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The New Solar Kiosk Model: A Sustainable Solution to Address the Uptake and Access of Renewable Technologies to Create Energy Kiosks That Improve Women's Income in Kiryandongo Refugee Settlement, Kiryandongo District, Northern Uganda.

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Thesis Development

A Project Proposal

For

The New Solar Kiosk Model: A Sustainable Solution to Address the Uptake and Access of Renewable Technologies to Create Energy Kiosks That Improve Women's Income in Kiryandongo Refugee Settlement, Kiryandongo District, Northern Uganda.

BY

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Acronym

ADP – Africa Development Promise
CAO – Chief Administrative Officer
CBO – Community-Based Organisation
CREEEC - Centre for Research in Energy and Energy Conservation
DRF – Dutch Relief Alliance
IDPs – Internally-Displaced Persons
LPG - Liquefied Petroleum Gas
NGOs – Non-Government Organisations
OPM – Office of the Prime Minister
PayGo – Pay As You Go
RIL – Relief Innovation Lab
RWCs – Refugee Welfare Councilors
SHS – Solar Home System
UNHCR – United Nations High Commissioner for Refugees
VSLA – Village Savings and Loans Association
SDG – Sustainable Development Goal
INGOs – International Non-Governmental Organisations
URRM – Uganda Refugee Response Monitoring System
UN – United Nations
MoU –Memorandum of Understanding
NGOs – Non-Governmental Organisations

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Personal Statement

In my first ten years, I grew up without power in the house. My mother made sure candles and kerosene lamps were available for us to study and use in our tiny kitchen outside the home. Every morning, my siblings would walk long distances to the hand pump to collect water for use at home, and every evening, to the nearby forest to collect firewood for home. I come from a background of using firewood, kerosene, candles, and I understand the distance to collect firewood or water. As a child, having to walk these long distances, not knowing what may happen in this process, led me to follow a path of finding solutions to this challenge.

I joined the solar sector ten years back, starting from the sales agent point at Barefoot Power Uganda, where I received training in different solar systems, the Solar System franchising model, and entrepreneurship. Later, I joined Village Power Uganda where Solar Home Systems were sold and installed in more than 250+ households in three years. My time at Village power introduced me to the rural side of Uganda where clean, renewable technologies are needed more than ever. It reminded me of my childhood and sealed my ambition to follow this route to end energy poverty in Uganda. At Village power alone, I sold more than 200 Solar home systems, which meant more than 500 household members were impacted and no longer using kerosene lamps or candles for light, hence saving their income for other family needs.

The opportunity arose for an Operations Officer for a Solar Kiosk project at Africa Development Promise (ADP). Working here introduced me to a new model of impacting the community. A group (Village Saving and Loans Association - VSLA) took charge of a Solar Kiosk with a start-up package that included solar products. The entrepreneurs are provided solar products a business loan to be paid back in installment, interest free.

The solar kiosk model highlights a sustainable development business model where entrepreneurs promote access to clean energy technologies. With access to products, household income increases, sturdy hours for children increase, and the environmental effects of the heavy burden on forests. I joined the humanitarian sector through securing employment with ENVenture powered by New Energy Nexus as a Project Officer for the Clean Energy Kiosks in Kiryandongo Refugee Settlement in Kiryandongo District. This is where I learned of the challenges of using kerosene for light, cooking with wood and the new clean energy kiosk model's solution to increase and access clean energy solutions in the refugee settlement.

Executive Summary

This thesis was carried out in the Kiryandongo Refugee Settlement in Northern Uganda to test a new model to improve access to clean energy technologies in the refugee settlement. The settlement hosts more than seventy-five thousand refugees, including the Internally Displaced Persons (IDPs) from Bududa landslides in Eastern Uganda. The literature review shows the challenges faced in the humanitarian sector. The challenge is met in providing lighting and improved cooking technologies to all refugees in settlements and camps globally. Refugees run to nearby countries with nothing for lighting and cooking and hence are provided with essential items like Jerricans (to collect water), Plates, cups, saucepans, tents, mattresses, and bedsheets. The food ratio is based on the number of family members, but they are not provided with clean energy technologies like solar for lighting and briquettes for cooking. The refugees tend to cut down trees in the surrounding forest, and the wood is used for firewood to cook and lighting up their homes. The solar kiosk model has improved access to affordable briquettes, which is a replacement for charcoal and firewood, while solar products provide clean light.

As discussed above, there are various challenges faced in the community; four installed solar kiosks have contributed to the distribution of 577 Solar Home Systems, 843 improved charcoal stoves and 18480.37 Kilograms of briquettes, and two purifiers were purchased.

In terms of accessibility, the time to buy the technologies has dramatically reduced because the clean energy technologies are closer to the community members. The sale of water purifiers is low, having sold only two pieces in a population where over 90% drink unsafe water from wells and boreholes in the settlement. This study established that there is a need for continuous product education for both the kiosk operators and the masses in the community to live more sustainably. Additionally, capital funding will increase on the product range in the kiosks creating a product portfolio that will drive the market in the refugee settlement and the host. Furthermore, this portfolio will create an increased clean technology usage in the refugee settlement and income for both the kiosk operators and the refugee community at large (the refugees employed as sales agents).

Literature Review

Introduction: Energy perspective

Global energy use is dominated by fossil fuels, with coal and natural gas mainly going to electricity and heating (Mayfield, 2016). The International Energy Agency report (International Energy Agency(IEA), 2021) indicates that as of May 2019, the number of people without access to electricity fell from 1.2 billion to 179 million people and by May 2020, the number of people lacking access to electricity increased by 30 million due to unaffordability. Latin America, the Caribbean, and Asian regions have advanced universal access with 98 percent of the population accesses electricity compared to the Sub-Saharan Africa region accounting for only 46 percent access rate. In the same year, 2020, out of the 20 countries that made progress in electrification, Bangladesh, Kenya, and Uganda, achieved annual growth of three percent in access to power.

Although there has been some progress, more effort is needed to close the gaps in the energy sector to achieve the global Sustainable Development Goal number 7(SDG7) to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.

In Sub-Saharan Africa, 20 to 25% of income is spent on kerosene (Munro et al., 2020), which is very high for most Africans who earn less than a dollar a day. Hence, we need better clean technologies, accessibility, and affordability solutions when looking at energy poverty solutions in Africa, especially in the refugee settlement locations.

Renewables provide the chance to leapfrog to a sustainable, prosperous future for all. Increasing access to reliable, affordable, clean energy resources is a key priority, particularly in sub-Saharan Africa. Around 600 million people in Africa still have no access to electricity, representing 48% of the continent's population of nearly 1.2 billion.

Closing the access gap to modern energy services in Sub-Saharan Africa requires establishing detailed action plans at national and regional levels, targeted policies and regulations, partnerships,

awareness, capacity building and investment support ("Scaling up Renewable Energy Development in Africa," 2020).

Vijay Modi and Hernan Pedro Figueroa (Figueroa, 2021) indicate that the year 2015 marked a significant milestone in the global debate on energy with the United Nations adoption of Sustainable Development Goals (SDGs), including the specific goal on energy (SDG 7) aiming "to ensure access to affordable, reliable, sustainable and modern energy for all". SDG 7 also addresses increasing power from renewable sources and promoting energy efficiency. Enough experts are available in the humanitarian sector like the UN, INGOs, NGOs, donors, universities, and the private sector to achieve this goal. There is a need to access current and clean technologies (Desgain & Mackenzie, 2015).

Globally, the growth of renewable consumption in the electricity sector also increased between 2017 and 2018. China became the most significant global consumer of renewables, while Italy, Germany, and the UK are the most progressive countries in renewable access (Modi & Figueroa, 202). Due to the high costs involved in grid expansion in rural areas, there is a need for other cheaper and faster options like a decentralised way of implementation to extend energy access to the rural regions of Africa (Ulsrud et al., 2015).

The Gaps in the Renewable Sector

In Uganda, refugees are often viewed as economic actors in charge of their destinies rather than beneficiaries of humanitarian aid (USAID,2020). Therefore, they are afforded freedom of movement, land ownership, employment, access to business capital, and other benefits not often seen in other countries. These rights enable economic progress, increased incomes, and purchase of Solar Home Systems (SHS). However, within the camps or settlements, there continues to be a need for essential services, such as access to electricity where many centers are not connected to the national grid or a micro-grid, and home lighting and electricity are sporadic (USAID,2020).

Alternative Energy-saving Techniques

Access to energy will be improved especially energy for cooking, lighting, and other productive use like charging electrical appliances. The alternative energy sources promoted at the energy kiosks bridge a gap in the market with interventions focusing on the distance to access, the quality of products, and the environmental effects of deforestation. The energy, environment, and climate–resilient interventions will be mainstreamed into the community with improved solutions in place (Price, 2020).

The (Uganda Refugee Response Plan (RRP) 2019-2020, Environment & Energy Dashboard - Quarter 4, January - December 2019 - Uganda, 2020) shows that 11,324 Households were sensitised on energy-saving practices, 596 Households had access to cooking bags/baskets, 115 groups trained in energy technology, 114,059kg briquettes were purchased by urban refugee groups, while in Kamwenge district, five groups actively engaged in establishing energy kiosks, and the urban refugee women were trained in fabricating cooking baskets.

Benefits of Clean Energy Technologies

In the Kiryandongo refugee settlement, there are different Village Savings and Loans Associations (VSLAs) composed of Male and female youth and adults who are affected by conflict and in dire need of empowerment and opportunities, which exceed the domain of humanitarian aid; A clean energy solution like the Solar Kiosk Model would support creating employment and innovation, business development and economic activity in the settlement (Amankwah-Amoah, 2019).

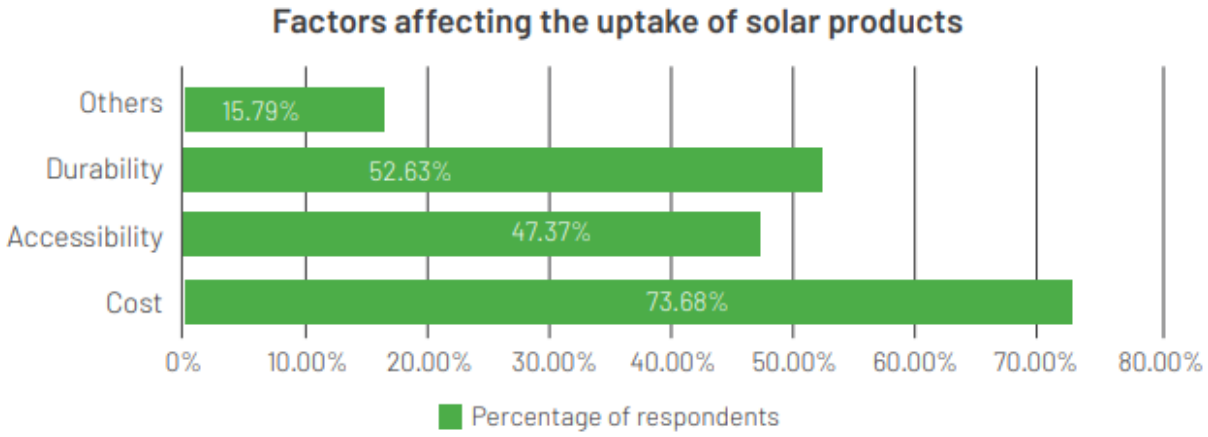
According to the research (Women, Energy and Economic Empowerment. Hedon Household Energy Network, - Google Zoeken, n.d.), access to reliable energy, particularly renewable energy positively impacts the environment, children's education, quality of life, income, health, farming, and general lifestyles in rural African families. An impact report of a Solar Aid intervention found that rural African families were saving around US $ 70 per year from solar energy access, and this saved money on better food, education, and farming. Furthermore, households have used 300 kilograms of carbon dioxide emissions each year (Why Solar Lights, n.d.)

Renewable Energy Challenges and Viable solutions

Today, the greatest challenge is to help get these solar lights to where they are needed most (Why Solar Lights, n.d.). The most affordable solar lights available retail at over $25, which is simply too expensive.

The availability of light will enable tutoring of children even after school hours and increase income and savings of the women, which will lead to the women empowerment process in the settlement (Women, Energy and Economic Empowerment. Hedon Household Energy Network, - Google Zoeken, n.d.).

Figure 1. The challenges faced in off-grid solar adoption in Uganda



The research by National Renewable Energy Association of East Africa (NREA) in figure 1 above was collectively carried out and involving 87 stakeholders including 38 solar companies, 11 civil society actors, government and NREAs' members as crucial informants across the East African region. The figure above covered five East African countries including Tanzania, Kenya, Uganda, Burundi and Rwanda.

The central high-cost challenge for solar products affects uptake in rural communities that are most affected and Off-grid. The high cost of purchase for renewable equipment caused by the tax regime is high; import duty of 18% VAT is levied on solar Photovoltaic (PV) panels and other essential components such as controllers, batteries and inverters, forcing companies to pass on the costs to

customers, effectively reducing uptake. Though upfront costs are high for productive use of solar systems, there are subsidisation programmes like discounts to popularise use and increase market reach (Strengthening the Off-Grid Solar Electrification Market Through, 2021).

Figure 2. The challenges facing renewable energy resources in Kenya Source: (Kiprop et al., 2019)

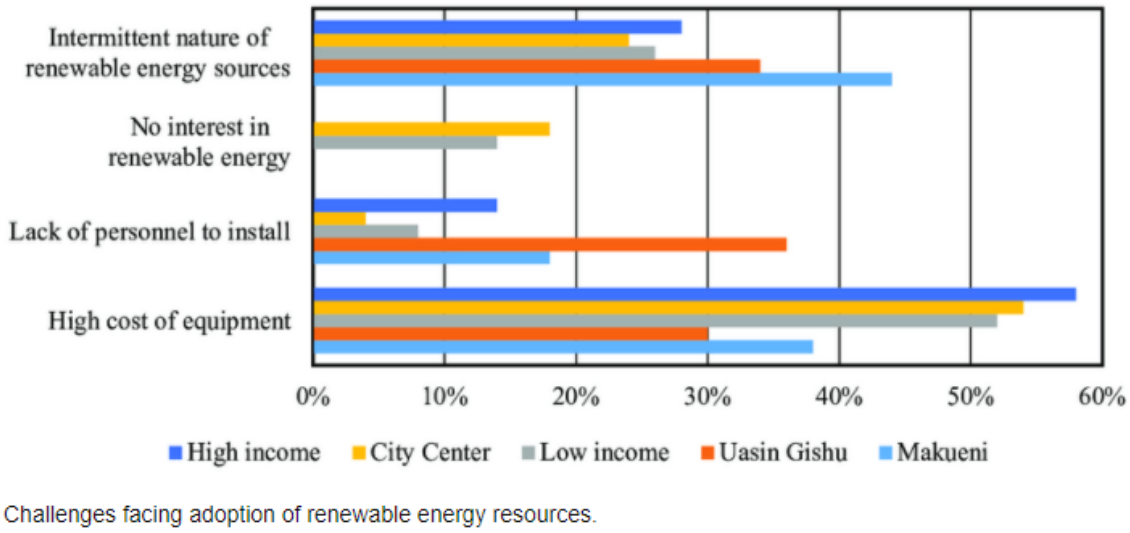


Figure 2 shows the significant issues faced in accessing renewable technologies in Kenya's surrounding areas including high income communities, urban centers (city centers), low-income communities and refugee communities of Uasin Gishu and Makueni refugee settlement communities. The research continues to mentions the major challenges in accessing clean energy technologies with over inflated costs of equipment (60%) and the lack of technical installation personnel (more than 30%) (Kiprop et al., 2019).

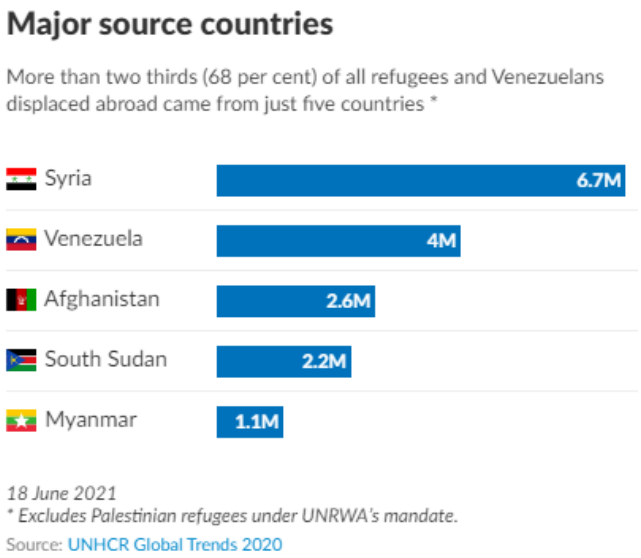
Kiryandongo refugee settlement is no different, according to the Whitaker Peace and Development Initiative (2020), entrepreneurs are available to take on initiatives to better their communities, however lack of technical support and inflated costs are affecting access to clean energy technologies. Still, there is a need to provide tangible resources, including grants and or loans, intangible resources like advice, specialised training tailored to their needs and businesses.

Monitoring these businesses is vital for at least one year. This process includes record-keeping, on-site visits and continuous training (Kiryandongo Refugee Settlement, 2021). Creating sustainable energy businesses that support communities with after-sale services, technical training, and fair prices for these products will increase household income, reduce energy poverty for families and provide business opportunities to achieve a safe environment and lighting (Munro et al., 2020).

The usage of solar for light is the only option because the community is off-grid without a national grid, hence the need for a sustainable model for access to solar products (Kiprop et al., 2019). The availability of the new solar model in the communities will enable more prolonged and more efficient lighting, which means more time for families to socialise after dark, often accompanied by a radio or a TV to listen to or watch the new (Ulsrud et al., 2015). The availability of the new solar model in the communities will enable more prolonged and more efficient lighting, which means more time for families to socialise after dark, often accompanied by a radio or a TV to listen to or watch the news (Ulsrud et al., 2015).

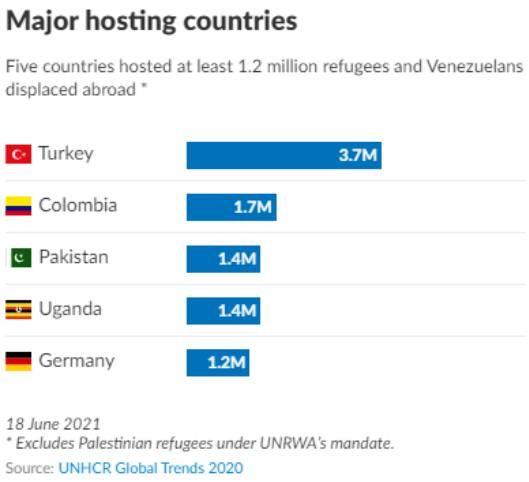
Refugees are often among the most disadvantaged in terms of energy poverty, and more than 82.4 million people continue to get displaced and require support from hosting countries and partners (United Nations High Commissioner for Refugees, n.d.)

Figure 3. Primary refugee sources in the world



By mid-2020, there were over 26.3 million refugees and eighty-six per cent live in developing countries, which puts pressure on the hosting country's environmental resources. The situation keeps escalating due to political instabilities across various countries the unending wars create internally displaced persons who become refugees in their own country.

Figure 4. Major refugee-hosting countries



In the above figure 4, there are five top countries hosting refugees, with Turkey coming in first, Colombia second, Pakistan and Uganda third, while Germany is fourth hosting 1.2million refugees (United Nations High Commissioner for Refugees, n.d.). UNHCR data by 29 February 2021 indicates 918,000 refugees were harbored in neighboring countries due to fresh waves of unrest in the Democratic

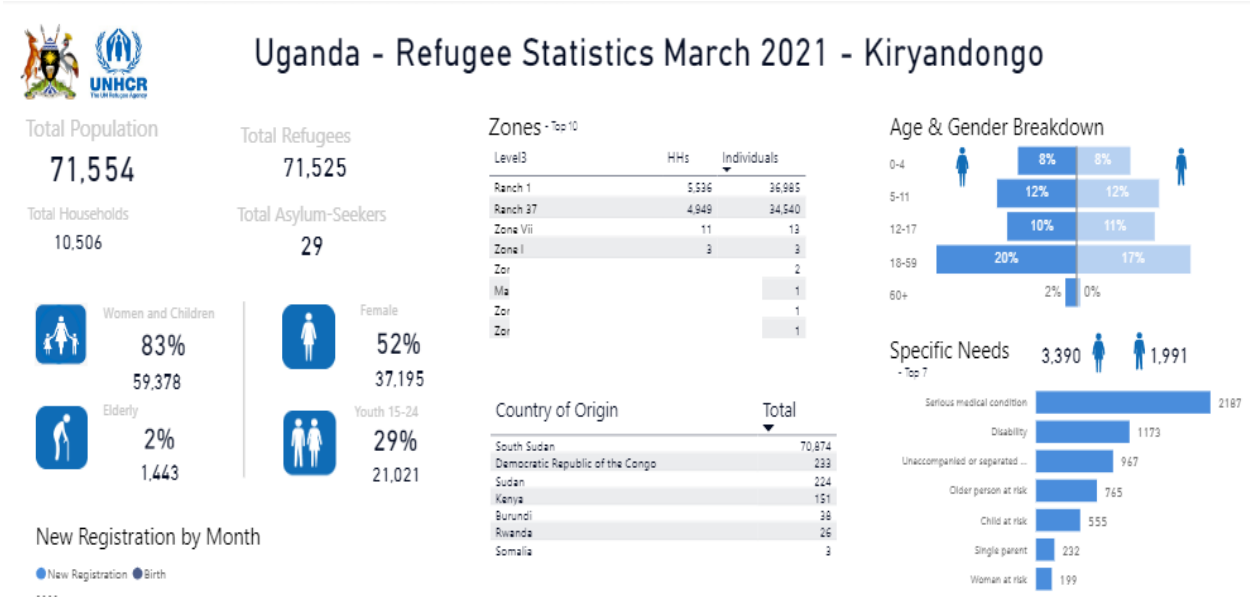
Republic of Congo, which displaced approximately five million people between 2017 and 2019, namely in the Kasai, Tanganyika, Ituri, and Kivu regions. By July 2020, 2.2 million South Sudanese had fled to the neighboring countries seeking for refuge and safety (United Nations High Commissioner for Refugees, n.d.). Since 2013, the brutal conflict in South Sudan has claimed thousands of lives and driven four million people from their homes.

Refugee Perspective in Uganda and Kiryandongo Refugee Settlement

With Uganda hosting the highest number of refugees in Africa (1.4 million), these increasing numbers put great pressure on the little available resources set aside by Uganda for refugees fleeing their countries. Therefore, there is a need to intervene in accessing sustainable energy technologies in the settlement (USAID, 2020).

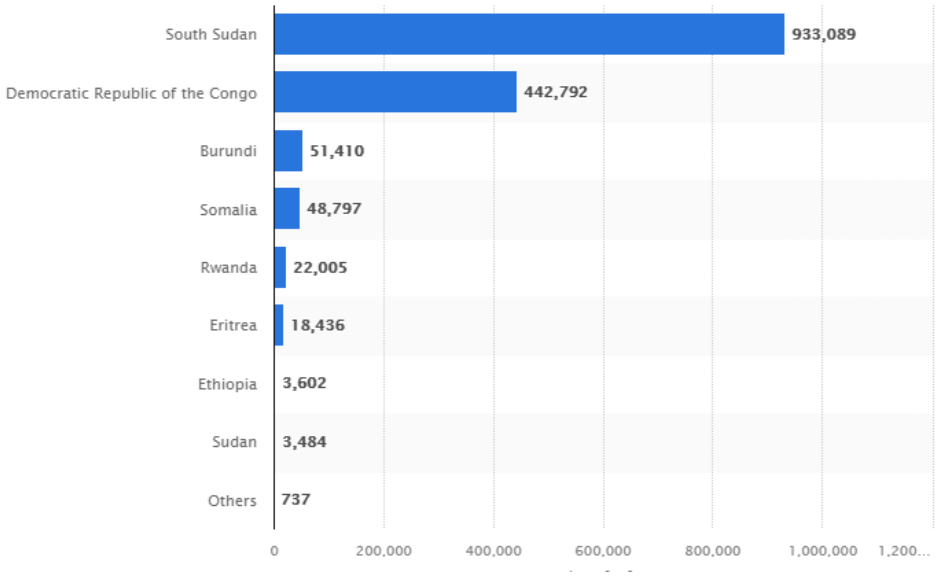
In March 2021, as shown in figure 5 below, 83% of the population in Kiryandongo refugee settlement are women and children while 52% are Women in general. The elderly is 2% while the youths are 29% of the general population (UNHCR, 2021).

Figure 5. UNHCR - Uganda: Kiryandongo Refugee Settlement Statistics of March 2021



The Uganda Refugee Comprehensive Response portal, Uganda hosts 1,470,858 refugees. The Kiryandongo refugee settlement in Northern Uganda has 71,554 refugees and an estimated host community of 322,300 people. This number has increased by 864 in four months to a total refugee population of 72,418 from July to September 2021 (Country - Uganda, n.d.). This puts pressure on land resources, the environment and energy. By 26 September 2021 - Kiryandongo settlement, a total of 10,600 households registered with a total refugee population of 72,418. Out of this number, 59,955 women and children account for 85%, the total of women is only 37,633, 52% of the population. The youth are –21,106, accounting for 28% of the refugee population, while the elderly total is - 1,453.

Figure 6. Total number of refugees from different countries



Uganda hosts a prominent S Sudanese population as shown in figure 6 above, followed by the Democratic Republic of Congo (DRC), while Sudan has less citizens.

What is The New Clean Energy Kiosk Model

Challenges and Solutions

In 2006, Solar Aid started a new model of training entrepreneurs to convert kerosene lamp usage into solar lights. Solar Aid designed, assembled and sold its solar lights; however, the challenge with this model was replication (Why Solar Lights, n.d.). The Endeva report (2014) supports the solar kiosk model by companies and organisations looking at profitable ventures and sustainability in the humanitarian aid sector.

Compared to the vendor business model, where sales agents move to a particular area to sell clean energy technologies, The New Clean Energy Kiosk Model provides an option of credit payments in the community since the kiosk is closer to the community members (Endeva, 2014).

The refitted solar kiosks are multi-purpose stations that create revenues from various income-generating activities like charging services, selling energy technologies and cold drinks, The two

strategies share many challenges as retail hubs. Examples are issues regarding the customer interface, identification, satisfaction of the market demand and cooperation with local operators (Endeva, 2014).

Endeva's (2014) energy kiosk model introduces us to an approach of providing light to low-income households in off-grid regions. Using the solar panels installed on the roof of the kiosk, the panels produce electricity stored on the batteries in the stalls; the generated power is then sold to users through charging devices like phones and laptops. The kiosk also sells clean energy technologies like Heat retention bags, non-electric purifiers, and Briquettes. Other income-generating activities are also encouraged at the booths, like selling refrigerated drinks, water, juice; consumer goods; and photocopying.

Research shows that various actors – including multinational companies, start-ups, governmental initiatives, and non-governmental organisations – are engaged in energy kiosk initiatives. The Kiosk models can be simple charging stations for lamps and batteries or multi-service stations offering retail products, entertainment, and education. One can find successful showcases, especially in Sub-Saharan Africa and India, though few projects have gone beyond the pilot stage. Although the model works in principle, it seems complicated to create, scale, and replicate projects that have a positive social impact and are economically viable in the long term (Endeva, 2014).

Uganda has climate-smart programming in refugee settlement regions focusing on water source protection, waste management, agroforestry, agriculture, and energy (Price, 2020). The New Clean Energy Kiosk Model would fall under climate-smart programming, where the focus is on the promotion of water source protection, clean technologies, waste management, agriculture, and energy (Price, 2020). Based on what has been successfully implemented in Kenya, the Solar Kiosk Model is a (modular solar powered) structure easily implemented in remote communities ("Solar Kiosks Help Light up Rural Kenya," 2015). Off-grid low-income households can overcome the problems associated with acquiring small solar light benefits in the long run through access to quality lighting and financial help with long term sustainable solutions through innovations like the Solar Kiosks, which also act as points for individuals to charge their electronic gadgets like phones and laptops (Amankwah-Amoah, 2019).

Alternative energy-saving techniques

Kiryandongo District landscape is flat, and the weather is hot due to turning to traditional Energy solutions for essential lighting services and the burning of wood (Tavernier, 2016). This thesis will analyse, try to understand, and address the main challenges in humanitarian response actions, especially in long-term situations using the Solar Kiosk Model to reduce the adverse effects on the environment in the Kiryandongo settlement camp (Fuentes, 2018).

In the context of the New Clean Energy Kiosk Model to improve the livelihoods of refugees in the settlements, the improvement of the infrastructure and the battery storage that will enhance the solar system's performance. The solar system will be used to power a refrigerator that will improve the income of the kiosk operators who will use it for refrigeration services like cooling drinks, water, and juice. The innovation will also support the different entrepreneurs' new activities like charging phones, laptops and other retail commodities ("Solar Kiosks Help Light up Rural Kenya," 2015).

Introduction to Community and Context

The UNDP Uganda Investment Authority Kiryandongo profile (2020) states that the refugees who ran from Kenya's 2007-08 post-election violence, the internally displaced persons (IDP), mainly the Acholi who were victims of the Kony's LRA rebel activities during the 1990s. Other groups are because of ethnic conflicts related to political differences. There are specific gathering areas of worship particular to the different tribes, supporting agents towards conflict management in the settlement.

These locations are also used in peace-building activities or sessions, especially peace and Justice and trauma support areas for different groups (Uganda Refugee Hosting Districts - Investment Profiles | United Nations Development Programme, n.d.-b). In support of peace building in the community, there are different non-governmental organisations involved in Kiryandongo refugee settlement, including Refugee Law Project (supports handling cases for refugees), Save the children (Children support and protection), Transcultural Psychosocial Organization (T.P.O) (Psychological and social support for refugees) and Danish Refugee Council (DRC) (community-based case handling and resolutions) (Price,

2020). There are key donors and multilateral organisations working in the environment and climate priority areas majorly from the European Union (EU), the World Bank, and the United Nations agencies namely United States Agency for International Development (USAID), Department for International Development (DFID) – UK, focusing on good governance; transport infrastructure; food security and agriculture (USAID,2020)

There are also Local Development Partners Groups (LDPG), which include Austria were most of its aid is delivered through Civil Society Organisations (CSOs) whose work focuses on water and sanitation; Denmark's support focuses on two thematic sustainable and inclusive development programs on governance and democracy. The Northern Uganda Resilience Initiative (NURI) supports enhanced resilience and equitable economic development, including climate-smart agriculture (where support is provided to clean practices in the farming and agriculture sector). The Danida support is strategic in creating partnerships with Danish Non-governmental Organisations (NGOs) in Uganda (such as Danish Refugee Council). Germany supports renewable energies and energy efficiency; rural development and food security; and water and sanitation projects (Price, 2020).

Country of Origin and Ethnicity

Uganda hosts refugees from different countries and ethnicities, South Sudan has a total of 71,648, the Democratic Republic of the Congo: 313, Sudan: 224, Kenya: 133, Burundi: 39, Rwanda: 26, while Tanzania, Kenya and Eritrea have the lowest number of only one person originating from each country. The refugees in Kiryandongo belong to diverse ethnic backgrounds because of their origin: the Acholi, the Masaaba, Kenyan Luo's, the Congolese and the South Sudanese Dinkas, Kuku, Nuer, Kakwa, Madi, and Siluk (Country - Uganda, n.d.).

Gender and Inclusion

Women as the primary household energy managers are disproportionately at risk for harmful emissions exposure every day. Women and girls endure the most of clean energy poverty (the lack of

access to modern sustainable energy services (Why Solar Lights, n.d.). The strategic engagement of women in the clean energy sector is critical in reducing the risks for displaced and refugee women, which are even more alarming as 75% - 90% of the rapes reported occur when women leave camps in search of cooking fuel (Brief for GSDR 2015 - Strategically Engaging Women | Department of Economic and Social Affairs, n.d.).

Based on my experience in Kiryandongo Refugee Settlement after speaking to the community leaders, women are the home managers responsible for cooked food, clean water, chores, and children. The males take care of any rations from the UNHCR and the money received in the home. I was always told to complete my activities by 6 pm before the daylight was gone. The reason for this rule by the settlement commander was that there since there was no power, it was advisable to move with a male counterpart for protection, as there was no other form of protection.

Increased demand for clean energy and low-carbon solutions is driving an unprecedented transformation of the energy sector although women are being left out. According to a new study (Progress on the Sustainable Development Goals: The Gender Snapshot 2021, n.d) only 5.8 million women are employed in Africa compared to the 8.8 million Men. This shows a considerable gap for work inclusivity and gender disparities at work.

Access to charging phones will also play a fundamental improvement for women to fully communicate and use their gadgets without moving long distances to recharge them. Cooking smoke is the biggest killer of women and children after Malaria and HIV/AIDS with combusting solid fuel in-house, which affects health in numerous ways (Clean Cooking Alliance, 2012). The significant negative contributions are acute respiratory infections, stunted growth in children, pneumonia, chronic bronchitis in women, chronic obstructive pulmonary disease (COPD), cataracts and other visual impairments, cardiovascular diseases, lung cancer, tuberculosis, and perinatal diseases (Langbein, 2017).

In my personal observation, the available shops that sell clean energy products are far away from the settlement (Bweyale Town), which means women must walk long distances to access clean energy technology and may never get after-sale services because of the cost attached to transport from the

settlement. These shops also sell uncertified products from unregistered suppliers, leading to cheap and fake supply of clean energy products in the settlement. With such challenges around these models, my observation was that the New Clean Energy Kiosk Model will benefit the community in closing all these challenges. The clean energy kiosks will be able to provide interest-free loans on clean energy technologies to encourage uptake and increase sales. The New Clean Energy Kiosk Model operators will directly connect with the suppliers. They will make direct orders of products, and sales services will be provided at the solar kiosk.

Providing electricity or even lighting devices in the settlement is quite a challenge. It can be advantageous in some cases but also retrogressive (USAID, 2020). Development agencies tend to provide these devices as handouts that distort the market for the community to purchase clean technologies. The handouts provide increased access to solar products but increase the dependency on aid in the settlement; therefore, creating enterprises/businesses for quality sanitary products will be a challenge, and sustainability approaches may be affected (USAID, 2020)

The assessment carried out by USAID (2020) shows increased private-sector PAYGO SHS company participation in the refugee settlements and host community. The Three SHS companies, Bright Life, Fenix International, and SolarNow, that participated are now actively selling PAYGO SHS in Kiryandongo. The potential for sustainable market-based solutions benefiting refugees and host communities. According to research, residents in the settlements are aware of the benefits of improved cooking technology (GOGLA, 2020).

The United Nations handout (Referred to as ‘mopokelo’ at 31,000 UGX/8.4 USD per household member per month) is a critical source of income for many refugees but is not enough to access fuel sources. The vastly impacted refugees will forego food or pay highly for these fuel sources, with 51% of 38 customers using kerosene and candles and 34% using solar. Among these sources for cooking are firewood, charcoal and maize stalks that are accessed from burning wood in the nearby forest in the Kiryandongo district. Another source for lighting is kerosene and candles sold in nearby shops. The assessment also highlights the need to constantly charge phones (phone touch), primarily primarily used

for light at night. Bright Life carried out training in Kiryandongo district that covered over 200 sales agents, 130 of which made at least one sale. The repayment rates for refugees nearly doubled with refugees achieving a 51% repayment rate and host community customers reaching 30% (USAID, 2020)

The research will focus on community-based assessments while implementing this project; therefore, the evaluation on cooking practices, consumer and light accessibility in the settlement will be vital in informing the thesis on what interventions to take and what products to invest in for stocking in the energy kiosks. Interventions such as setting up energy kiosks equipped with improved cook-stoves, high-quality Pico PV products, and other energy-related services, such as phone and lantern charging, will be an opportunity for income generation in the sustainable energy sector (Commission, 2019).
Most businesses are more likely to be owned by host community members and dominated by vendors from the host community. There is a need to get the refugees involved in energy businesses (USAID, 2020). Companies include irrigation, cinema/television showcasing, bars, retail, large-scale mobile phone charging, hair salons, health clinics, selling cold drinks, and food preservation.

The Mid-Term Review of the EU's Regional Development and Protection Programme (RDPP): Support Programme for Refugee Settlements in the Northern Uganda (SPRS-NU) confirmed that the refugee population are overall skeptical of alternative energy-saving techniques and practices: for instance, only 35% of host communities and 17% of refugees have adopted add-on skills training in their day-to-day practices (including brick making, energy-saving stove construction, tree planting activities) (Commission, 2019). One agent interviewed mentioned that the training was 'tedious' and almost gave up; therefore, this training should be followed by frequent refresher training sessions (USAID, 2020).

Stakeholder Analysis

Table 1. Stakeholder analysis description: type of stakeholder, name of person or organisation, relationship to the project, incentives/motivation/risks, and how to engage

No	Type of Stakeholder	Name of Person/organisation and concise description	Relationship to Project	Incentives, motivations, risks	How to engage
1	NGO	The United Nations High Commissioner for Refugees (UNHCR), is a UN agency mandated to aid and protect refugees, forcibly displaced communities, and stateless people and assist in their voluntary repatriation, local integration, or resettlement to another country	-Overseer of the settlement and foremost representative at the international level for refugees -Must be informed of every project in the settlement.	-Major contributor in research and data. -Partner in measuring impact in the settlement. Submission of Timely Reports to avoid donor reviews being affected.	-Inception meetings and update sharing. -Meeting attendance when called upon.
2	NGO	Save the Children International (SCI) also aims to protect children in emergencies to ensure they survive and thrive. Five significant focus areas are: survival, Learning, protection, emergencies, and campaigns.	-Lead Partner -Monitoring and evaluation -environmental campaigns in the settlement -Tapping into their formulated VSLA bank	-The objectives are aligned with the project -They already influence the settlement community	-Partners on the project proposal and implementation. -Support on inception and engagement meetings

3	Government	Office of the Prime Minister, the office which is charged with Coordination of Government Ministries, Departments, and Agencies to ensure effective delivery of services to the people of Uganda	-Give ENVenture permission to operate in the settlement. -Provide land in the settlement for ENVenture to construct kiosks.	-OPM Coordinates the development of capacities in camps and settlements with which the project aligns with. -Risks: Bureaucracies involved.	-MoU signing -Updating OPM office through the Uganda Refugee URRM system -Get approvals for implementation
4	NGO	International Donors: Response Innovation Lab (RIL) focuses on localisation and contextualised innovations to the humanitarian response. Conversely, it scales proven local innovations to reach beyond the answer? to which they were intended.	-They believe in tested models for humanitarian ecosystems -Funders to the project	-Funds -Risks: delay in funds to start the project	-Processing of contracts and implementing of the project
5	NGO	ENVenture (ENV) A program by **New Energy Nexus** empowers rural CBOs in Uganda to start clean energy enterprises. Through our Seed Incubator, we invest	-Oversee the project implementation. -To create partnerships with suppliers and the New clean energy kiosks -Carry out monitoring and evaluation of the project.	-Experience in the humanitarian sector in the Bidi Bidi settlement. -Risks: Will the refugees pay back the product loans?	- MoU with OPM, District -Introductory letters from the lead partner. -Inception meetings at district and OPM Kiryandongo settlement

		tiny amounts in many CBOs. As a project officer at ENV, my primary role is to implement project activities and monitor and evaluate progress successfully.			
6	Community	Refugees Internally Displaced Persons Host community	-These are all stakeholders -The children will benefit through access to energy that will boost hours of study	-This project directly impacts women and children. -Risk: Ability to purchase the products.	-Introductions should be made through the Refugee Welfare Councilors (RWCs) -Formal engagements in the community.
7	NGO	Lifeline Fund (ILF) gives people a lifeline to better lives by working with them to solve their essential clean water and energy needs.	-As partners in the refugee settlement, ILF will become a supplier of clean energy stoves at a fair price for refugees. -ENVenture has an MoU already with them. -As suppliers, together with the kiosk operators, they will provide aftersale services.	-They have a distribution point in Kiryandongo; hence access to supply is easy. -Experience working in the settlement -Provide aftersale service and free product training -Risk: the market share is small.	-Update the current MoU to serve the refugees. -Make orders

			-As collaborators, support will be provided in product training sessions.		
8	NGO	Danish Refugee Council (DRC) works with humanitarian, development and peace building activities to ensure a dignified life for refugees, the displaced, and displacement-affected people.	-Lead energy and environment practitioners in the settlement -Introduce us to briquette making VSLAs for partnership	-Experience in skilling VSLAs in briquette making in the settlement. -supplier of briquettes to the clean kiosks	-Introductions and engagements for a partnership
9	Company	Spouts of Water provides access to safe and clean drinking water through the production and distribution of the Purifaaya ceramic water filters in East Africa.	-Supplier of the non-electric water purifiers to the kiosks Already have an MoU with them.	-Ready to supply when orders are made. -Almost 99% of refugees do not drink boiled water; hence there's a need to solve this problem. Risk: Products may be pricey for the community	-Training how the product works -Market activation with supplier
10	Company	D-light sells solar power products and services in over 65 countries. Solar LEDs, off-grid systems, and solar battery-	-Supplier of solar products to the kiosks -Already have an MoU with them.	-Have a branch in Kiryandongo -The market share is small.	-Review MoU to fit in the settlement -Make orders and pay for them.

		charging systems have won awards and recognition from various respected sources worldwide.		-The buying power is low. -They supply at the locations.	

Needs assessment

The process of assessing demand for clean energy products will start with the end-users for energy, including local households in the settlement and the host community. The type of technology used will be based on energy efficiency, effects of harmful smoke or emissions, cost, size, technology type and materials. The kiosk inventory management process requires data collection to identify the needs, challenges, and solutions.

To carry out this activity, I will use short and structured questionnaires for household respondents, which can be used to gather information on access, availability, and consumption of clean technologies. The questionnaires will be administered in person, as one-on-one question and answer due to the anticipation that some respondents cannot read and write. An interpreter will be available to support the process.

The technology demand will be assessed on technical and social-economic data, which will be carried out using focus group discussions, semi-structured interviews with key informants like NGO employees and refugee welfare councilors. Apart from interviews, participatory rural appraisal (PRA) technique and Observations will be used.

The Research design and sampling strategy before and during fieldwork will be carried out and elaborated considering the following:

- Available data and past, present, and ongoing socioeconomic studies;
- Approach (e.g., quantitative, qualitative, mixed methods);

▶ The field methods and interview guides (e.g., questionnaire surveys, semi-structured interviews, PRA);

▶ For statistical accuracy, time and resource constraints, an appropriate sampling size is selected;

▶ Preliminary selection of respondents including VSLA members, key informants, and social groups);

▶ Arrange the coordination and other practical arrangements including selecting a data collection tool (Using Google, printing out the questionnaire tool), transportation means and any other additional costs (meals and drinks);

▶ Feasible work plan. Quantitative survey questionnaires usually select a sample population, as the total settlement population is too large to cover given the timeframe and available resources;

The structured questionnaires will be used to collect information from informants that will provide detailed quantitative socio-economic data such as the size of the household, consumption, expenditure, and sources of clean energy technologies. The questionnaires will be filled in with an interactive conversation with the sampled population due to the language barrier.

The questionnaires will be supplemented by qualitative methods such as semi-structured interviews and participatory rural appraisal (PRA) techniques, including six focus group discussions (targeting groups of five to ten people in six refugee settlement locations in Ranch 1,18 and 37). The mapping exercises will be used to develop the survey tool. The exercise will be carried out with the involvement of the local leaders and organisations in the settlement.

The thesis will achieve flexibility and in-depth information from the respondents' responses. The focus group discussions will consist of mixed people in a community. The participatory rural appraisal will comprise a set of approaches and methods for understanding and assessing the local context and livelihoods of people and social groups within a particular geographical area (“Revolutions in Development Inquiry,” 2018) such as the settlement for displaced people, refugees, and a host community.

The interactive Participatory Rural Appraisal (PRA) methodology is usually implemented by following three main steps:

(i) Selection of a community or village;

(ii) A preliminary visit;

(iii) Actual application of PRA

The above steps will be applied in the standard PRA techniques, including the use of Focus group and interviews (four groups of five to ten aged between 18 to 65 years). The assessment will focus on the number of people using clean energy technologies, gender, and type of clean energy technology demanded. The approaches will enable generate useful qualitative data on pure technology demand and related challenges for the thesis (Macbeth, n.d.).

We will assess the population trends in Kiryandongo refugee settlement with two support staff on the UNHCR data portal. There will be the usage of several indicators for guidance, including

- Total current population and fluctuations over time;
- Demography: disaggregation of data according to gender and age;
- Social groups: countries of origin and specific ethnic groups;

Several factors influence the demand and uptake for clean energy products in the refugee settlements. These factors affect the quantity, efficiency, quality, and technology consumed. The data on this will be obtained while combining the following:

(i) Rapid, structured and quantitative questionnaires with respondents (seventy individuals);

(ii) Focus group discussions (disaggregated by gender) with household members (Four groups); and

(iii) Semi-structured interviews with key informants, including Refugee Welfare Councilors (RWCs), community mobilisers (RWCs), community leaders (RWCs, OPM, District leaders) and clean energy technology producers (ILF, DRC).

Data collection and assessment

The data collection will be carried out by five research fellows in the three locations of Kiryandongo Refugee Settlement Namely Ranch 1,18 and 37.

Table 2.Planned data collection and assessment plan

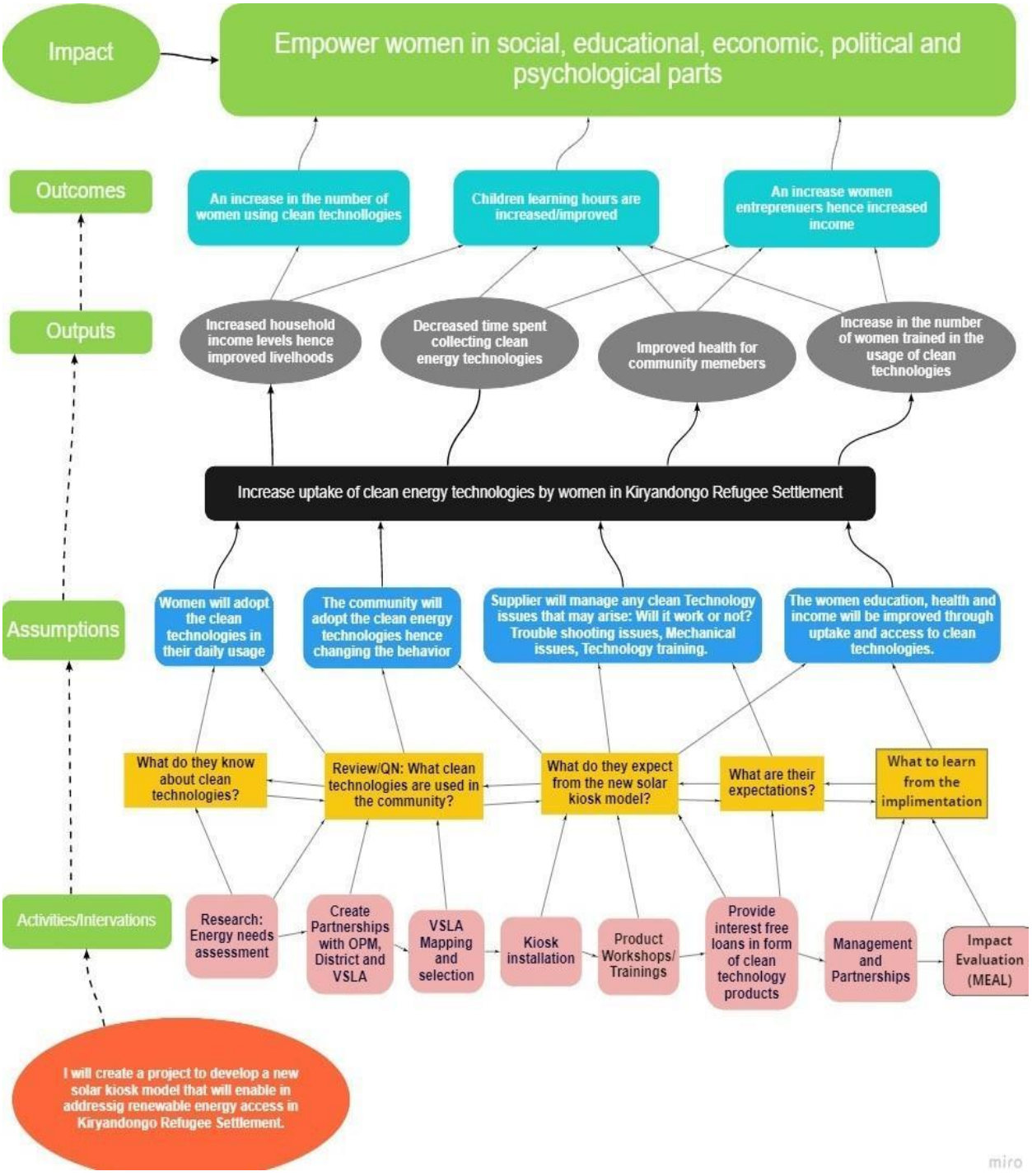
Instrument	Target number	Target group	Type of information to collect
Focus groups	4 groups	18 and above years Women and men, youth and business owners	-What is the clean energy demanded? What type of clean energy technologies do you know? -How much do you spend on clean energy technologies? -What is the gender of the household head. -What products would you like to see in the kiosk?
Surveys	70 individuals	25 and above years. Women, Men and Youth. Community leaders, NGO representatives.	-What clean energy solutions are available in the settlement? -Is The New Clean Energy Kiosk Model a solution to the uptake of clean energy technologies? -Which suppliers are well known to supply clean energy technologies. -What clean energy technologies are you using? -Are you willing to pay for clean energy technologies? -How much are you spending on fuel (daily, weekly, Monthly)? -What lighting do you use in your household? (Kerosene, Solar, Candles, Battery Torch, etc) - How much are you spending on the lighting (Daily, weekly, monthly)?

Figure 8 exemplifies the theory of change with a descriptive plan for the project to use a new solar kiosk model where particular activities will be carried out to enable the refugee settlement community to access clean energy technologies to empower women in their social, educational, economic, political and psychosocial areas.

With 52 percent of the settlement population female and 83percent female and children (UNHCR, 2021), there is a need to focus on uplifting their social ability (to sustain a family, and social life with their husbands if married), educational ability (for children to have extended study time after school), economic ability (to improve the income of the family to sustain the family needs and create a saving lifestyle) and psychological ability (to learn a lifelong skill and live an independent life without donor support; to earn a living). The theory of change supports the thought process of the details of the project plan, activities, challenges and assumptions relating to viable solutions. The theory of change clearly shows the possible implementation plan right from movements to the outcome of the thesis.

Theory of Change

Figure 8. Theory of change from the problem statement to activities, assumptions, outputs, outcomes and impact.



Assumptions

After training and carrying out partnerships with different stakeholders, the women will adopt clean energy technologies, which will lead to improved lifestyles and behavioral change. Behavioral change will be a lifelong process, but this will be monitored through the continuous evaluation of the number of briquettes and improved cooking stoves purchased which are used for cooking as a replacement for firewood. Continuous community training about clean energy technologies (both the types and benefits) will be carried out if the assumption is not achieved.

The second assumption is that the community will adopt clean energy technologies hence the refugees will change the behaviors towards safeguarding the surrounding forests and environment (increased briquette purchase and usage for cooking purposes). Follow-up mobilisation towards training for the kiosk operators (managing, after-sales technics, technical expertise) on clean energy technologies will be carried out.

The third assumption is that the suppliers will resolve any clean Technology issues. With the memorandum of understanding signed between the new solar kiosks and the suppliers, I presume technical and mechanical training for the operators will occur, and the warranty will also support faulty products. I suppose this will increase the uptake and usage of the technologies.

The fourth assumption is that education, health, and income will be improved through uptake and access to clean technologies. Since the settlement is not connected to the national grid and the community solely depends on buying specifically renewable energy for light, I presume that households who have access to clean energy technologies will have an improved livelihood in the settlement.

Program Description

In the transition to a low-carbon economy, the adoption of renewable energy (RE) technologies by energy investors, power utilities, and energy consumers are critical. In developing countries like Uganda with a high rate of urbanisation, this transition requires urban and rural residents' proactive responses to using renewable energy sources. In this regard, a better understanding of residents'

perceptions about renewable energy investment, RE sources availability, climate change, environmental conservation and other factors can lead to more efficient and sustainable implementation of renewable energy policies (Kiprop et al., 2019).

Goal(s) and Objectives

The project's primary goal is to understand the community needs, which will enable the new solar kiosk model to improve access to clean energy technologies in the Kiryandongo Refugee Settlement.
The project's primary objective is to understand if the new solar kiosk model will improve the livelihoods and income levels of the kiosk operators.
I also want to understand if the model would improve access to clean energy technologies in the community.

Partners and Funding

The project will partner with various stakeholders with both the government and district, at all levels of implementation. The partners will participate in the inception meetings, research and business management training to ensure the project's sustainability. The project funders include the Dutch Relief Alliance – Response Innovation Lab (DRA – RIL) put out a call for funding for the **Energy Challenge** – 'How might we improve accessibility (distance) for refugees (in particular women) to be able to purchase quality and affordable clean energy solutions and obtain after-sales/maintenance?'
ENVenture was successfully selected and awarded funding worth UGX650,000,000 ($184815.21), with the most significant part of the budget reserved for the technical staff to support high-quality implementation, research, evaluation, and external audit. Support costs were kept at under 15% of the budget. The budget was split based on the activities conducted. This thesis was integrated into the challenge to achieve the set goals and objectives with this funding.

The thesis was implemented in partnership with the government of Uganda, represented by OPM as the overall government representative in Kiryandongo refugee settlement. Partners directly submit plans and implementation reports monthly. The UNHCR is the international overseer of the payment and now monitors all projects implemented in the territory. Other partners include NGOs implementing Energy and Environment related projects in the settlement. The partners play a crucial role in research and creating synergies around the project implementation.

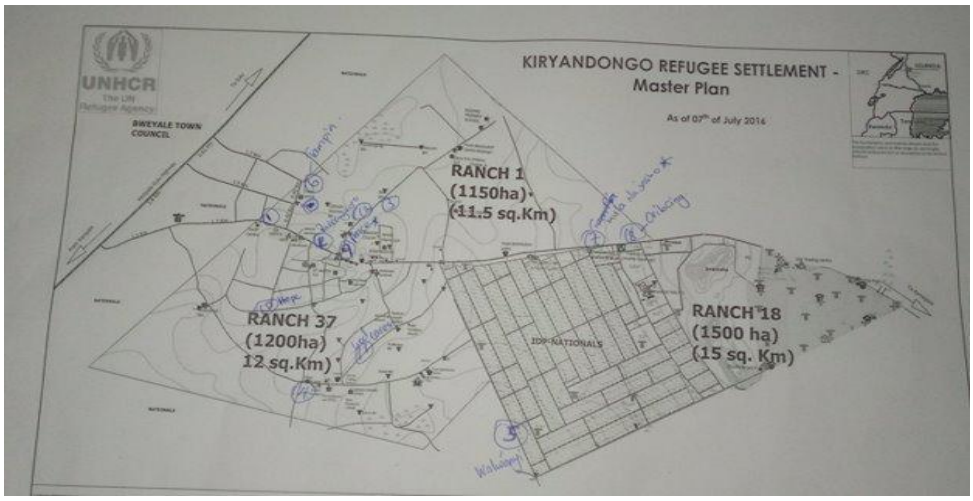
Activities

The Inception Meetings will create partnerships with multiple stakeholders operating in the settlement. A session with the settlement leaders included the settlement commandant Ms Monica Kyokutamba and OPM Environment Officer Mr Joseph Agotre will present the project to the OPM and a separate meeting with the district leadership council. The third inception meeting was carried out at the RWC offices in the settlement. It was attended by seventeen settlement leaders from the three ranches.

Needs Assessment Survey Activity

This study investigates the role of the clean energy kiosks model in increasing access and adoption to renewable energy technologies in Kiryandongo Refugee Settlement in Kiryandongo district, Uganda. The settlement is divided into three ranches, including Ranch 1, 18 and 37. The ranches are divided into clusters and Zones (like smaller villages). The leadership council includes the chairperson, the women's head, and the youth head. To achieve this, a questionnaire survey was administered among 72 household consumers in four different areas in the settlement, including Cluster P, Cluster N-Reception Centre, Cluster D – Go down Centre and Zone C2 – Walwanyi Centre.

Figure 9. Map of Kiryandongo Refugee Settlement research focal points: twelve groups interviewed in three ranches



The above image shows the areas where VSLA mapping and profiling exercise was carried out. The interaction in the community to find out the group formation, location, group activities, registration, training, group dynamics, and operations. This activity was vital because the installed clean energy kiosks had to be run by the community members. This resulted into interviewing and profiling 12 VSLAs in Zone C2, Clusters MR1, D, P, K, N. Total of Refugees F - 245, M - 28, IDP Nationals – 49.

Table 3. Selected cooperatives to take charge of the solar kiosk model

Selected Cooperative Name	**Location**	**Reason for selection**
Walwanyi Energy Cooperative Association (WECA)	Walwanyi trading center, Ranch 37	-Walwanyi is a pivotal point of business in Ranch 37 with a large population, proximity to members' homes and school, secure, and the management of the energy kiosk could be easy. The center is easily accessible by all members of WECA.
Oribcing Community Energy cooperative (OCEC)	Go-down trading Centre, Ranch 18	Being a trading Centre makes it a significant point of business, large population, is proximity/near to members' homes, Secure.

Tam Pia-Anyim Energy Cooperative	Cluster N junction near Save the Children child-friendly space, Ranch 1	Being a trading Centre itself makes it a primary point of business, the intersection connects to OPM entrance route and Bweyale town entrance, large population, proximity to members' homes, Secure
Lubangenyo Energy cooperative	Reception trading Centre, Ranch 1	Being a trading center, makes it pivotal point of business, large population, proximity to members' homes, Secure, located near the market and Boda-boda stage.

The training of the energy cooperatives is another activity that took a 12-day boot camp hosted at Save the Children safe space and Tampia Nyim meeting place in Kiryandongo Refugee Settlement to equip the cooperatives' management teams with a business management skills set.

A team of two extra business management trainers conducted the training. The trainers were:

- Acheng Gloria - Lead trainer certified with International Labour Organisation
- Adubango Micheal Mugisa - Local resource with entrepreneurial training experience
- Musiimenta Joy Kellen – Skilled in startup/entrepreneurship training and project management.

During the training, product partners like Spouts for Water (supply water purifiers) and Mandulis (supply briquettes) trained members of the energy cooperatives with first-hand experience in using the positive product' selling points to drive high sales. First-time relationships were established for long-term working relationships.

The construction of clean energy Kiosk activity was key in the project implementation. This activity included scouting for land for construction and partnership with the respective energy cooperative leaders and RWCs. Upon identifying the locations, plans were submitted to the settlement commandant for approval. The site visit was conducted, and construction commenced. After the solar hub installation, they were launched and handed over to the respective energy cooperatives to handle and manage their day-to-day operations. The stall was also branded to increase visibility in the community.

To increase kiosk traffic, each hub was provided charging station for up to fifty phones and one refrigerator to sell cold drinks to their communities. This will increase their monthly revenue and attract more customers to their clean energy kiosks. Additionally, public address systems were given to each booth to aid them during marketing activities.

These clean energy technologies include improved cooking stoves (in 3 assorted sizes.), water filters are a replacement method for boiling water, solar lanterns as an alternative for firewood, kerosene as a lighting method, and briquettes as a replacement for charcoal and firewood. The management teams in the clean energy kiosk were engaged in the product selection process, and they each chose products according to what they deemed fit. Solar kits and lanterns took up to 50.87% of the loan amount, improved cook stoves were up to 27%, and water filters and briquettes were 13.75% and 8.41%, respectively.

Case Study Sample

The Energy needs assessment is meant to understand the energy needs of the communities in the project's target areas and gather the information that will generate solutions to meet the community energy needs. A number of stakeholders were contacted to participate in the activity, they included development partner staff in Kiryandongo refugee settlement; the Dan Church Aid (DCA), International Life Fund (ILF), and Save the Children. The data collected was based on number of sales made for both the clean energy technologies and income from the income generating activites.

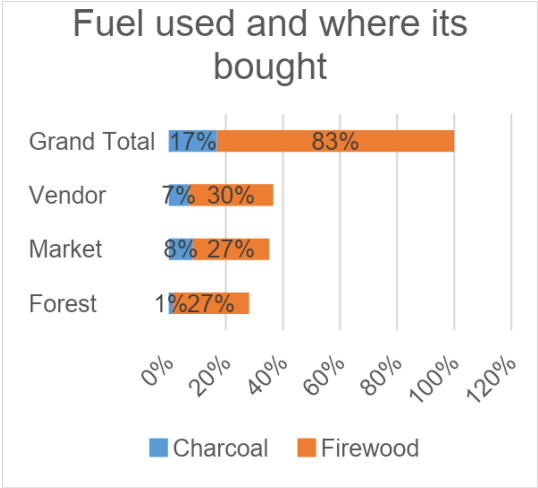
In collaboration with the Kiryandongo refugee settlement leaders, a focus group discussion was carried out with the OPM, RWCs, cluster leaders (15 individuals) leaders who attended.
Four support staff from ENVenture joined me in carrying out the survey. Another focus group discusion was carried out with the four energy cooperative group members.

Figure 10. Summary of the research sample

The survey took seven days, and the engagement was carried out among business operators, market dwellers, and live-at-home mothers. Figure 10 indicates the total sampled population of 72 respondents from different branches, namely 1, 18 and 37, including refugees and internally displaced persons. The questionnaire was divided into three categories: Solar Access, Wood fuel, and Clean Energy Kiosk.

Major findings from the assessment are elaborated below: Fuels used, expenditure on fuels and where they are accessed.

Figure 11.Type of fuel used and where it is purchased



As can be seen in figure 11, the primary fuel source for most households in the settlement is firewood (83%), bought from vendors, markets, and the forest. 27% of the firewood used in the Households is collected directly from the forest, which negatively affects the environment, refugee settlement, host district, and country. The vendors sell charcoal and firewood using a door-to-door

method where they move house to house selling and collecting charcoal and firewood that the locals have gathered from in and around the nearby forests.

Figure 12. Variations in percentages of household income spent on the purchase of fuels daily and monthly.

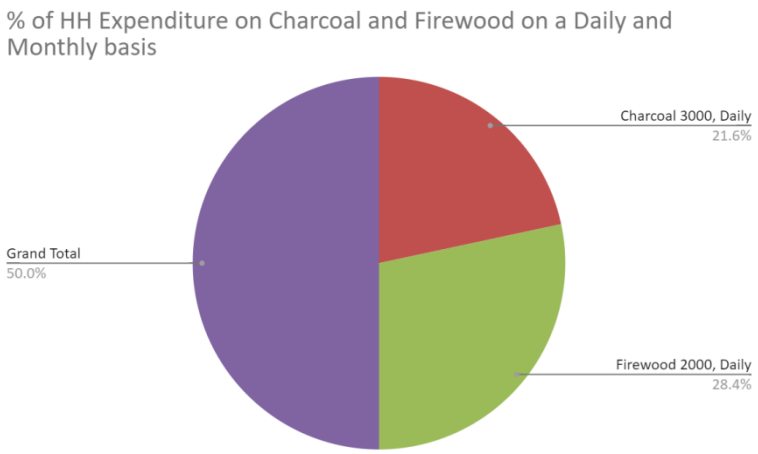
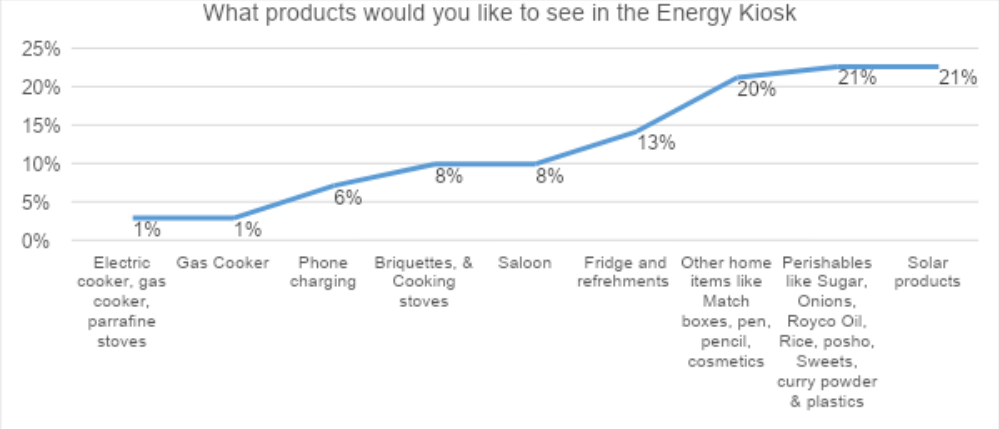


Figure 12 indicates 50% of respondents spending UGX60, 000 (USD16.01) on purchasing wood, while 21.6% are spending more money on charcoal with UGX90, 000(USD0.24.04).

Figure 13. Products needed in the energy kiosk



Solar products, Fridges, Briquettes, cooking stoves and phone charging products are some of the energy products mentioned that the cooperative members will include in the energy Kiosks that will be established. Stocking the mentioned products will be essential for vulnerable women in the settlement. However, the cooperatives might consider including other suitable products like Mobile money services

to improve women's household income. The communities prefer much emphasis on stocking adequate energy products.

Figure 14, Types of stoves used for cooking

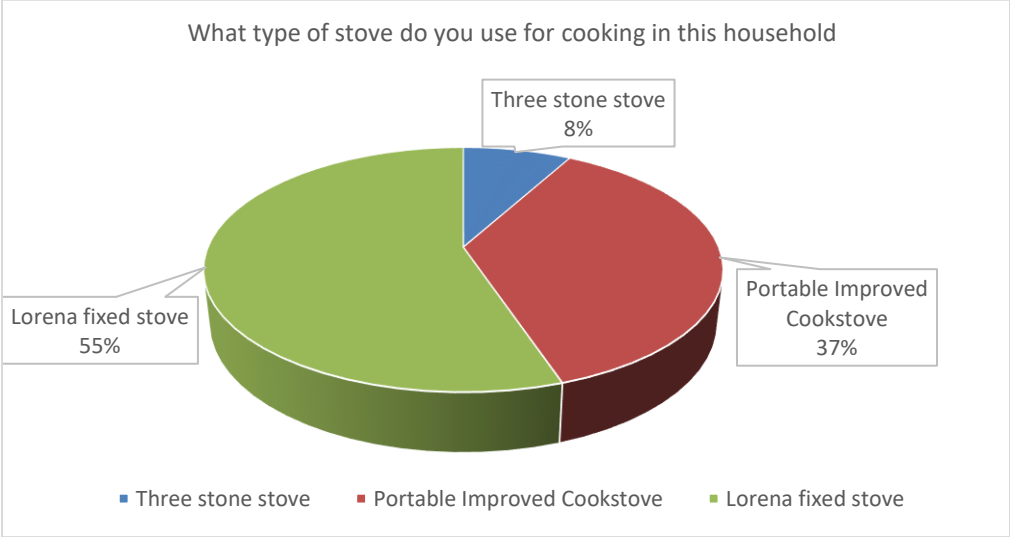


Figure 14 shows that although high percentage of the respondents use Lorena Fixed stoves, they are considered environmentally unfriendly because of the smoke produced. Furthermore, a high number of the respondents still use the traditional three-stone stoves, which is deemed dangerous to the health of the women who are majorly engaged in cooking and use hazardous fuel. A significant number of the respondents have been using portable improved cookstoves, and this number should improve by reducing the price tag, quality, and accessibility of the stoves. Adaptation of the stoves will significantly reduce indoor air pollution and smoke, and thus prevent health-related complications within families due to the 50% reduction of gas emissions while using improved cooking stoves.

There are various types of stoves being produced to manage indoor pollutants however in Kiryandongo refugee settlement, below are the images showing the three types of stoves most used and accessed in the settlement.

Figure 15. Woman using a Lorena stove with firewood for cooking

Figure 16. Three-stone stove using firewood for cooking

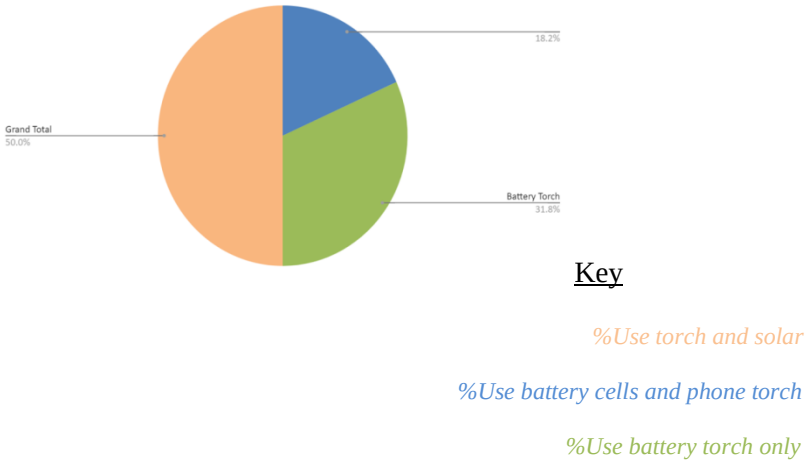
Figure 17.Portable low carbon-improved stove that saves 50% of cooking fuels

The thesis explored using other modern, clean cooking stoves for the women who still use the traditional three-stone method. A monthly expenditure of more than Sixty Thousand Ugandan shillings (about $17) is not realistic to a refugee who may not have a daily income of more than a dollar a day.

The main lighting items used in the Kiryandongo refugee settlement are three light solar systems, a battery torch, candles, grass for lighting, a phone torch and Pico solar. Among these, using grass for lighting was shocking because one needs dry grass to temporarily light and stop it, which is quite a challenge reading in dim light.

As seen below in figure 18, the numbers indicate the need to invest in solar systems for a more decent quality light for reading and cooking. Most households continuously invest in candles and phone torches, which need a daily investment to buy the candles or charge the phone, this indicates a high expenditure on lighting which affects the family income and livelihoods.

Figure 18. Chart of daily and monthly expenditure on lighting items in the household



The primary source of lighting for most households in the settlement is solar and battery torches, with 50 percent represented in figure 16 above. The average household spends Ugx 500($0.14) daily and UGX3000($0.85) monthly on torch charging and hiring solar systems for lighting respectively. This takes a more significant percentage of the incomes of the vulnerable men and women in the settlement. The use of battery cells and phone torches, including replacing battery cells, also come with challenges, considering women's vulnerability towards earning an extra income.

Also, candles negatively affect the households, especially the women and girls who use the candles in the kitchen to cook, which may lead to a fire hazard like burning down the house where they live because most homes are grass thatched tents. In figure 18 above, 18% of respondents use a battery

torch, which shows a high expenditure on battery cells and phone charging, which increases the expenses on lighting per household.

Recommendations

Increase charcoal Use;

The project explored alternative fuel sources like briquettes to reduce the use of traditional wood that affects the environment and to reduce the percentage of household income spent on purchasing hazardous fuels like charcoal or firewood. The saved household income will instead be used in other household needs like promoting healthy lifestyles, paying for children's school fees and 'putting food on the table.' Since most people get firewood free from the forest, emphasis on behavior change is needed to reduce the adverse negative effects on the environment in the refugee settlement. Based on the gender roles in the Kiryandongo refugee settlement, these negative impacts are majorly faced by girls and women directly engaged in collecting the wood.

Improve Household Income;

Income improvement through the operation of the Kiosks will help diversify the various Income Generating Activities (IGAs) already carried out by group members rather than participate in the charcoal business. Those engaged in sales of products like fruits and foodstuff will boost their capital and engage in energy as a business by selling the clean energy products in the established Kiosks. To have sustainability of the established kiosks, there is a need for partnership linkage in the environment sector where livelihood support from other development partners so that they cannot revert to ventures that cause harmful effects to the environment, like charcoal and firewood selling.

Increase Solar light technology usage;

Building the marketing skills of the cooperative energy members will help expand the sales of clean energy products not only in the locality but also in the host district. They will have to explore marketing opportunities in the refugee settlement like the open market days and the food distribution days because these are particular to gathering people. The key to the sustainability of the clean energy kiosks is

that the beneficiaries will purchase products from these established kiosks even after the project ends. There is also a need for continuous interaction between the project team and members of the cooperatives to identify gaps that will need immediate interventions, including training, coaching, and ensuring solid and inclusive governance at the group level.

Create funding opportunities**;**

Escalation of the project to other refugee settlements in the country requires a funding opportunity that will increase the chances of safeguarding the environment in and around the host communities, improve and increase access to clean energy technologies. If a subsidy factor in the funding is included, it will kick start access to clean technologies, which in turn will allow the refugees to have first-hand usage and promotion of the products.

Create supplier partnerships;

There is an opportunity to collaborate and create long-term synergies with clean energy technology suppliers near the refugee settlements who would be willing to continuously offer training to the refugee entrepreneurs. This opportunity will reduce the costs involved in carrying out training sessions and supplying solar products. Such partnerships eliminate and reduce fake products on the markets and in the settlement. The suppliers will be able to provide technical support and after-sales service to the solar kiosk entrepreneurs.

Pay As You Go system

Due to the low incomes of the refugees, a system where the refugees are enabled to make small deposits on the clean energy technologies purchased will elevate the access and usage of these technologies. The PAYGO system will support the kiosk operators in monitoring and evaluating the type of sales closed and payments made per client.

Conclusion

If most of the energy challenges highlighted above are not addressed, communities will continuously face multiple adverse consequences. The project will need to develop Low Carbon interventions rooted in innovative, community-based programming and solutions that reduce emissions and support the livelihoods of the vulnerable women in the communities.

Clean Energy kiosks need to stock the community's preferred clean energy technologies. Conducting capacity-building exercises for the energy cooperative members and product research/customer feedback will ensure access to knowledge related to clean energy products, which will lead to improvements in sales and inventory procurement for refugee community access.

Providing Energy Vouchers and discounts to some of the vulnerable women in the refugee settlement will help increase access to alternative clean energy products. The vouchers will also create a high footprint at the clean energy kiosk to increase sales; however, they tend to distort the market, affecting the project's sustainability; therefore, the coupons should be distributed to market the use of clean technologies. The result of these coupons should be promote the use of these technologies rather than the 'free giveaway mentality' for refugees. Training of the kiosk operators about providing after-sale services is critical. Connecting the suppliers with the kiosk operators will enable the project to sustain technical support for community members.

Annex

Table 4. Energy Needs Assessment Data: *Energy Needs Assessment Raw Data*

(https://docs.google.com/spreadsheets/d/15xPpZLAPD4_NDo4QPej24jehDLktS7Zw/edit#gid=212786060)

Table 5. Energy Needs Tool/Questionnaire

ENVenture carries out this survey to enable the group members and the ENVenture team to make the right investment decision for what products/inventory for the Energy Kiosk/Hub. All shared information is kept CONFIDENTIAL based on Ugandan Laws and shall only be used FOR THE ENERGY KIOSK PROJECT. When you agree to take this survey, you permit us to use this data for this project.

Person conducting activity	
Date	
Place, District, Country	
Signature	

1. Name: ……...
2. Age……Tel: No…….
3. Gender……
4. Sign……..
5. **Category of PSN [**single mothers/caregivers, single women, Lactating mothers, pregnant women, widows, older women, women with disabilities, a survivor of violence, older adult with 60yrs+**]**……
6. Country of origin: ……..……
7. Year of resettlement: ……
8. Number of dependents…….……
9. What water sources are near you?……..…..……
10. How long does it take to fetch water?…..……
11. Do you boil the water? YES NO
12. How long does it take you to boil the water?……..……
13. What Income Generating activities are members of this household involved in……...
14. What cooking fuel do you use? (TickTick appropriate)

a. Firewood
b. Charcoal
c. LPG
d. Briquettes
e. Cooking baskets

i] Where do you get it from?.....
ii] How long does it take to and from? [in terms of time and distance] ……..…….
15. How much do you spend on cooking fuel mentioned in [14] above on a daily, weekly or monthly basis?…….……...

16. What type of stove do you use for cooking in this household?
f. Lorena fixed stove
g. three stone stove
h. portable improved cook stove
i. others (specify)…….……
17. What do you use for lighting in this household? [Candle, kerosene lamp, rechargeable lamps, rechargeable/battery torch].....…
a] How much do you spend on lighting items on a daily, weekly or monthly basis?.....
18. Does anybody have a phone in this household? (Yes, No). If yes, where do you change your phones from? Other…….……
19. How much do you pay for charging each phone?.....
20. What products would you like to see in the Energy Kiosk?……..……...
21. Do you have any questions for us?.....
Discussion, willing to:
Pay for a product
Installment payment terms
Type of products
Types of suppliers - Price points
Think of suppliers we shall need
Think of existing suppliers already in the settlement, like the Briquette people and others?
How can other value-adding services be added to the kiosk to drive foot traffic? Could it be phone charging?

Thank you for your participation

Figure 19. Group members in a break out session discussion before presenting to their colleagues

Figure 20. Solar Kiosk design

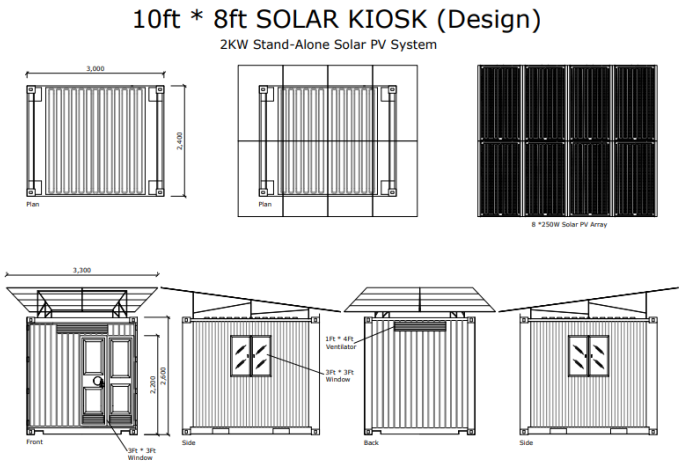


Figure 21. Clean Energy Kiosk fully installed at Cluster P in Kiryandongo Refugee Settlement

Figure 22. Staff from Purifaaya (one of ENVEnture's clean energy products partners) explains key marketing strategies for the ceramic water filter.

Figure 23. Community training on the products found in the Clean Energy Kiosk.

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