident that respondents mostly had at least two meals a day with the exception of host respondents from Kiryandongo and Nakivale where majority had three meals a day i.e. 49% and 53% of the respondents respectively. For the refugee community in these two settlements, only 22% in Kiryandongo and 14% in Nakivale reported having three meals.

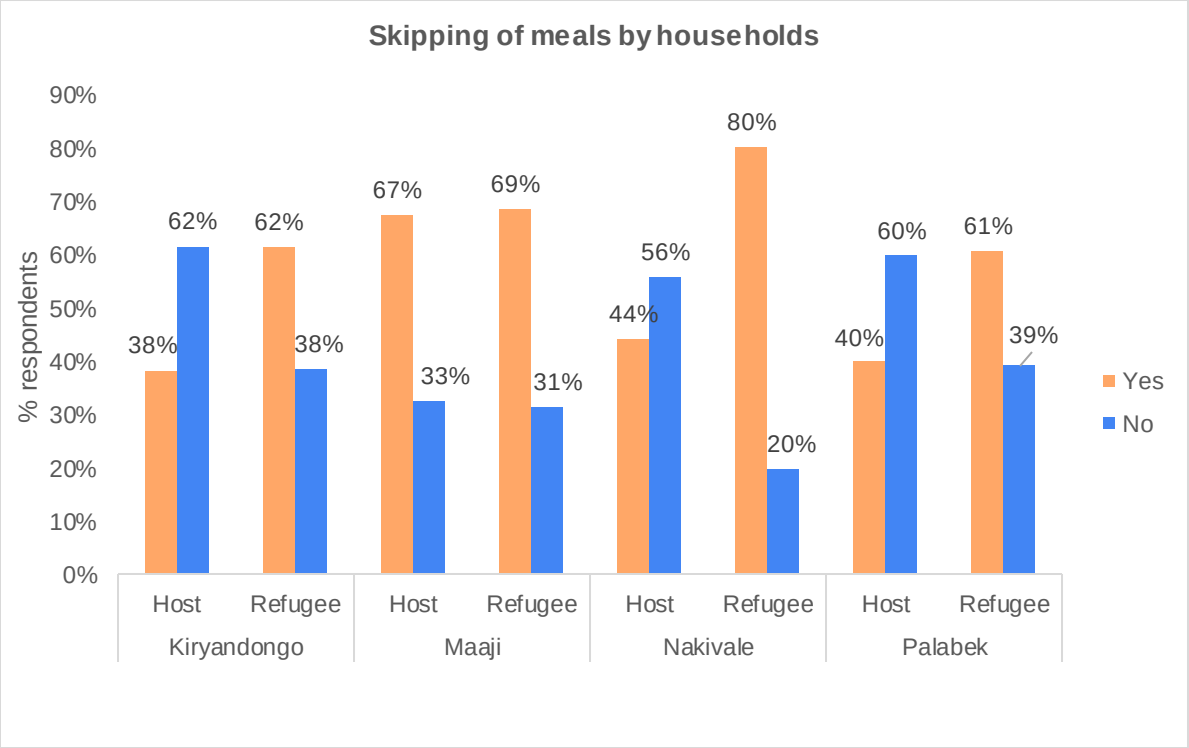


Figure 44; Skipping of meals by households

Skipping meals in this research was defined as omitting some meals than the usual standard number of meals eaten per day, of which the standard number of meals is assumed to be three. The graph above confirms that a significant percentage of the respondents reported to be skipping meals. This was attributed mostly due to food shortage and fuel shortage which took 58% and 33%respectively of the respondent's responses. A detailed scan of the survey results show that it is mostly the refugees that skip meals with Nakivale having the highest percentage (80%) of refugees skipping meals. In addition, Nakivale still had the highest number of respondents reporting only fuel shortage as a reason for skipping meals (21%).

However, overall (i.e. a combination of refugees and hosts), of those who reported skipping meals, Maaji had the highest percentage of respondents at 31%, followed by Nakivale 25%, then Palabek and Kiryandongo both at 22%.

Cooking technologies:

There was also need to assess the cooking stove technology used by the respondents. The graph below shows that majority (42%) of the respondents were using the mud wood stove, followed by mud charcoal stove at 39%, three stone fire (29%) and the metal charcoal stove 21%. The three stone fire and metal charcoal stove are the common traditional stoves in Uganda, the mud charcoal and mud wood stove are relatively improved stoves over these traditional stoves. Other technologies were also in use though smaller percentages of respondents were using them as shown below.

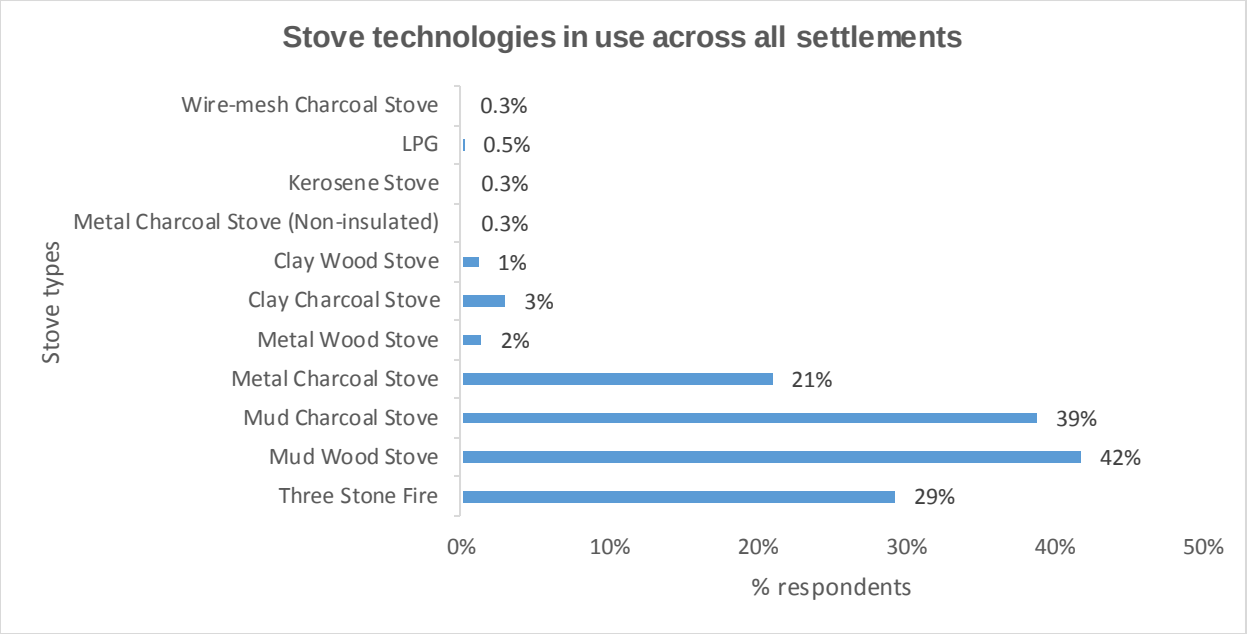
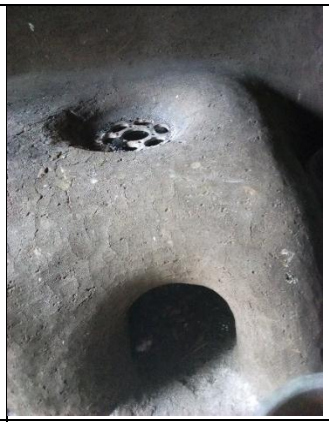


Figure 45: Stove technologies in use across the settlements

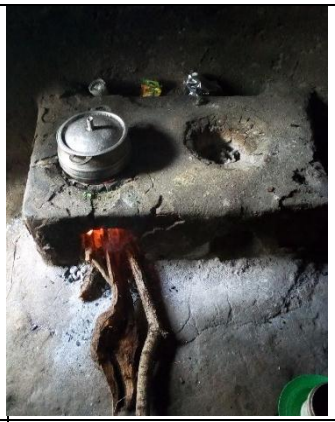
The different cooking technologies in use across the settlements are shown below;

		
Clay wood stove	Clay charcoal stove	LPG
		
Kerosene stove	Metal charcoal stove (non- insulated)	Metal charcoal stove

Metal wood stove (Biolite)



Mud charcoal stove



Mud wood stove

Three stone fire

Wire mesh charcoal stove/ Woven charcoal stove

Figure 46: Cooking technologies found in the settlements

There were other stoves in use though the number of users were few. However, it is important to note that stove users had more than one type of cookstove in use. Overall, majority (64.3%) of the respondents were using one cooking technology, while 34% reported using two cooking technologies, 1.2% used three and 0.1% used four. Below is a detail of the number of cooking technologies used in households;

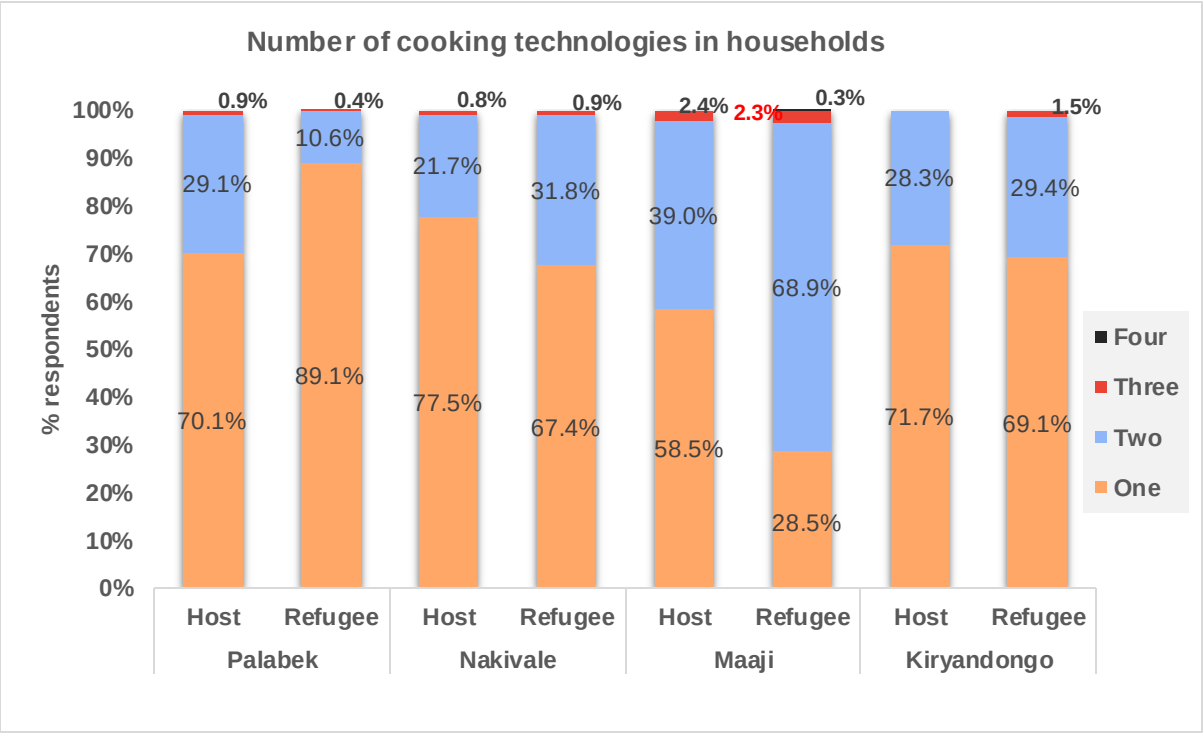


Figure 47; Number of cooking technologies used

Maaji settlement was quite an exception as 68.9% of the refugee community were mostly using two cooking technologies and also had 2.3% using three technologies and was the only settlement that reported one user with four cooking technologies. This situation in Maaji was majorly because of the dual mud stoves constructed by the artisans/community workers hired by DRC. These stoves were designed to use dual fuels i.e. firewood and charcoal. These communities were also using portable stoves prior to the introduction of improved cooking stoves by DRV in the settlement

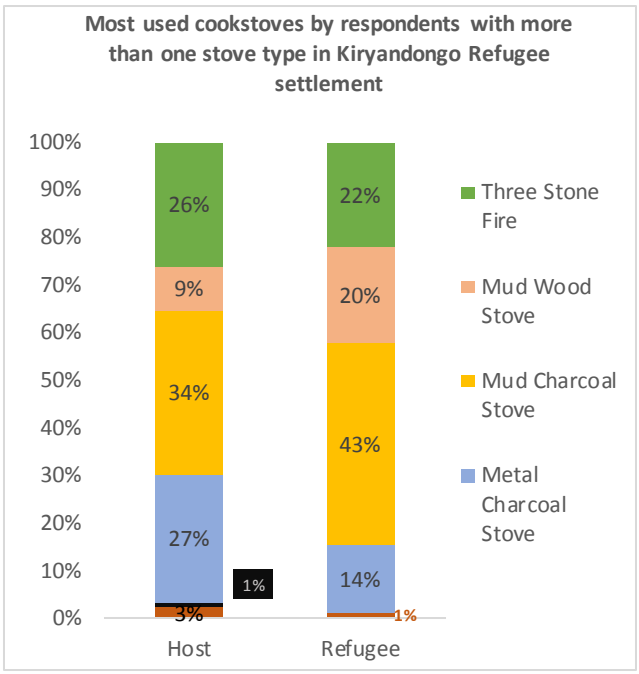
Furthermore, an analysis of the most used cookstove for users who had more than one cooking technology is as shown below;

Overall for all respondents (i.e. those using one cookstove and more than one cookstove); in Kiryandongo, the mud charcoal stove was the most used stove with 41% respondents followed by the three stone fire (29% respondents) and then the mud wood stove with 21% respondents.

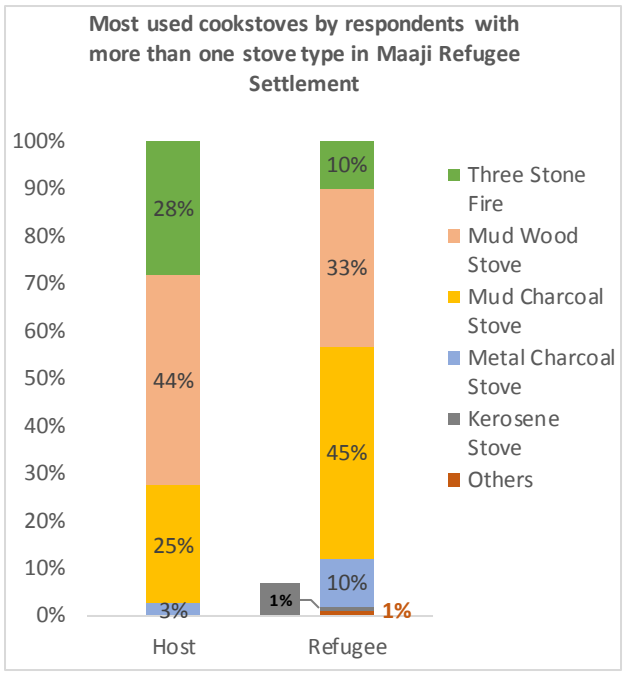
In Maaji, the mud wood stove and mud charcoal stove were the most used stove i.e. 66% and 61% of the respondents, followed by the three stone fire (29%).

In Nakivale, the most used stove was the metal charcoal stove (i.e. the traditional metallic stove) with 40% of the respondents, followed by the three stone fire (28%), mud wood stove (27%), and mud charcoal stove (23%).

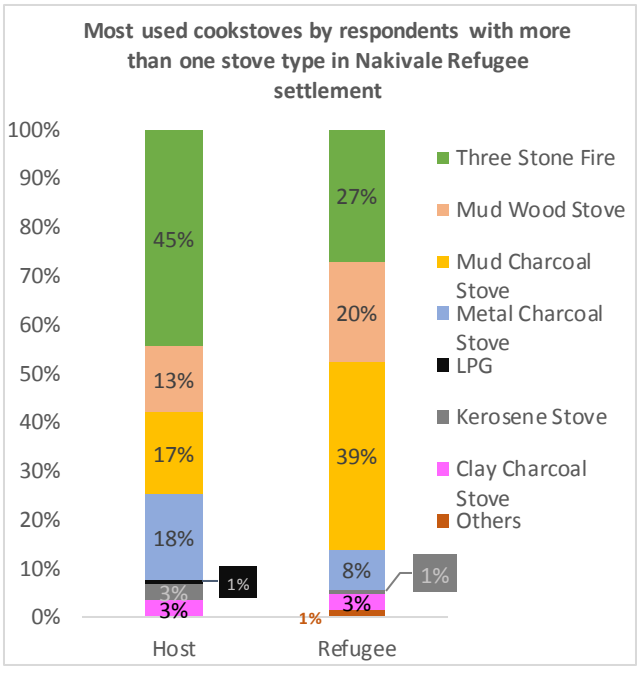
In Palabek, 50% of the respondents used the mud wood stove, followed by the three stone fire with 31% respondents and mud charcoal stove with 28% respondents.



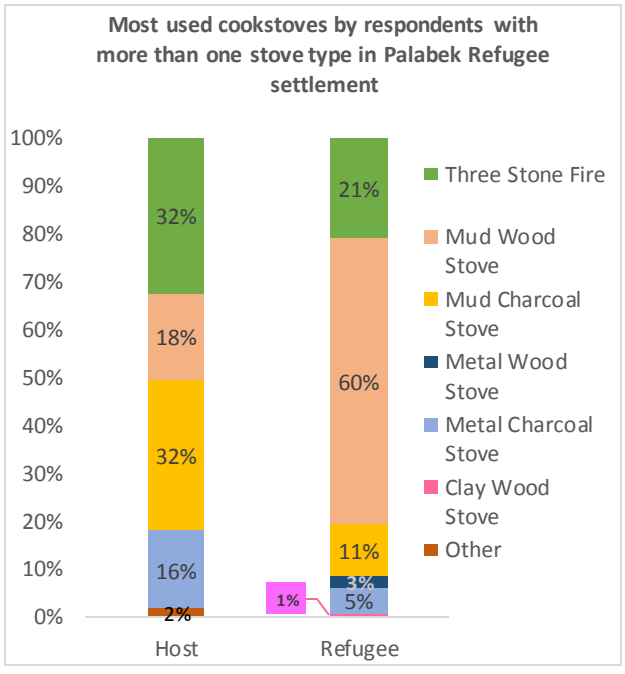
In Kiryandongo, the mud charcoal stove was the most used cookstove for both the refugee and host commmunity, followedby the metal charcoal stove and 3 stone fire for hosts; and 3 stone fire then mud wood stove for refugees. Other stoves in use were the metal wood stove, kerosene stove, woven charcoal stove, clay charcoal stove and LPG



In Maaji, the mud wood stove was the most used cookstove among the hosts, followed by 3 stone fire and mud charcoal stove. For the refugees, the mud charcoal stove was the most used, then the mud wood stove then the 3stone fire anf metal charcoal stove. Other stoves in use were the wire mesh charcoal stove and metal wood stove.



In Nakivale, the three stone fire was the most used cookstove amongst the hosts, followed by the metal charcoal stove then mud charcoal stove. For the refugees, it was the mud charcoal stove, then the 3 stone fire and mud wood stove. Other stoves in use were the metal charcoal stove (non-insulated) and metal wood stove



In Palabek, the three stone fire and mud charcoal stove were the most used stoves amongst the hosts while for the refugees, it was the mud wood stove, followed by the 3 stone fire. Other stoves in use were the kerosene stove and clay charcoal stove

Given the mix of cooking technologies used for the households, a variety or combination of fuels were used for cooking for most households as shown in the graph below;

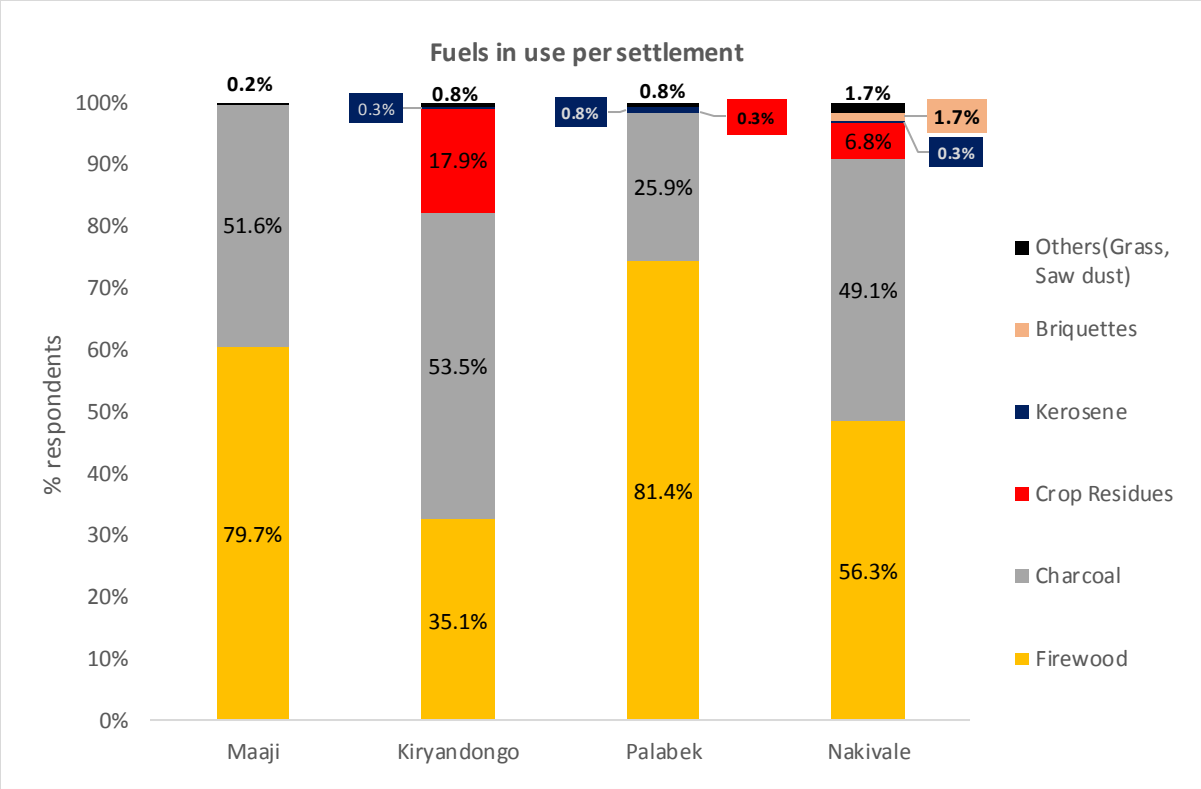


Figure 48: Fuel in use per settlement

In Maaji, the most used fuels were firewood (79.7% of the total respondents in Maaji) and charcoal (51.6%). In Palabek, the most used fuels were firewood (81.4%) and charcoal (25.9%); respondents also used crop residues, kerosene and grass.

However, in Kiryandongo, the most used fuel was charcoal (54.3% of the respondents), then firewood (35.8%), and crop residues (18.7%). other fuels in use were kerosene and sawdust.

In Nakivale, the most used fuels were firewood (57.2%), closely followed by charcoal (48.4%); crop residues, kerosene and briquettes were also in use. Nakivale was the only settlement were users reported using briquettes.

The mix of fuels in the settlements, is an indicator that demand is not readily met by the available supply of fuel. Examples of crop residues were bean pods and shrubs.

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4.3.1.10.2 Consumer Preferences

Willingness to pay

Willingness to pay for an improved cookstove was assessed and overall findings that only 40% of the total respondents were willing to pay. At settlement level, respondents in Palabek were least willing to purchase any improved cooking technologies, with 88% saying No, whilst Nakivale had the highest percentage willingness with 63% saying yes followed by Kiryandongo at 52% and Maaji at 36%. The graph below shows the detail of respondents' willingness refugee, host per settlement.

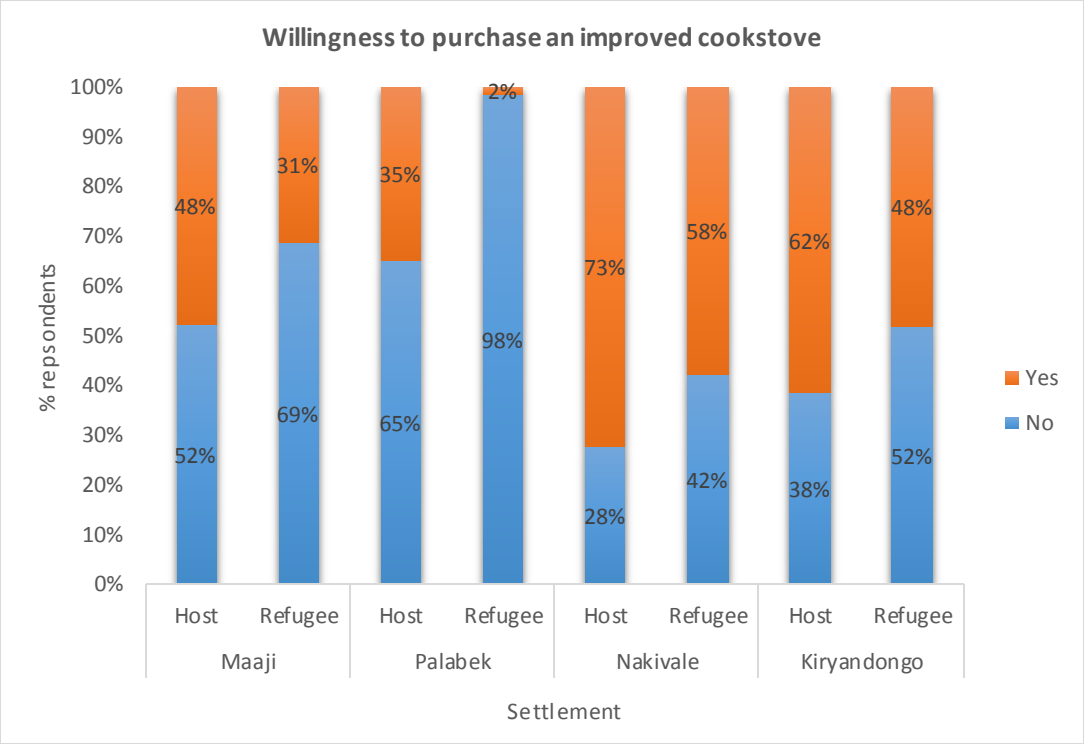


Figure 49; Willingness to purchase ICS per settlement

In Palabek, only 2% of the refugees were willing to purchase an improved cookstove while 35% of the host community was willing to purchase. In Maaji 31% of the refugees were willing to purchase as compared to 48% of the host community. In Nakivaale, 58% of the refugees were willing to purchase as compared to 73% of the host community. In Kiryandongo, 48% of the refugees were willing to purchase as compared to 62% of the host community.

Generally, the host community across all settlements was more willing to purchase an improved cookstove as compared to the refugee community.

The overall findings on willingness to pay could be related to respondents' awareness to the benefits of an improved cookstove as Palabek had the lowest awareness levels at 31%, followed by Kiryandongo at 42%, Maaji at 55% and Nakivale reported the highest awareness levels at 57%.

To assess respondents' awareness levels, respondents were asked whether they knew about the benefits of improved cookstoves and were further probed on what benefits they knew. Some of the benefits mentioned included less smoke, less fuel used, stove is easy to handle,

more durable, fast cooking and less costly. They reported learning about these benefits from NGOs, friend and relatives as well as traders.

The graph below shows the detail of host refugee awareness level per settlement.

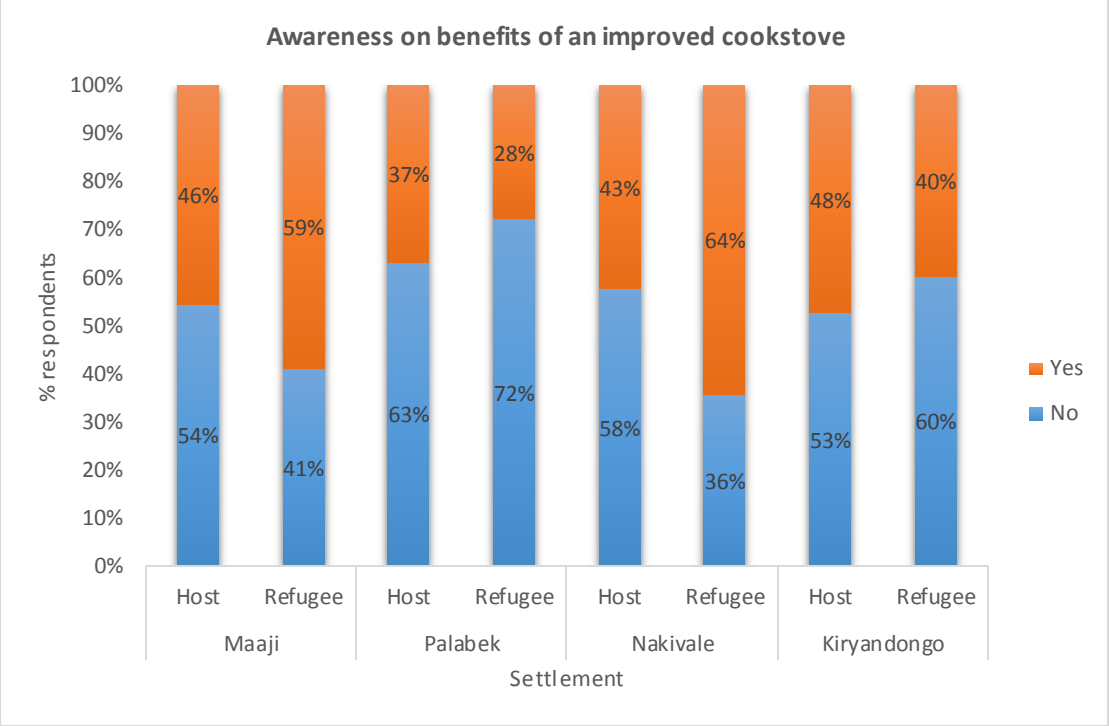


Figure 50; Awareness level on ICS technology

In the settlements of Palabek and Kiryandongo, the host community were more aware about ICS technology as compared to the refugee community with percentages of 37% versus 28% in Palabek and 48% versus 40% in Kiryandongo. This finding corresponds well with the willingness to purchase in these two settlements at host refugee level.

Whilst in Maaji 59% of the refugees were aware of ICS technology as compared to 46% of the hosts, and in Nakivale 64% of the refugees were aware of ICS technology as compared to 43% of the hosts. Thus, the refugees were more aware of ICS technologies though more hosts were willing to pay for ICS. This could be as a result of a combination of factors such as income levels. In Maaji and Nakivale, the host community had relatively higher income levels as compared to refugees.

Desired payment amount

After the assessment of the willingness to pay, assessment was done on the desired amounts that the respondents would be willing to pay or what they were able to pay. The graph below shows a breakdown at settlement level of desired amount to pay for ICS.

Overall findings showed that for Nakivale and Kiryandongo that had the highest willingness to pay; in Nakivale Only 5% were willing to pay below UGX 5,000 21% of these respondents in were willing to pay between UGX 5,000-10,000, 20% between UGX 10,000 to 15,000 and another 20% between UGX 15,000 to 20,000 and 33% could afford paying over UGX 20,000.

In Kiryandongo, 28% were willing to pay between UGX 5,000-10,000 and 22% between UGX 10,000 to 15,000 and another 22% between UGX 15,000 to 20,000.

In Maaji, majority (34%) were willing to pay between UGX 5,000-10,000 while in Palabek, most respondents (48%) were willing to pay UGX 10,000 to 15,000.

Further analysis on desired cost for ICS technology for those willing to pay at refugee host level per settlement is as detailed in the graph below;

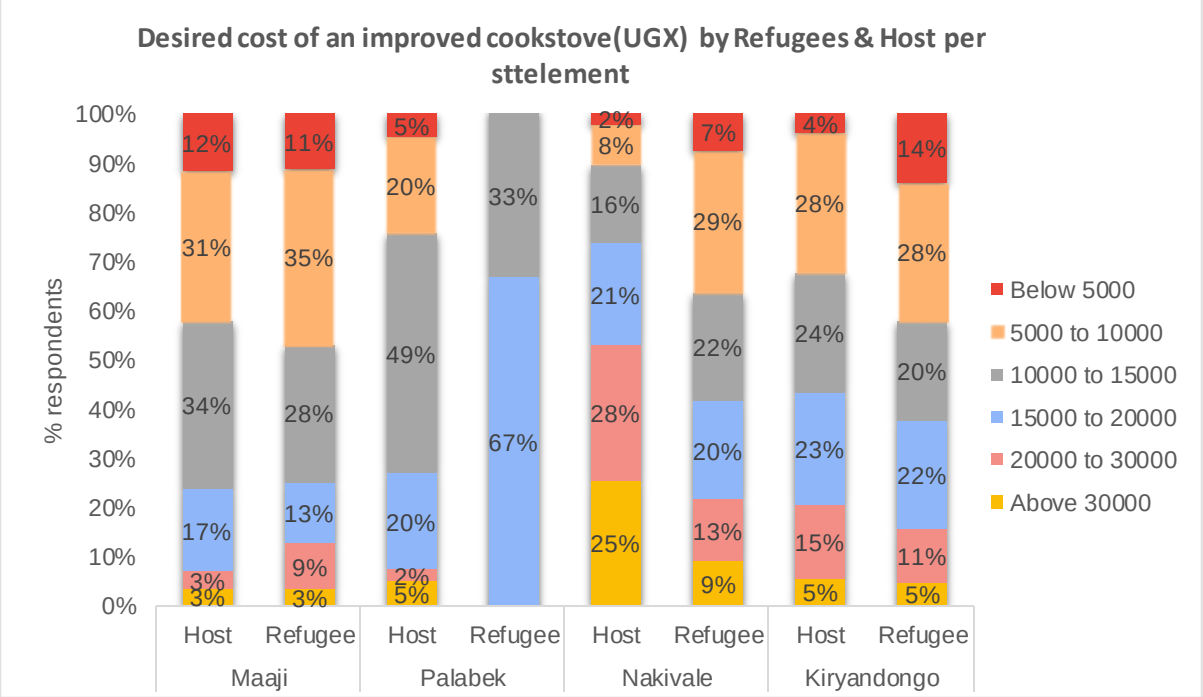


Figure 51: Desired ICS cost within settlement

In Maaji, majority (31%) of the host were willing to pay between UGX 10,000 to 15,000 while the refugees (35%) were willing to pay between UGX 5,000 to 10,000. In Palabek, majority (49%) of the host were willing to pay between UGX 10,000 to 15,000 while the refugees (67%) were willing to pay between UGX 15,000 to 20,000.

In Nakivale, 28 and 21% the hosts were willing to pay between UGX 20,000 to 30000 and UGX 15,000 to 20,000 respectively while the refugees (29%) were willing to pay between UGX 5,000 to 10,000. Nakivale had the highest percentage of respondents willing to pay above UGX 30,000.

In Kiryandongo, majority (28%) of both the hosts and refugees were willing to pay between UGX 5,000 to 10,000.

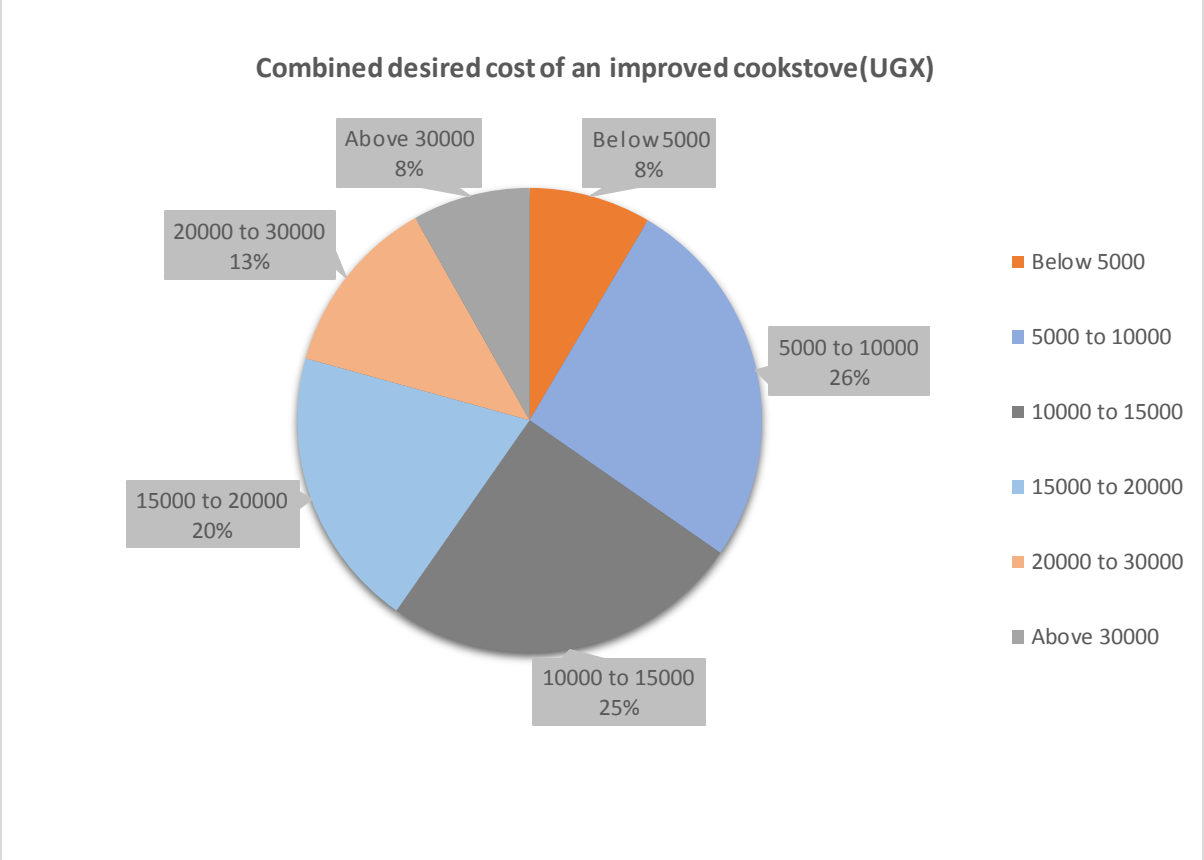


Figure 52: Combined desired ICS cost across all the settlements

On the market right now the lowest price of an ICS is between UGX 20,000 to UGX 30,000. This implies that only 21% of the respondents who were willing to pay can afford this product however another 20% who said UGX 15,000 to 20,000 can easily stretch to meet the cost of the products.

It is important to note that 39% of the total respondents were willing to acquire an ICS by putting in some working hours not through direct cash payment.

Preferred payment plan

The respondents were further asked how they would prefer to pay for the stove. Majority (49%) of those that responded preferred to pay for the stove in regular installments but get the stove right at the start, similar to a Pay As You Go system, while 26% preferred to pay upfront and get the stove right away and 25% preferred regular installments and only obtain the stove at the end of the payments. A breakdown of preferred payment plan per settlement is shown below;

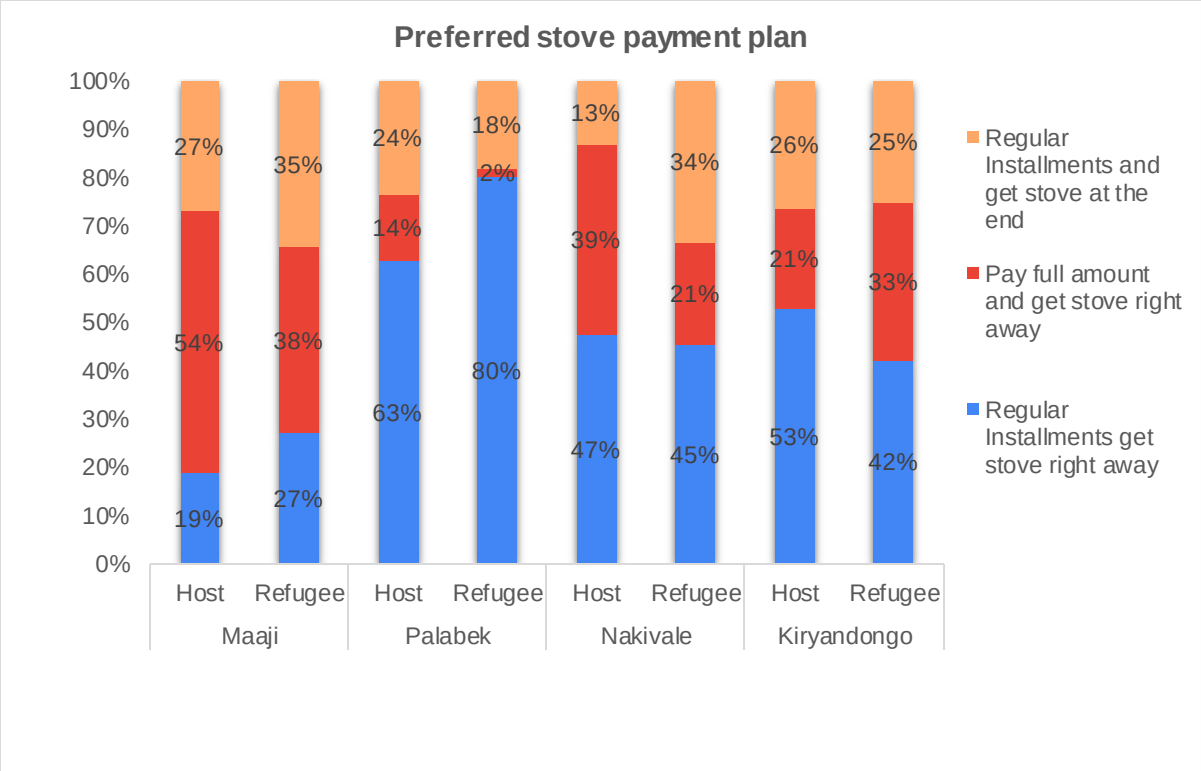


Figure 53: Preferred stove payment plan per settlement

As seen in the graph above, in Maaji, majority of the respondents both host (54%) and refugee (38%) preferred to get the stove right away, while in Palabek, Nakivale and Kiryandongo, majority of the respondents both host and refugee preferred regular installments and getting the stove right away.

Awareness Level:

According to the Oxford dictionary "awareness" is the knowledge or perception of a situation or fact. To assess the awareness level of the respondents on improved cooking stoves, the areas assessed included the level of knowledge on the benefits as well as the source of the knowledge**.** From the analysis, 54% of the respondents reported to having no awareness of ICS technologies. The highest lack of awareness was found in Palabek settlement with 69% unaware of the benefits of ICS. It is also important to note that one of the settlements which had the highest willingness to pay for ICS that is Nakivale also had the lowest lack of awareness at 43%. Though this still leaves a lot of room for improvement in terms of communication.

4.3.1.11 ENERGY FOR INSTITUTIONS

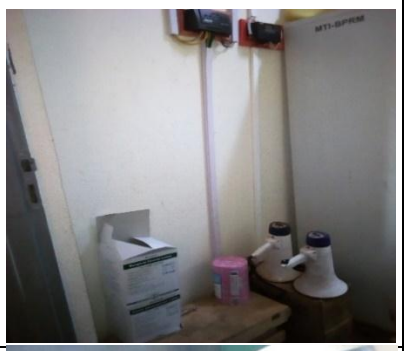
Schools and Health centres

The existing solar systems are small only for lighting, cooking is mainly done using mud-stove with firewood as the main fuels and from the few schools visited, below are the details.

Table 9:Energy utilization by the schools and health centres

Institution	Current energy situation	Intervention / Desired system	Picture
St Josephine Nursery School, Maaji	• Cooking done using 3 stone fire • Children are tasked to bring a piece of firewood termly. • Cooking is difficult as there is a lot of smoke. • Much firewood is used for cooking. • Collecting firewood has become a big challenge.	An energy saving cooking technology with less smoke production and can cook for many people at once	
	• No lighting system in place	Solar system	
Ayiri Health Centre III, Maaji	• Have no cooking technology • Have 3 solar systems to power each block which function well •	Solar system requires maintenance	
Ukusi-Joni Health Centre III Located: Adjumani District - Ukusi-Joni Sub-county	• No coking technology • 4 solar systems to power each block over 1-year-old ○ 2 systems are non-functional due to faulty battery system • Systems were funded by Ministry of Energy and Mineral Development	Solar Grid electricity	

Institution	Current energy situation	Intervention / Desired system	Picture
Bright International Primary School, Nakivale Located at Kigali base camp	• Mud stoves are used for cooking • The school spends UGX 1.2 million per term on firewood which translates to 6 trucks per term at UGX. 200,000 • During cooking there is a lot of smoke. • Firewood is expensive and difficult to get.	Rocket lorena type of stove that is fuel efficient	*Roof Mounted solar system*
	• Solar system is used to provide lighting. It functions well	Solar	
Nakivale Primary School Located at Kakoma	• Uses mud stove for cooking and spends UGX 600,000 per term. • Stove consumes a lot of firewood, a lot of smoke produced, firewood is not available which makes it expensive. •	Fuel efficient cook stove	
	• Have a solar system for lighting, no challenges experienced	Solar system with provision for AC power	
Koozi Primary School Located at Kityaza, host community, Nakivale	• Mud stove used for cooking using firewood. • A lot of smoke is produced during cooking. • A lot of fuel used. • UGX 300,000 is spent on fuel per term.	Fuel efficient cook stove	
	• There is solar system for lighting only	Solar system is maintained by the seller. Desire to have a solar system with provision sock ets	

Institution	Current energy situation	Intervention / Desired system	Picture
Kibengo health centre – Nakivale	• Installed solar system • *No cooking is done at the centre. They have a solar system which is mainly used in the maternity ward.*	*The main challenge is the lights are dim and therefore don't provide enough light needed.*	 
Arnold primary school, Kiryandongo	• Use three stone fire for cooking after abandoning the rocket lorena stoves that it cooks slowly. • Buy firewood from Karuma forests and also sometimes children are tasked to bring a piece of firewood. • The national grid connects to five school blocks though the headmaster complained that it's expensive to pay for it monthly since children do not pay school fees • Some classes are connected with solar systems.		
Bidong Primary school, Kiryandongo	• They use firewood for cooking. Also they abandoned the rocket Lorena stoves because of too much heat in the small kitchen. • Office block is connected with solar systems. • Children bring firewood twice a week and sometimes they buy though		

Institution	Current energy situation	Intervention / Desired system	Picture
	it's expensive, a trip of firewood is 350,000=.		
Panyadoli vocational training institute, Kiryandongo	• Use firewood for cooking • The school is connected to the national grid and they also have solar system. • Students are trained in solar technologies.	Grid and Solar	
Panyadoli Health Centre 3, Kiryandongo	• Have a solar system. • No cooking at the health centre		
Nyakadoti health centre 2, Kiryandongo	• Connected to national grid it's in the host community.		

4.3.2 Supporting Functions

Financing for Entrepreneurs

Apart from the funding that is channeled through the implementing partners in the settlements and the calls for proposal that are availed towards refugee settlements, over the past few years there has been a rise of private sector funding / market based approaches; the latest being United States Agency for Development (USAID's) grant to solar companies managed by Green Powered Technology towards de-risking solar pay–go. The current implementers of this grant include BrightLife, ix and SolarNow. Loans also exist for energy entrepreneurs and individuals in various SACCOs and VSLA's in the settlements. These loans are given at rates of 3-5% depending on the SACCO. In Kiryandongo Whitaker Peace and Development Initiative (WPDI) provides cash to women groups to help them start their businesses.

Financing for Consumers

BRAC has branches in Kiryandongo and Nakivale settlements, though they have not yet started giving out loans to the refugees, but they are helping in forming VSLAs groups in Kiryandongo settlement. There are currently several pay go options as of now in Kiryandongo, these are being offered by Fenix, Brightlife and Solar Now, the mobile money services are also available both in the settlement and host communities, VSLA's and banks are also available. It was noted that there is a high concentration of financial services in Kiryandongo and Nakivale however the situation is different in Palabek and Maaji where its mostly VSLA's and SACCOs that are the main finance options for the community.

Education and Training

Nsamizi Training Institute of Social Development, which is the leading energy implementer for UNHCR in Nakivale, trains people on making briquettes and also distributes free briquettes to Extremely Vulnerable Individuals (EVI's).

In Kiryandongo, supportive government partners (RMF and UNHCR) have set up a vocational training center – Panyadoli Vocational Training Institute (PVTI) and are spear heading knowledge transfer in tradable skills such as energy including solar technology, Bricklaying and Concrete Practice, Carpentry and Joinery, Tailoring and Garment Cutting. DRC has trained the local artisans to construct Rocket Lorena stoves, some refugees were trained and they charge a small fee for the labor from clients. Save the children also trained the young girls on hands on skills such as tailoring. Only 39% of the vendor respondents indicated having received some kind of training mostly on finance and book keeping. About 64% of the vendors reported facing several challenges which included; availability of stock, competition from counterfeit products, seasonal sales income, competition from lowly priced goods, lack of sales support, customers not being able to afford the products, distances of the customers, low profit margins, lack of consumer awareness and insufficient capital. Some of these challenges can be mitigated by providing some essential business skills to the vendors.

Labour market

It was found that 58% of the refugee respondents had received energy training and 42% of the hosts had received energy training. This training had been received from various agencies; for the refugees a greater percentage had received the training from NGOs and for the hosts most had achieved the training through universities or institutes.

Table 10: Results from the vendor respondents showing numbers trained per institution

	Settlement	Institute/University	NGO	Solar Now
Refugee	Kiryandongo	1	2	-
	Maaji	1	-	-
	Nakivale	-	1	-
	Palabek	-	2	-
Host	Kiryandongo	3	-	-
	Maaji	-	-	1
	Palabek	-	1	-

For example, in Adjumani, NGOs like DRC have carried out some training and skilling energy interventions regarding stove construction thereby creating a network of skilled artisans called community workers[4]. These have largely been trained in construction of improved mud stoves and they have had a great impact in the community as evidenced by the wide adoption of the mud stoves in the community. This achievement can be built upon by training more artisans in the settlement.

[4] These artisans however are mostly in the community and not having shops thus were not surveyed in the vendor interviews.

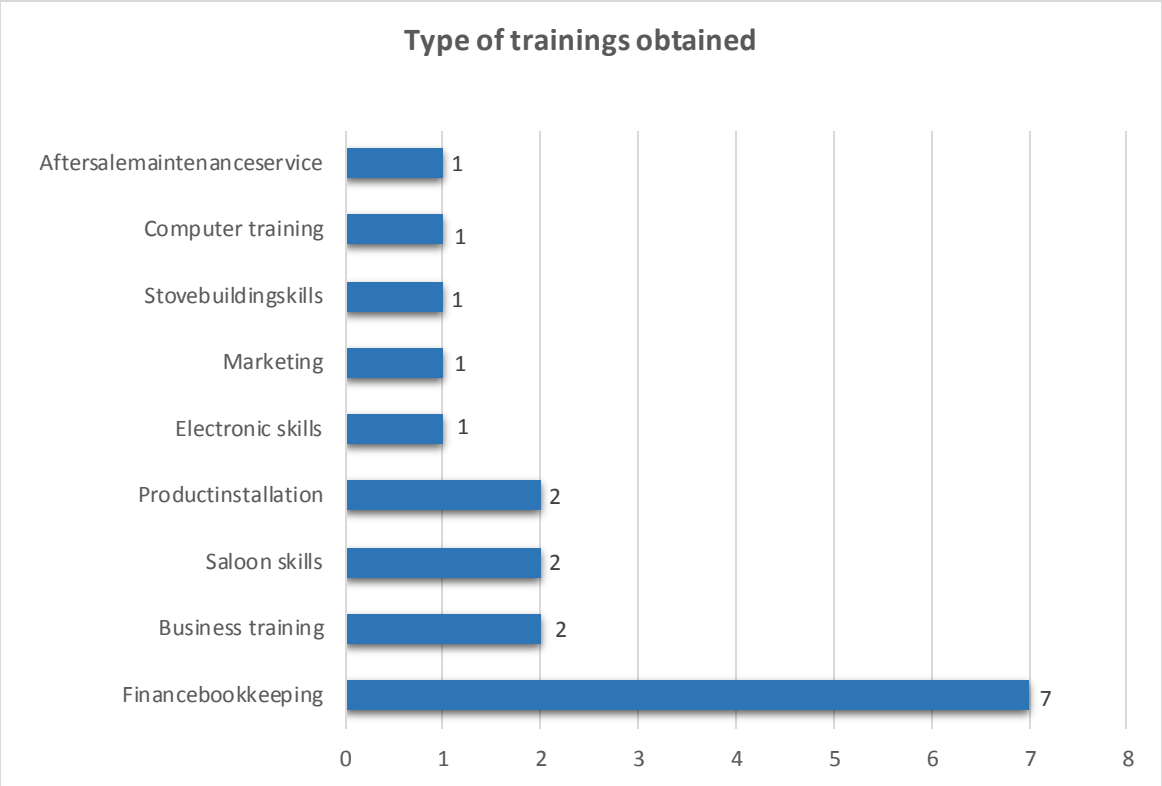


Figure 54; Training needs of the vendors across the settlements

4.3.3 Market Rules Indicators

This observation level includes the relevant legal institutions, regulatory frameworks, taxes, duties, and other macroeconomic and legal conditions that make-up the rules of trade of energy access products and services and control their dissemination and use through compliance mechanisms. Market rules can be favourable for but also hinder the development of energy access markets; they are crucial in determining the competitive (dis)advantages against conventional fuels and energy technologies (Kemper, 2000)

Taxes

Currently in Uganda, operators selling solar home systems are exposed to two different kinds of taxes: those based on business operations, such as corporate income tax, and those based on the product, such as Value Added Tax (VAT) and import duties. Recent amendments to the Excise Duty Act 2018 (mobile money tax) introduced a new category that will affect PAYGO transactions through mobile money directly (UOMA, 2018). The current tax regime, includes some VAT and import exemption (only on solar generation). However, for many consumers especially those in the rural areas these products are still too expensive and also due to the irregular tax levy that is not applied to all products, many companies still price their products inclusive of all the taxes. This makes it difficult to note a change in pricing even when there is a tax exemption on solar generation.

Incentive Schemes

With one of the most progressive refugee policies, the Uganda government permits refugees in Uganda to live, farm and work freely with an aim to pursue a better life. This has since cultivated a sense of belonging among the refugees and although the majority still suffer from lack of sustainable income sources, some have been able to establish their own businesses. And so, with this policy, more development can be realized with the right skilling and funding programs in the settlement.

The Government of Uganda has also demonstrated strong commitment to create and strengthen the environment for existing and new investors to be competitive within Uganda, regionally and internationally. In Palabek, the government has constructed a major road network which focuses on enabling and enhancing business operations and other income generating activities. However, modern energy still remains a significant challenge with the closest grid line connection being 15 km away from Ogili Sub County the host and about 25 km from the refugee settlement.

Quality Regulations, Norms and Standards

Quality is a cross cutting challenge in the energy sector and some efforts have been undertaken by the Uganda National Bureau of Standards (UNBS) to enforce standards in this sector however a lot is still left to be done. This will greatly help increase customer confidence in huge investments especially in the solar sector that had the most complaints.

From the survey, it was found that there were several quality issues on the market. Quality is still a big challenge in the settlement, affecting households, businesses and institutions. For solar, there were a number of complaints on the quality of the solar products that were disseminated to refugees on arrival. During the household survey, it was noted that most solar lamps had gotten spoilt; and while repair had been done for some, those who could not repair had abandoned the products. Complaints were mostly reported on the quality of the batteries, which could also be attributed to the lack of charge controller connections. However, batteries in the health centres in Maaji still suffered premature battery failures even when connected to a charge controller, this signifying that other issues had led to their failure.

Some of the traders in both the refugee and host community reported that some batteries are usually returned by customers after 2 to 4 weeks after purchase for replacement. The traders then have a challenge of returning these products to the original suppliers given that they are distant. This has altogether created a bad attitude towards solar in certain areas.

However, part of this short-term usage can be attributed to customer purchasing behaviors. From our observational studies, it was noted that customers prefer to buy a battery and a solar panel minus a charge controller, which is a crucial component for the long term survival of the battery. This, we concluded, is due to a lack of awareness of the benefits of this unit to the health and life of the system and as such it is considered as an extra cost that can be avoided. Additionally, it was found that many installations are done by the customers (refugees & host community residents) which leaves high chances of poor connections that damage the systems in the long

run. This was common in Nakivale settlement. For the cook stoves, the main challenges reported was the fact that they easily break, produce a lot of smoke and have high fuel consumption.

4.4 DEMAND GAPS FOR ENERGY PRODUCTS

In market-based approaches, only sustainable solutions that meet the needs of the people should be recognised for up-scaling. For instance, the introduction of a technology in humanitarian settings requires special focus on end user acceptance. However, for most energy interventions in refugee settlements in Uganda, we found that the end users are not part of the information flow within the humanitarian market.

To be able to identify the demand gaps for energy products for household use, productive use and public institutions, three different areas were assessed; the demand side, the supply side and the framework conditions.

Demand for energy in the refugee energy market is mainly constrained by perception, network or market linkages, marketing, retail opportunities, access to financial services, quality assurance of energy products, energy market maturity, population size of refugees and host, location, political/cultural norms. This was all found in varying levels per settlement as shown below.

Demand side:

Product gaps: In Maaji refugee settlement, energy products were not commonly sold, majority of the businesses dealing in energy in the settlement were service oriented. This further helps to put into perspective the purchasing power of the population of Maaji refugee settlement. With service-oriented businesses, a consumer parts with money when need-be; and in this case it is small amounts of money for example UGX 500 for phone charging, UGX 1500 for a haircut, UGX 200 – 500 for entertainment and the commonly used single use torches of UGX 500 – 1000; but are reluctant to put large amounts of cash into product purchase.

Business models: Another challenge that was commonly reported in all the settlements was the high price of the products especially solar. For example, In Maaji, complaints were in form of unfavorable models as LWF, the energy partner in the settlement, uses a cash on delivery model that consumers feel is unsuitable for them. The consumers of the goods and services are willing to pay for new technology as long as the solutions presented to them are affordable with flexible terms of payment. This indicates that the financing model that favors them doesn't exist yet so developing financing models that accommodate the interest of both vendors and consumers will help fill the gap.

Awareness gaps/ Perception: According to the GIZ – Measuring Market Development Indices "Consumer awareness refers to the ability of potential consumers of a specific product (category) or service to assess, choose, specify and use the product/ service" (Buss, 2013). For this analysis, the level of consumer awareness was assessed for both the improved lighting and improved cook stove products. It was found that, the consumers are less informed about the benefits of using improved cook stoves, many are still using the traditional inefficient stoves. The appropriate technologies might be existing, but people are not aware about them especially their availability and benefits consequently causing a low uptake

Supply side:

Supply of energy solutions, Grass and trees are used for construction while charcoal and firewood are the most used fuels for cooking. The women in Palabek during the FGD said that with regard

to cook stoves they had more options however with fuels this was a growing challenge with the natural resources becoming scarce and expensive. Cases of theft and even rape during fuel collection are reported therefore better alternatives to the existing cooking solutions in terms of fuels are required to fill the gap.

The development partners involved in the provision of energy solutions are very few and they focus mainly on the construction of rocket Lorena and mud stove with limited implementation of lighting solutions. Energy is very crucial for day to day life in the settlement and this gap can be addressed through strategic and coordinated partnerships.

Many people in the settlement and hosts have electrical gadgets for entertainment and communication and most of them use electricity which they access from specific points like kiosks. Increasing coverage of these decentralized energy service points will enhance access.

Security lights in most settlements were not there or limited and this has exacerbated various crimes and snake bites as reported from Maaji settlement.

Framework conditions:

Quality assurance: The willingness to embrace the new technology exists, however, concerns still remain on the durability, strength, ease of use and level of brightness in the case of lighting solutions. Many cook stoves are mud-stoves which don't last for long so coming up with alternatives that last, are more efficient and are easy to use will fill the gap. The lamps in use in the settlements hardly last a year and many provide few hours of lighting per day; this thus shows that the technological solution being provided doesn't meet the needs of consumers.

Entrepreneurial/ skill gaps: From the focus group discussions, it could be noted that many of the refugees lacked technical skills in repair and maintenance of these energy solutions both the lighting and cooking ones; this technical gap if addressed will help reduce on dumping what otherwise would have been repaired and re-used saving money buying new ones. There is a gap in the skill level of the artisans needed to implement the construction of energy saving stoves and fuels for cooking in the various settlements. While for the solar, many of them once they got damaged many moved back to their traditional methods of lighting.

Aftersales service: As a weakness already with 90% of the energy businesses in Uganda, this is not different in the refugee settlements with many purchasing products and finding challenges in terms of warranty support and times of failure.

Access to financial services: There financial institutions in existence in the various settlements through their agents and SACCOs, however there is no evidence or clear linkages that they provide loans to the refugees or the vendors to support them in acquiring and supplying goods and services. There is also a fear amongst the communities both refugee and host on accessing loans through banks due to the high interest rates.

Network/Market linkages: Distance to markets was another challenge that was voiced during the FGDs held in Nakivale and Palabek. Participants mentioned that they face a challenge in accessing energy services/products as the distance moved to access these markets is long. The host community in Nakivale mentioned that the suppliers as well are unreliable with delivery of

the stoves of which the main supplier was reported to be coming from Masaka town which is approximately four to five hours drive away.

Infrastructure constraint: Another challenge affecting market linkages is the infrastructure. The roads in the settlements are very poor creating challenges in reaching households plus the rural communities are also dispersed reducing economies of scale.

Monitoring: The monitoring and evaluation of existing services and solution aren't effective enough to ensure sustainability of the already existing solutions, this has continuously created a gap in meeting energy needs in the settlements. For example, in Maaji the street lights were not functioning and no repair had been done at the time of the survey; this could also be partly attributed to funding issues thus making the case for sustainable design stronger.

5 DESCRIPTION OF EXISTING MARKET BASED APPROACHES IN THE FOUR SETTLEMENTS

5.1 Market based approaches

1. Cash-based initiatives

UNHCR's cash-based interventions seek to increase protection by reducing the risks faced by displaced populations. By enabling refugees to meet their priority needs through flexible and appropriate assistance, harmful coping strategies, such as survival sex, child labour, and family separation are mitigated. Other cash-based initiatives exist in the settlements for example in Kiryandongo Green powered technology based in the US is providing grants to solar pay go companies. To increase entry in risky markets, "The De-risking PAYGO SHS project" is a Power Africa initiative under the Smart Communities Coalition (SCC) where Power Africa co-chairs with Mastercard a grant program currently being serviced by three companies BrightLife, SolarNow and Fenix International. The objective of the grant is to reduce market penetration risk of profit-making solar companies in refugee settlement areas. The SCC is an initiative seeking to improve the service delivery for those displaced involuntarily (refugees) using innovative approaches. This program is designed to bring the SHS market to the settlement and host community in order to improve livelihoods through energy access. The companies do business, with support from the grant, in the project locations of Kiryandongo and Rwamwanja with each having their targets. Since June 2019, the three SHS companies have sold more than 3,400 PAYGO SHSs in the two refugee settlements and host communities, resulting in the creation of more than 100 local jobs. (Energy4Impact, 2020)[5]

In Palabek, a number of models have been tested by LWF to ensure sustainable supply of energy products among the refugees and host. These models include; dissemination of solar lamps and energy saving wood fuel stoves, and training on construction of rocket Lorena stoves. However, it was noted that some of these labelled relief products leaked into the open market. This motivated introduction of models with favorable incentive regimes that allow consumers to pay a fee for the product. This happened in 2018 after a study was conducted revealing the failure of the free distribution approach. Thus LWF opted for a TOT approach where members of the community are trained as artisans and empowered as the energy champions, these artisans are also given skills to sell solar lamps. These energy champions acts as marketing agents and hawk the solar lamps which are sold at UGX 25,000. The cook stoves are built at a cost of UGX 20,000 however, if the household has its own materials, the price is reduced by half to cater for the labour.

In Kiryandongo and Maaji, DRC is the energy partner and follows this same approach for the cookstoves however, they don't have a solar package.

In Kiryandongo, Whitaker Peace and Development Imitative (WPDI) also supports women groups with finances to start a business as well as "Give Directly" that gives in proportion to the number of members in the household. This normally can come up to a figure of UGX 1,000,000 and its

[5] The Managing Director of Green Powered Technology Mrs. Salome Galiwango was contacted to understand the lessons learned of this project however the findings were not ready at the time.

targeted to members who have stayed in the community for more than five years and vulnerable members of the community

2. In-kind distribution

In kind approach constitutes of methods of supporting the refugees with the physical items they need directly. This has been the traditional method WFP supports in distribution of food to the refugees, delivery of high-energy biscuits upon arrival for new refugees, cooked meals at transit centres, and dry food rations. Other donor partners such as UNHCR also provide shelter kits, as part of the kit refugees are provided with a stove and a solar kit (sun king plus other Non-Food Items (NFI). However after a study it was noted that the stoves were not put into use thus the package no longer contains stoves; other user centered approaches have been taken through UNHCR implementing partners to disseminate ICS technologies.

3. Cash for food

Cash for food is an initiative popularly practiced by WFP where instead of the food rations it often provides to the refugees, an equivalent cash amount. WFP uses cash transfers to empower people with choice to address their essential needs in local markets, while also helping to boost these markets. In Uganda currently WFP provides cash for food for approximately 170,000 refugees; In particular Nakivale from May 2020 will be receiving cash 100%, while Palabek will remain on food 100% and Kiryandongo and Adjumani get a mixed ration depending on household preference). This programme was first piloted in Uganda in June 2014, the refugees are given the choice of cash or food and the field monitoring officers check their progress quarterly to see how they are faring, and also to check how the market copes with the changes. Where markets and the financial sector are functioning, cash transfers can be an effective path to achieve food security and nutrition outcomes. Uganda allocates refugees a small portion of land and allows them to grow their own food. But sometimes with persistent dry conditions and failed rains, this cash becomes the only source of livelihood for the refugees. (WFP, 2019)

4. Cash for work

Cash for work is an approach that involves the refugees being given an opportunity to work and they are paid for their labour. This programme has been piloted by United Nations Development Programme (UNDP), the activities include road maintenance, tree planting, rubbish pit digging, garbage collection and cleaning. These activities were selected through consultations with representatives of both refugee and host communities, local authorities, and other stakeholders in consideration of the needs on the ground. After thirty (30) days' work, participants receive 434,691 Uganda shillings, an equivalent of 120 US dollars.

Participants were required to save one- third of their daily wage and at the completion of their work, they had the choice to take their saving and leave the project or continue with a business skills training for small enterprises development where their savings would be tripled by the programme. The programme catered for both refugees and locals from the host community.

The purpose of this programme was to economically empower refugees and local populations to improve their self-reliance. The Emergency Employment and Social Protection Support Project was implemented among the three West Nile districts of Arua, Yumbe and Adjumani (inclusive of Maaji I,II,and III settlements) in Northern Uganda. The project targeted both refugees and the host communities with Cash for work and other livelihood initiatives. A total of 192 households received cash for their labour. According to the project manager, Denis Lubangakene, the five-month project focused on empowering the most vulnerable families by giving them a small income for the labour they provided within the project. (World Vision, 2020)

This project was also found to have benefitted respondents in Nakivale. UNDP paid UGX 10,000 per day for road construction activities carried out in the settlement. Others benefited from being hired as data collectors and field guides during research activities for different organizations.

The Northern Uganda Resilience Initiative (NURI) is one of eight development engagements under the Denmark-Uganda Country Programme 2018 – 2022 (NURI, 2018). The objective of NURI at outcome level is enhanced resilience and equitable economic development in supported areas of Northern Uganda, including for refugees and refugee-hosting communities. NURI pursues this objective by supporting activities in climate smart agriculture, rural infrastructure, and water resources management. Activities in support of agriculture focus on improving farmer's knowledge on climate-smart production methods, as well as their understanding of and ability to engage with markets and services. Support to rural infrastructure and water resource management are in those areas that contribute to agriculture sector outcomes, particularly access to markets and improving water resource management within the landscape.

Under these projects, NURI recruits refugees, in Palabek for example they have a three year project and intend to support 39000 through VSLA's (2019-2022) through extension services in climate smart agriculture They also offer UGX 10,000 for a day's work for example in road construction as they help increase access to markets

DanChurch Aid (DCA) as well provides some cash for work opportunities for refugees in Kiryandongo, This is conducted during their tree planting program, here youth groups are recruited to clear and plant half an hectare and are paid UGX 500,000 per group at the end of the activity.

5.2 Kiosks

For the purpose of this study, an Energy Kiosk is defined as a station that has reliable access to energy and provides energy related services which can include phone charging, secretarial services or others.

Table 11: Energy kiosks in the settlements

/	Maaji	Palabek	Kiryandongo	Nakivale
No. of kiosks found	Two (one in Maaji II that was no longer functioning and another in Maaji III)	No dedicated kiosk found	4 kiosks all in ranch 37[6]	None (The one that was existent closed)

[6] Kiryandongo is organized in clusters and ranches

Products/ Services offered	Phone charging	Phone charging as part of the other services in the shop	Phone charging, hair cutting, phone repairs, computer training and repairs.	
Management	Youth leader		Individuals \refugees)	
Approach used	In Maaji, the kiosks were handled by RWC leaders supervised by UNHCR/DRC and in both instances, this model was found to have gaps especially in regards to maintenance, operation and profitability.		Shop model	
Recommendations	Training and skilling of kiosk operators in the installed technology so as to acquire operation and maintenance knowledge for optimum operation of the kiosk. Privatization of these kiosks to increase their chances of profitability. Increase in the range of services offered by these kiosks such as lamp renting and battery charging.		To use the over 30 VSLA's created by BRAC for management and operation of the kiosks to ensure profitability	

Figure 55: Energy kiosks found in Maaji settlement

6 ANALYSIS OF FINDINGS

Income

The findings revealed that the income of the respondents in Nakivale and Kiryandongo was higher than in Maaji and Palabek settlements with more than 50% earning between UGX 100,000 and UGX 400,000 in Nakivale and Kiryandongo, while in Maaji and Palabek an average of 21% earned in this same bracket. This disparity can largely be attributed to the sources of income of these communities. In Palabek, almost 70% of the refugees surveyed reported to have no income source and with the majority of the earning host and refugee population dependent on agriculture as a source of livelihood; the limited market opportunities and the dry nature of the soils greatly affect the harvest and as such the income.

Lighting

i. Lighting for household use

In all the settlements, there was more than 50% adoption of solar systems by both the host and refugee communities, the next most used product for lighting was the torch; however, in Maaji the torches were at a different price (i.e. UGX 500) and were dubbed by the research team *as "single use torches"* based on the comments from the respondents revealing their short product life. The source of the lighting products was mainly UNHCR during reception; however, for the majority once they got damaged, there was no place for repair.

ii. Lighting preferences

All the surveyed settlements had a general appreciation of solar and had a preference towards solar with their most desired attributes being long hours (29.3%), followed by brightness (28.8%), then durability (21.8%); interestingly affordability was not among any of the top factors considered. There was generally high willingness to pay for better lighting, however, Nakivale had a higher willingness for lighting products and Palabek had the lowest willingness to pay. These results were consistent with the awareness levels implying that the less aware people are on the benefits of a product, the less willing they are to purchase it.

iii. Lighting in public areas

Street lighting was found in all these settlements, however, it was commonly observed that the lights in isolated places were missing, whilst in some places the lights were not operational. In Maaji, for example, there was an issue of poor maintenance of the street lights and thus many were not operational. FGD participants in both the host community and refugee areas complained of snake and insect bites in the night and a high number of theft cases due to the darkness.

iv. Institutional lighting

The lighting in the surveyed schools and health centres was mostly from solar systems, however, it was noted that the installed solar systems did not cover the lighting for the entire facility. For example, in the schools, the solar lighting only covered the administration block and a few classes leaving many schools without an option for night study.

v. Supply:

Nine vendors out of forty-four were found to be selling solar products in the settlements. This however, were only the vendors who had shops and not the hawkers during the market days. This is also not inclusive of Kiryandongo's Fenix power, solar Now and Power trust that were located in Bweyale town.

The nine vendors were mostly found to be dealing in solar batteries and panels and only one of these had a charge controller. This technically implies that the systems are sold without safe guards more than 90% of the time reducing the protection to the system. The main products found were ADH batteries, Exide Chloride and sunshine solar panels. The highest cost of these products was UGX 400,000 for the 100 Ah battery. The commonest challenges found were on the qualities of the batteries.

Cook stoves

i. Cook stoves for household use

The mud wood and mud charcoal stoves, metal charcoal stoves and the three stone fire were the most commonly used stoves across the settlements. The three stone fire was still popular as many of the respondents liked the fact that it was affordable (the stones are just collected), durable and fast. Given that most of the respondents cook from outside, the stoves are left outside, implying that the stove design should be able to withstand the various weather conditions they will be subjected to. The three stone fire stove can withstand all these challenges with no maintenance required however the users also complained that this stove has a lot of smoke and has a high fuel consumption. This leaves quite an interesting gap to be filled by the stove sellers in terms of an innovative stove solution that is affordable, cooks fast and can handle outside cooking conditions.

Various NGOs in the settlements have tried different business models. An example is in Palabek where LWF trains artisans or rather village energy champions who sell stoves and construct rocket lorena stoves in the community. This model has had success as the cost of the stove lowers if you provide the materials. The full cost of the stove is UGX 20,000, however, if the household provides the materials then they can pay just for the labour. These energy champions also sell solar lamps at UGX 26,000 and receive a commission for each sale. A similar model has been employed by DRC in Kiryandongo and Maaji. Nsamizi also trains artisans in Nakivale.

This model has found great success though some challenges have been reported for example DRC in Kiryandongo reported that the 80% female dominancy in the settlement affected the trainings as many of these were not interested in learning technical skills. OPM and UNHCR key informants also confirmed that there is a high dependency syndrome amongst the refugees as well as a low uptake of these technologies due to a poor attitude towards the technologies.

The willingness and ability of the households to purchase ICS technologies also revealed that the settlements of Maaji and Palabek had less than 50% willingness to pay while Nakivale and Kiryandongo had greater than 50% willingness to purchase. Nakivale had the highest willingness while Palabek had the least willingness, this was synonymous with the level of awareness in these settlements.

For the fuels, firewood was the most used fuel in the settlements of Palabek and Maaji while in Kiryandongo, the most used fuel was charcoal. Nakivale had a mix of both charcoal and firewood. From the incomes reported during the household surveys vis a vis the preferred payment models for the stoves, 80% of the refugees in Palabek preferred to pay for the stove in regular installments as they use the stove, while in Maaji 46% of the respondents preferred to get the stove when they have paid the full amount, this showing their skepticism of hire purchase methods. In Nakivale and Kiryandongo an average of 48% of the respondents preferred acquiring the stove using the hire purchase system[7].

ii. Cook stoves for institutional use

Of the surveyed schools and health centres, it was found that 90% of the institutions use three stone fire for cooking. In Kiryandongo, one institute reported to have abandoned the rocket lorena stoves due to their slow speed in cooking.

iii. Gaps in existing approaches

With the various approaches identified in the settlements the most common one was the LWF model which was also adopted in a similar pattern by DRC. This model of training community artisans as energy champions has many benefits especially since the community is empowered as well as there is trust as the person advocating for the technologies is one of their own. However, some gaps do exist, for example, in Kiryandongo where there is a dominance of females in the settlement, many are not willing to learn these skills. *Mr. Naboth, the Energy and Environment Officer at DRC, Kiryandongo reported that they get challenges in meeting the gender quota for their trainings*. Another challenge that has been faced is the poor attitude to the technologies and low uptake of the energy saving stoves, thus necessitating more mind set change programs with every energy intervention introduced.

Energy for productive use:

The settlements were found with some productive use applications. Maaji and Palabek had grain milling stations powered by diesel generators. In Nakivale, they were more salon and phone charging applications as compared to grain milling. In Kiryandongo ranch 37, there were two peanut butter processing machines operated manually by female vendors.

Table 122: Market comparison across the settlements summarizes the assessment of the four refugee settlements for appropriateness to implement market based energy access interventions. This analysis was undertaken using the following assumptions

Demand:

The number of buyers was taken considering the number of consumers for the energy products. Willingness, ability to pay and awareness was assessed basing on the percentage of respondents who responded affirmatively in these areas per settlement. For the level of income, the income range earned by the settlements in the range of UGX 100,000 to UGX 400,000 was considered.

[7] Hire purchase is a system where one pays for a thing in regular instalments while using it.

Supply: To assess the supply, the amount of the products on the market and the warranty offered for these products was considered. For the products, the number of brands found in the settlement was considered as the source of the data.

Supporting functions: The supporting functions were assessed on the following parameters; the number of training institutions and the level of skilled labour for energy products. The training institutions were categorized considering NGOs that conduct training as well as training institutes in those areas. The level of skilled labour considered the number of vendors who responded affirmatively to receiving training, this was similarly done for the number of financing institutions.

Market rules: Under market rules, the incentive schemes were considered. The incentive scheme looked at various schemes currently in the settlements that are actively motivating private sector to engage or invest in a particular sector or activity such as the USAID grant and the LWF commissions for sales in Palabek.

Table 12: Summary assessment of the 4 refugee settlements for appropriateness to implement market-based energy access interventions. In the table below *four represents the highest rank and one represents the lowest rank.*

Table 122: Market comparison across the settlements

	Attributes	**Kiryandongo**	**Nakivale**	**Maaji**	**Palabek**
Demand	Number of buyers	3	3	3	3
	Willingness to pay	3	4	2	1
	Awareness level	3	2	3	1
	Level of income	3	4	2	1
Supply	Amount of products on the market	2	3	3	3
	Warranty	3	2	2	3
Supporting functions	No. of training institutions	4	1	2	3
	Skilled labour (energy products)	3	2	2	3
	No. of financiers	3	3	2	2
Market rules	Incentive schemes	4	2	2	4
Ranking for appropriateness		**3**	**4**	**2**	**1**

6.1 Conclusion and Recommendations

The availability of cheap and often free energy resources has been the main reason for the prevalence of traditional energy options such as grass for lighting, wood fuel for cooking.
In humanitarian settings the energy market is underpinned by three factors; availability, accessibility and cost. Solving these three is the key to a sustainable market system; this research has broken down the recommendations in the four components of a market system i.e. demand, supply, supporting functions and market rules.

DEMAND
The findings from all the settlements revealed a presence of demand for clean energy and lighting products. However, it was noted that in Nakivale and Kiryandongo settlements, there is a higher willingness to pay and desire due to an equal amount of increased awareness on these products. The residents in these settlements have also been lived there longer. These two settlements were also found to have a higher purchasing power, in this regard they can afford more expensive products than the residents of Maaji and Palabek with lower incomes.

Appropriate interventions: The demand gaps in the various settlements present opportunities to increase the coverage of *one stop energy kiosks* with local operators skilled in basic business and technical knowledge required to operate and maintain the kiosks. These energy kiosk artisans will be responsible for training other people in their respective locations to construct the improved stoves as well as conduct awareness campaigns. These kiosks attendants can be agents for knowledge sharing to improve, perceptions, access to technical information and after sales support for the renewable energy technologies in supply.

Appropriate groups: No particular group was identified to manage the kiosks, however, there are two categories of people that can be considered; first, the VSLA groups set up in the community and second could be the ex-trainees from trainings held by the energy partners in the settlements. KIIs done revealed that each group was formed for a different purpose thus it is more valuable to set up another group to avoid conflict of objectives.

Appropriate locations: The following locations are recommended for the location of the energy kiosks; in Maaji, Maaji II and III have the busiest trading centres, while in Palabek, Nazareth market and Palodar which is a market before the reception centre have market days and auction events that gather a lot of people from both the refugee and host communities. In Kiryandongo, cluster H and N are appropriate locations given that they did not have any kiosks yet they had a high demand for energy products. In Nakivale, Rubondo Karitima village can host a kiosk, it is a fairly well developed trading centre and has a high demand for energy products and services.

Appropriate models: The need for innovative and alternative energy solutions is great in Maaji settlement, seeing that there is no penetration of alternative cooking fuels to substitute firewood and charcoal. The energy situation at Palabek refugee settlement is moving from fair to worse because of weak models that only provide cash on delivery but do not offer credit support. However, there is a higher cost incurred by the organization or company when a hire purchase method of service/product delivery is offered, though this is needed to increase adoption.

Traditional cooking methods remain popular among refugees and host despite the fact that positive interventions were taken to enhance transition from traditional to modern energy sources. This is mainly due to the lack of awareness of the benefits of these technologies especially the ICS thus for continuous sustainability there is need to have *intensive, continuous and demo* sensitization of the beneficiaries that help people visualize the benefits of green technologies.

SUPPLY

Solar is the preferred lighting option present in the settlements, however, for some settlements such as Palabek, it is limited in supply. There is therefore need to involve more entrepreneurs in and around the settlement in energy businesses.

One key component that was found lacking in the supply chain of energy products was linkages and partnerships. About 64% of the surveyed businesses did not have any partnerships created. These partnerships can be created and built further by building linkages of the suppliers to current and potential retailers through match making events in the settlements.

Another challenge that was reported by the vendors is the high transportation costs to bring the products into the settlements. This we recommend can be solved through bulk warehousing or joint bulk purchasing to reduce the costs and the delay time reported in waiting for suppliers. However, this could be limited by the challenge faced by vendors on lack of capital which hindered their expansion. To counteract this, vendors could be encouraged to pool resources and form associations that could help them in overcoming some of these challenges.

To solve the issue of a lack of supply centres for improved cook stoves, hubs can be set up for stove production with a consideration of specialization in production so that different activities or components are performed or produced by the different groups of people; thus maximizing efficiency, quality of the stoves produced, ensuring a constant supply of stoves, as well as reduce unnecessary competition.

SUPPORTING FUNCTIONS

Building of associations: VSLA's[8] have had great success not only in the refugee settlements but also in the host communities. This method has greatly aided the distribution of energy products such as solar in the past and can now be expanded to also cater for clean cooking solutions. This method is greatly enhanced when the refugees are provided with avenues such as cash for work programs or cash for food as they are able to get money to contribute to these groups. Furthermore, these associations help in strengthening the supply chain for the businesses. Using the associations, a model can be built that aids joint purchase and transportation of goods. This will help suppliers have a lower cost of their goods through the volume.

Donors should support facilitators and NOT providers; the role is not to be a permanent subsidized presence in market systems but rather to be an external catalyst for change, addressing the constraints that prevent markets from working effectively.

[8] Community formed institutions /SACCO's were found to have less accountability than organization set up institutions as these have rules and regulations that are closely followed in case of any misconduct.

Training of technicians for every product introduced in the settlements; Creation of a network of bio energy artisans specially dealing in construction of improved cook stoves and production of alternative cooking fuels like briquettes. Business skilling of youth both women and men in energy businesses to create a new breed of passionate energy practitioners.

Most refugees and some hosts are overly dependent on aid from different development partners and government and this has created a dependency syndrome. This is a gap which can be filled through business training with focus on experiential and action learning in order to create self-sustainability. For example, in 2019, CARITAS in Palabek provided stoves to the refugees; such efforts thwart private sector engagement as the beneficiaries feel they can always wait for the free products to come.

Quality: The mud stoves adopted are not durable with some cracking within their first year and so there is need for proper skilling. Other improved cook stoves are yet to penetrate both the market and the households.

MARKET RULES

Incentive schemes: Despite the high willingness to pay for the clean technologies, a hamper has been on the ability to pay, thus subsidies on the products for **a defined period of time** that are **well communicated** can help increase demand and improve their entire business in these areas. The subsidies should be well communicated and only for a period of time as they are not sustainable, thus from the beginning a model must be identified to state the time the subsidy should stop and exactly what area needs to be subsidized.

These activities when implemented can be measured with the following metrics;

Table 13: Project indicators to be measured

Impact	**Outcome**	**Output**
Improved quality of life	Increased income Increased adoption of solar lighting Increased adoption of ICS technology Alternative livelihoods Improved security	Improved artisan skills Increased customer confidence Number of new market linkages Number of people trained and practicing % change in knowledge level Number of trainings held Reduced numbers of SGBV during fuel collection Number of kiosks set up
Improved education	Improved school grades	Number of child attendance Number of increased reading hours
Improved maternal and child health	Improved respiratory health	% change in adoption Number of new Installations of solar in the health centres

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