Food and Agriculture Organization of the United Nations

Practical ACTION

Kenya | Uganda | South Sudan

Key success factors and obstacles for FAO energy projects in humanitarian settings

An evaluation of FAO's energy-in-emergency portfolio to inform future programming in three Eastern African Countries

Kenya | Uganda | South Sudan

Key success factors and obstacles for FAO energy projects in humanitarian settings

An evaluation of FAO's energy-in-emergency portfolio to inform future programming in three Eastern African Countries

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Acronyms

DAE	Digital Agents for Energy+
E4I	Energy 4 Impact
FAO	Food and Agriculture Organization of the United Nations
FES	Fuel-Efficient Stoves
FGDs	Focus Group Discussions
HH	Household
ICS	Improved Cookstoves
IDPs	Internally Displaced People
KII	Key Informant Interview
MEI	Moving Energy Initiative
PAYGO	Pay As You Go
SAFE	Safe Access to Fuel and Energy
SNV	SNV Netherlands Development Organisation
UNHCR	United Nations High Commissioner for Refugees
USADF	United States African Development Foundation
VSLA	Village Savings and Loan Association

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Executive summary

Through its work under the Safe Access to Fuel and Energy (SAFE) programme, FAO has contributed to improving resilience and livelihoods among refugees and internally displaced people in 14 countries. This evaluation seeks to inform future programming through a review of FAO's energy-in-emergency portfolio in three Eastern African countries: Kenya, Uganda and South Sudan. Activities carried out during the evaluation included:

- exploring the energy access situation in humanitarian settings and its intersections with issues surrounding gender, conflict and natural resources;
- identifying results and lessons from past interventions delivered under FAO's SAFE initiative;
- mapping the challenges that affect energy markets in humanitarian contexts;
- developing recommendations for innovative programming options for SAFE in Kenya, Uganda and South Sudan, informed by the findings of the other parts of the study.

In Kenya, Uganda and South Sudan, most refugees and displaced persons rely on energy resources that are unsustainable and that pose high risks to their health and well-being. In particular, the lack of access to energy for cooking poses a high security risk for refugees and internally displaced people. Many households (HH) are highly dependent on firewood collected from areas around the settlements to supplement the fuel which they receive from humanitarian agencies or purchase through markets. Intense demand for this natural resource has led to the degradation of forests and conflicts with the host communities.

Methodology

The evaluation process was undertaken based on key underlying principles derived from FAO's SAFE Framework and the relevant FAO strategic objective. The evaluation used mixed methods, combining qualitative research and econometric analysis of quantitative evaluation data. Specifically, the data collection consisted of household surveys carried out with refugees and internally displaced people (IDPs), focus group discussions with community leaders and beneficiary groups, interviews with humanitarian organizations and government representatives, as well as a review of literature on energy access and market-based approaches in the humanitarian settings in refugee camps in Kenya, Uganda and South Sudan.

Findings

Income and livelihoods: Most households depend on donations, support from relatives, informal employment, and or business activities for their living. Most households have more than one source of income due to engagement in a variety of income-generating activities. For instance, in Uganda, refugees have access to agricultural land, so are able to supplement their income based on seasonal harvest periods. Charcoal production and agriculture production are reported as the main livelihood strategies in South Sudan. In Kenya, refugees are unable to legally work so as a result rely more heavily on remittance and donations. The average household income levels for refugees in the camps were estimated to be less than United States Dollar (USD) 150 per month in Kenya, less than USD 66 per month in Uganda and less than USD 77 per month in South Sudan.

Energy demand: Energy is mainly used for cooking and lighting with preference mostly being on the use of firewood and charcoal in households for cooking. The cooking culture necessitates the use of more than one stove per household. Different stoves are used for different pot sizes and to allow a variety of meals to be cooked. Most households cook a maximum of two meals per day. The commonly used lighting technologies in the camps included the tin-lamps used by over 40 percent of the households, candlesticks, pico solar lanterns, and kerosene lamps. Although households received most of the lighting technologies from the United Nations High Commissioner for Refugees (UNHCR) or other organizations, less than 15 percent purchased their lighting systems.

Energy supply: FAO distributed energy-saving cooking stoves among refugees and host communities in the three countries. Households understanding of the usage of FAO stove and proper utilisation resulted in reduced cost of energy per household between USD 0.25- 1.51 monthly. The market penetration of improved stoves and cookstoves (ICS) and solar lighting is still low as market actors perceive refugee settlements to pose high costs due to dispersed communities, poor road network and lack of other support infrastructure. Only low-tier mostly uncertified solar products are available in the common market; good quality solar products are only available in a few outlets. Suppliers also lack a good understanding of customer demand and segmentation in the area ultimately resulting in inability to market products effectively.

Host and refugee communities: It was evident that there is high interdependence of refugees and the host community. For instance in Kenya, the refugees provide food for the host community in Kakuma town with the host community providing labour and fuel. In Uganda thanks to a more conducive refugee policy, refugees are more integrated into the local economy and they are allowed to engage in productive activities such as agriculture, paid employment and business.

The commonly used lighting technologies in the camps included the tin-lamps used by over **40 percent** of the households, candlesticks, pico solar lanterns, and kerosene lamps.

Cost and willingness to pay for energy products: Some Non-Governmental Organisations (NGOs) have distributed energy products in-kind, creating dependency and leading to market distortion thus hindering the scale up of commercial models. Households expressed willingness to pay for dual purpose stoves and pico solar appliances. However, most payment mechanisms for solar appliances and stoves require upfront cash or for the households to save and make at least a deposit of the purchase amount. Repayment periods are often short and inflexible to accommodate the irregular cash flows for refugees.

Off grid financing mechanism: The upfront cost of energy products is a barrier to purchase with most transactions cash-based. The cost of most cooking stoves ranged from USD 1.5-6.00 depending on household income, type of cooking stove, and place of purchase. Mobile money as a payment option is constrained by the poor quality of service, low availability of agents to serve a dispersed population, and increased transaction costs. A semi-formal mechanism, such as Village Savings and Loan Associations (VSLAs), as a financing intermediary, has been explored by various NGOs. The use of savings groups and VSLAs is widespread and these groups and associations can serve as an important point of entry for off-grid financing. However, the need to facilitate the VSLAs with adequate liquidity to finance members is key.

Awareness creation and sensitization: Community sensitization and awareness creation campaigns have been conducted to increase adoption of solar and clean cooking solutions among households. However the focus has been more on awareness creation for household use rather than a productive use of energy. Market awareness strategies on productive use opportunities for refugees and host communities would open new opportunities for local economic development and livelihood improvements including the energy-agriculture nexus.

Distribution models: Distribution of cookstoves and solar products is mainly through NGOs/ Community Based Organization (CBOs) who often offer the products at a subsidized rate. Most private companies involved in the distribution of these products have opened up stores and shops within towns in close proximity to the refugee camps with some engaging sales agents inside the refugee camps to sell and distribute the products. Non-governmental organizations and other development agencies mostly work with local CBOs for distribution of products. For instance in Kakuma UNHCR and FAO partner with Lotus Kenya Action for Development (LOKADO)in their production centres to distribute cookstoves whilst in Uganda World Wildlife Fund (WWF) partners with Rural Initiative for Community Empowerment (RICE)-West Nile in implementing the public private partnership initiative utilising the Civil Society Organisations (CSO) models to increase access to home solar systems and energy saving stoves through a consortium of 16 CSOs in six districts in Northern Uganda. Key challenges in effective distribution of energy products include infrastructural challenges and policies that restrict access to refugee camps. We consulted some private sector players who expressed interest in offering clean cooking and lighting products however would like to see the involvement of humanitarian agencies in supporting infrastructure development, allocate financial incentives to reduce risk and operating costs for private sector engagement.

The implication of humanitarian response: There is a gradual shift from in-kind food aid distribution to cash-based assistance to build financial inclusion and self-reliance. Several humanitarian organizations implementing energy-related projects in the refugee settlement are often constrained by the short-term nature of the projects therefore not capable of meeting long term impact and sustainability of energy interventions due to funding cycle.

Policy implications: Well-planned and secure government policies with defined goals and consistent regulatory actions are key to scaling-up private sector investment and facilitating the integration of the water-energy food-nexus. The evaluation realized the different countries have various policies for instance in Kenya, restricted movement of refugees and restraining policies (curfews) results in reduced livelihood opportunities and contributes to reliance on humanitarian assistance whilst Uganda operates an open-door

policy for refugees where refugees are allowed freedom of movement and are entitled to work and allocation of land. Uganda has made progress in advancing self-reliance from refugees specifically, Uganda National Refugee Policy and Uganda Refugee Management Strategy. In South Sudan, the UN in South Sudan has developed an UN-wide Peacebuilding Plan 2018–2021 that will strategically channel resources and guide activities.

Gender dynamics: Within the humanitarian settings, women are more vulnerable to energy poverty and often bear the brunt of inequitable energy access especially on matters of cooking. It was found that in most cases, the distance travelled in search of firewood was between 0.1–5 km and spending 1–10 hours with most of the households spending a mean of 5 hours collecting cooking fuel. Some of the challenges experienced while collecting firewood include hostility from the host community with refugees been chased, attacks by animals, and bad weather conditions. The evaluation indicated that, if the number of hours used for collecting cooking fuel was reduced by one hour; the cumulative cost of energy fuel for cooking would reduce by USD 0.63–1.33 per month.

Sustainable natural resource management: One of the main drivers of degradation is the demand for wood as fuel and to produce charcoal, which is used by both displaced and local populations. FAO has developed a land and forest resource-use management plan to support energy needs and contribute to food security and nutrition. By curbing firewood demand, clean cooking technologies can reduce environmental degradation and related resource tensions with local communities. Use of quality cooking fuel and utilization of Fuel-Efficient Stoves (FES) would substantially reduce ecosystem cost by USD 2.03 per month per household.

The report considers six recommendations that are needed to help transition refugee communities from the current traditional or just basic improved cooking technologies to the Tier-IV range of technologies in both cooking and lighting in line with Sustainable Development Goal (SDG) 7 targets. The six recommendations are as follows:

Recommendations

01

Building capacity for the development of a market ecosystem to support delivery of energy services This intervention would aim at holistic sector development through the provision of technical advice to various sector actors (government, humanitarian agencies, private sector), advocacy leading to behaviour change and targeted financial assistance. This requires the creation of an enabling environment for the private sector to play a much larger role in delivering energy access in camps. Programmes should also go beyond household energy to support refugees and host communities to take up opportunities for the productive use of energy.

02

Market-based programming and private sector engagement: Traditionally aid agencies have delivered energy goods and services directly through in-kind distributions or service provision. Therefore, to date, the promotion of clean energy in humanitarian settings is largely led by humanitarian and development agencies. While this was at times necessary especially in providing a humanitarian response, there is need for a gradual shift towards facilitation as opposed to provision by development agencies. This implies the need to change to a markets-centred approach that allows for provision by private companies. This would require humanitarian agencies to partner with the private sector to develop programmes and explore innovative funding models to support end-users and enterprises.

03

Scaling up community inclusive market-based solutions: From the data presented in this report, there is still a large population of refugees and IDPs that are yet to receive any form of modern energy services. These households can most effectively be reached through a market-based approach. Development agencies should therefore seek to support alternative delivery options that are locally available and economically, technically and culturally appropriate for the end-users. Furthermore, the focus should be on leveraging already piloted solutions that have been developed through a bottom-up approach taking into account community needs. In the scale up of clean energy solutions in humanitarian contexts, it's however important to be sensitive of the differentiated needs of men and women as well as the most vulnerable (people with disabilities, the elderly, the sick) so that no one is left behind.

04

Multi-sectoral collaboration: Often without a proper institutional home for energy in the humanitarian setting in most countries, there is a strong need for enhanced coordination and collaboration amongst stakeholders to discuss and establish suitable interventions on energy management. This intervention appreciates the different state, non-state, community and global actors in the energy sector. Current policies and interventions often treat water, energy, and food security separately. They are not separate, but rather

inextricably interdependent. Any effort to address sustainability in one of these sectors must begin with the understanding of this interdependence. It is important to seek holistic solutions, aligning interventions with government policy, to achieve clean energy access targets.

05

Community-based solutions-to drive awareness and uptake of clean cooking: The intervention appreciates the role of the community as the consumer of the energy products. The evaluation process identified that "the community has its solutions to energy needs" and thus, their involvement will help establish more resilient communities. With the greatest need being in improving access to cleaner cooking options, there is need for massive sensitization and follow up to accelerate use cleaner technologies and fuels with a focus on the socio-economic benefits of alternative cooking fuels and technologies. In raising awareness on the benefits of improved cooking technologies, it is also important to include awareness raising on efficient cooking practices beyond the stove and fuel.

06

Prioritizing the preservation of the natural environment: This intervention is very critical to create a sustainable natural resource base and related biomass that will ensure long term efficient and quality cooking fuel and related biomass fuels. Innovations, policy guidelines, and integration of natural resource management into programming is needed in a bid to regenerate and build existing natural resources to promote increased awareness, responsibility, and accountability of local natural resources. Key actions include promotion of sustainable charcoal production, alternative fuels such as briquettes, bioethanol, LPG and other improved cooking solutions as well as immediate reforestation efforts. By targeting interventions at the food-energy-water nexus, programming options can improve resilience to climate change, address water scarcity and protect agricultural ecosystem services.

SECTION ONE: SYNTHESIS REPORT

1. Synthesis report

1.1 Background

Access to energy is a basic requirement for decent human lives and livelihoods. Across the world, millions of refugees and displaced people struggle to access safe and sustainable energy services, instead relying on energy resources and technologies that pose high risks to their health and well-being[1] and to the integrity of natural ecosystems. As the global population of displaced people keeps growing, the cumulative health burden and pressure on natural resources also grows.

In humanitarian settings many displaced people – and often the nearby communities that host them – lack access to clean, safe and secure energy services.

In the domestic sphere, energy services enable cooking, heating and lighting; energy is typically used in the provision of clean water; and energy is an enabler of many income-generating activities. However, in humanitarian settings many displaced people – and often the nearby communities that host them – lack access to clean, safe and secure energy services. People living in and around refugee camps and settlements often have little income, and the remote nature of these settings limits access to more modern energy products and services. Inadequate funding for such services is another important reason for this deficit[2].

Energy is considered a crucial component of the physical capital needed to ensure sustainable livelihoods[3] but is often overlooked in humanitarian response interventions in acute emergencies and protracted crises. Only in the recent past has energy become a key topic of discussions in the humanitarian sphere. It is becoming widely accepted that the provision of food aid without addressing recipients' access to a secure and efficient source of energy for cooking and lighting will rapidly result in increased levels of risk for displaced people, as well as leading to deforestation and desertification in the mid to long term. The provision of sustainably sourced fuels coupled with appropriate, efficient and clean energy use technologies, can function as a life-saving intervention. For example, the production of fuel-efficient stoves has been shown to have an important multiplier effect on livelihoods, environment, food security, and nutrition[4].

1 Lahn and Grafham(2015). ***Heat, Light and Power for Refugees Saving Lives, Reducing Costs,*** Chatham House Report for the Moving Energy Initiative

2 Gunning, R.(2014). T***he Current State of Sustainable Energy Provision for Displaced Populations: An Analysis***, Chatham House Research Paper, December 2014,

3 DFID, 1999: ***Sustainable Livelihood Framework***

4 Arnold, K. et al., 2016. ***Energy in Emergency Settings***. Boiling Point, Issue 68, p. 1


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> It is becoming widely accepted that the provision of food aid without addressing recipients' access to a secure and efficient source of energy for cooking and lighting will rapidly result in increased levels of risk for displaced people, as well as leading to deforestation and desertification in the mid to long term

In Eastern Africa, as in other regions, refugees and host communities often depend on insufficient 'in-kind' donations of fuel from humanitarian agencies. The quantities received are typically insufficient to meet all of a household's cooking needs, or to carry out productive activities that require heat. In order to supplement these inadequate donations, refugees often have to travel long distances to collect fuel, exposing themselves to the risk of attack and/or sparking conflict with host communities[5]. Other households end up using what little income they have to purchase traditional fuels for cooking. Direct donations from humanitarian agencies also feature heavily among the routes through which displaced people obtain energy use technologies, such as cookstoves and solar lights. The success of such distribution programmes varies. There is evidence that commercial markets for energy use technologies are growing in importance and reach in humanitarian contexts in the region.

Whilst refugee camps and displacement settings are characterised by energy deprivations, they present an opportunity for private sector companies in the fuel and lighting technology sectors. This sizeable opportunity arises due to the large populations presenting an available market for energy related products and technologies. These populations include the host communities present in affected regions who also benefit from the emerging market for

5 Chatham House, n.d. *Moving Energy Initiative*

energy products. The goal of a market-based approach in the humanitarian setting is to work in existing market systems to support energy access to affordable, quality products and services that are critical to the survival of vulnerable populations[6]. Stakeholders within the humanitarian setting have explored ways of engaging the market before, during and after emergencies to ensure long term development and deliver effective programming[7]. These programme approaches include:

- market-integrated relief (cash transfer/voucher interventions);
- providing support to energy market actors (market chain actors and energy service providers);
- market strengthening and development (value chain programming with the aim of making markets work for the poor and improving livelihoods).

These approaches enable the inclusion and empowerment of refugee and host communities to utilise market opportunities and provide tailor-made solutions to meet local needs.

FAO coordinates its energy-in-emergency work under the Safe Access to Fuel and Energy (SAFE) programme. SAFE interventions contribute to improving the management of natural resources in displacement settings, which is a key priority of the organization's Strategic Objective 5: *Increase the resilience of livelihoods to threats and crises*. SO5 is one of the objectives approved at the 38th Session of FAO Conference in June 2013[8].

The SAFE program (as outlined in FAO strategic programmatic documents[9]) seeks to provide the adequate energy access necessary for people's health, well-being, and livelihoods. Notably, limited access to energy heightens the risks of malnutrition, spoiled food, respiratory diseases, environmental degradation and conflict. Poor energy access results in more people engaging in unsustainable and precarious livelihood activities, such as charcoal making or wood selling, at the expense of other opportunities. Where cooking fuel is collected rather than purchased, it is women and children who usually bear the burden of collecting wood - increasing their workload and the risk of gender-based violence[10].

6 MEI. 2019. *Adopting a Market-based Approach to Boost Energy Access in Displaced Contexts*

7 Oxfam & WFP. 2013. *Executive Brief: Engaging with markets in humanitarian response.*

8 FAO. 2016. *Evaluation of FAO Strategic Objective 5: Increase the resilience of livelihoods to threats and crises.* Office of Evaluation, Thematic evaluation series

9 http://www.fao.org/3/i8012en/I8012EN.pdf; http://www.fao.org/3/CA0021EN/ca0021en.pdf; FAO SAFE briefing notes: nutrition, sustaining peace, resilient livelihoods, disaster risks and climate change, gender and protection, and the water – energy and food nexus

10 IUCN. 2019, *Gender Based Violence and Environmental Linkages*

This evaluation of FAO's energy-in-emergency portfolio in Kenya, Uganda and South Sudan seeks to inform future programming decisions through:

- exploring the energy access situation in humanitarian settings and its intersections with issues surrounding gender, conflict and natural resources;
- identifying results and lessons from past interventions delivered under FAO's SAFE initiative;
- mapping the challenges that affect energy markets in humanitarian contexts;
- developing recommendations for innovative programming options for SAFE in Kenya, Uganda and South Sudan, informed by the findings of the other parts of the study.

People living in and around refugee camps and settlements often have little income, and the remote nature of these settings limits access to more modern energy products and services.

This report is structured into two main parts. Part One consists of six sections. The first section provides an introduction and explains the background and context of the evaluation. The second section introduces the SAFE programme in more detail. Section Three provides an overview of the methodological approach and the scope of the report. The fourth section explores the findings of the evaluation, focusing on key demographic characteristics of target population, the status of energy demand and supply, and the market implications of these factors in humanitarian settings. Section Five presents the general constraints which hinder markets' ability to deliver energy access in the three focus countries. The final section outlines six innovative programming options for improving energy provisioning in humanitarian settings.

Part Two of the report contains the three case studies for Kenya, South Sudan and Uganda which are rich in country-specific data and context analysis.

1.2 Introducing SAFE

Over the last decade, the humanitarian community has increasingly recognized the importance of addressing energy needs in emergencies, especially in cases of forced displacement. Acknowledging the urgent need to address energy use and access in humanitarian settings, the Inter-Agency Standing Committee (IASC) established a Task Force on Safe Access to Firewood and Alternative Energy in 2007. As part of the task force, FAO together with 24 other humanitarian agencies and NGOs worked to develop and implement a coordinated multi-sectoral strategy for cooking fuel in humanitarian settings combining improved technologies, alternative fuels, and livelihood and environmental activities to address energy use and access in humanitarian settings.

Livelihood improvements are reflected through better food security, nutrition and health

FAO's approach to improving resilience and livelihoods through its Safe Access to Fuel and Energy (SAFE) programme comprises of three interlinked pillars:

- Ensuring a sustainable supply of energy, by promoting sustainable natural resource management, sustainable bioenergy production, and the use of alternative and renewable energy sources.
- Addressing energy demand, through the promotion of fuel-saving cooking practices and fuel-efficient technologies for cooking, heating, and livelihood activities.
- Promoting sustainable livelihoods by promoting income-generating activities in both energy- and non-energy sectors as an alternative to selling wood fuel.

The FAO-SAFE project was implemented between 2014 and 2018. The programme supported more than 400 000 individuals in four types of activities: clean cooking, forest management, renewable energy in agri-food chains, and policy support in 14 countries.

2014 and 2018

The programme supported more than **400 000** individuals in four types of activities: clean cooking, forest management, renewable energy in agri-food chains, and policy support in **14 countries.**

FAO's work under SAFE produces a multiplier effect on the livelihoods of its beneficiaries. Livelihood improvements are reflected through better food security, nutrition and health, factors that are in turn linked with the sustainable management of natural resources and also result in greater resilience to climate change and natural hazards. The growing awareness of the importance of including sustainable energy access activities in humanitarian settings promotes environmental management and welfare enhancement within protracted crisis settings. These demonstrated benefits have led to the SAFE programme being incorporated into larger resilience-building projects and programmes to meet the energy needs of the world's most vulnerable populations in refugee/IDP camps and settlements.

The growing awareness of the importance of including sustainable energy access activities in humanitarian settings promotes environmental management and welfare enhancement within protracted crisis settings.

Following the interventions, the monthly income of host community households has increased by **84 percent,** and the income of refugee households by **15 percent.**

This evaluation of the FAO SAFE programme covered three countries, Kenya, Uganda, and South Sudan. The evaluation was undertaken within the SAFE interlinked pillars – ensuring a sustainable energy supply, addressing energy demand and promoting sustainable livelihoods in both energy and non-energy sectors – with FAO's Strategic Objective 5 (SO5: *Increase the resilience of livelihoods to threats and crises*) as its underlying basis. The interventions evaluated through this study all target crisis-affected populations including refugees, internally displaced persons, and their host communities who often have severely constrained access to energy for cooking, heating, lighting and productive activities.

This section looks at the key projects sampled from the FAO SAFE programme that formed the basis of the study. The study areas were identified by the consultants in collaboration with FAO country teams.

1.2.1 SAFE programme in Kenya

In July 2015, FAO carried out a mission to assess the fuel needs and associated risks and challenges faced by women in the Arid and Semi-Arid Lands (ASALs) of Kenya[11]. Recognising the impact of refugee populations on local natural resources, subsequent FAO-led interventions strengthened linkages and supported dialogue between refugee and host communities in Kakuma and Kalobeyei camps (Kenya) with the aim of reducing pressure on natural resources while improving incomes, food security and nutrition.. FAO engaged with host communities to promote the sustainable production of charcoal using improved kilns that reduce the industry's impacts on the environment. FAO provided ten new charcoal producer groups with one steel kiln each, and members were trained on sustainable charcoal production and business management. In total, the project supported more than 400 charcoal producers from the host community to improve their process efficiency, contributing to building resilience. The market model ensured that refugees bought the charcoal produced by the host community, creating new economic linkages between the two communities. Following the interventions, the monthly income of host community households has increased by 84 percent, and the income of refugee households by 15 percent. FAO also provided 8 000 dual-purpose stoves (charcoal and wood) to both refugees and host communities. Women's and youth refugees' exposure to protection risks whilst collecting fuel was significantly reduced[12,13].

11 http://www.fao.org/resilience/multimedia/photos/photo-detail/en/c/384003/

12 FAO (2018). *Building resilience through Safe Access to Fuel and Energy (SAFE).Moving towards a comprehensive SAFE Framework.* Food and Agriculture Organization of the United Nations Rome, 2018

13 FAO (2018).*Safe Access to Fuel and Energy (SAFE) Strengthening resilience of crisis-affected populations*

FAO distributed energy-saving cooking stoves among **700 refugees** and **300 host families** in Uganda's Yumbe district between October 2017 and June 2018.

1.2.2 SAFE programme in Uganda

Uganda currently hosts over 1 million refugees mostly from South Sudan, Burundi and the Democratic Republic of Congo. The refugees live in camps and settlements, among them Bidi Bidi Settlement in Yumbe District, one of the largest refugee settlements in the world. Three refugee settlement areas were included in the evaluation – Palorinya, Imvepi and Omugo.

FAO distributed energy-saving cooking stoves among 700 refugees and 300 host families in Uganda's Yumbe district between October 2017 and June 2018. The severity of the humanitarian crisis in this region, characterised by a large-scale and very rapid influx of refugees, meant that the pressure on the environment exerted by refugees and host families was acute. The adoption of the distributed cookstoves contributed to reducing the pressure on the environment and promoted energy security. FAO has further supported access to energy for displaced and host communities and the minimisation of forest degradation through land and forest management planning. Projects adopting this approach resulted in the establishment of woodlots and two small-scale solar-powered irrigation schemes on host community lands, one in Moyo district and the other in Yumbe[14].

1.2.3 SAFE programme in South Sudan

In 2017, FAO provided **30 000 emergency livelihood kits** which included fuel-efficient stoves to crisis-affected populations in camps, improvised settlements, and host communities in South Sudan.

In 2017, FAO provided 30 000 emergency livelihood kits which included fuel-efficient stoves to crisis-affected populations in camps, improvised settlements, and host communities in South Sudan. FAO also trained households on fuel-saving cooking practices and stove use to ease pressure on natural resources, reduce possible tensions between communities and to help protect women from risks of violence associated with collecting firewood. Efforts are also being made to decrease the pressure on forests and woodlands near to displacement settlements by promoting improved pruning techniques for the selective collection of firewood.

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14 FAO. 2019. T*he State of Food and Agriculture 2019. Moving forward on food loss and waste reduction.* Rome. Licence: CC BY-NC-SA 3.0 IGO

1.3 Related initiatives applying market-based approaches

Within the SAFE programme and related initiatives involving other implementers, the last five years has seen a shift from ad-hoc handouts to projects that develop local markets for energy products and services. The results of these market-based approaches show how better and more coordinated access to energy can reduce energy costs on a long-term basis, kick-start economic activity and transform camp culture from dependency to empowerment and self-reliance. Some programmes applying market-based approaches in the region (as discussed under smart community coalition)[15] include;

The **Moving Energy Initiative** (MEI). This is a partnership between Energy 4 Impact, Practical Action, the Office of the United Nations High Commissioner for Refugees (UNHCR), the Norwegian Refugee Council and Chatham House, with funding from the UK Department for International Development (DFID). The consortium was established in 2015 with the aim of changing how the humanitarian system responds to the issue of energy.

Digital Agents for Energy+. The DAE is a consortium of the Norwegian Refugee Council, the International Trade Centre, Netherlands Development Organisation (SNV), Total Access to Energy, BioLite and Mastercard. The partnership works together to strengthen local small businesses and entrepreneurs working as last mile distribution points for clean energy products in Kakuma Refugee Camp (Kenya). In its operation, the consortium makes use of a digital platform deployed by Mastercard that connects energy suppliers with local youth willing to act as agents for the sale of energy products and services to refugees and host community members. The agents can also provide after-sales services, thus extending the life and impacts of access to affordable and reliable energy.

De-Risking Pay-As-You-Go (PAYGO) Solar Home Systems Grants. The programme involves grants awarded to a three Solar Home Systems companies: Fenix International, BrightLife and SolarNow. The grant programme is designed to enable the partners to sell products in two Ugandan refugee settlements and host communities while keeping product costs at the market rate. Through this intervention, it will be possible to demonstrate the viability of commercial distribution models for off-grid energy products in protracted humanitarian settings.

Rwamwanja Mini-grids and **CE3+.** This is a USAID-supported initiative that is promoting market-based community energy solutions coupled with internet infrastructure and market development and livelihood programs in the Rwamwanja refugee settlement and host community in Uganda.

15 https://nextbillion.net/serving-refugees-mastercard-and-usaid/

1.4 Methodology

1.4.1 Approach

This review of FAO's energy-in-emergency portfolio explored the energy access situation in humanitarian settings and its intersections with issues surrounding gender, conflict and natural resources. Results and lessons from past interventions delivered under FAO's SAFE initiative were recorded through a variety of information-gathering methods. Analysis of these findings was supplemented with further primary research to map the challenges that affect energy markets in humanitarian contexts, and to develop recommendations for innovative programming options for SAFE in Kenya, Uganda and South Sudan[16].

The methodology development, research design and follow-on analysis used key concepts presented in FAO's SAFE Framework to select key focus areas. The three pillars provided a lens through which both energy markets and individuals' experiences could be assessed (supply, demand, livelihoods)[17]. Building research questions around the framework objectives ensured that the evaluation reflected the multisectoral nature of energy access: the status of fuel-efficient stoves and practices; renewable energy and alternative fuels;, livelihood diversification and income-generating activities;, sustainable natural resources and forest management; disaster risk reduction; conflict; and gender. Within these themes, the evaluation explored both qualitative and quantitative indicators in line with the FAO SAFE Framework[18].

In the first phase of the evaluation, the data-gathering methods used were document review, household surveys and key informant interviews. The respondents for the interviews were purposefully selected[19] through stratified random sampling. The second phase involved a validation process conducted through three country-specific webinars through which the consultants engaged with FAO head office and country team staff to discuss key findings and recommendations[20].

16 Bradley, T & Katherine Liakos. K.(2019). *Using Energy Programming to Address Violence Against Women and Girls in Humanitarian Settings*. Moving Energy Initiative

17 http://www.fao.org/energy/emergencies/en/

18 FAO, 2018. *Building resilience through Safe Access to Fuel and Energy (SAFE). Moving towards a comprehensive SAFE Framework*

19 Purposeful sampling is a qualitative research method that seeks to maximize understanding of the phenomenon but does not aim for true statistical representativeness.

20 https://www.ajol.info/index.php/majohe/article/download/90214/79643

1.4.2 Sampling frame

The primary research targeted various types of respondents including:

- households who were direct beneficiaries of SAFE-related interventions (refugees, IDPs and host communities);
- value chain actors in energy market systems;
- non-state actors of relevance to humanitarian energy in the target locations, including programme implementing partners (humanitarian agencies and NGOs);
- state actors, including government agencies relevant to energy-in-emergency.

Among the target group for the household surveys, direct beneficiaries, the target sample size was determined in order to give a confidence interval of 5 percent and a confidence level of 95 percent . Key informant interviews were undertaken to gather information from the other groups, with a sample size selected according to Daniel (1991)[21]. Target and actual sample sizes are presented in Table 1.

Table 1: sampling framework

Method: household surveys	**target group:** direct/nominal beneficiaries		
	Kenya (ke)	Uganda (ug)	South sudan (ss)
Target population	191 500	229 401	45 000
Target sample size	383	384	381
Actual sample size	298	361	198

Method: Focus group discussions	**Target group:** direct beneficiaries		
	Kenya (ke)	Uganda (ug)	South sudan (ss)
Target sample size	2	2	2
Actual sample size	2	2	2

Method: Key informant interviews									
	Target group: state actors			**Target group:** non-state actors			**Target group:** value chain actors		
	Ke	Ug	Ss	Ke	Ug	Ss	Ke	Ug	Ss
Target sample size	3	3	3	4	4	4	6	6	6
Actual sample size	3	3	3	4	3	3	4	3	3

21 Daniel(1991). A Foundation for Analysis in the Health Sciences. Wiley and Sons, New York-Chichester-Brisbane-Toronto-Singapore, 5th Ed.

1.4.3 Data collection and analysis

The review used both qualitative and quantitative data collection methods including:

- **Household interviews:** The interviews were carried out in the selected implementation geographies. The rapid interview targeted direct and indirect individual household beneficiaries. The number of household interviews carried out in Kenya, Uganda, and South Sudan were 298, 361 and 198 respectively.

- **In-depth interviews (Key informant interviews - KII):** These included one-on-one semi-structured[22] interviews conducted with actors in the value chain and various state and non-state actors. The total number of in-depth interviews carried out was 29 across the three countries.

- **Focus group discussions (FGDs):** The focus group discussions targeted direct and indirect beneficiary groups. The FGDs generated qualitative information, including contribution stories providing lessons relating to the different components of the project.

- **Beneficiary impact stories:** To enable the evaluation team to gain a deeper understanding of the impact that projects implemented under the SAFE programme have had on their beneficiaries, we documented impact stories told by a smaller sample of direct

22 Following a scripted but natural-seeming conversation pattern.

beneficiaries. The project beneficiaries from whom impact stories were elicited were selected using purposeful sampling techniques, relying on the existing data available about project beneficiaries as well as the data collected through the household survey. We documented one impact story in each of the target countries, aiming to solicit stories that offered the most in terms of unpacking success factors, challenges and lessons learned. Incorporating impact stories into the assessment aimed to give strength to the beneficiary voice and to embed real individuals' perspectives into evaluation findings. In collecting and documenting the impact stories, the evaluation team employed the Most Significant Change (MSC) approach to understand the changes experienced by beneficiaries and their businesses as a result of the SAFE project, and the subsequent perceived benefit.

- **Observation (OBS):** Participatory observation methods were achieved by interacting with the target beneficiaries and non-beneficiaries and observing the activities they were engaged in at that time. This data was recorded using photographs after acquiring consent from participants.

The data collected through each of these work streams were analysed under the following key themes:

1. Demographic, social and economic characteristics of each regional population
2. Energy use portfolio
3. Energy fuel characteristics
4. Cookstove analytics
5. Energy for lighting characteristics
6. Willingness to pay for alternative cooking fuel, lighting technologies and fuel-efficient stoves.

1.4.4 Econometric analysis

Econometric analysis was used to estimate certain impacts of the SAFE programme among direct beneficiaries. This analysis proposed a relationship between various factors relevant to energy access, household expenditure on energy and the cost of energy. These included inter alia demographic factors namely; the household size, the uptake of clean cooking and the number of years spent in the camp. The factors also included the various uses of energy, gender aspects and natural resource management. The analysis was based on a reduced form expenditure regression model in which the household real expenditure was regressed on the household characteristics and endowments[23],[24]

23 Glewwe, Gragnolati, & Zaman, (2002). Who Gained from Vietnam's Boom in the 1990s?, Economic Development and Cultural Change 50(4):773-92

24 Baye Menjo, F. 2006. "Growth, redistribution and poverty changes in Cameroon: A Shapley decomposition analysis". Journal of African Economies, Vol. 15, No.4.

The regression model is a log-linear form expressed as:

$$\ln(E_{hcg}) = X_{hcg}\beta_g + \eta_g + \varepsilon_{hcg}$$

Where E_{hcg} is the real expenditure for a household h with clean cooking, forest management, renewable energy in agri-food chains in the project c at a location g within the service area. The $1*k$ vector of regressors $X_{hcg}X_{hcg}$ includes a household's characteristics and endowments while β_g is a $k*1$ vector of parameters (returns) expressed in terms of satisfaction and time saved from varying distances from the original main source of energy g. $_g$ is the effects of the region while $_{hcg}$ are the idiosyncratic random error terms which may include unpredictable economic conditions, climatic conditions, government policies, the market factors related to willingness to pay for alternative energy uses, cultures and beliefs of the consumers (among others). The model adds to the number of years households lived in the region as part of household characteristics[25].

In this evaluation, the econometric analysis included expression of the cost of energy on the overall household welfare. This cost was expressed in both direct and indirect costs associated with the acquisition of cook stoves, the market direct and indirect cost of cooking fuel, and lighting technologies.

1.4.5 The market systems approach

The quantitative analysis of survey data (econometric and non-econometric) was complemented by qualitative analysis. The questions in the qualitative analysis were framed using an **energy market systems** approach. It should be noted that energy markets are broadly defined: they involve the exchange of energy-related goods or services between suppliers and customers, but the exchanges do not necessarily need to involve money. Various internal and external factors influence the price and other features of the transaction, including policy and regulation, social norms, access to information and the availability of finance. All but the simplest of energy market systems involve multiple 'actors': those involved in the different stages of value creation and end use, but also those who shape the enabling environment or create barriers to the functioning of the market[26].

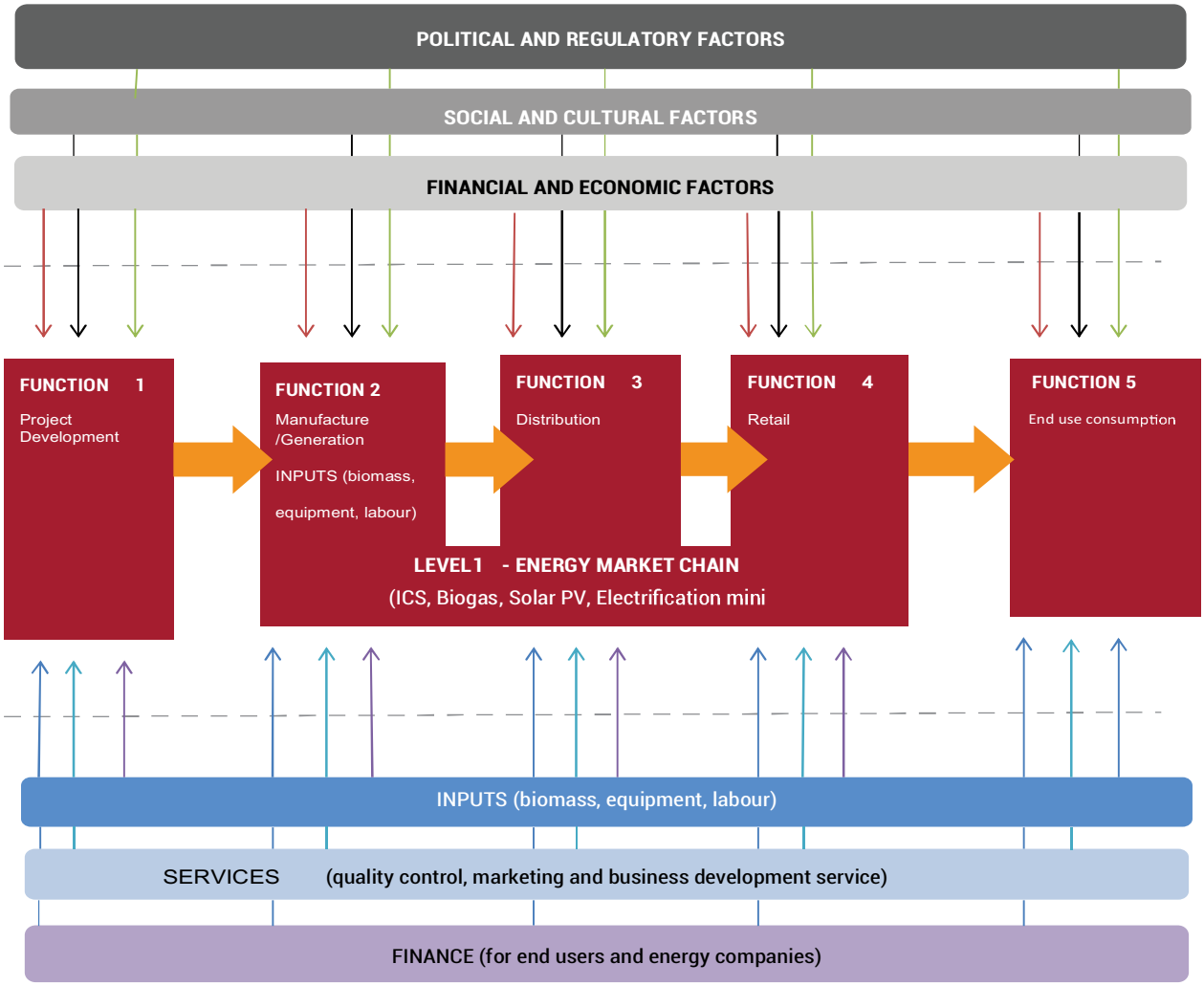
In humanitarian crises, agencies and practitioners can use an understanding of market systems to inform their role in supporting local markets that are failing or underperforming without compromising their future recovery (e.g. by creating parallel competing services). A Market Systems Development Approach (MSDA) that takes into consideration interactions in the market

25 Van de Walle, D. & Gunewardena, D. 2001, Sources of Ethnic inequality in Viet Nam. Journal of Development Economics, 65,177-207. http://dx.doi.org/10.1016/s0304(01)00133-X

26 Whitehouse, K. 2019. *Adopting a Market-based Approach to Boost Energy Access in Displaced Contexts,* Moving Energy Initiative

(demand and supply), as well as the supporting functions and rules related to energy provision in the context of humanitarian setting, was used in the evaluation process[27].

Figure 1: Energy Market System Map



27 Ruffer, T., Bailey,H., Dahlgren, S., Spaven,P., & Winters,M.2018. Evaluation of the market systems development approach Lessons for expanded use and adaptive management at Sida Volume I: Evaluation Report, 2a

The authors of the evaluation used the market map as a framework to explore the challenges that affect energy markets in the target locations and thereafter to develop recommendations for potential support interventions designed to address the problems and blockages identified in the market system.

The market systems framework identifies key features that explain the characteristics of and challenges affecting the existing market system. The evaluation identified 11 key market features that defined an energy market system in the settings targeted by the SAFE programme in East Africa:

1. Income and livelihoods
2. Energy demand
3. Cost and willingness to pay
4. Awareness of and information about energy options
5. Energy supply
6. Distribution models
7. Finance availability
8. Humanitarian approach
9. Policy (national and humanitarian)
10. Gender dynamics
11. Sustainable natural resources management

The analysis also considered the implications for the market if the barriers presented by different features were addressed and possible opportunities enhanced. Specific examples of the characteristics of each market feature and subsequent implications for the market are contained in the country case studies. The key market features are presented in Table 2.

Table 2: Key features of energy access markets

Demand-led market features	Supply-led market features	Supporting function features	Cross-cutting features
Income and livelihoods	Energy supply	Humanitarian approach	Gender dynamics
Energy demand	Distribution models	Policy	Sustainable natural resource management
Cost and willingness to pay	Off-grid financing models		
Awareness and information about energy options			

1.5 Findings

Beginning with an exploration of the implications of demographics and socioeconomic characteristics for energy access in humanitarian settings, this section explores the current energy access situation in the refugee and IDP settlements in Kenya, Uganda, and South Sudan that were studied as part of this evaluation. Research findings help to paint a picture of the demand for energy and the energy services that are currently provided in these settlements. We explore some features of energy access markets in humanitarian settings, implications for gender and conflict issues and the role of natural resource management.

It should be noted that the findings reported in this section apply to the beneficiaries of interventions carried out under the SAFE programme, but are not necessarily representative of the refugee, IDP and host community populations at large.

1.5.1 Understanding target populations

The demographic and socioeconomic characteristics of displaced people are typically different from those of either the original source population or the host community, region or nation[28], [29]. The design of interventions to benefit refugees, internally displaced people and host communities should take account of demographic and socioeconomic information. This is especially true where programmes seek to improve livelihoods.

The household interviews conducted as part of this evaluation gathered data on various demographic and socioeconomic parameters. Analysis of these parameters for different groups (e.g. refugees/IDPs and host communities) provided information relevant to the understanding of past progress and the development of future programming. For example, it was found that the number of household members in each unit determined the overall demand for cooking fuel in the household, but that economies of scale were present.

The households also tended to be larger than national averages: approximately half of households had more than 6 members **(57 percent in Kenya, 42 percent in Uganda, 42 percent in South Sudan)**

Demographic data from the households surveyed in the three countries generally showed high populations of under eighteen within the refugee camps; hence a high dependency ratio. The households also tended to be larger than national averages: approximately half of households had more than 6 members (57 percent in Kenya, 42 percent in Uganda, 42percent in South Sudan).

28 World Bank. 2019. *Informing the Refugee Policy Response in Uganda: Results from the Uganda Refugee and Host Communities 2018 Household Survey World Bank, 2019* 211 http://documents.worldbank.org/curated/en/571081569598919068/Informing-the-Refugee-PolicyResponse-in-Uganda-Results-from-the-Uganda-Refugee-and-Host-Communities-2018-HouseholdSurvey

29 UNHCR-World Bank. 2020. Understanding the Socioeconomic Conditions of Refugees in Kalobeyei, Kenya: Results from the 2018 Kalobeyei Socioeconomic Profiling Survey UNHCR and World Bank, 2020 https://www.unhcr.org/ke/17413-world-bank-and-unhcr-launch-report-on-understanding-thesocioeconomic-conditions-of-refugees-in-kalobeyei-kenya.html

The most common housing type for refugees is "temporary" with **87 percent** of refugees surveyed in Kenya living in temporary housings.

Most households sampled in the study depended on donations, support from relatives, informal employment and/or business activities for their living. Average household income levels for refugees in the camps were estimated to be about USD 150 per month in Kenya, USD 66 per month in Uganda and USD 77 per month in South Sudan. In South Sudan income mostly arose from donations (including cash transfer programmes and support from relatives), followed by income from informal employment, business activities and income from formal employment. The proportion of income from donations was estimated to be 57 percent in Uganda, 41.4 percent in South Sudan and 70 percent in Kenya.

The most common housing type for refugees is "temporary" with 87 percent of refugees surveyed in Kenya living in temporary housings. The proportion was 53 percent in Uganda and 48 per cent in South Sudan, where an approximately equal proportion live in semi-permanent houses. It was also established that a change to a better quality housing; for instance from "temporary" to "semi-permanent" would reduce the monthly cost of energy by USD 6.5 in South Sudan, USD 1.04 in Kenya and USD 3.8 in Uganda. The reduction was explained in terms of the living environment which was enclosed, that led to a reduction in the amount of cooking fuel used. In addition, the change in housing type indicated an improved social status that led to a shift to cleaner more efficient energy products.

Figure 2: number of years spent by refugees in host country

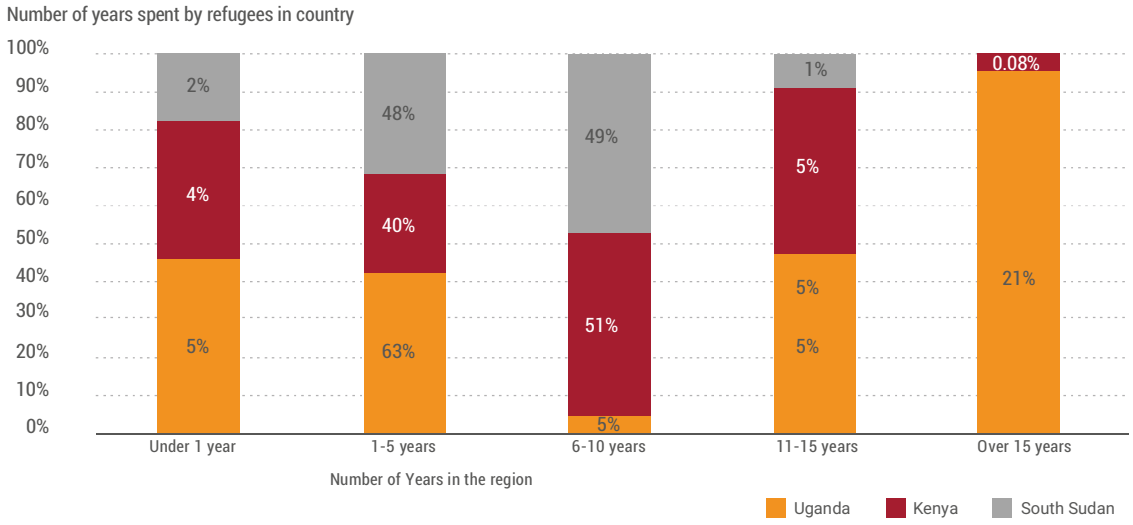
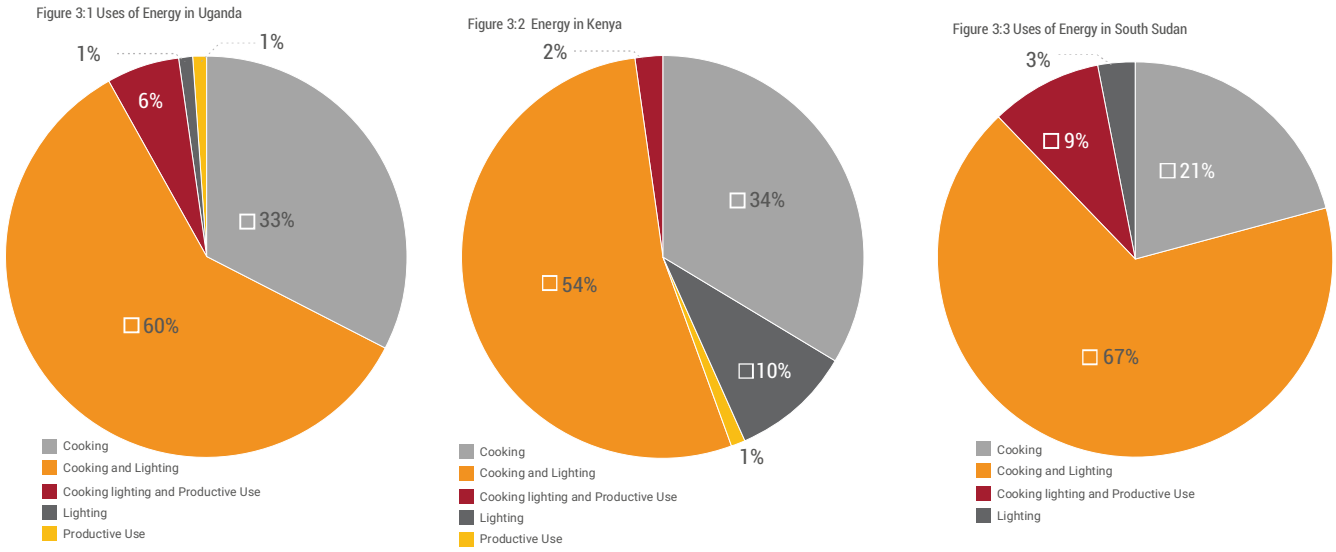


Figure 2 above shows the distribution of the refugees/IDPs in the study's sample according to host country and the length of time that they had lived in the camp. Most (68 percent) of the refugees in Uganda had been in the camp not longer than 5 years. On the other hand 56 percent of the refugees in Kakuma camp in Kenya had been in the camp for 5 years. The duration of stay was found to be a determinant of how people adapt to changes in cooking fuel acquisition, the degree of cookstove improvisation and the uptake of fuel-saving cooking practices. Knowledge of the optimal utilization of available cooking and lighting technologies depends on the period for which the displaced person has lived in the region. Household members with longer periods of stay were more likely to have been able to reduce their energy costs. This was quantified at a monthly cost of USD 0.38-0.56 for Kenya and Uganda and USD 1.00 in South Sudan

1.5.2 Household energy use

Respondents in three countries acknowledged that energy was important in their lives and listed their household energy uses incorporating energy for cooking, lighting and productive use. Respondents prioritized these three or a combination of two or three energy uses as being important in their lives. Across the three counties, cooking and lighting was regarded as the most important energy use by 67percent of the respondents in South Sudan, 60 percent in Uganda and 54 percent in Kenya (Figure 3)

Figure 3: Energy use by application (cooking, lighting and productive use)



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1.5.3 Energy demand in humanitarian settings

1.5.3.1 Cooking fuel use

Refugees and internally displaced people in the three countries generally have limited access to modern cooking solutions. Households rely heavily on biomass as the main source of cooking fuel. Households provided information on their main cooking fuel based on access, affordability and availability among other factors. The amount of cooking fuel used in the refugee camps was dependent on family size; income levels; the number of cooking fuels, frequency of cooking, and cooking appliances used by households. The most commonly used cooking fuel in the three regions was firewood which was the first priority fuel for 62 percent of households in South Sudan, 63 percent in Uganda, and 47 percent in Kenya. Other available cooking fuels included charcoal and briquettes. The study found out that if the households using firewood were to switch to a cleaner fuel, they were likely to reduce the monthly cost of energy by an average of USD 0.12-9.68 within the three countries. A switch to the second choice of cooking fuel which was firewood for South Sudan and charcoal for Kenya and Uganda would also lead to a reduction in the cost of energy in a given household by USD 0.12-31.07 monthly. The reduction was attributed to several factors such as cost of the cooking fuel, access levels and availability among others.

The most commonly used cooking fuel in the three regions was firewood which was the first priority fuel for **62 percent** of households in South Sudan, **63 percent** in Uganda, and **47 percent** in Kenya.

Table 3 reports the fuels chosen by households in the target locations, the factors considered when making cooking fuel choices and the sources of those fuels when they are acquired commercially. Household heads and their spouses were mostly the key decision makers on the type of energy used in the household.

	Kenya	Uganda	South Sudan
Type of fuel	Proportion of households using that fuel		
Firewood	47%	63%	62%
Charcoal	40%	62%	25%
Briquettes	5%	3%	4%
Determinants of choice of fuel	Proportion of households reporting that determinant		
Low cost of fuel	55%	44%	38%
Availability and access	62%	32%	40%
Compatibility with cooking appliance	7%	4%	3%
Quality	59%	31%	37%
Others	8%	5%	3%
Source (if commercially acquired)	Proportion of households obtaining fuel from that source		
Market	58%	44%	42%
Distributors	41%	44%	44%
Community groups	47%	23%	36%

Table 3: Choice, determinants and sources of cooking fuels in Kenya, Uganda and South Sudan

1.5.3.1 Cookstove technologies

Cooking technologies used in the refugee locations in the three countries included the traditional three stone open firs; home-made clay stoves; and commercially-acquired traditional metal stoves, improved metal stoves (with liners) or the fuel-efficient stoves (FES). In Kenya, households preferred to use the dual-purpose stoves and Maendeleo stoves (two types of FES) (20 percent and 53 percent respectively)[30]. However, in South Sudan and Uganda, the majority of refugees and IDPs use a combination of locally-designed and produced metal stoves and three-stone open fires (60 percent of refugees in Uganda and 88 percent of IDPs in South Sudan).

> Results from SAFE
>
> Through the SAFE project, FAO identified several fuel-efficient stove (FES) types which are appropriate for building energy, climate, and livelihood resilience for refugees and host communities. These stoves are specifically designed to reduce fuel consumption per meal and curb smoke emissions from the operation of traditional three-stone fires inside poorly ventilated dwellings. In South Sudan, together with project implementing partners, FAO trained women's groups in the construction of mud stoves using local materials such as clay soil, while in Kenya FAO distributed 8 000 manufactured fuel-efficient stoves.

The evaluation found that the most desired cookstoves were the energy saving stoves (67 percent of respondents). This category included the dual purpose cookstoves which majorly comprised of FAO-distributed stoves (desired by 20 percent of respondents) and Maendeleo type of cookstoves (desired by 53 percent).

Research carried out for the purposes of this evaluation reinforces the findings of other studies[31],[32],[33] that many households use more than one cookstove. Through the econometric analysis of survey data, it was estimated that stove stacking (the use of more than one cookstove) reduced the cost of energy for an average household by a range of USD 0.77-3.4 per month in Kenya and South Sudan but increased by USD 2.62 per month in Uganda. The outcome for each country is largely dependent on the particular stove use combinations that are most prevalent.

30 The preferred type of cooking stove depended on the cost of the stove, availability, and compatibility with cooking fuel among other factors for the three counties.

31 ADP [Accenture Development Partnerships]. 2012. *East Africa Regional Market Assessment*. Washington, DC: Global Alliance for Clean Cookstoves. Accessed 26 April 2019.

32 UEI-PDF & Practical Action. 2015. Building Energy Access Markets: A Value Chain Analysis of Key Energy Market Systems. Eschborn: EUEI-PDF. Accessed 26 April 2019.

33 Barbieri, J., Riva, F., & Colombo, E. 2017. Cooking in refugee camps and informal settlements: A review of available technologies and impacts on the socio-economic and environmental perspective. Sustainable Energy Technologies and Assessments.

The most commonly-used points of purchase in the market systems that were outlined by respondents include **local distributors (used by 42 percent), local market centres (used by 34 percent), retailers (40 percent) and community groups (47 percent).**

Households reported their reasons for purchasing alternative cookstoves as follows:

- the household needed a new cookstove
- the household needed a a cookstove that would both cook faster and was easy to use
- the household needed a cookstove with low levels of pollution (emissions) and also cooked faster
- the household required a fuel-efficient cookstove.

The ability to acquire the different types of cookstoves through different means (purchase, donations, borrowing from neighbours, making etc.) was a factor that led to stove stacking. The most commonly-used points of purchase in the market systems that were outlined by respondents include local distributors (used by 42 percent), local market centres (used by 34%), retailers (40 percent) and community groups (47 percent).

Our field research found that many households favour dual-purpose stoves largely due to their ability to use multiple fuels. The information guiding the stove use that was provided during the acquisition of the cookstoves influenced households' perception of the quality of the cookstove. Further, provision of stove use information also influenced fuel use and ultimately the cost of energy incurred by the household.

> Results from SAFE
>
> FAO distributed 8 000 dual-purpose stoves in Kakuma and Kalobeyei refugee camps in Kenya, and provided training to users that resulted in reduced energy costs. It is estimated that household expenditure on energy reduced by between USD 0.25 and 1.51 per month as a result of the training. The uptake of some form of improved cookstove already meant that household energy costs were USD 5 to 10 lower.

1.5.3.3 Energy for lighting

Lighting is an integral part of household survival in the camps. Surveys carried out as part of this evaluation found that all households living in the refugee camps in the three countries had at least one source of lighting. It was also evident that, use of more than one type of lighting technology was prevalent in the three countries; where use of more than one source of lighting technology in Uganda was estimated at 22.9 percent; 74 percent in Kenya and 16.9 percent in South Sudan. The commonly used lighting technologies in South Sudan was tin lamps(47 percent) while Pico solar lanterns were mostly used in Kenya and Uganda by 48 percent and 47.2 percent respectively. Households reported having received most of the lighting devices from the

UNHCR or other organizations, with less than 15 percent having purchased their lighting systems themselves.

1.5.3.4 Productive uses of energy (PUE)

Productive use of energy in humanitarian settings is still limited to basic activities like cooking in local eateries, brewing and phone charging. There is scope to broaden this to be a livelihood opportunity for refugees and host communities through the promotion of energy literacy, strengthening the supply of PUE equipment, and supporting appliance financing.

The evaluation found that only about 13 percent of the households in the refugee camps (13 percent in Kenya, 12 percent in Uganda and 24.4 percent in South Sudan) used cooking fuel for productive purposes. Some of the activities included making bread, cake, buns and traditional liquor. The estimated income from these activities was between USD 38 and USD 200 per month per enterprise.

Refugees and communities are open to exploring new businesses and livelihood opportunities, particularly in the agriculture and natural resources sectors. They are looking not only for finance but also for skills, training and access to markets. It is therefore recommended that programme implementers develop customized approaches and tools for productive use of energy based on different contexts.

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1.6. Energy supply in humanitarian settings

1.6.1. Supply of fuel

The supply of fuel was found to vary in the three countries. For instance, in the Kakuma refugee camp, the supply of firewood was mainly coordinated by humanitarian agencies. Since the firewood rations were only sufficient to last a refugee household for a few days, recipients resorted to either cash or barter trade in firewood or travelled long distances to collect fuel - exposing themselves to the risk of attack and/or sparking conflict with host communities. In Uganda and South Sudan, refugees and IDPs sourced their firewood from diversified sources. The ways through which households funded the purchase of fuel by households was dependent on the type of energy and household income levels.

In all three countries, refugees and host communities engage in the trade of fuel within the camp settings. Charcoal is the most commonly traded cooking fuel. For instance, in the Kakuma refugee camp (Kenya), an earlier report by Practical Action[34] indicated that the charcoal trade has an annual value of

34 MEI: Prices, products and priorities.

USD 2 million. The charcoal trade in Kakuma is run exclusively by the host community. In Uganda, trade for charcoal is also led by the host community in the Arua and Moyo regions. However, the internally displaced people in the South Sudanese locations are sometimes able to produce their own charcoal. Where this is not possible, charcoal is purchased from the market in the host community of Nimule.

> Results from SAFE
>
> In Kakuma refugee camp in Kenya, FAO supported the host community to improve the sustainability and profitability of charcoal production as well as the development of a value chain for its distribution.

Firewood is also a traded commodity, in especially in the Kakuma camp where firewood is increasingly scarce due to continued degradation and overexploitation of the local wooded area. Refugees also exchange donated food rations for firewood as the UNHCR firewood rations are not usually enough to sustain a household. As with charcoal, the market for firewood in the Ugandan locations is also led by the host community. In South Sudan, IDP households can normally freely collect firewood from the nearby forest, but in periods when this is not possible it is purchased from a host community market.

Other traded fuels include briquettes, kerosene, and bioethanol, although the total quantities involved are much smaller (as reported by research carried out in Kakuma).

1.6.2. Supply of cookstoves

Most of the refugees and internally displaced people surveyed received their cookstoves for "free" from UNHCR, FAO and other partners. Some households also made their own cookstoves. The "free" cookstoves received by households were often associated with poor utilization. Our modelling shows that this non-utilization of stoves has an inherent economic cost for an average household of USD 0.16 per month.

> Results from SAFE
>
> Between October 2017 and June 2018, FAO distributed energy-saving cooking stoves to 700 refugee and 300 host families in Uganda. These cookstoves contributed to reducing the pressure exerted on the environment by both groups and promoting energy security.
>
> In South Sudan, FAO distributed over 30 000 fuel-efficient stoves in camps, improvised settlements, and host communities in Bentiu, Malakal, Melut, Nimule, Mingkaman, and Lainya.

In Kenya, FAO also provided 8 000 dual-purpose stoves (charcoal and wood) to both refugee and host communities. It was reported that this stove had a maximum longevity of 3-5 years; thereafter, households tended to purchase new cookstoves according to cost relative to their available resources. The purchased cookstoves were sourced from retailers, distributors and the open market, or via community groups.

Recent years have seen the emergence of a new generation of clean cookstoves that are available on a commercial basis. Examples from a number of cookstove companies are beginning to find their way into refugee camps, especially in Kenya and Uganda

1.6.3. Lighting and electricity supply

Among the households surveyed, various lighting technologies were in use - mostly solar lamps. These devices were either provided by UNHCR or its partners or purchased by households. In some instances, especially among the poorest households, firewood was used for lighting. The acquisition of clean lighting technologies comes at a cost born either by households and/or humanitarian agencies.

Supply of clean lighting devices cannot always keep up with demand. Households reported instances of stock-outs for various energy technologies and fuels. These stock-outs are likely to increase the household cost of energy by USD 0.93 per month (relative to the situation within a fully-functioning market) while households resort to alternative options.

In the refugee camps, UNHCR supplied electricity to other humanitarian agencies within the camp, mainly through operating diesel-powered generators. Diesel-powered mini-grids supplying power for productive use to households were also reported. For instance, in Kakuma I one of the largest informal diesel mini-grid owners supplies power to approximately 100 businesses and 20 households from an 85 kW generating set. This electricity supply is provided for a monthly fee of USD 30 for entertainment businesses, USD 30 to 40 for small business services such as printers and USD 50 for businesses powering a refrigerator.

Several Pay as You Go (PAYGO) solar companies that have begun to establish themselves in refugee camps, offering a range of solar home system packages. Mini-grid companies are also targeting refugee settlements as a viable market due to the dense nature of settlements that tends to reduce the cost of distribution.

1.7 Market-based approaches

The evaluation noted that there was a ready market in Uganda and South Sudan for FES and alternative cooking fuels. In Kenya on the other hand, the potential may be said to be lower because the market-based approach is already being applied, and therefore the unserved market might be smaller. Generally, there is a need for scaling-up of the market for energy technologies in the Eastern Africa region: demand and willingness to pay for modern energy technologies is growing and new market players are expanding their reach with innovative products, financing and distribution models to help humanitarian populations and host communities to transition to cleaner and more sustainable energy options.

The private sector is increasingly playing a key role in the delivery of modern energy services within humanitarian settings. It is now recognized that refugee markets that have previously often been seen as temporary are now an integral part of local economies. Cookstove companies, PAYGO solar providers and mini-grid installers are increasingly beginning to establish themselves in or near refugee settlements.

Willingness to pay is a critical element in the development of a market system. Figure 4 reports the proportion of survey respondents in each country that were willing to pay for different as represented by 68.7 percent of respondents in Uganda, 61.5 percent in Kenya and 71 percent in South Sudan. Among the lighting technologies, pico solar lanterns and solar home systems were the most preferred.

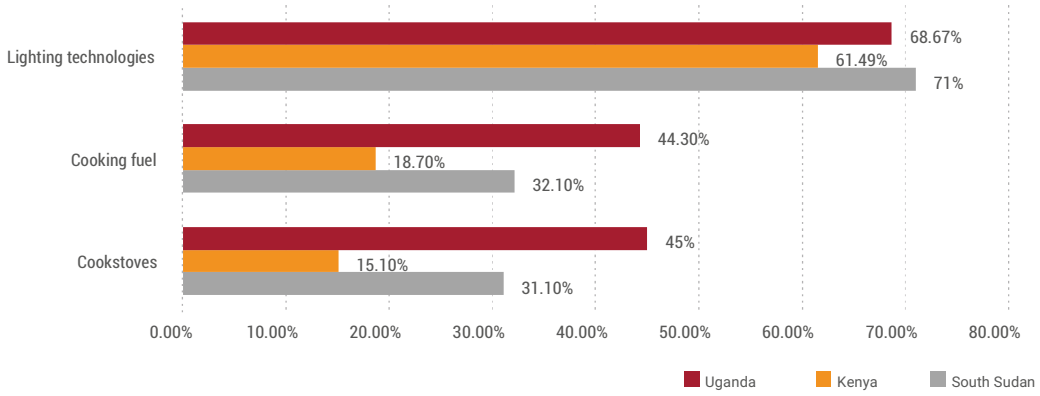

Figure 4: Willingness to pay for energy services

The increasing participation of the private sector in the provision of energy technologies and fuels has opened new opportunities for promoting market-led approaches in energy service provision. This is likely to increase adoption and willingness to pay for clean energy by households in the refugee/IDP regions, and ultimately will deliver better and more widespread access to energy in Kenya, Uganda and South Sudan. Creating a market-based approach for cleaner cooking solutions requires enabling environments for the private sector to play a major role in delivering alternative clean cooking solutions which has in the past been largely provided by the development agencies. The market-based approaches are elaborated in the country reports.

1.8 Gender and conflict in energy access

The evaluation assessed the time and distance taken by women and children in the collection of fuel. It was found that that women and children were forced to walk long distances in insecure environments to gather fuel for cooking and lighting. As environments become degraded and natural resources become more scarce the problem of access to firewood increases. The distance travelled by households to collect cooking fuel can be significant, ranging between 1 km and 5 km for many individuals. For females engaged in fuel collection, the distance travelled and location covered determined the extent of vulnerability to gender-based violence.

	South Sudan	Kenya	Uganda
less than 1 km	60.30%	59.40%	30.40%
between 1-3 km	20.60%	31.50%	27.90%
between 3-5 km	15.10%	7.40%	28.20%
over 5 km	4%	1.70%	13.50%

Table 4: Distance travelled to collect cooking fuel

The distance travelled and the number of hours spent while collecting firewood was taken into consideration in the econometric model to determine the overall cost of energy. In most cases, the distance travelled was between 0.1 and 5 km. Households spent a mean of 5 hours collecting cooking fuel in a given day when cooking fuel was collected, but some spent as many as 10 hours.

The evaluation found out that if the time used for collecting cooking fuel was reduced by one hour, the economic cost of energy for cooking would reduce by USD 0.63 to 1.33 per month per household. In addition, if the distance covered in collecting cooking fuel is reduced by 1 km, there would be an increase in the cumulative cost of energy by USD 0.12 to 2.14 per month reflecting some levels of inefficiency that resulted from relaxation by household members during collection of cooking fuel; hence more time used as compared to when the distance travelled to collect cooking fuel was longer (as firewood is perceived to be fairly easy to obtain).

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Competition between locals and refugees for scarce resources (wood fuel, animal fodder and water) can easily result in conflict and resentment. Where there was a shortage of natural resources, friction between displaced people and host communities was prevalent and firewood collection was a dangerous endeavour. Households in the Imvepi region reported being attacked by animals and bad weather conditions respectively. Other risks experienced while refugees collected firewood included attacks by members of the host community. When attacks are experienced, our analysis estimated that the monthly cost of energy is likely to have increased by USD 1.57 due to the “cost of fear” (that is, households will opt to buy more expensive charcoal than travel to collect firewood. However, when there are no attacks among the household, the household cost of energy would reduce by an estimated USD 0.94 to 2.94 monthly

1.9 Sustainable natural resources and forest management

ecosystem loss due to refugee settlement was estimated at **USD 90.7 million** for 2016/17, constituting about **28 percent** of the total public cost of refugee protection and management

The increased demand and use of firewood for cooking and productive uses threatens existing natural resources including forest cover, water flows and food security (as a consequence of soil erosion). Due to a high refugee population density in settlements and surrounding areas, environmental degradation has become a matter of significant concern with minimal or no action to reverse the degradation. For instance, studies undertaken in Uganda found that the ecosystem loss due to refugee settlement was estimated at USD 90.7 million for 2016/17, constituting about 28 percent of the total public cost of refugee protection and management[35],[36]. The contributing factors to ecosystem loss include land degradation, deforestation, loss of vegetation cover, and water contamination among others. The need to conserve the environment and enhance sustainable forest management has been judged to be critical given the increasing number of refugees[37].

From the evaluation carried out in the three countries, it was evident that there was little being done in terms of advocacy on climate change and environmental management issues, and consequently there is correspondingly poor implementation of measures to address climate and environmental concerns through managing utilization of cooking fuel. This was demonstrated through the high dominance of wood fuel in the energy mix for cooking and productive activities. During the evaluation, households in the refugee camps expressed their concern about the effect of fuel use on the environment. Despite the low action on environmental impact and emerging climate change effects, the community expressed their willingness to engage in climate change adaptation activities if involved but they also wanted to see an immediate livelihood benefit during engagement.

Results from SAFE

To address forest degradation and deforestation, FAO is implementing a project in Kakuma (Kenya), engaging with host communities to promote the sustainable production of charcoal using improved kilns that use small branches from Acacia trees and invasive species as a feedstock.

35 UNHCR. 2017. *Livelihoods socio-economic assessment in the refugee hosting districts.*

36 GoU & UNHCR. 2017. Uganda: 2017 Refugee Humanitarian Needs Overview

37 Moretti, M.; Djomo, S.N.; Azadi, H.; May, K.; De Vos, K.; Van Passel, S.; Witters, N. A systematic review of environmental and economic impacts of smart grids. Renew. Sustain. Energy Rev. 2017. 68, 888–898.

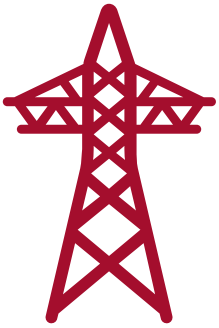
In Uganda, under the UNHCR project on "Understanding Forest Resource-Use Drivers And Economic Implications In Refugee-Hosting Areas of North Uganda", 4 081 ha of energy woodlots have been established and 12 554 ha have been restored.

In South Sudan, FAO is supporting in the advancement of technical approaches in capacity development, monitoring forest cover and working with the government in development of policy and advancement of practices relating to land use sector. This is in addition to FAO's work at the community though distribution of fuel-efficient stoves aimed at reducing natural resource depletion in forests in South Sudan.

It was also noted that, in Kenya, the national policy on the protection of indigenous tree cover has increased the use of "exotic trees" hence providing an environmentally friendly forest cover for the community, both the host and refugee community. At some point, national and county levels policies were adopted by the refugee settlement regions to manage the natural resources whose depletion is increasing by the day[38].

1.10 Energy-Water-Food Nexus

The nexus approach is gaining ground in terms of awareness worldwide. However in some contexts including the humanitarian sector, practical knowledge is still at its early stages. The relevance of the nexus approach in the context of this evaluation is difficult to tell due to limited information that was available during the evaluation process and it was also not directly in the scope of the evaluation. In particular the evaluation did not identify any major areas of energy use in food and water production, however, this is not to say that the scope is not there. While the three country contexts are different socio economically and agro ecologically, there are obvious energy needs in the agriculture and related sectors to support activities such as grain milling, food preservation and drying among others. In Uganda, refugees engage more in agricultural activities relative to the other two countries due to the conducive policy on integrating refugees in the local economy. Electricity access in the country still stands at 28 percent and thus obviously limiting its availability to support productive activities especially in the off grid areas. In Kakuma refugee camp, there are a number of mini grid electricity suppliers but cost of electricity is high and therefore it serves as a disincentive for productive use.



Electricity access in Uganda still stands at **28 percent** and thus obviously limiting its availability to support productive activities especially in the off grid areas.

38 UNHCR. 2015. *Safe Access to Fuel and Energy. A UNHCR Strategy and Plan of Action for Refugee Operations in Kenya*, 2015-2018.

Generally there is limited understanding in the agricultural sector on how the energy system works and vice versa because this information is not readily available. Humanitarian agencies with discrete responsibilities – such as water, agriculture, NRM etc. – should therefore work more closely together to address nexus inter-linkages. A coordinating "nexus committee" would ensure that nexus-related constraints and opportunities are collectively defined together with private sector entities and relevant civil society and resource user groups (such as water user associations, forest committees, and framer groups. This will help find the connection points between the value chain needs and the energy offers as well as to identify where and how these can combine to generate positive financial, social and environmental outcomes.

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2. Challenges affecting energy markets in the humanitarian setting

This section looks at the general constraints and challenges to energy access in the three countries covered by the study. This was largely informed by qualitative research and literature review. The analysis identified five key constraints whose intensity and impact varies from country to country but which are universally present. The development of new programming must take account of, or directly address, these constraints and challenges.

Figure 5: General constraints to access to energy in the target locations

1. Affordability

Purchasing power among refugees remains low given limited household incomes and low economic development

2. Limited access to quality alternative energy product

86 per cent of the household in Kakuma 1 rank as Tier 0 or Tier 1 (out of six tiers) for cooking and lighting signifying a service deficit and a failure to meet basic levels of energy access commensurate with a healthy and productive life.

The residents of Kakuma 1 spend over USD 1.5 million a year on poor-quality and harmful energy supplies

3. Market distortion

Often, NGOs have distributed energy products in-kind, creating dependencies and reducing commercial market opportunities

4. Limited market knowledge

Limited market awareness by private sector on opportunities for alternative energy

Insufficient market intel leads to low interest and risk appetite by private sector to make long term investments

5. Competition for limited biomass resources

Competition among host communities and refugees resulting to conflict over limited biomass resources and trade for fuel

2.1 Affordability

Although the transition from material aid support for refugees to cash-based transfers will allow for more efficient spending decisions, the affordability of modern energy solutions, especially when they are not paired adequate supporting financing mechanisms, remains a major barrier to their uptake.

Low incomes, low economic development

Purchasing power among refugees remains low. Meeting basic cooking, lighting and phone-charging needs is costly for households in the camps, consuming a significant share of stretched monthly budgets. Most refugee and host community households survive on very low levels of income, with the majority living off monthly incomes of less than USD 10. These households are left with very little disposable income which can be spent on anything beyond bare household necessities. A large part of the refugee population barters their handout provisions to be able to purchase items of choice or items they need more pressingly. Although the transition from material aid support for refugees to cash-based transfers will allow for more efficient spending decisions, the affordability of modern energy solutions, especially when they are not paired adequate supporting financing mechanisms, remains a major barrier to their uptake.

2.2 Limited access to quality clean energy products

Supply chain limitations

Many families receive energy products upon arrival at the camps or through subsequent handouts. Priority is not normally given to establishing local production capacity for improved cooking technologies, especially not at the scale called for to serve the market needs of displaced settlements. Most improved cookstove suppliers are based in and around the major cities and rely on sourcing their products or parts from outside of the country. Other cleaner energy alternatives such as LPG and bioethanol were generally found to be expensive tow purchase and difficult to transport due to a lack of infrastructure and the absence of distribution networks.

By contrast, solar lantern penetration is fairly high, especially in Uganda and Kenya. Furthermore, several Pay as You Go companies offering solar lighting products have established a presence in the camps. However, these only serve a small minority of refugees and host communities. It was also reported that some of the imported energy products, although innovative and advanced, often fail to sustain themselves in local contexts or, worse still, break down and users are not able to fix or replace them.

2.3 Market distortion

Impaired commercial market development

There are multiple agencies within refugee communities providing cooking and lighting energy interventions to the most vulnerable part of the population. For instance, in Bidi Bidi camp in Uganda, data collected by

A large population **(78 percent)** of refugees and host communities that are yet to receive any form of modern cooking solution, although some of this group may have purchased products themselves or received them through other channels

Practical Action found that 22 percent of the population had a donated cookstove, and a total of 17 organizations[39] have distributed cookstoves in the settlement at one time or another. These handouts have mainly prioritized vulnerable households due to limitations on individual organizations' funding for such interventions. In practice, due to lack of coordination on clean cooking interventions among the various organizations, vulnerable households often ended up receiving multiple cookstoves, whilst non-vulnerable households received none. This means that there is still a large population (78 percent) of refugees and host communities that are yet to receive any form of modern cooking solution, although some of this group may have purchased products themselves or received them through other channels

It is financially difficult and unsustainable in the long-term to supply a large portion of the population with modern energy solutions through handouts. A market-based approach needs to be introduced to allow technically and culturally appropriate solutions to reach households in need. Product distribution needs to be accompanied by after-sales support. Such an approach is likely to deliver higher rates of ownership of modern cooking solutions.

2.4 Limited market knowledge

Demand-side and supply-side gaps

In all of the three country case studies, firewood emerged as the most frequently used fuel followed by charcoal. A negligible proportion of refugees used briquettes or other cooking options. Qualitative analysis of data gathered through interviews with stakeholders revealed that uptake of other technologies was low due to the majority of consumers' perception of biomass being a free resource; for many, the notion of paying for an alternative fuel such as briquettes was not logical. Many households have never had to buy a cookstove. In addition, the gendered nature of cooking leads to men not being involved in the direct effort and risks women undertake to source enough firewood to produce a meal. Subsequently, investments in improved technologies are viewed as being unnecessary by men who are in charge of household finances but who are not involved in cooking and the sourcing of cooking fuel.

39 These organizations include: ADRA, Save the Children, Catholic Relief Services (CRS), Oxfam, Mercy Corps, CARE, DanChurchAid (DCA), Peace Wind, Danish Refugee Council (DRC), World Vision, United Nations High Commissioner for Refugees (UNHCR), ARC, IRC, Red Cross, Caritas, NRC, and CEFORD.

There is generally a slightly higher level of awareness of lighting technologies, which have been promoted more aggressively in refugee settlements and host communities.

On the supply side, some companies who would be interested to enter into humanitarian markets report that they have limited understanding of consumer tastes, preferences, and purchasing power in these locations. This lack of knowledge has geography at its origin, with such companies for the most part being based in bigger towns away from camps. Awareness gaps are also exacerbated by the entry restrictions imposed on the camps by the government, which discourages companies seeking to enter those markets.

Given the increasing refugee population in this Eastern Africa, there is an urgent need to plan and implement environmental management interventions in order to protect the existing forests and other woodlands and to support the energy and more broadly food, nutrition and livelihood needs of refugees and host communities

2.5 Competition for limited biomass resources

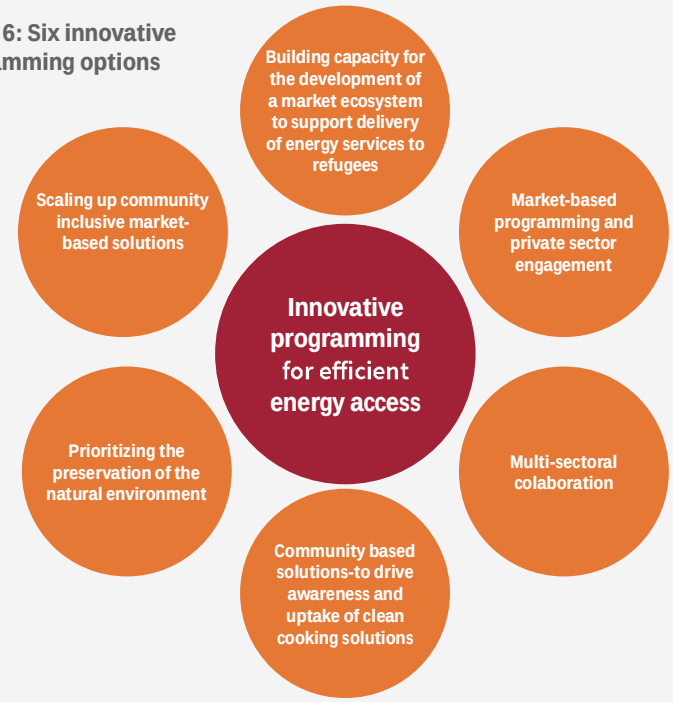
The need for environmental management

There is an ever-growing need for natural resources to sustain refugee and host populations especially biomass for cooking. This creates a high risk of environmental degradation and long-term economic and social losses. Given the increasing refugee population in this Eastern Africa, there is an urgent need to plan and implement environmental management interventions (including but not limited to rehabilitation, restoration and afforestation/ reforestation) in order to protect the existing forests and other woodlands and to support the energy and more broadly food, nutrition and livelihood needs of refugees and host communities. Cooking energy is a major drain on biomass resources in humanitarian settings. Refugees obtain firewood in various ways: receiving it as a fuel ration, collecting it from the area surrounding the camp, buying it on the local market, and trading food rations for it. In the case of Kakuma, firewood collection around the camp is prohibited, though widely practiced as a strategy for families to reduce fuel expenditure. It is a time-consuming activity that increases residents' vulnerability to assault. Women and children are particularly at risk, as they do most of the fuel collection work.

3. Innovative programming options

The analysis of data from primary research, the application of the market systems framework and the undertaking of collaborative workshop webinars with FAO staff resulted in the identification of six options that could be built into innovative programming for energy access within the refugee settings in Kenya, Uganda and South Sudan. These six interventions are generally applicable in all three focus countries and could be deployed as sort of standard operating procedures to guide FAO's humanitarian energy programming. However, these options still need to be contextualized at country level. The six options are shown in Figure 6.

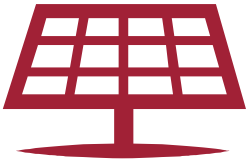
Figure 6: Six innovative programming options



3.1 Building capacity for the development of a market ecosystem to support the delivery of energy services to refugees

This intervention aims at holistic sector development through the provision of technical advice to various sector actors (government, humanitarian agencies, private sector), advocacy leading to behaviour change and financial assistance. Capacity building is needed to facilitate understanding of the Total Energy Needs for refugees and host communities and the least cost options for meeting those needs. This includes energy for domestic, community services and productive use. It also includes cooking and lighting. An enabling environment for doing business could be promoted through capacity-building of the private sector for the development innovative business models for the humanitarian market.

Through this intervention, it should be possible to help each country to develop a framework to transition refugees from the current basic improved cooking technologies to clean (Tier 4+ technologies such as LPG and bioethanol) technologies and electric lighting based on specific country contexts and opportunities. Programmes can also support refugees and host communities to take up opportunities for the productive use of energy. The result would be to increase the uptake of assets needed to drive market activity and development while increasing household income.



Kenya's off grid energy market is relatively more developed than is the case in Uganda or South Sudan, and the same applies to humanitarian energy markets

Kenya's off grid energy market is relatively more developed than is the case in Uganda or South Sudan, and the same applies to humanitarian energy markets. Past interventions in Kenya's Kakuma camp complex, for instance, offer a number of lessons on how the local energy market system in a humanitarian context can be developed to improve energy access. For example, in delivering projects under the Moving Energy Initiative in Kakuma, Energy 4 Impact (E4I) partnered with other aid agencies to jointly market energy products and services and to deliver other supporting functions, e.g. training and credit facilities for local retailers. These interventions were delivered through a combination of direct and indirect support – E4I would either temporarily perform the function itself (e.g. delivering activities to strengthen the skills of businesses operating in the camps), or finance other actors to perform that function[40].

3.2 Market-based programming and private sector engagement

To date, the promotion of clean energy in humanitarian settings has largely been led by humanitarian and development agencies. While this was at times necessary - especially in providing a humanitarian response - there is need for a gradual shift towards facilitation as opposed to provision by development agencies. This implies the need to change to a markets-centred approach that allows for provision by private companies. In a market-based approach, aid agencies identify and support opportunities to leverage local markets to deliver goods and services. De-risking the process of expanding into humanitarian situations will facilitate the private sector to deliver enhanced energy access, particularly in contexts where household incomes are unstable. This would require humanitarian agencies to partner with the private sector to develop programmes and explore innovative funding models to support end-users and enterprises. Such approaches would ensure that accountability for the acceptance and performance of energy interventions lies with local providers and implementers.

40 MEI. *Products, prices and Priorities*

The Moving Energy Initiative provides an example of the benefits of private sector engagement. In Kakuma camp in Kenya, engagement with the private sector for the development of cooking fuel distribution infrastructure has led to a reduction in costs and is supporting a gradual transition away from subsidies. Thanks to the facilitation of larger, longer-term investments by the private sector, nearly 30 000 of the camp's 180 000 refugees can now access clean energy.

To attract the private sector in the delivery of clean energy solutions in humanitarian settings the following steps are proposed:

- Demonstration of the energy market need and potential, in displaced settings and their host communities, to the business community
- Providing private sector companies with access to market intelligence - such as this report - and creating dialogue for partnerships in market-based intervention approaches
- Piloting and facilitating interventions to prove various business models
- Providing responsible financing options to support entry into the market, such as appropriate subsidisation, results-based financing and access to climate funds and challenge funds.

3.3 Scaling up community inclusive market-based solutions

From the data presented in this report, there is still a large population of refugees and IDPs that are yet to receive any form of modern energy services. These households can most effectively be reached through a market-based approach. Development agencies should therefore seek to support alternative delivery options that are locally available and economically, technically and culturally appropriate for the end-users. Furthermore the focus should be on leveraging already piloted solutions that have been developed through a bottom-up approach taking into account community needs. Such approaches would ensure that accountability for the acceptance and performance of energy interventions lies with local providers and implementers. In the scale up of clean energy solutions in humanitarian contexts, it's also important to be sensitive of the differentiated needs of men and women as well as the most vulnerable (people with disabilities, the elderly, the sick) so that no one is left behind.

The private sector needs to be supported to enter the markets and through appropriate financing schemes so as to enable them to price their products at an affordable price. For example in the case of Uganda already the Improved

Lorena mud-stoves have a high degree of user acceptance and have been taken up by a large portion of the refugee population that received training on how to build such stoves. Skilled builders should be supported to train others on building such stoves with readily available material, and sensitise others on the benefits of improved cooking solutions.

Since the refugee population in the three countries is still overwhelmingly cooking on solid biomass, with little experience with alternative fuels such as biogas, LPG, ethanol or others, cooking solutions should, in the immediate term include improved solid biomass cook stoves. These fuels are more readily available and acceptable to the communities and improved biomass cook stoves can assist in halting the speed of current environmental degradation. Not dismissing other alternatives, and in planning for the medium term, other alternative cooking fuels can be piloted and tested for user acceptability. Interventions should furthermore be developed inclusively with the community and be preceded by behavioural change campaigns to ensure uptake and sustainability. This will address cook stove stacking and shift users to use sustainable cooking energy solution(s) wholly. The development agencies could support the local community through training and income generating activities associated with modern cooking interventions.

3.4 Multi-sectoral collaboration

Often without a proper institutional home for energy in the humanitarian setting in most countries, there is a strong need for enhanced coordination and collaboration amongst stakeholders to discuss and establish suitable interventions on energy management. To avoid duplication of efforts and any market distortive interventions, and to ensure efficiencies, there is need to rethink past energy-related delivery models and move towards sustainability anchored on community participation. One way this could be achieved is through information sharing among stakeholders to facilitate scaling up of successful delivery approaches.

Moreover, energy and environment should be mainstreamed in the messaging of all development agencies operating humanitarian settings. Beyond this, it is also important for all stakeholders to understand their programmes' direct and indirect links to cooking energy efficiency, and that cooking energy has implications on health, nutrition, environment, safety, livelihoods and potential for conflict between refugee and host communities. For example, food aid agencies should look to distribute specific types of beans that require shorter cooking times whilst ensuring the needed nutritional value, as such measures could significantly lower the demand for cooking fuel. It is therefore important that all agencies with any form of interventions related to the cooking sector inform and coordinate their efforts.

This would allow for the alignment of their objectives, and agreement on how to achieve the most sustainable solutions in the long-run, and at scale. It will further create a strong need for enhanced coordination and collaboration amongst stakeholders to discuss and establish suitable interventions on energy and resource management in the refugee settlements. The model will also ensure that partners go out of their comfort zones working and investing together- the WEF nexus approach, while promoting effective and conflict-sensitive actions to integrate water, food, and energy and ecosystem concerns at the local level. This will ensure efficiencies, and rethinking past energy-related delivery models and move towards sustainability anchored on community participation.

Further, enhanced collaboration will strengthen regulation and especially avoid situations where cheap and sub-standard products that crowd out products of better are allowed to enter into refugee camps.

3.5 Community-based solutions-to drive awareness and uptake of clean cooking

The intervention appreciates the role of the community as the consumer of the energy products. The evaluation process identified that "the community has its solutions to energy needs" and thus, their involvement will help establish more resilient communities.

With the greatest need being in improving access to cleaner cooking options, there is need for massive sensitization and follow up to accelerate use cleaner technologies and fuels with a focus on the socio-economic benefits of alternative cooking fuels and technologies. Associated environmental and health benefits, although important, tend not to be the effective marketing tools, rather communities appeared more interested in the efficiencies of the stoves, their durability and practicality – among other preferences stated in earlier chapters. For most effective sensitisation, community based solutions are necessary and require the community's involvement and active participation. Furthermore, appropriate alternative cooking interventions need to be advocated for by the community for the community. This would ensure interventions are sustainably tailored to the needs of the communities and reach scale effectively. In raising awareness on the benefits of improved cooking technologies, it is also important to include awareness raising on efficient cooking practices which can be implemented alongside. These include soaking pulses before cooking, covering pots with a lid during cooking and using dry firewood (as opposed to moist) in order to achieve thermal efficiencies and reduction in the amount of fuelwood used.

In addition, awareness-raising efforts need to take into consideration the fact that the majority of female household heads make stove selection decisions and provide the money for new stove purchases. Integration of awareness

through Farmer Field Schools and other local agricultural extension programmes need to be supported.

3.6 Prioritizing the preservation of the natural environment

This intervention is very critical to create sustainable natural resources and related biomass that will ensure long term efficient and quality cooking fuel and related biomass. Innovations, policy guidelines, and integration of natural resources to programming in a bid to regenerate and built existing natural resources are addressed. The perseveration of the natural resources will require standard operations procedures within the refugee environment that will also integrate partnerships with community-based organizations to promote increased awareness, responsibility, and accountability of local natural resources. The model will also promote sustainable charcoal production and improved charcoaling technologies to reduce the pressure on forest resources while scaling up sustainable charcoal production and promoting a market-based approach by engaging different value chain actors including distributors and consumers to address value chain constraints. Given that charcoal is one of the highly preferred cooking fuels, the innovation will enhance charcoal governance for instance certification of charcoal production from specific species eg *Prosopis* in Kenya. There may also be need to manage the switch from firewood to charcoal, a big market opportunity which has a negative environmental impact. Further, the extent of environmental degradation and loss of biomass resources that have occurred in and around the refugee settlement over the past few years can be attributed to the high demand for fuelwood coupled with inefficient cooking energy practices, and the high demand for wooden poles used for the construction of shelter

The extent of environmental degradation and loss of biomass resources that have occurred in and around refugee settlements settlement over the past few years, can be attributed to the high demand for fuelwood coupled with inefficient cooking energy practices, and the high demand for wooden poles used for construction of shelter. Given that the current demand for firewood cannot be further sustained and yet firewood still remains to be the preferred choice of cooking fuel, the level of biomass degradation needs to urgently be halted. This can be achieved through improved cooking solutions, as well as immediate reforestation efforts and supporting local biomass producers to manage resources and produce fuels, such as firewood and charcoal, sustainably. Communities should be involved in reforestation efforts and could be supported to plant fast-growing, calorific and non-water demanding biomass in the vicinity of their households or in designated woodlots. Such reforestation efforts could also allow for access to climate funds which could in turn support market-based interventions for improved cooking.

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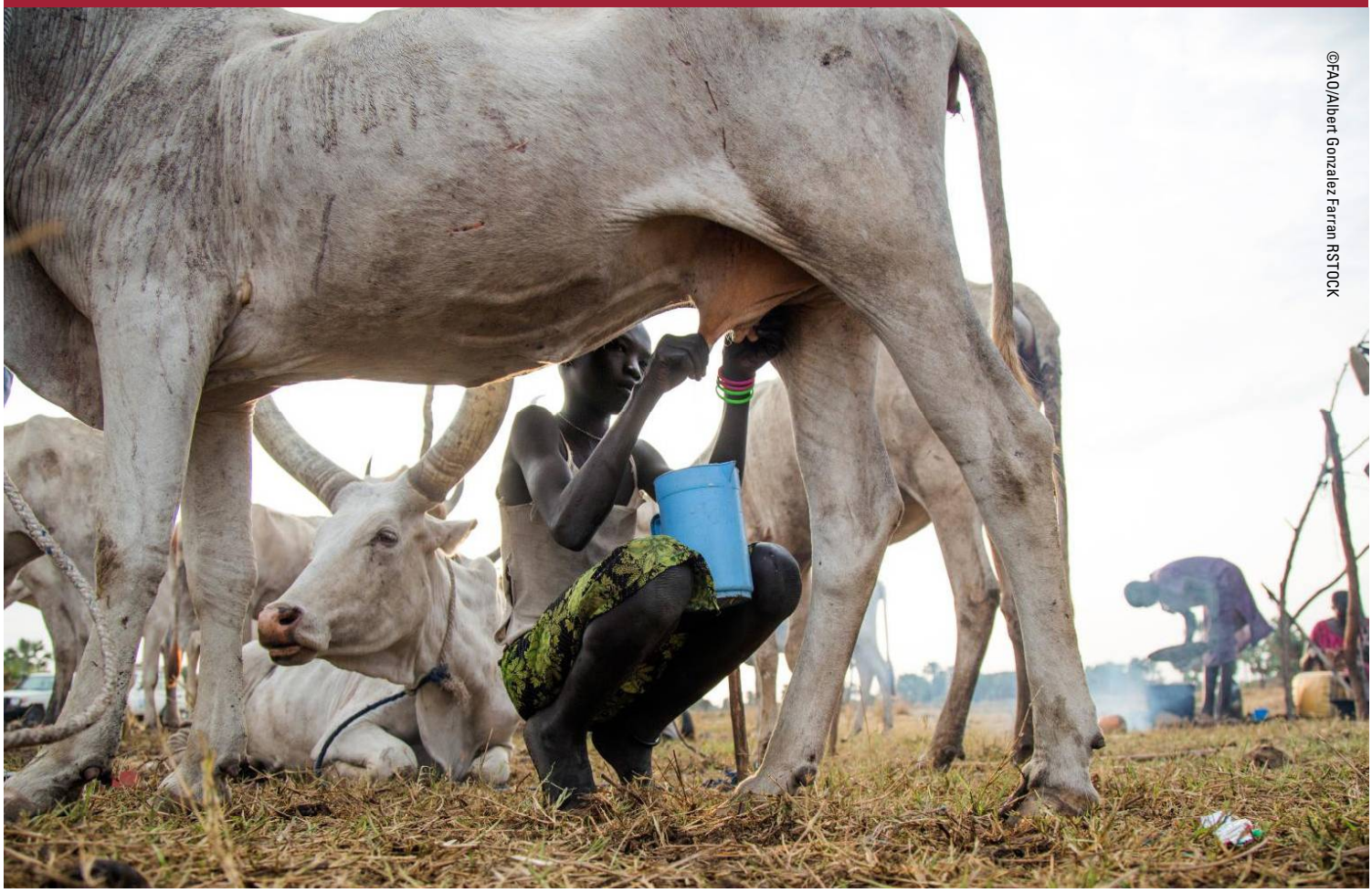

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SECTION TWO: COUNTRY REPORTS

Evaluation of SAFE programming in Eastern Africa: **Kenya Country Report**

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4. Context of the Kenyan report

4.1 Background

There is growing awareness on the importance of including sustainability in energy access activities within humanitarian settings. FAO is seeking to integrate the SAFE program into the larger resilience-building projects and programs to meet the energy needs of the world's most vulnerable populations in refugee/IDP settings. This report gives the Kenya case study with rich country-specific data and context analysis. The report has seven sections including the introduction that provides the context, and characteristics of the households in the evaluation. This is followed by three sections looking at energy for cooking, lighting and productive use. The fifth section focuses on compounding factors on energy in emergency situations such as gender, conflicts, and implications to natural resources. The sixth section looks at how the findings on energy access and use affects the "actual" cost of energy. The final section focuses on the threats to, opportunities of and innovations for energy programming in emergency situations. The SAFE evaluation in Kenya was undertaken in the Kakuma refugee camp (Figure 7).

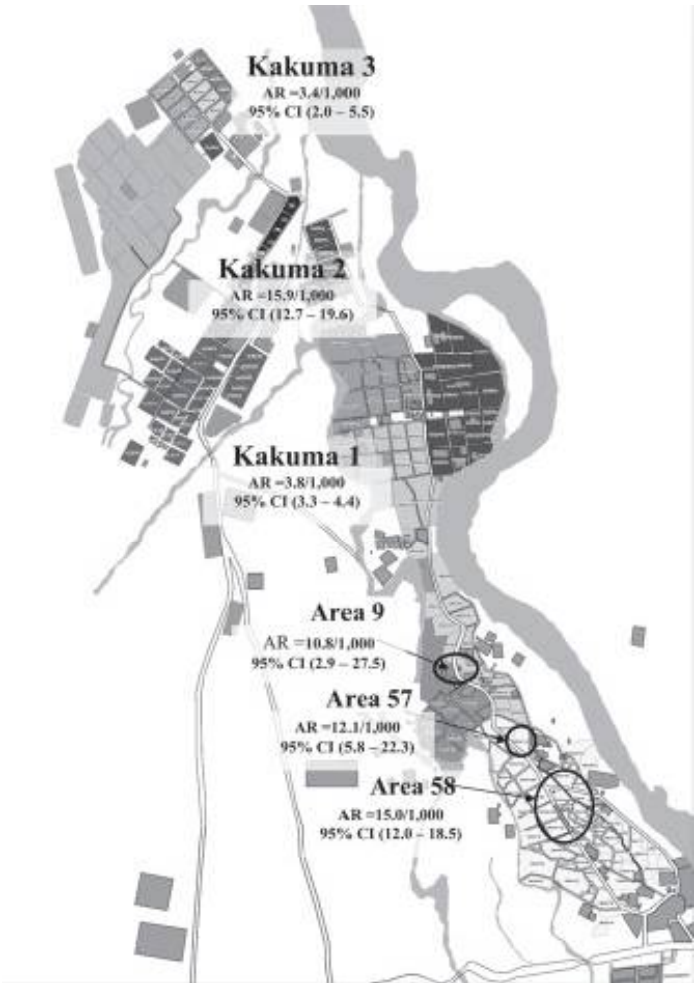


Figure 7: Map of Kakuma refugee camp. Source: Adapted from map provided by the International Rescue Committee

The refugee camp is divided into four regions, Kakuma 1, Kakuma 2, Kakuma 3, and Kakuma 4, from which the evaluation was undertaken. The regions are further divided into blocks and zones as shown in Figure 22. Household interviews were undertaken in 298 households distributed as shown in Table 5.

Region	Number of blocks	Number of zones	Number of households sampled	Proportion of total sample
Kakuma 1	9	4	122	41%
Kakuma 2	7	2	61	20%
Kakuma 3	16	11	80	27%
Kakuma 4	8	4	35	12%
			298	100%

Table 5: sampling in the Kakuma refugee camp for the evaluation

4.2 Characteristics of the households

The households in the study were characterised by the demographics (age, sex, and household size), household income, the type of structure they live in and their perception on and use of energy.

4.2.1 Demographics

The population in Kakuma refugee camp is largely youthful, with 59 percent of the population sampled aged below 18 years. 41 percent is in the economically active bracket of 18-59 years (Figure 8).

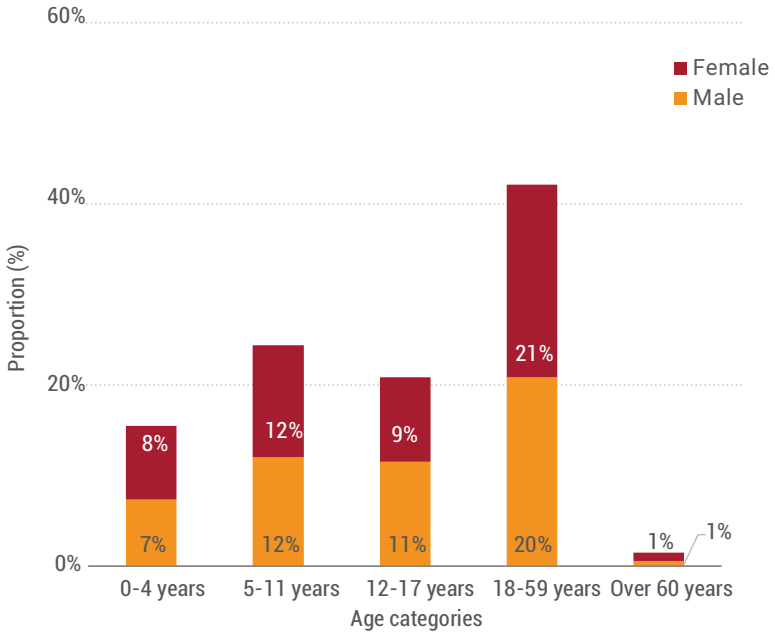
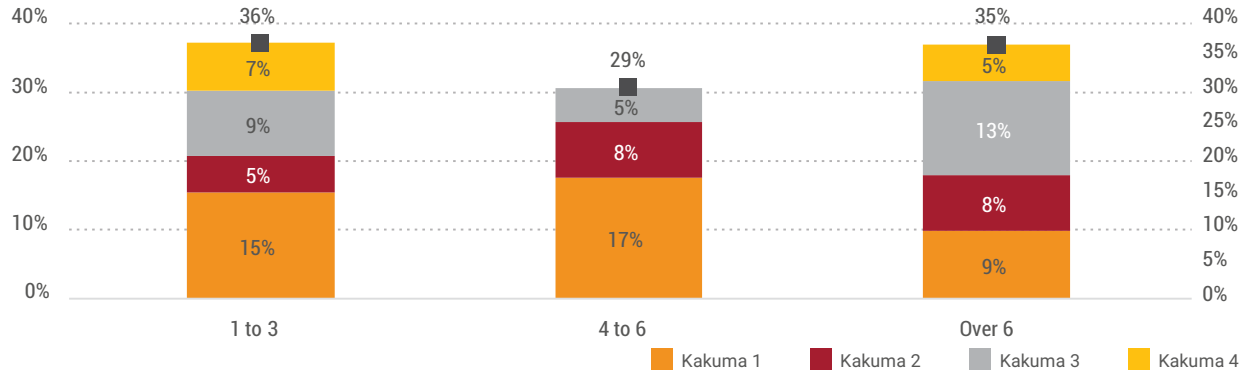


Figure 8: Age and sex of the population in Kakuma refugee camp

The household size in the refugee camp is between 1 and over 6 individuals per household (Figure24). While in Kakuma 1 majority the households have between 4 and 6 members, in Kakuma 2 the households have four (4) members or more. In Kakuma 3, the household size is mostly over 6 individuals, while in Kakuma 4, the household size is mostly between 1 and 3. Therefore there is a fair distribution of small(1-3 members), moderate(4-6) and large(over six members) families across the camp.

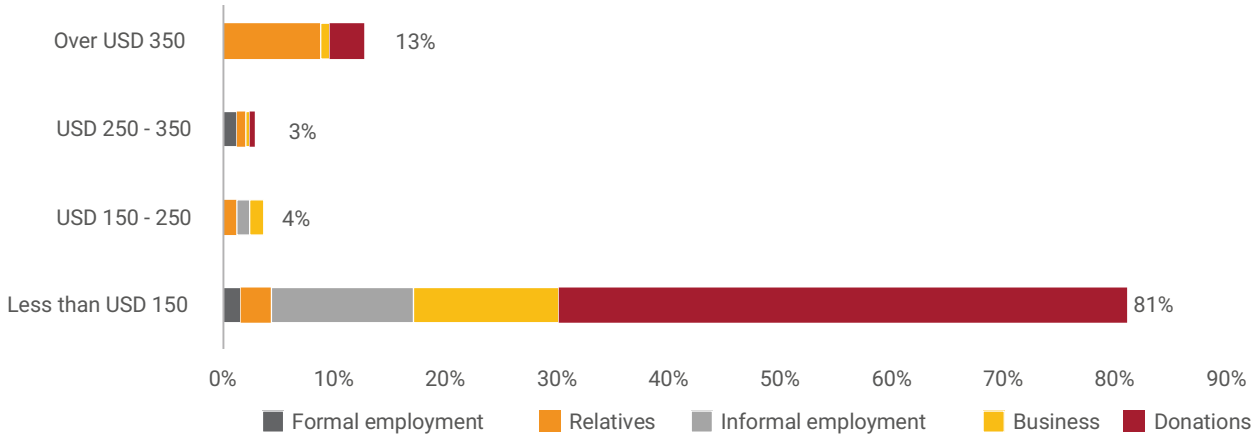
Figure 9: Household sizes in Kakuma refugee camp



4.2.2 Income

The evaluation found that 82 percent of the households (see Figure 10) were earning less than USD 150 per month. Of this 51percent was from donations, 13 percent from businesses, 13 percent in informal employment, 3 percent from relatives and only 2 percent from formal employment. The top income strata consisting of households that earned over USD 350 per month (13 percent), mostly got it from relatives (9 percent), businesses (1percent) or donations (3 percent). On average, monthly income among the households in the Kakuma camp was estimated between USD 100 and USD 190.

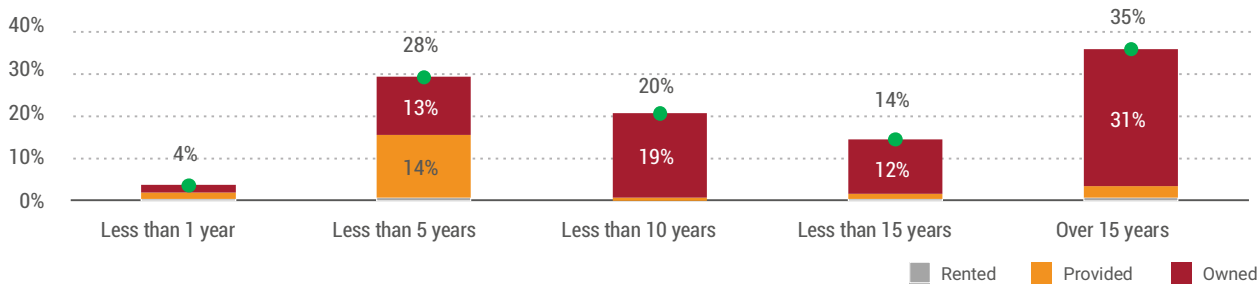
Figure 10: Sources and amounts of income among the households in Kakuma refugee camp



4.2.3 Dwelling and period of stay

The dwelling infrastructure in the Kakuma refugee camp depended on period of stay in the region, the income levels, and family size. From the evaluation 48 percent of households lived in temporary structures while 49 percent lived in semi-permanent structures. The majority of the inhabitants live in structures which were provided when they moved into the camp. Further, 49 percent of the households have been living in the refugee camp for over 10 years. 28 percent have been in the camp for the last 5 years while only 4 percent came into the camp in the last one year. The households that have been in the camp for less than 5 years, mostly live in the dwellings that were provided by UNHCR, while those that have been in the camp longer own their houses.

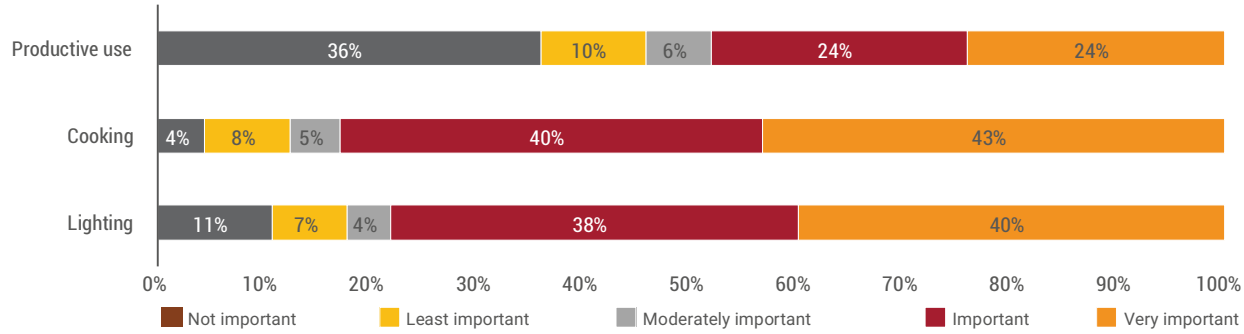
Figure 11: Duration of stay in Kakuma and ownership of dwelling structure at the camp



4.2.4 Perceptions on and use of energy

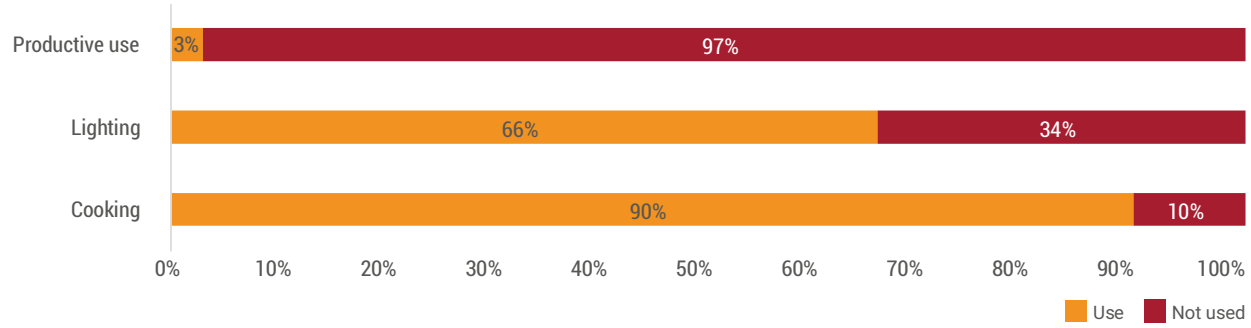
Households' perception on energy use were categorized on the basis of importance. The households that ranked energy as important or very important were 48 percent for productive use, 83percent for cooking and 78 percent for lighting (see Figure 12).

Figure 12: Perceptions on energy among the households in Kakuma camp



Respondents were also asked what they used energy for, including multiple uses. 90 percent said it was for cooking while 66 percent said it was for lighting (see Figure 13). Only 3 percent of the households in the refugee camps used energy for productive use which included small restaurants, hotels, eateries, and breweries.

Figure 13: Uses of energy in Kakuma refugee camp



4.3 Energy for cooking

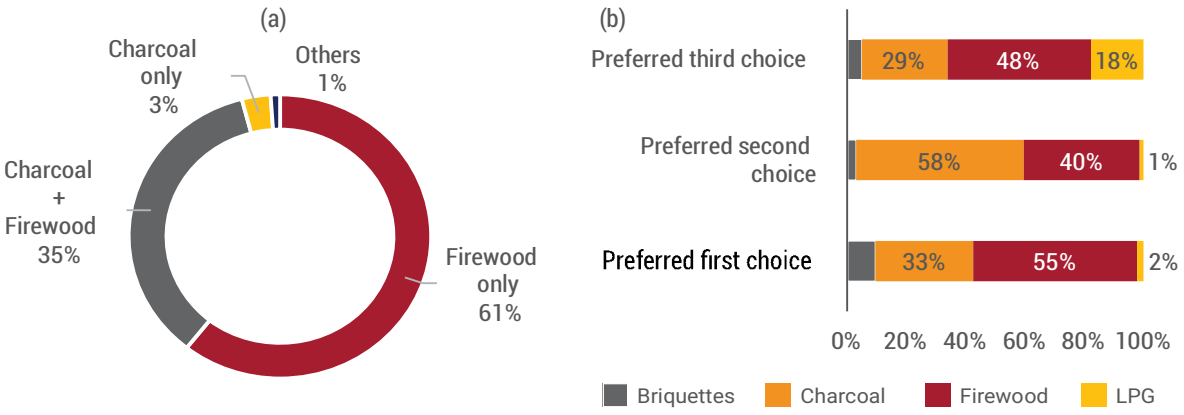
The section presents the findings from the study regarding energy for cooking in Kakuma. The section details the findings on cooking fuel, cookstoves, and cooking practices.

4.3.1 Cooking fuel

4.3.1.1 Type of fuels

The evaluation identified four main fuel types including firewood, charcoal, briquettes and liquid petroleum gas (LPG). However, majority of the households (see Figure 14a) use wood fuel (61 percent), charcoal (3 percent), or a combination of both (35 percent).

Figure 14: Fuel types (a) used in Kakuma refugee camp; and (b) preferred by the households in Kakuma

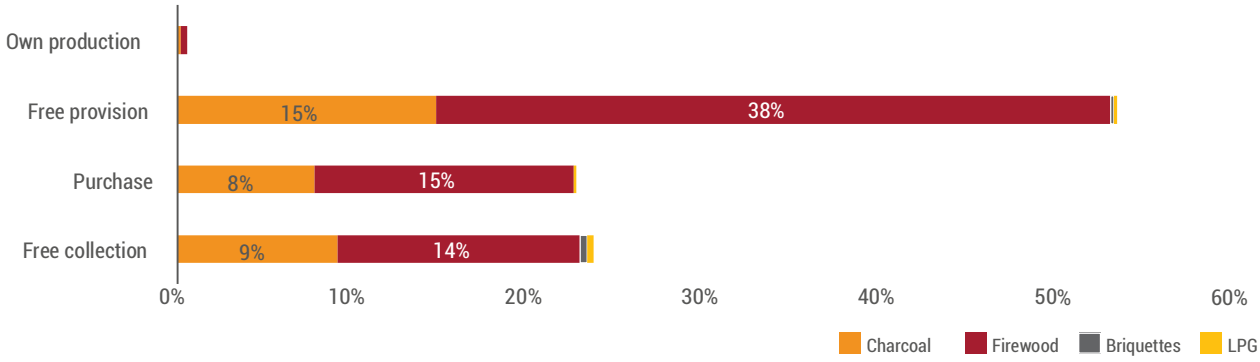


On the other hand, the preferred fuel options (see Figure 14b) as first choice is fire wood (wood fuel), the second choice being charcoal, and the third choice LPG. Nonetheless, 55 percent of households used wood fuel as their first preferred choice, while 33 percent had charcoal as their first preferred choice of cooking fuel. In addition, 58 percent of the households preferred charcoal as the second choice while 40 percent also preferred wood fuel as their second-choice preference. Notably, 48, 29, and 18 percent preferred wood fuel, charcoal, and LPG as their third choice of cooking fuel. The determinants of the choice of cooking fuel included its availability (cited by 59 percent of households), low environmental damage (11 percent), compatibility with stoves (8 percent), and of low cost (8 percent).

4.3.1.2 Sources of fuels

Households in the Kakuma refugee camp acquired their cooking fuel mainly through provision by institutions such as LOKADO which is contracted by UNHCR (53 percent), and also by free collection from within the host community (24 percent), and through purchases 23 percent) as demonstrated in Figure 15.

Figure 15: Sources of cooking fuel for the households in Kakuma refugee camp



4.3.1.3 Amounts and costs of fuel used

Majority (54 percent) of the households use between 3 kg and 5 kg of firewood per day, while 33 percent use between 10 kg and 20 kg, and 7 percent use less than 2 kg, with the remaining 6 percent using between 6 kg and 10 kg of cooking fuel per day.

The evaluation revealed that majority (61 percent) of households spend less than KES 500 (USD 5) on cooking fuel per month, with 48% of these being firewood users 7 percent of charcoal and 6 percent briquettes users (Figure16). LPG is only used by the small proportion (1percent) of the higher income segments earning over KSh 3000(USD 30) per month.

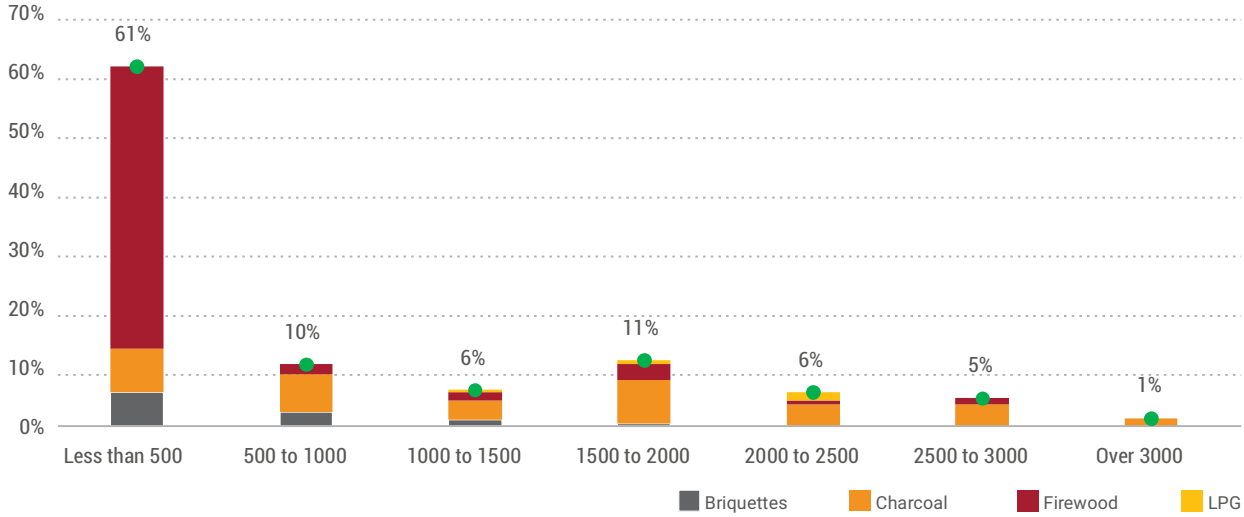


Figure 16: Expenditure on cooking fuel per month among the households in Kakuma refugee camp

The lower cost of firewood and the relative ease of accessing it, has made it a major source cooking energy in the Kakuma refugee camp. The evaluation findings indicated that 91 percent of the households in Kakuma refugee camp use exotic trees the source of wood fuel. The reason for using exotic trees by households was reported to include:

- **Availability:** indicated by 51 percent of the households, who cited the use of *Prosopis juliflora* - a widely available and invasive exotic tree.
- **Affordability:** indicated by 28 percent that stated that the exotic trees were used because they were affordable.
- **Burn intensity:** indicated by 17 percent of the households citing the use of exotic trees due to their extent of burning when used with an improved and energy-saving cookstove.

Despite the current costs of cooking fuel, the evaluation recorded that 30 percent of the households were willing to pay KES 10-100 (USD 0.1-1) more, for alternative fuels, while 27 percent were willing to pay over KES 500 (USD 5) higher for cooking fuel. 25 percent and 18 percent were willing to increase their expenditure on cooking fuel by KES 300-500 (USD 3-5) and KES 100-300 (USD1-3) respectively.

4.3.1.4 Constraints and interventions for cooking fuel

The main constraint on cooking fuel identified was stock-outs. The frequency of stock-outs reported by 69 percent of the households was between 0-5 days in a month, while 27 percent of the households reported that stock-outs occurred between 6-10 days. Only 4 percent of the households reported stock-outs taking place for over 10 days in each month. The causes of stock-outs were identified as high cost of firewood (identified by 29 percent of the households), fewer suppliers in the market (reported by 32 percent of the households), and market unreliability (reported by 18 percent of the households).

The identified interventions against stock outs included an increase in amounts of fuel provided by UNHCR through LOKADO (identified by 50 percent of the households) and improving the cooking efficiency through the adoption of clean cookstoves (identified by 37 percent of the households. 13 percent of the households proposed that cookstove manuals should incorporate tips on energy savings. In addition, a wide range of energy-saving practices already in place with some households were considered key in mitigating stockouts. These included putting off the fire after use and re-using the remaining charcoal or firewood to prepare the next meal (reported by 67 percent of the households); reducing the number of times they cook in a day (reported by 27 percent of the households) and supplementing the use of firewood with charcoal (cited by 6 percent of the households). As a result of these energy-saving methods, 42 percent of the households were able to reduce their cost of cooking fuel by KES 100-500 (USD1-5); while 15 percent were able to save at least KES100 (USD 1) in a month.

4.3.2 Cooking technologies

4.3.2.1 Types of cookstoves used

An evaluation of the type of cookstoves used in the refugee camp revealed that the Maendeleo stove was the most commonly used by 53 percent of the households. The stove was mainly provided to refugees by UNHCR. The dual-purpose stoves were also highly used (20 percent of the households). Other stoves used in the refugee camp are presented in Table 6.

Table 6: Type of cookstoves used in Kakuma refugee camp

	Maendeleo stoves	Dual purpose stove	Traditional open fire	Traditional metal stove	Improved charcoal stove	FAO Energy saving stove
Sample view						
Percentage of users	53%	20%	9%	8%	6%	5%

It was evident that the private sector was increasingly penetrating Kakuma refugee Camp as was demonstrated by the increasing number of players working in the region, and a corresponding surge in the number of commercially distributed cook stoves as well as those provided by development partners. It was noted that the Netherlands Development organization (SNV), was at the forefront of increasing market-led approaches in the acquisition of alternative cookstoves. Some of the commercially available cookstoves types are presented in Table 7.

	Charcoal stoves	Jikokoa stoves	Metalic stoves
Type 1			
Type 2			

Table 7: Commercially available stoves in Kakuma refugee camp

The evaluation also confirmed that stove stacking is a common practice in the camp. It was noted that the increased use of more than one stove in households was dependent on their income levels and the cost of cooking fuel. 70 percent of the households surveyed in the camp practiced stove stacking as presented in Table 8. The analysis also found that 33 percent of the households who initially had dual-purpose stoves additionally got improved charcoal stoves, while 22 percent and 9 percent of these households adopted the traditional metal stoves and FAO stoves respectively. At the same time, households that initially got the Maendeleo stove still continued using the traditional open fire (85 percent), FAO stove (78 percent), traditional metal stove (61 percent), and improved charcoal stove (22 percent). The results also indicated that between 15 and 85 percent of the households who initially had the Maendeleo stove eventually acquired an additional stove.

Table 8: Probability of cookstoves stacking among the households in Kakuma refugee camp

Type of additional stove

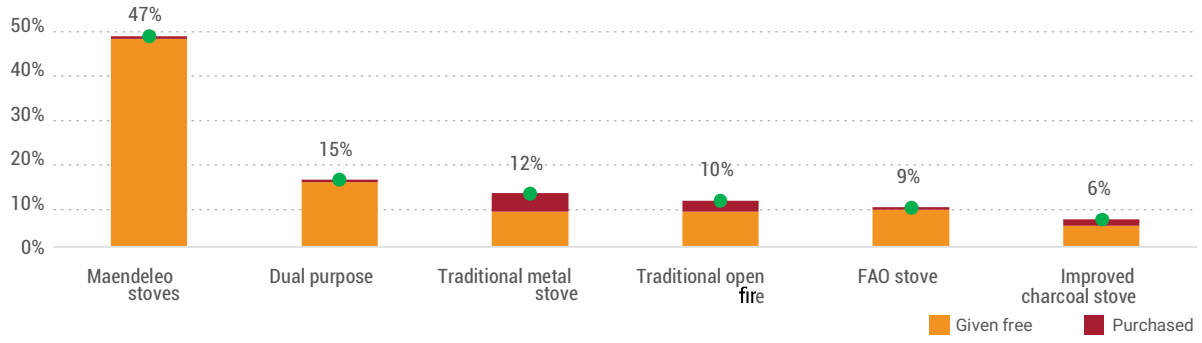
Type of initial stove	Dual purpose	FAO stove	Maendeleo stove	Traditional metal stove	Improved charcoal stove	Traditional open fire
Dual purpose		9%	3%	22%	33%	
FAO stove						
Maendeleo stove		78%				
Traditional metal stove	38%	4%	24%			
Improved charcoal stove	23%	4%	3%	9%		
Traditional open fire						

4.3.2.2 Sources of cookstoves

The cookstoves were acquired through free donations or purchased in Kakuma refugee camp area. However, majority (90 percent) of the households were given the stoves for free, with only 10 percent purchasing their stoves. Most of the purchased stoves were traditional metal stoves and material (stones and fuel) for open fire setups, and improved charcoal stoves (

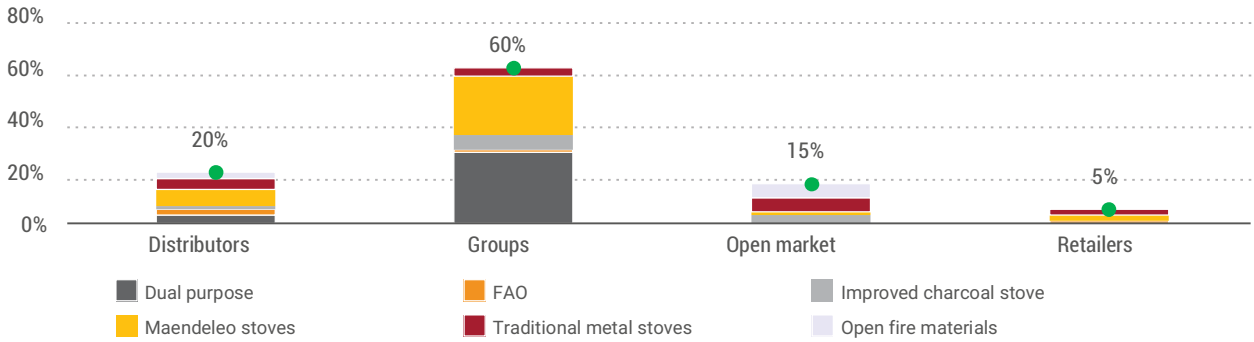
Figure 17). Out of the households that were given the cookstoves for free, 42 percent of them could not recall the source of the cookstove they were using and only responded that they were given to them in the camp. 19 percent of the households reported receiving cookstoves from FAO and 16 percent received their cookstoves from UNHCR. Further, 9 percent of the households reported having received cookstoves from LOKADO, and 14 percent received cookstoves from other NGOs working in the region.

Figure 17: Acquisition of cookstoves in Kakuma refugee camp



The stoves are mainly supplied to the households mostly through groups (60 percent), distributors (20 percent), open market (15 percent), and retailers (see Figure 18). The Maendeleo stoves, dual purpose stoves, and improved charcoal stoves were mainly supplied to the households through groups, while traditional metal stoves and were supplied through open markets and distributors. The FAO stove although initially distributed for free were later picked up by local producers and stoves were being supplied through distributors and retailers in the camp.

Figure 18: Supply of cookstoves to the households in Kakuma refugee camp



4.3.2.3 Costs of and willingness to pay for cookstoves

The cost of cookstoves used in the camp mostly varied from KES 350 and KES 1 000 (USD 3.5 to USD 10). The common stoves acquired by households for less than KES 350 (USD 3.5) included the dual purpose stove (67 percent); FAO stove (86 percent); improved charcoal stove (100 percent); Maendeleo stove (85 percent) and Traditional metal stove (100 percent). In addition, only the dual-purpose stove (22 percent) and 12 percent of the Maendeleo stoves were acquired at a cost between KES 400 and KES 700 (USD 4 to USD 7). It was also found that 11 percent of the dual-purpose stove, 14 percent of the FAO stove, and 3 percent of the Maendeleo stove were acquired at a cost between KES 700 and KES 1 000 (USD 7 and USD 10). The households were willing to pay more to acquire the energy-efficient cookstoves. The analysis reported that 59 percent of the households were willing to pay an additional KES 100 to KES 1 000 (USD 1 to USD 10) for an alternative cookstove; 29 percent of the households were willing to pay an additional KES1 000 to 2 000 (USD 10 to USD 20) while 12 percent of the households were willing to pay more than KES 2 000 (USD 20) for alternative cookstoves.

4.3.2.4 Factors considered in acquisition and use of cookstoves

The evaluation identified three main factors considered in acquisition and use of cookstoves among the households in Kakuma refugee camp. These included the perceived quality of the stove, the fuel needed and cost of the stove.

The quality of a stove was defined in terms of whether it was perceived to be fuel saving, clean and environmentally friendly (see 19). The results indicate that traditional metal stoves are perceived (by 58 percent of households using it) to be fuel saving, however, the stove is slightly clean (cited by 29 percent) and slightly environmentally friendly (cited by 26 percent) compared to other stoves. The perceived best performing stove was the dual-purpose stove with moderate fuel saving (cited by 48 percent of users), clean (cited by 45 percent), and environmentally friendly (cited by 38 percent). The FAO stove was perceived as the lowest performer in fuel saving, and least clean as cited by 15 percent and 12 percent of the stove's users. It is important to note that these results are based on user perceptions which may not necessarily conform to technical expectations or conventional wisdom. For instance, in this case, the traditional metal stove without any known energy saving capabilities was ranked higher than the FAO stove which has a liner and should therefore normally perform better in terms of fuel efficiency.

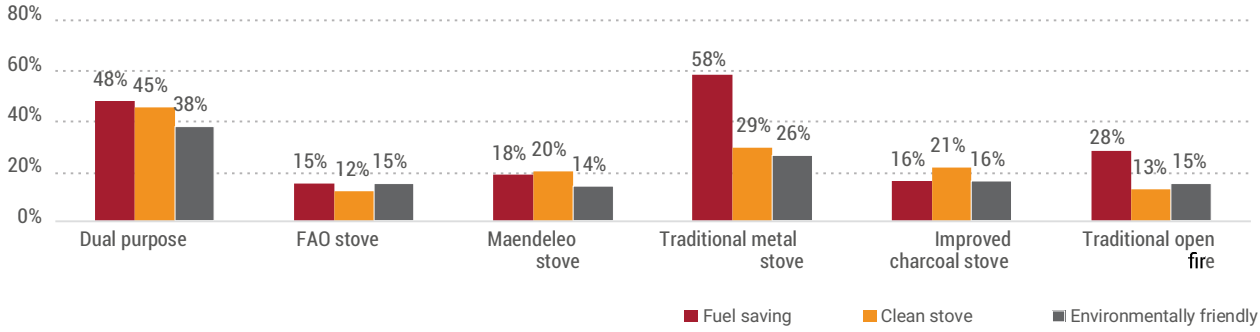


Figure 19: Perceived quality of stoves used in the Kakuma refugee camp

The characteristics of the fuel used included whether the fuel was perceived to be clean (with low indoor pollution potential) and whether it makes it easy to clean cooking pans when used. The findings indicate the fuel used for Maendeleo stove is considered clean, with low indoor pollution potential and results in cooking pans that are easy to clean (see Table 9). On the other hand, traditional open fire fuel (wood fuel) is perceived to be less clean, with high indoor air pollution and results in cooking pans that are hard to clean.

Table 9: Perceived characteristics of the fuel for the cookstoves used in Kakuma refugee camp

	Characteristics of the fuels use		
Type of cookstove	Clean	Low indoor pollution	Clean on utensils
Dual purpose stove	13%	10%	32%
FAO stove	6%	24%	0%
Improved charcoal stove	11%	4%	7%
Maendeleo stoves	47%	39%	46%
Traditional metal stove	10%	14%	7%
Traditional open fire	13%	8%	7%

The perceived cost of cookstoves indicate that the Maendeleo stove is considered as the most affordable, in comparison to the other stoves; while the improved charcoal stove was cited as the least affordable (see Table 10).

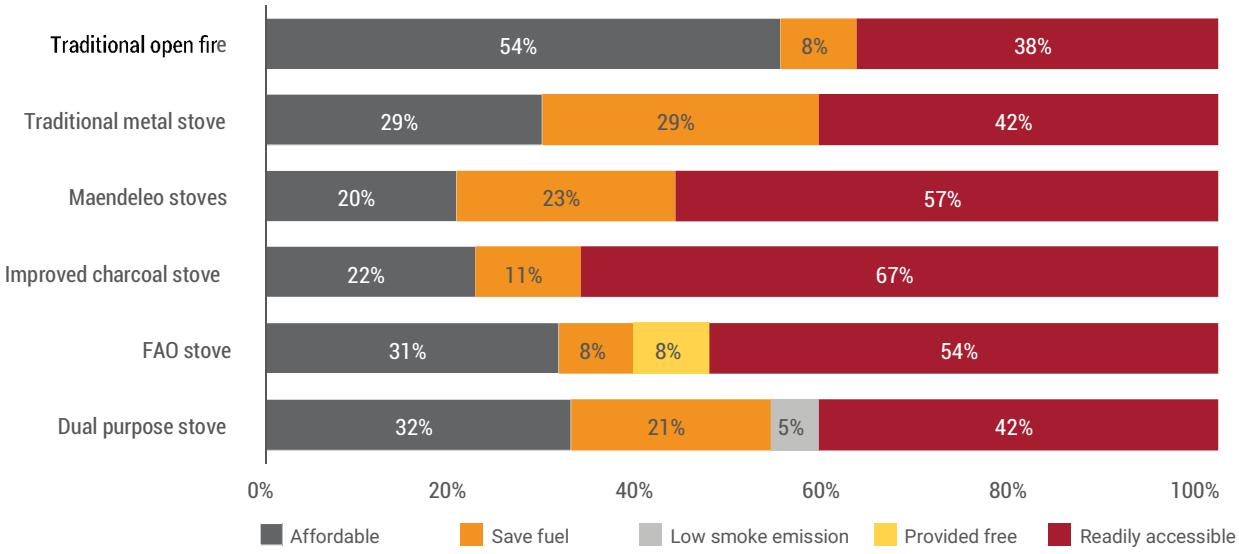
Table 10: Perception on costs of stoves used in Kakuma refugee camp

Type of cookstove	Affordable to users
Dual purpose stove	15%
FAO stove	12%
Improved charcoal stove	7%
Maendeleo stoves	36%
Traditional metal stove	13%
Traditional open fire	16%

4.3.2.5 Adoption of alternative cooking technologies

The refugee camp environment requires efficiency in the use of available resources and various preferences for the adoption of alternative cooking technologies. The analysis presented in Figure 35, reveals that the major considerations made on any alternative cookstove technologies was accessibility and affordability.

Figure 20: Consideration on potential for adoption of alternative cookstove technologies



In addition, 19 percent and 15 percent of the households living in the area were willing to pay for better and quality cooking fuel and cookstoves respectively while 74 percent of the households cited low levels of income leading to the unaffordability of the alternative technologies as reasons for not willing to adopt new technologies. Furthermore 14 percent of the households noted that they lack insufficient information on alternative technologies in order to adopt them, and 6 percent of the households cited a combination of insufficient information and unaffordability as well as quality of service as reasons for not willing to pay for alternative cooking technologies.

4.4 Energy for lighting

This section explores the lighting technologies, sources of lighting and the cost of lighting as documented in the study at Kakuma.

4.4.1 Types and sources of lighting

There was a wide range of lighting technologies in use in Kakuma Refugee Camp. These ranged from the basic candle and tin lamps to generators and mini grid electricity. The lighting technologies in use in the camp included single source lighting and more than one source lighting. Majority (77 percent) of the households had more than one lighting source, while 23 percent had single lighting sources (see Table 11).

Table 11: Types of household lighting used in Kakuma refugee camp

Single source of lighting for households	23%	More than one source of lighting for households	77%
Pico solar lanterns	11%	Generator enabled electricity and Pico solar lanterns	25%
Candle	4%	Solar home systems and Pico solar lanterns	8%
Mini-grids	1%	Other and Pico solar lanterns	5%
Kerosene lamp	1%	Candle and Pico solar lanterns	19%
Solar home systems	0.5%	Pico solar lanterns and kerosene lamp	3%
Tin lamp	1%	Pico solar lanterns and tin lamp	16%
Generator enabled electricity	1%		
Firewood	0.2%		
Mobile phone	4%		

The most commonly used single lighting source was the pico solar lanterns (cited by 11 percent of the households), while the use of a combination of small household generators, mini –grids and pico-solar appliances was the most popular multiple lighting sources. At the same time, it was established that households in the refugee camp acquired their lighting technologies (mostly solar lamps) as donations by UNHCR through Lokado, through schools and from other NGOs operating in the area while only a few of the households purchased their lighting appliances. These included the PAYGO models of solar home systems.

4.4.2 Payment for lighting

There was general willingness to pay for lighting. 74 percent of the households in the camp were willing to pay for lighting because of the sense of security it brings. The study also revealed that 39 percent of the households were willing to adopt portable lighting solutions in their houses. Out of these 33 percent were willing to pay for the same. It was further revealed that 27 percent of the households would be willing to pay for grid electricity and 21 percent would prefer to pay for a combination of grid electricity and solar lighting. The households generally would prefer alternative lighting solutions especially the Pico solar system (33 percent), mini-grids (26 percent), combination of mini-grids and solar systems (21 percent), solar home systems (15 percent), and small generators (5 percent). The reasons for their willingness to consider alternative lighting solutions included affordability (27 percent), easily accessible (22 percent), reliable (18 percent), energy saving (15percent), efficiency and effectiveness (11 percent), and the potential to serve dual purposes – e.g. charge phones in addition (7 percent).

4.5 Energy for productive use

This section looks at how energy is to contribute to income generation by households and enterprises and to foster local economic development by increasing productivity in other sectors such as agriculture and water provision.

Only a small proportion (3 percent) of the households in the Kakuma refugee camp used part of the energy for productive use. 75 percent of

these households undertook business activities including running of small hotels and eateries within the camps. A further 25 percent of households prepared illicit brews as an income-generating activity using the fuels. Other households – organised in groups, produced fuels that they sold for an income (for instance the Loitakori Group. These activities generated less than KES 3 000 (USD 30) for 63 percent, between KES 3 000 and KES 6 000 (USD 30 to USD 60) for 19 percent, and over KES 6 000 (USD 60) for 18 percent of the households using energy productively in the camp every month. Further, some households were able to do business while using alternative lighting energy, including providing phone charging services.

BOX 1 **Impact story on energy for productive use**

LOITAKORI PRODUCTION SITE, KAKUMA

We visited Loitakori area where we met and interacted with 20 group members (both male and female) who were earning a source of income from production of charcoal from *Prosopis juliflora* using improved charcoal production kilns provided by FAO. The production process involved both the men and women. The men cut down the wood and the women ferried to the kilns. Both men and women filled the wood in to the kilns. After the production, women transported the charcoal to Kakuma town for sale, and saved the proceeds with their treasurer. Through the savings from sale of charcoal in Kakuma town and the Kakuma refugee camps, the group opened a savings account and were able to improve their livelihoods. For instance, one of the members was able to open a small shop after receiving money from the group whilst another member was able to pay school fees for their child in secondary school. The group was optimistic of their progress and eager to increase the charcoal production if they get the right tools such as power saw to harvest the *Prosopis juliflora* and extra kilns for charcoal production as one of their kilns was faulty.

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The evaluation did not identify any major areas of energy use for food and water production. This may be explained by the limited opportunities for farming and other productive activities in the camp as a result of the restrictions on refugees in Kakuma.

4.6 Compounding factors for energy access

Beyond energy for cooking, lighting and productive use, this section details other significant compounding factors associated with energy access including the gender contexts in energy access, conflicts in Kakuma that could influence energy access dynamics, and the implication of energy access on natural resources (especially forests).

4.6.1 Gendered contexts in energy access

4.6.1.1 Decisions on cooking fuel use

The decisions on the choice of particular energy technology and/or fuel used within Kakuma refugee camp was dominated by household heads who accounted for 57 percent of all the choices made. It was also revealed that children and other relatives of households that have been in the region for longer periods seemed to have some limited authority to the choice of the type of technology used.

4.6.1.2 Responsibilities for and efforts in cooking fuel collection

In Lodwar and Kakuma town, wood fuel is collected by approximately three-quarters of households while the rest purchase it. Because wood fuel is distributed for free to residents of Kakuma Refugee Settlement, less than 5 percent of households collect their firewood themselves (Practical Action Consulting, 2018). The analysis revealed that in 42 percent of the households, household heads collected cooking fuel while spouses were responsible in 24 percent of the households with children being responsible in 13 percent of the households. In 12 percent of the households. Firewood was collected by both children and female spouses. Households collected cooking fuel from varying distances within their neighbourhoods. 59 percent of the households collected their cooking fuel within less than 1 km from their dwelling, 32 percent had to travel between 1 and 3 km to collect cooking fuel, 7 percent travelled between 3 and 5 km, while 2 percent travelled for more than 5 km from their areas of residence. In addition, it was established that 73 percent of the households spent less than 5 hours weekly in collecting cooking fuel, while 14 percent and 13 percent spent between 6-10 hours and more than 10 hours in collecting cooking fuel in a given week respectively.

4.6.1.3 Energy related conflicts

Historically, firewood collection has been a source of conflict between the camp and the host community, who consider the areas from which firewood is collected to be their communal land. Cases of gender-based violence including rape have been reported among female refugees foraging for

firewood, and have been a key reason why UNHCR introduced firewood rations. The distances travelled to collect cooking fuel could lead to cases of sexual assault and robbery among women and children. In most cases, the women and children, do not report the sexual assault as they are afraid of social stigma as well as further persecution by the police and the local security authority (Women's Refugee Commission, 2014). The insecurity in the refugee camp was attributed to refugee and host community conflict, reported by 27 percent of the households who felt insecure in collecting and using the cooking fuel available. While 68 percent of the refugees were afraid of a human attack from the host community, 24 percent were affected by the bad weather conditions, which included flooding during the rainy season and high temperatures during dry seasons. Only 4 percent were afraid of attacks from wild animals..

4.6.2 Energy access and natural resources

A number of national policies and legal frameworks remain pertinent to environmental and energy programs in Kakuma refugee camp, including the Kenya Constitution of 2010. The Constitution devolves certain functions such as agriculture, water and forestry policies to county governments, allowing county governments to domesticate national legislation and policies. Turkana County Government has ratified a charcoal policy and identified fuel efficient stoves and engaged in the promotion of solar energy for domestic use and biogas for schools as flagship projects. Moreover, there are considerable efforts by the County Government of Turkana to fulfil the forestry and energy policy, as demonstrated by county government support to Community Forest Associations, and its interest in promoting the adoption of clean energy technologies and renewable sources of energy. Through the community forest association, protection of indigenous tree cover has increased the use of "exotic trees" hence providing an environmentally friendly source of fuel while maintain forest cover for both the host and refugee community. The use of forest resources includes harvesting more of the *Prosopis juliflora* for wood fuel and charcoal and retaining the indigenous tree cover. The policy outlines stringent penalties and sanctions for host and refugee community harvesting indigenous trees. The UNHCR has also awarded contracts for the supply of wood fuel from exotic trees, hence supporting the implementation of the policy through its firewood procurement process.

4.7 Cost of energy

The cost of energy was determined to include the variables of clean cooking, renewable energy in agri-food chains, and forest management. The analysis was based on a reduced form expenditure regression model in which the household real expenditure was regressed on the household characteristics and endowments.

4.7.1 Market impact on the cost of energy

To establish the impact of the SAFE programme among the target beneficiary population, an econometric analysis of consumption on clean cooking, forest management, renewable energy in agri-food chains energy products was based on reduced form expenditure regression model in which the household real expenditure was regressed on the households characteristic and endowments (Glewwe et al., 2002). The regression model is a log-linear form expressed as:

$$\ln(E_{hcg}) = X_{hcg}\beta_g + \eta_g + \varepsilon_{hcg}$$

Where*:*

E_{hcg} is the real expenditure for a household h with clean cooking, forest management, renewable energy in agri-food chains in the project c at a location g within the service area. The $1*k$ vector of regressors x_{hcg} includes household's characteristics and endowments while β_g is a $k*1$ vector of parameters (returns) explained in satisfaction, time saved from varying distances from the original main source of energy g. $_g$ is the effects of the household cost of energy while ε_{hcg} are the idiosyncratic random error terms which may include unpredictable market indicators, economic conditions, the extent of stock-outs, government policies, cultures, market-led assumptions including the willingness to switch to alternative energy sources and beliefs of the consumers among others. The model adds to the number of years households lived in the region [41] as part of household characteristics.

In this evaluation, the econometric analysis included expression of the cost of energy on the overall household welfare. This cost was expressed in both direct and indirect costs associated with the acquisition of cook stoves, the market direct and indirect cost of cooking fuel, and lighting technologies.

Some of the assumptions that informed the determination of the estimated cost of energy included the following:

1. The actual cost of energy that households spent on energy were estimated at a mean of KES 1 416 (USD 14.2) with a minimum of KES 240 (USD 2.4) and maximum of KES 4 000 (USD 40) per month

2. The unit cost also took into consideration income earned from productive use of energy which was partly used to purchase cooking fuel. This income was estimated at an average of KES 4 414 (USD 44.14) where an estimated 15 per cent was used to purchase cooking fuel, i.e. KES 441 (USD 4.41) was used as the cost of energy.

41 Van de Walle, D. and Gunewardena, D. (2001), Sources of Ethnic inequality in Viet Nam. Jo

3. The cash transfer to households to purchase cook stoves was estimated at a mean of KES 520 (USD 5.2), however, households purchased cooking stoves at an estimated mean of KES 330 (USD 3.3). Its assumed, part of the savings was used in the purchase of energy products,

4. Kenya's minimum wage 2015 - 2018 was estimated at KES 13 572 (USD 135.7), The daily hourly income was therefore estimated at KES 57 (USD 0.57) when calculated based on 8 working hours[42]. It was estimated that the mean number of hours used by households to collect cooking fuel in a day was 0.69 (42 minutes), equivalent to KES 39 (USD 0.39). Thus, the mean monthly cost of energy estimated from the hours spent collecting cooking fuel is KES 1 179 (USD 118).

5. The energy savings from efficient use of cooking and lighting fuel was estimated at a mean of KES 300 (USD 3).

6. Further, the daily cost of cooking fuel was estimated at KES 35 (USD 0.35), with households reporting an average cost of 5 days of stock-outs. Purchase of energy to cover these days resulted to KES 184 (USD 1.84).

7. Notably, the monthly household's income was estimated at KES18 192(USD 181.9) with a share used to purchase energy for the households.

Based on assumptions (ii), (iii), (v), and (vi) above, the direct baseline cost of energy for households per month is estimated at KES 1 476 (USD 14.8)

4.7.2 Implications of the findings in the cost of energy

4.7.2 .1 Implications of the demographics on the cost of energy

The evaluation estimated that increasing the number of households in a zone would increase the cost of household energy by KES 436 (USD 4.36) per month. This is because more households would increase the demand of energy, and consequently the effort needed to acquire household energy, as well as the pricing. This would mean that an increase in the number of refugees in the camp needs to be accompanied by increasing support for the households to cover the costs energy provision.

On the other hand, a longer duration of stay in the camp was likely to encourage a change in the type of dwelling units to permanent housing, and consequently a reduction in the cost of energy by KES 380 (USD 3.8) in a given month ostensibly as households adopted better coping mechanisms. At the same time, the enhanced adapting capacity of the household had a higher potential of promoting FES and clean lighting technologies, thereby reducing

42 https://tradingeconomics.com/kenya/living-wage-individual

the cost of energy by KES 300 (USD 3) monthly per household. Essentially, the potential of permanency among the households would positively contribute to long term investments in energy, thus reduced cost of energy. For programming, partnering to provide alternative housing will be important for improving energy access.

4.7.2.2 Implications of cooking fuel on the cost of energy

Availing adequate cooking fuel would lead to an increase in the supply, with the analysis indicating that it would result to a reduction in the household cost of energy by KES 84 (USD 0.84). Moreover, the choice of fuel that is perceived as best quality would reduce the cost of energy by KES 12 (USD 0.12) per household monthly. This finding provides opportunities to the host community to deliver locally available cooking fuel, especially when the perceived quality of the fuel is satisfactory among the refugee households.

4.7.2.3 Implications of cooking fuel stock-outs on the cost of energy

At the same time, considering the practices for countering stock-outs in the refugee camp (including putting off the fire after use and re-using the charcoal or wood fuel, reducing the number of times they cook and amount of fuel used), the analysis indicated that adopting these measures reduced the cost of energy by KES 61 (USD 0.61) per month. This requires that the hosueholds in the camp become more aware of the potential measures to manage stock-outs. Similarly, the adoption of alternative, higher quality cooking fuels would reduce the monthly household cost of energy by KES 87 (USD 0.87).

4.7.2.4 Implications of cookstoves on the cost of energy

The beneficiaries of the FAO stoves were reportedly able to reduce their monthly cost of energy by KES 141 (USD 1.41) while those who received training in the use of the cookstove were able to further reduce their monthly cost of energy by KES 10 (USD 0.1). This shows the positive impact of both consistent and correct use of cookstoves on the household cooking economy. This consistency needs continuous capacity building on cookstove options, and stove use efficiency.

The perception that a stove was fuel efficient, and investing in that stove, was likely to reduce the cost of energy by KES 33 (USD 0.33) monthly, when the perception is factual. As such, the type of cookstove adopted by a household was critical in determining the cost of energy. Moreover, households that used more than one cookstove based on the perception that the cookstoves were effective and within their means were likely to reduce the cost of energy by KES 78 (USD 0.78) monthly. This finding points to how important perceptions on energy products (i.e. cookstoves) were in determining choice of cookstoves, and therefore the need for scaling up community inclusive solutions integrated into the market systems, and benefits of co-created cookstoves that promotes trust in the camp community.

4.7.2.5 Implications of energy for lighting on the cost of energy

The adoption of alternative clean technology for lighting was found to reduce the monthly cost of energy per household by KES 30 (USD 0.30). This is implying that while the clean lighting technologies might attract higher initial costs, the spread of cost over its lifetime resulted in reduced monthly costs. Moreover, clean lighting is associated with lower potential for indoor pollution and respiratory illnesses, which reduces the overall household burden that can be offset by cost lighting. However, this would require development of customised lighting technologies that fits the context and budget of the households in the camp, and private sector engagement to improve on product availability, accessibility and after sales service.

4.7.2.6 Implications of energy for productive use on the cost of energy

The income generated from productive energy use among the households, would essentially increase the disposable income among households, thereby allowing household investments on alternative energy sources. As such, the analysis indicated that households that engaged in the use of cooking fuel for productive use were able to reduce their overall cost of energy by KES 19 (USD 0.19) per month. Keeping this trend would need integration of community-based solutions that promote productive use of energy that would contribute to scaling of community inclusive market based solutions.

4.7.2.7 Implications of compounding factors on the cost of energy

Considering that majority of the households in Kakuma get fuel rations, distance and time spent in fuel collection was not seen as a significant issue. However, the economic cost of wood fuel collection by the households indicated that the further the distance for wood fuel collection, and longer the duration in collection, the higher the cost of energy by KES 100 (USD 1). Furthermore, that the feeling of being unsafe during fuel wood collection as a result of potential to experience violence led to an increase in the cost of energy by KES 157 (USD 1.57) per month – applied where the household was not supplied with cooking fuel. Consequently, there would be need to promote local production of alternative fuels, through empowering entrepreneurship – especially women entrepreneurs, in energy products.

4.8 Threats and opportunities for energy access

The focus of this section is on constraints and opportunities associated with energy access in Kakuma, and the available innovations in energy programming for future energy in emergency portfolio initiatives.

4.8.1 Threats to energy access

The common energy access challenges that affect displaced communities can be found in Kakuma refugee camp. Current efforts by government and development partners to improve energy access in the camp are increasingly focussing on providing opportunities to enhance private sector involvement

in the provision of cooking and lighting solutions within the host and refugee community. The evaluation however identified 5 major constraints to access to energy by the host and the refugee community (see Figure 21). These include: (i) Affordability (ii) Limited access to quality alternative energy product (iii) Market Distortion (iv) Limited market knowledge, and (v) Competition for limited biomass resources.

Figure 21: Main energy access and use constraints in Kakuma refugee camp

1. Affordability

Purchasing power among refugees remains low given limited household incomes and low economic development

2. Limited access to quality alternative energy product

86 per cent of the household in Kakuma 1 rank as Tier 0 or Tier 1 (out of six tiers) for cooking and lighting signifying a service deficit and a failure to meet basic levels of energy access commensurate with a healthy and productive life.

The residents of Kakuma 1 spend over USD 1.5 million a year on poor-quality and harmful energy supplies

3. Market distortion

Often, NGOs have distributed energy products in-kind, creating dependencies and reducing commercial market opportunities

4. Limited market knowledge

Limited market awareness by private sector on opportunities for alternative energy

Insufficient market intel leads to low interest and risk appetite by private sector to make long term investments

5. Competition for limited biomass resources

Competition among host communities and refugees resulting to conflict over limited biomass resources and trade for fuel

4.8.2 Opportunities in energy access

The evaluation identified key market features that help to address the general constraints limiting access to and use of energy in the Kakuma refugee camps (see Figure 22). The features have been categorised into demand, supply, and supporting function features.

Figure 22: Key market features in promoting energy access and use in Kakuma refugee camp

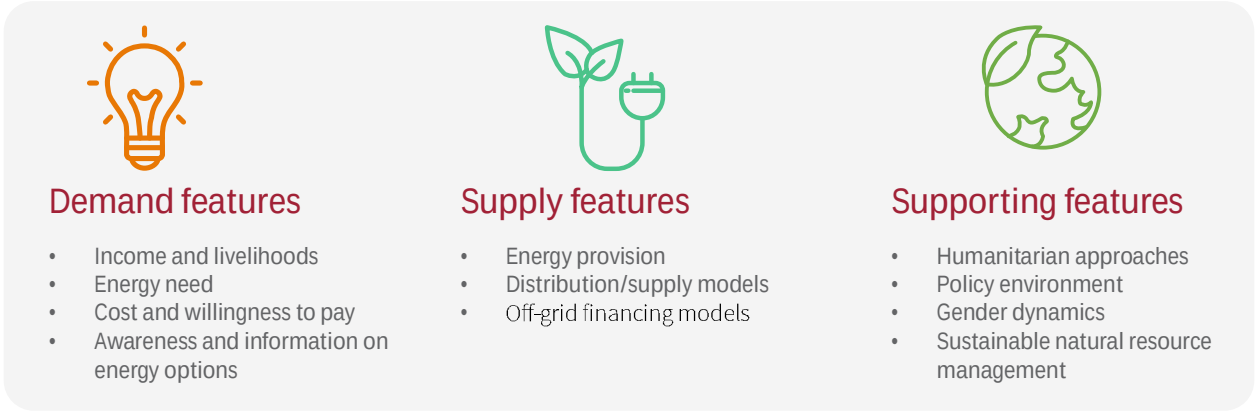

Table 12, Table 13 and Table 14 provide details on the assumption/ characteristics for the key features, and the implication of the identified characteristics.

Table 12: Demand features for promoting energy access and use in Kakuma refugee camp

Key Demand features characteristics	Demand features market implication
Income and livelihoods	
• Refugees in Kakuma heavily relied on international aid (donation and aid) as their major source of income. • Refugees are unable to legally work. Reliance on remittance (16 percent) due to lack of credit, accessible loan options, and employment opportunities. • Other income sources from business/informal employment (28 percent) trading in hardware, clothing, and food • 74 percent of the households cited low levels of income hindering their adoption of new technologies (cooking & lighting) • Only 8 percent of the population of Kakuma I engage in livelihood activities and/or have means of survival other than the aid provided	• The interdependence of refugees and host community (e.g. the refugees provide food for the host community in Kakuma town with the host community supplying labour and fuel) • Host communities often frequent the camp in search of trade opportunities such as firewood and charcoal or even washing clothes • There is prevalent trading of goods (i.e., food portions) for fuels, influencing cooking to spend as most refugees get fuel and stoves for free • Refugees receive basic services (education, food, healthcare) for free, therefore a significant percentage of refugees have disposable income for consumer goods

Energy need	
• Up to 80 percent of the wood fuel consuming households, cook only once per day • FAO has trained host communities on effective charcoal production using kilns • Many host community households take part in the trade of fuels e.g. charcoal and firewood	• Recurring fuel costs are made up primarily of charcoal purchases, making charcoal saving stoves the highest viable products • The household who adopt a higher quality of cooking fuel was likely to reduce the monthly cost of energy by USD 0.87
Cost and willingness to pay	
• NGOs have distributed energy products in-kind, creating dependencies • USD 1.5 million spend on energy per year excluding provision by humanitarian agencies • Households expressed willingness to pay for dual purpose stoves and small solar appliances. For cookstoves, WTP is however just about 50 percentage of market price	• Efficiency saving from Quality fuel and energy savings estimated at USD 0.15 - 5 by 29 percent of HHs • Lighting has showed high demand and willingness to pay however lower willingness to pay for cooking fuel due to giveaways • Market distortions hindering scale of commercial models • Alternative fuel used with the right FES would reduce the cost of fuel by USD 1.26 per month
Awareness and information on energy options	
• Community sensitization and awareness creation campaigns have been conducted to increase energy adoption of solar and clean cooking among households with little emphasis on productive uses of energy • Most awareness campaigns are pegged on specific projects rather than aiming to improve energy literacy on a sustained basis	• For the private sector awareness creation is a huge cost that many energy businesses are not able to absorb • HHs awareness of existing energy options and knowledge of alternative cooking fuel would reduce the cost of energy for cooking by USD 0.89 per month for the household. • Market awareness strategies on productive use opportunities for refugees and host communities would increase the adoption of productive use of energy

Table 13: Supply features for promoting energy access and use in Kakuma refugee camp

Key supply features characteristics	Supply features market implication
Energy provision	
• Firewood and stoves are distributed for free with stock-outs recorded within five days • Distribution of Maendeleo portable firewood stoves made at Lokado production units within the camps. • FAO distributed energy-saving cookstoves among refugees • Mini grids are becoming a practical alternative for electrifying the refugee camp. Already REA is building mini grids. Kenya Off-grid Solar Access Project (KOSAP) is doing Mini grids, SHS and clean cooking (fuels and Result Based Financing (RBF)for stoves) • Existence of informal private suppliers of power through diesel mini grids powered by generators serving households and businesses • Private sectors are being helped by development partners e.g. SNV to access the refugee market • The high cost of doing business in Kakuma discourages private sectors from venturing into Kakuma	• There is a strong business case for cleaner charcoal stoves whose adoption rates are higher than firewood stoves • Strong potential to attract private sector actors in the near-term for cookstoves and briquette production. Market model to acquire stove reduces cost by USD 1.8 • Obtaining energy-saving and efficient cookstoves would reduce the cost of cooking fuel by (USD 0.78) per month per household. • The solar market is already existent; competition and additional actors could drive down prices

Distribution models	
• Several PAYG companies have set up shops in Kakuma town and use distribution agents to sell PAYG products in the camp • Suppliers try to overcome the costs of 'last mile' distribution by teaming up with other delivery partners, such as wholesalers, supermarkets or hardware stores • The high cost of doing business in Kakuma discourages private sectors from venturing into Kakuma e.g. bioethanol or raw material for products	• The high cost of business the private sector impedes promoting market-based approaches as they can hardly compete favourably with local actors • Due to low market penetration, consumer education and awareness are necessary. • Innovative distribution models are needed to overcome key market barriers of remoteness, ability to pay and last-mile distribution
Off-grid financing models	
• The upfront cost of energy products is a barrier in buying the products, since most transactions cash based. • KOSAP have a debt and RBF facility to incentivize the private sector to deploy cooking and lighting technology • Presence of financial institution facilitating access to energy with Organization such as Equity Bank has a clean-energy loan product called EcoMoto, Action Africa for Help International (AAHI) promoting financial access for productive use	• The semi-formal mechanism, such as VSLAs, as a financing intermediary. However, the need to help the VSLAs with access to capital to capital and training to distribute products • The need to shift to more cash-based aid can allow for the potential for more market-based interventions to be explored and scaled up • Due to unstable income among refugees, there is a need for subsidization of products and financing to address high upfront costs necessary (Smart subsidies to support demand creation and seasonal promotions)

Table 14: Supporting features for promoting energy access and use in Kakuma refugee camp

Key Supporting features characteristics	Supporting features market implication
Humanitarian approach	
• UNHCR distributes 10 kilograms of free firewood per person every two months. This equates to 935 tonnes per month for the entire camp of Kakuma and costs more than USD 1 million per year • implementation of several markets-based energy interventions in refugee settlements in Kakuma both at the household level and institutional level • In the absence of an institutional 'home' for energy in the humanitarian framework, energy supply is typically provided in an ad hoc and piecemeal manner • Implementing partners in the camp also spend more than USD1 million per year to power compounds, health facilities, schools, and other buildings	• In view of limited humanitarian budgets, there is a need for innovative delivery models for the refugee and host communities (leave no one behind • There is a need for a coordinated approach to sustainably deliver energy interventions based on institutional ability for instance recent initiative by World Bank, UN, and Africa Enterprise Challenge Fund (AECF) in promoting private sector investment in Kakuma • The humanitarian institutional market is a low hanging fruit to showcase innovative energy delivery models for offices, compounds and community services

Policy	
• Restricted movement of refugees and restraining policies (curfews) results in reduced livelihood opportunities and contributes to reliance on humanitarian aid • Kalobeyei resettlement plan to promote the self-reliance of refugees. Government pursues policy options that ensure a positive impact on the local economy • Existence of the Kakuma Energy and Environment Working Group	• Opportunity to target the market with long term market-based solutions for increased access to energy • Limited mobility means that refugees are dependent on hosts to vend charcoal/wood
Gender Dynamics	
• 30 percent of the households felt insecure in collecting and using the cooking fuel available. • 68 percent of the refugees were afraid of an attack from the host community • 31 percent had to travel between 1-3 kilometres to collect cooking fuel, from their areas of residence. 73 percent of the households spent at least 5 hours weekly in collecting cooking fuel. Mostly women and children	• Need to promote opportunities for women economic empowerment through empowering them to be not just consumers but also providers of energy services • Reduction cooking fuel collection time by 1 hour and distance by 1km would reduce the economic cost of cooking energy by USD 0.26 and USD 0.82 respectively. • Women who collect firewood are vulnerable to gender-based violence; also increased tension with host communities
Sustainable natural resource management	
• One of the main drivers of degradation is the demand for wood as fuel and to produce charcoal, which is used by both displaced and local populations. • Households spend an average of 3-5 kg of firewood each day, leading to a dramatic depletion of forest resources near the camps • Groups formed by FAO are contributing to the sustainable production of charcoal by using kilns • Nurseries and woodlots have been set up to distribute seedlings to households and institutions • Use of *Prosopis juliflora* in meeting the energy demand	• By curbing firewood demand, clean cooking technologies can reduce environmental degradation and related resource tensions with local communities. • Reforestation by institutions managing nurseries in Kakuma who distribute tree seedlings including fruit trees to refugee camps especially during the rainy seasons leading to the development of woodlots and nurseries in camps • Enhancing and supporting existing policy, legal, institutional frameworks for continued implementation • Reduced use of biomass by using the invasive species

4.9 Innovations for energy programming

This section gives the innovative programming options that can be adopted by the FAO Kenya programme to improve energy provision in the humanitarian context. These programming options are informed by the specific context in Kenya, including the energy access situation, challenges opportunities and key market features. They are divided in six thematic areas namely: building capacity for the development of a market ecosystem to support the delivery of energy services to refugees; market-based programming and private sector engagement; scaling up community inclusive market-based solutions; multi-sectoral collaboration; community-based solutions-to drive awareness and uptake of clean cooking solutions; and sustainable natural resource management.

4.9.1 Building capacity for the development of a market ecosystem to support the delivery of energy services to refugees

Though the humanitarian energy system in Kakuma refugee camp is relatively developed as compared to other camps in the Eastern Africa region, it still falls short of meeting the SDG 7 targets for both cooking and lighting. Similarly, productive use of energy is yet to gain traction in the camp and host communities. Further, reliance of the households on free provisioning requires attention as this on its own is unlikely to help sustainably meet the needs of the refugee community. As such the proposed actions include:

i. Technical assistance to key lighting and cooking energy ecosystem actors at the Kakuma camp for transition to cleaner energy options there. This includes appropriate advocacy on universal energy access with ambitious targets for Kakuma camp.
ii. Building the capacity of refugees and host communities on productive energy use opportunities. This would help drive uptake of assets needed to stimulate market activity and development
iii. Taking advantage of recent innovations in the clean cooking sector to develop a business case for transitioning refugees from the current basic improved cooking technologies to cleaner (Tier 4+ technologies such as LPG and Bioethanol) technologies

4.9.2 Scaling up community inclusive market-based solutions

The energy ecosystem in Kakuma refugee camp has shown the disadvantaged position women find themselves in when accessing energy in an environment with low resource availability, and its negative effect to overall cost of energy. Programming options should therefore consider:

i. Mainstreaming inclusion: Proactively ensuring the inclusion of host and displaced individuals in all their diversity across the program cycle
ii. Support alternative energy options that are locally available and economically, technically, and culturally appropriate for the end-users
iii. Promoting women's economic empowerment approaches in energy delivery. This includes building the capacity of women entrepreneurs through technology training and business support
iv. Promoting youth employment and entrepreneurship opportunity in energy enterprise.

4.9.3 Community-based solutions-to drive awareness and uptake of clean cooking solutions

Kakuma refugee camp now has a wide range of clean cooking solutions that were either introduced by humanitarian organizations or by the private sector. For the market to scale up a number of measures to drive awareness are needed:

i. **Awareness-raising efforts** taking into consideration the fact that most female household heads make stove selection decisions and provide the money for new stove purchases.

ii. Working with communities to **counterbalance power dynamics** e.g. the provision of electricity inside refugee camps can map closely onto the camp's social organization, which is largely along the lines of national and ethnic identity

iii. In raising awareness on the benefits of improved cooking technologies, it is also important to include awareness-raising on **efficient cooking practices** which can be implemented alongside the technologies such as soaking grains before cooking, use of lids on pots and design of cooking spaces among others.

4.9.4 Market-based programming and private sector engagement

Embedding a market-based approach to the delivery of energy services in the camp requires active private sector engagement. This can be achieved through:

i. Building **human capital** for private sector players by capacitating refugees and host community on alternative livelihood opportunities such as energy entrepreneurship and small scale agriculture

ii. **Providing incentives to attract more private sector** players to successfully deploy energy products/services in refugee camps

iii. Creation of new **financing models** that improve access to financing for private sector players to help them absorb some of the initial risks of developing products that address energy needs.

iv. Cash transfers to **increase** household **purchasing power** and bridge the viability gap for energy services

4.9.5 Multi-sectoral collaboration

Kakuma refugee camp has many actors involved in energy service delivery. However, there is need to improve coordination and collaboration among both public, private sector, civil society and humanitarian organizations. Collaboration is needed to help establish an institutional "home" for energy that will in turn bring together resources and capacities- expertise, finance, policy and institutional support that are needed to improve energy access in the camp and host community. Specific measures include:

i. Strengthening the **Kakuma Energy and Environment Working Group** consisting of representatives of FAO, GIZ, LOKADO, UNHCR Kenya, World Food Programme (WFP) and World Vision International (WVI),

ii. Having **wider stakeholders** (taking the water food and energy (WFE) nexus approach) involved (including energy and non-energy players) working and investing together in developing the energy ecosystem in the camp.

iii. Promoting of **effective and conflict-sensitive actions** to integrate WFE and ecosystem concerns at the local level

4.9.6 Sustainable natural resource management

The strong connection between cooking fuel and the natural resources needs a holistic approach that integrates sustainable management of forests and water resources in the area. The action points for this would include:

i. **Scaling up sustainable** charcoal production and promoting market-based approach by engaging different value chain actors including distributors and consumers to address value chain constraints.

ii. Enhancing **charcoal governance** for instance certification of charcoal production from specific species e.g. *Prosopis juliflora*.

iii. Partnering with community-based organizations to promote increased awareness, responsibility, and **accountability of local natural resources** e.g. utilization of *Prosopis juliflora* in carbonized briquette production.

iv. Manage the **switch from wood fuel** (with negative environmental impact) to charcoal, with a bigger market opportunity.

Evaluation of SAFE programming in Eastern Africa: **South Sudan country report**

5. Context of the South Sudan report

5.1 Background of the report

Energy needs in South Sudan are predominantly met by biomass, consisting of the burning of charcoal, wood, grass, cow dung, and agriculture residues. Over 96 percent of the population in South Sudan uses firewood or charcoal as the primary fuel for cooking (which typically constitutes 90 percent of the energy used in a rural household); while over 95 percent of the households in Juba, the capital city of the Republic of South Sudan, cook with firewood or charcoal – the vast majority using charcoal (South Sudan National Bureau of Statistics (NBS), 2012). Those in the low-income housing areas, where 75 percent of the population lives, spend 10-15 percent of their average monthly household income on charcoal. Firewood is the most popular source of lighting as it is used by 35 percent of the population in South Sudan, grass used by 15 percent and paraffin lamps used by 13 percent, while 27 percent of the population has no documented source of lighting. Only about 1 percent of the population has access to grid electricity. Those who have electricity are mainly in Juba, with the remaining few in the towns of Wau and Malakal (Abd-Elfaraga and Langoya, 2016). Moreover, South Sudan faces serious energy crisis due to several factors including devastating conflicts (e.g. 1955-1972, 1983-2005 and 2013–present), and reliance on the fossil fuel source. The country has the lowest energy consumption rate in Africa and the highest cost of producing energy. Previous studies also noted that charcoal was the dominant cooking energy, with 95.52 percent of the households using it, only 9.45 percent used cooking gas, and 13.93 percent use firewood for cooking, especially in the urban areas. In rural areas, over 95 percent of the households used firewood for cooking and lighting (World Bank, 2016).

There is growing awareness on the importance of including sustainability in energy access activities within humanitarian settings, the aim being to shift the humanitarian response towards a more marked based approach. We use energy as a resource to highlight the intersectionality of the challenges facing communities living with fragility, violence and conflict. Energy poverty is also at the heart of a complex of problems affecting fragile communities.

The SAFE program is being incorporated into larger resilience-building projects and programs to meet the energy needs of the world's most vulnerable populations in IDP reforms. The evaluation of the SAFE Programme in South Sudan was undertaken in Melijo IDP camp in Nimule Region. The Internally displaced persons living in the Melijo region ran for their safety from the southern part of South Sudan and the majority were reported to have lived in Jonglei Region only 50 km from Juba town, a region currently occupied by militia and rebels. The Nimule town lies at the border of South Sudan and Uganda hence there was increased cross-border movement. The South Sudan region was different from Uganda and Kenya

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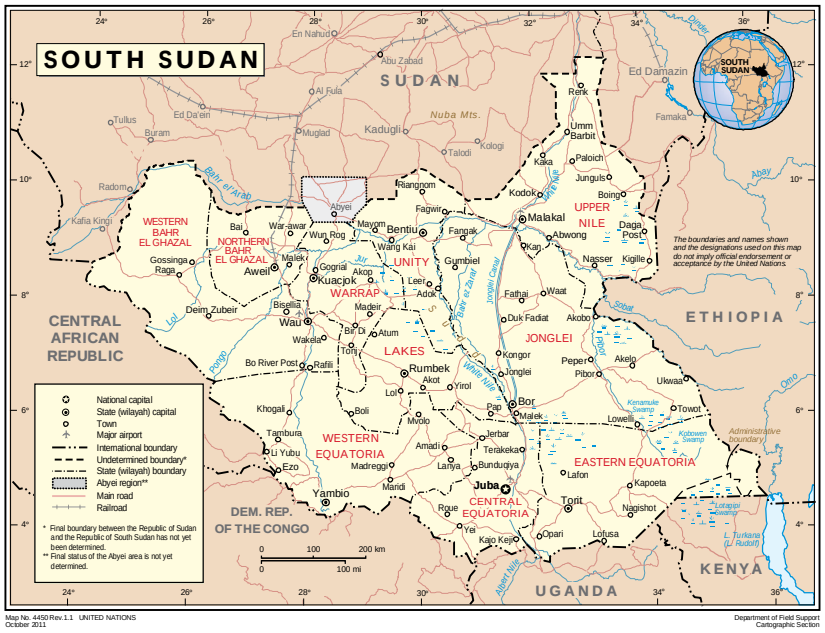


Figure 23: Map of South Sudan showing the location of Nimule Town

(Source:https://www.un.org/Depts/Cartographic/map/profile/southsudan.pdf)

as these were households of internally displaced within their own country, having been in the IDP camps since 2015. The camp hosted more than two thousand Internally Displaced People (IDPs) who had fled violence (USAID, 2014).

This report gives the South Sudan case study with rich country-specific data and context analysis. The report focused on the Melijo IDP camp with an estimated household population of 500. Nimule is a town in the southern part of South Sudan in Magwi County, Imatong State (see Figure 38). It lies approximately 197 km (122 mi), by road, southeast of Juba, the capital of South Sudan, and the largest city in the country. The town also lies approximately 120 km (75 mi), by road, north of Gulu, Uganda, the nearest large city. Thus, the survey took place in Melijo IDP camp, in Nimule. In the IDP camp, 198 households were sampled for the evaluation.

5.2 Characteristics of the households

The households in the evaluation are characterised by the demographics (age, sex, and household size), income per household, the type of structure they live in, and their perception on and use of energy.

5.2.1 Demographics

The evaluation documented that the respondents in the Melijo IDP camp in Nimule region, was mostly (91 percent) individuals of productive age (between 18 years and 60 years) as presented in Figure 24.

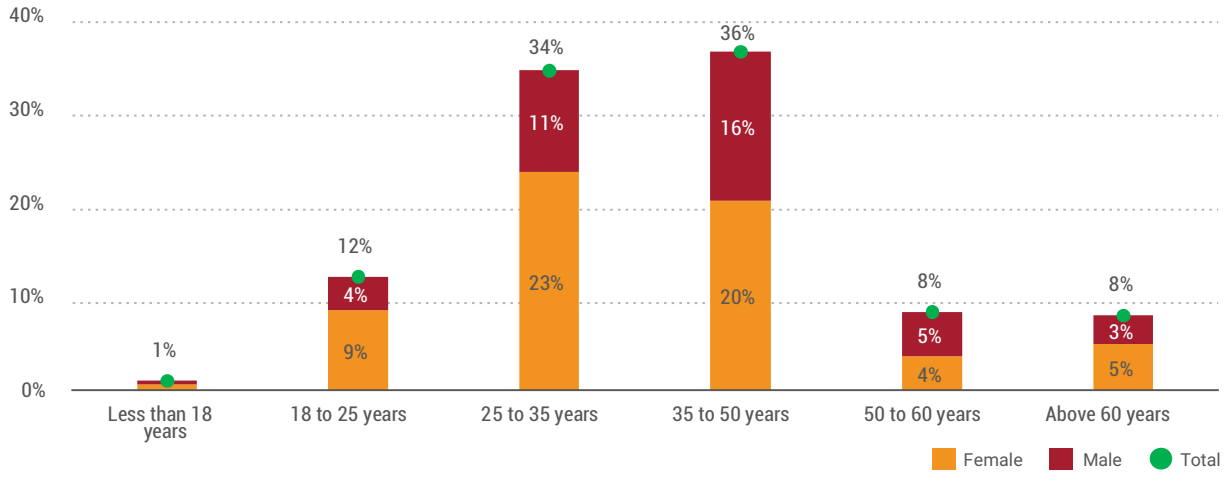


Figure 24: Age and sex of the Melijo IDP camp population in Nimule region

Majority (71 percent) of the respondents were married, while 12 percent were single and never married, 8 percent were single parents, 7 percent were separated, and 2 percent were divorced. More than half of the households had over six (6) individuals, while one-third of the households had between 4 and 6 individuals, an indication that more than 80 percent of the households had a household size of over 4 individuals (see Figure25).

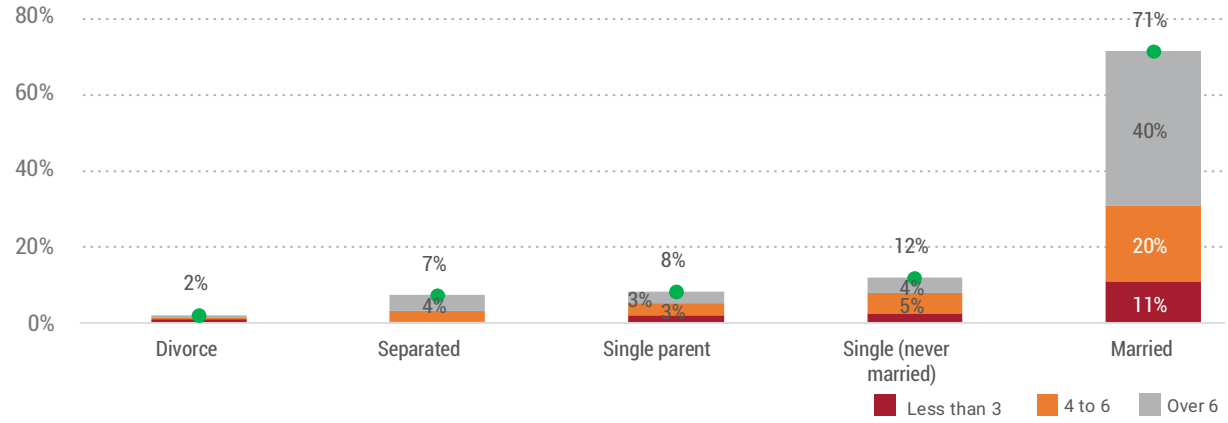
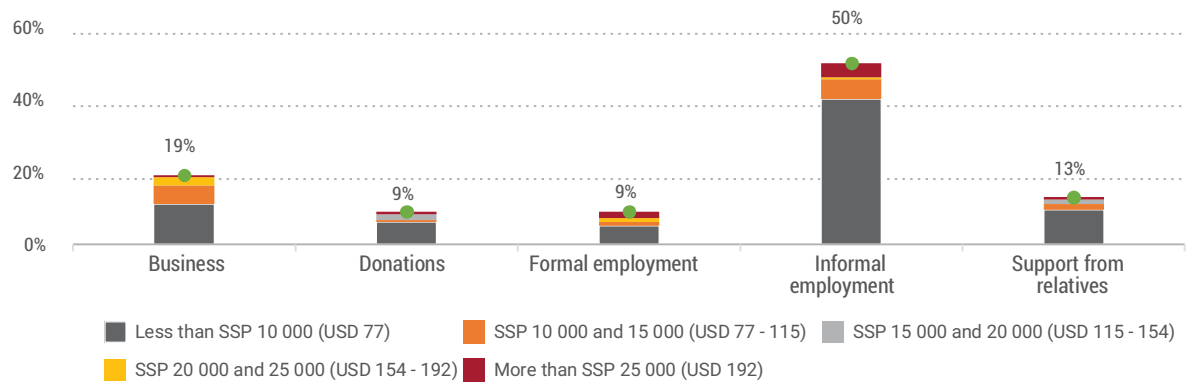


Figure 25: Household sizes and civic status of respondents in the Melijo IDP camp

5.2.2 Income

The evaluation revealed that half of the respondents (see Figure 1) were informally employed earning less than SSP 10 000 (USD 77) per month. In general, majority of the households earn less than SSP 10 000 (USD 77) per month, and the highest earners ,over SSP 25 000 (USD 192), were respondents who were employed either formally (represented by 2 percent), or informally (represented by 4 percent).

Figure 26: Sources and amounts of income among the households in Melijo IDP camp



5.2.3 Dwelling

The households lived either in semi-permanent (13 percent) or temporary (87 percent) dwellings, that were mostly (96 percent) owned by the households. Half of the households have been in the IDP camp for less than 5 years, although considerable proportions (44 percent) of the households have been in the camp for more than 5 years (see Table 15).

Table 15: Ownership of living structures and duration the households have stayed in the camp

Duration of stay	Owned	Provided by Government	Provided by UNHCR	Provided by relatives	Rented	
Less than 1 year	2%	0.5%				
1 to 5 years	50%		0.5%	0.5%		1.0%
5 to 10 years	44%	0.5%	0.5%			
10 to 15 years	1%					
Cumulatively	96%	1.0%	1.0%	0.5%		1.0%

5.2.4 Perception on and use of energy

The households in the IDP camp indicated that energy for lighting was the most important (cited by 87 percent of the respondents), followed by energy for cooking (cited by 77 percent of the respondents), and almost half (cited by 48 percent of the respondents) of the households indicated the importance of energy for productive purposes (see Figure 27).

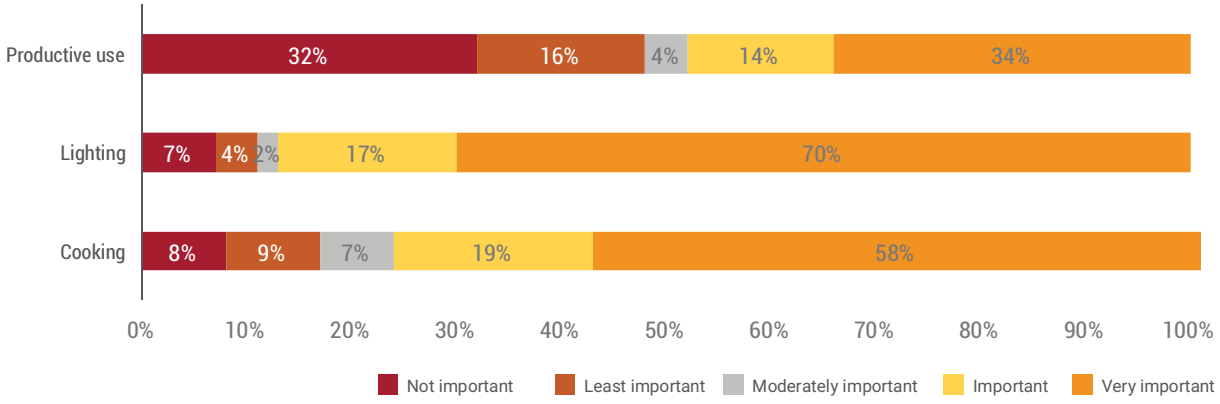


Figure 27: Perceptions on energy among the households in the IDP camp

The households use energy mostly for cooking and lighting (67 percent), or only cooking (21 percent), while 12 percent of the households used energy for productive purposes in combination with either cooking and lighting, or lighting only as presented in Figure 28. Cumulatively, 97 percent of the households use energy for cooking, while 77 percent use energy for lighting. Therefore, energy was mainly used for cooking.

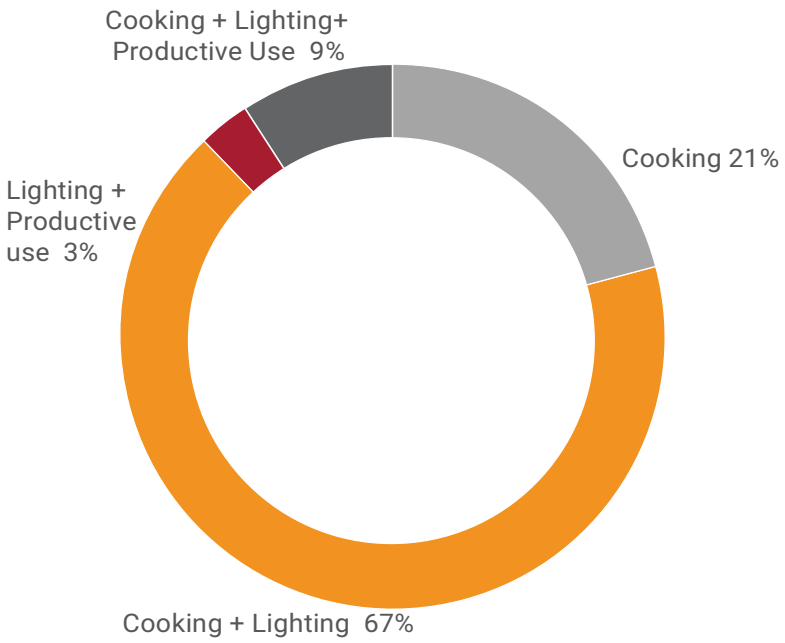


Figure 28: Energy uses in the IDP camp

5.3 Energy for cooking

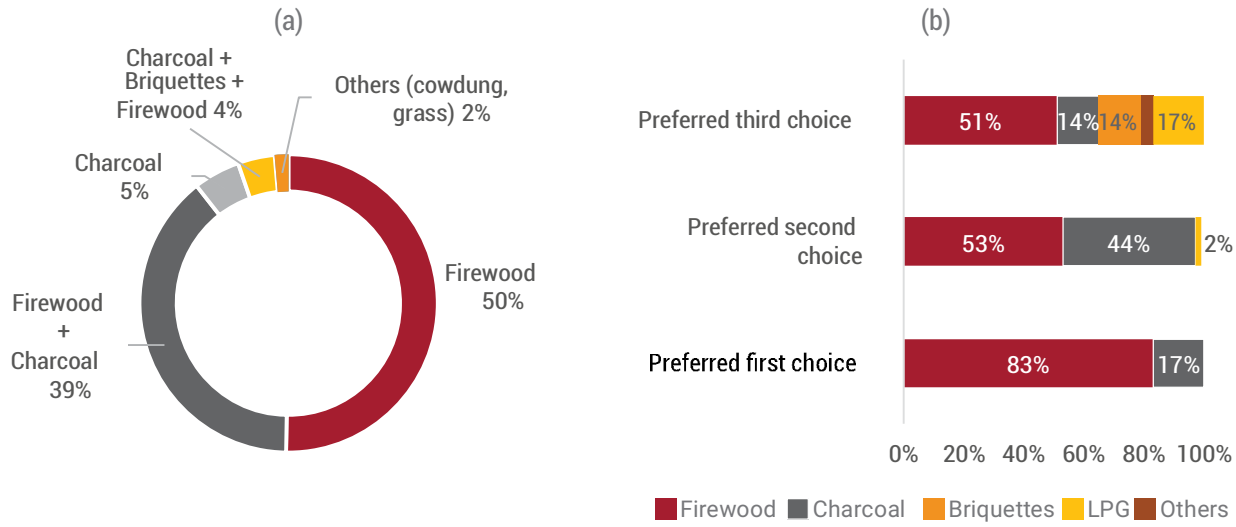
The section integrates the findings from the study regarding energy for cooking in Melijo IDP camp. The section details the findings on cooking fuel, and cookstoves.

5.3.1 Cooking fuel

5.3.1.1 Type of fuels

The most used fuel type documented in the study was firewood (cumulatively used by 93 percent of the households), followed by charcoal, briquettes, and others (mainly cow dung and grasses). However, half of the households used firewood only, while 39 percent was using a combination of firewood and charcoal (see a). At the same time, firewood was the most preferred (by 83 percent) first choice, while for second choice, firewood and charcoal were preferred. The third choice of preferred fuel included briquettes and LPG (see Figure 29). It was also noted that the majority (55 percent) of households in Melijo IDP camp used one type of cooking fuel while 39 percent of the households used at least two types of cooking fuels, and further 4 percent used more than three types of cooking fuels.

Figure 29: Fuel types (a) used in Melijo IDP camp; and (b) preferred by the households in the camp



5.3.1.2 Sources of fuels

Majority (70 percent) of the households in the camp got their fuel through free collection in the areas around the camp, while others produced their own fuel (especially firewood, charcoal, and briquettes). 8 percent of the households purchased their cooking fuel (especially firewood and charcoal), while 4 percent of the households got fuel provisions (see Figure 30). Nonetheless, 25 percent of the households sourced cooking fuel using multiple ways while 74 percent either used free collection or received provisions.

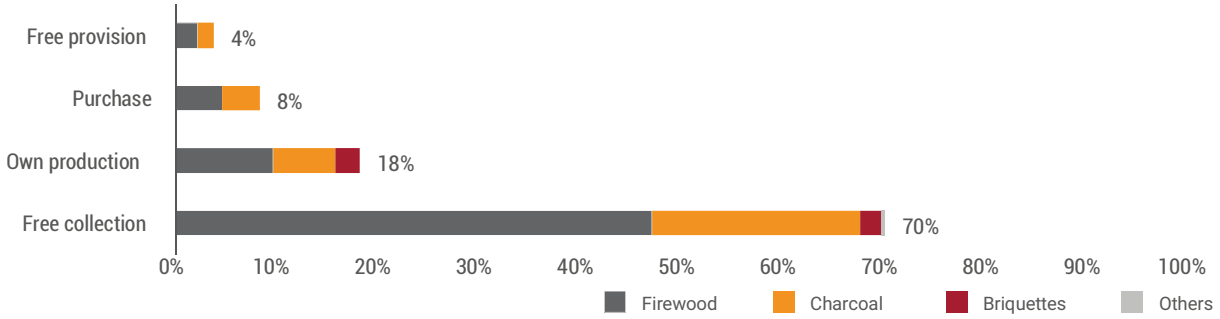


Figure 30: Sources of cooking fuel for the households in Melijo IDP camp

5.3.1.3 Amount of fuel used

In the analysis, it was found that 16 percent of the households used more than 10 kg of firewood per day. Another 51 percent of the households used between 5 kg-10 kg per day while 33 percent used between 2 kg-5 kg of firewood, or an equivalent of a share of the charcoal.

The evaluation revealed that 37 percent of the households perceived the quality of cooking fuel they used as being high. A further 20 percent reported that the quality was average while 43 percent of households reported that the quality was of low. Quality was mostly defined in terms of ease of lighting and burning. The community noted that their choice of cooking fuel was determined by its availability and its environmental friendliness as reported by 29 percent and 24 percent of the households, respectively. Further, other considerations made included a combination of availability and physical access as well as a combination of physical access and being environmentally friendly (8 percent); affordability and physical access (11 percent) and reliability (6 percent) respectively.

5.3.1.4 Costs and payments for fuels

The cost of cooking fuel per day was estimated at SSP 100 (USD 0.77) from 60 percent of the households while 32 percent of the households spent between SSP 200 - 400 SSP (USD1.5 - 3.1) with 9 percent of the households spending over SSP 400 (USD.3.1) on cooking fuel. 47 percent of the households spent on average between SSP 1000 - 2000 (USD 7.7-15.3) per week while 25 percent and 16 percent of the households spent between SSP 2 000 (USD15.3) and 5 000 (USD 38.4) and over SSP 5 000 (38.4) on cooking fuel, respectively. However, only 13 percent of the households spent less than SSP 1 000 (USD 7.67) weekly.

It was further noted that, when no fuel saving approaches were provided (such as putting off the fire after cooking or reducing the number of cooking times); 60 percent of the households would spend less than SSP 3 000 (USD 23), while 11 percent of the households would spend between SSP 3 000 - 6 000 (USD 23 - 46), and 11 percent of the households would spend between SSP 6 000 - 9 000 (USD 46 - 69) per week on fuel. Only 10 percent and 8 percent

would spend between SSP 9 000 - 12 000 (USD 69 - 92), and over SSP 12,000 (USD 92) per week, respectively.

Moreover, 32 percent of the households were willing to pay more for cooking fuel. Of these, 73 percent were willing to pay between SSP 200 (USD 1.5) and SSP 500 (USD 3.8) more for cooking fuel.

5.3.1.5 Constraints and interventions for cooking fuel

The main constraint on cooking fuel emerged as stock-outs. The evaluation identified that 48 percent of the households reported cases of cooking fuel stock-outs; out of which 74 percent of the respondent reported stock-outs at least 1- 5 days in a month, with 20 percent of the respondents reporting cooking fuel stock-outs at least 6-10 days in a month. Some of the causes of the stock-outs included poor infrastructure within the area reported by 41 percent of the households while the cost related to cooking fuel was a major cause as reported by 68 percent of the respondents. Further, the limited number of suppliers especially for charcoal was cited as a cause of stock-outs as reported by 33 percent of the households. These attributes, if addressed would reduce the frequency of cooking fuel stock-outs.

Management of the stock–outs required strategies that were used to save the amount of fuel used. Some of the fuel saving strategies used by the households included reducing the amount of fuel used per cooking (cited by 32 percent), putting off fuel after use (cited by 30 percent), reducing the number of cooking per day (cited by 24 percent), and acquiring fuel efficient stoves (cited by 14 percent). These measures were able to contribute to monthly cost savings on fuel of less than SSP 200 (USD 1.5) estimated among 48 percent of the households, while 19 percent of the households were able to save an equivalent of SSP 1 000 - 2 000 (USD 7.7 -15.3) each month. 33 percent of the households saved over SSP 2 000 (USD 15.3) monthly.

5.3.2 Cooking technologies in Melijo IDP camp

5.3.2.1 Types of cookstoves used

The main types of cookstoves used in Melijo IDP camp included the three stone open fire (used by 42 percent), traditional metal stoves (used by 34 percent), FAO stoves (used by 10 percent), Maendeleo stove (used by 7 percent), dual purpose (used by 4 percent), and improved charcoal stove (used by 3 percent). However, 54 percent of the respondents stacked more than one stove. It was observed that most households that primarily used the three stone open fire, had a traditional metal stove (cited by 20 percent), a FAO stove (cited by 7 percent), a Maendeleo stove (cited by 4 percent), or a dual purpose stove (cited by 3 percent) as presented in Table 16.

Primary stove	Improved charcoal stove	Improved charcoal stove	Maendeleo stoves	Maendeleo stoves	Maendeleo stoves	FAO stove
	+	+	+	+	+	+
Stacked stove	Dual purpose	FAO stoves	FAO stoves	Traditional metal stove	Three stone open fire	Improved charcoal stove
Proportion of responses	1%	1%	1%	1%	1%	1%

Primary stove	FAO stove	Traditional metal stove	Traditional metal stove	Traditional metal stove	Traditional metal stove	Traditional metal stove
	+	+	+	+	+	+
Stacked stove	Traditional metal stove	Improved charcoal stove	Dual purpose	Maendeleo stoves	FAO stoves	Three stone open fire
Proportion of responses	1%	1%	1%	1%	2%	13%
Primary stove	Three stone open fire	Three stone open fire	Three stone open fire	Three stone open fire	Three stone open fire	
	+	+	+	+	+	Total proportion of respondents stacking stoves
Stacked stove	Improved charcoal stove	Dual purpose	Maendeleo stoves	FAO stoves	Traditional metal stove	
Proportion responses	1%	3%	4%	7%	20%	54%

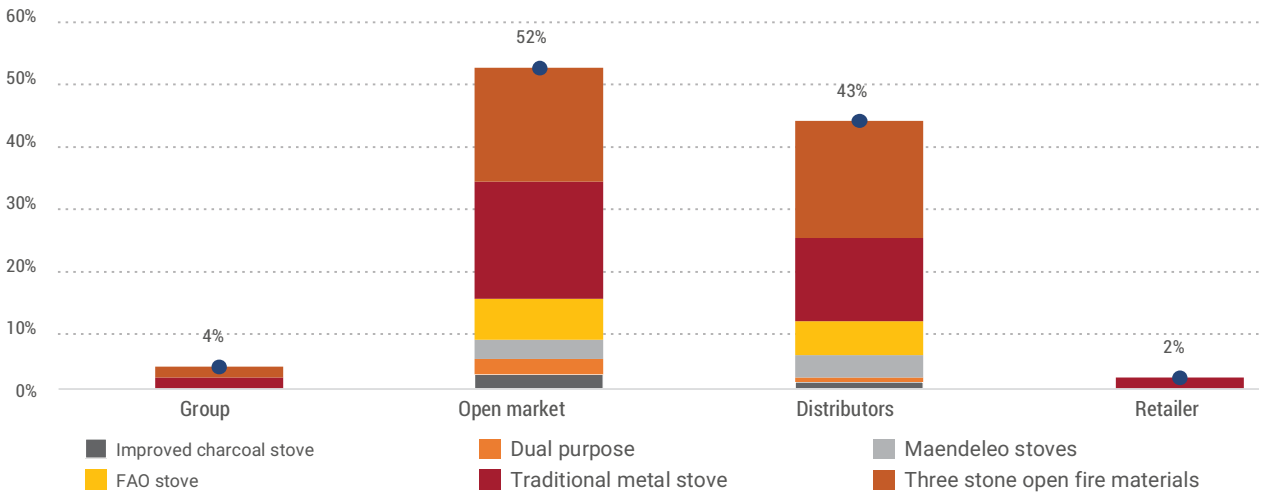
Table 16: Probability of cookstoves stacking among the households in Melijo IDP camp

5.3.2.2 Sources of cookstoves

The Nimule community reported that 52.3 percent of the households used cookstoves which were acquired from various sources. Among the sources indicated during the evaluations, it was noted that 33 percent of the households participated in community awareness on cookstoves after which they made their own cookstoves. Also, 25 percent of the households acquired cookstoves from family members while 19 percent, 11 percent, and 6 percent of the households received their cookstoves from neighbours, friends; and FAO, respectively. Besides, 57 percent of the households reported that their cookstoves were provided for free; while 21 percent of the households reported that the cookstoves were purchased.

The number of development organizations supporting households to acquire cookstoves in the region is very few. For the households who reported having bought stoves, they gave a number of reasons for this: (i) the households needed a new cookstove; (ii) they needed a cookstove that would cook faster and that was also easy to use (iii) households required a cookstove with low levels of pollution and could guarantee quality cooking, and (iv) households required cookstoves that were efficient and cost-effective. 52 percent of the households purchased their cookstoves from the local market with 43 percent of the households purchasing the same from distributors. However, 4 percent and 2 percent of the households acquired their cookstoves from groups and a retailer, respectively. Notably, most of the fuel-efficient stoves were acquired either from distributors or open markets (see Figure 31).

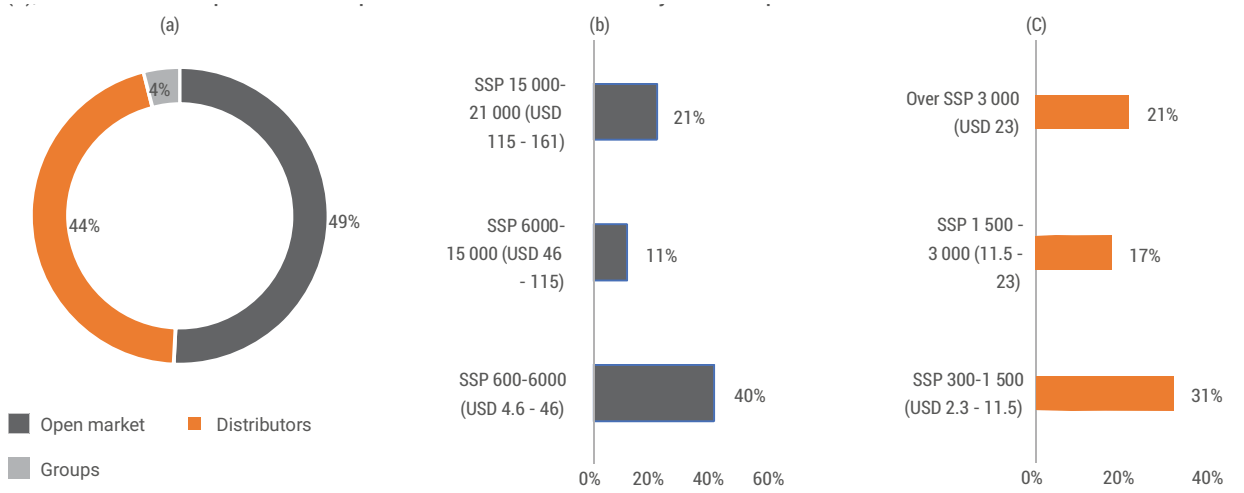
Figure 31: Supply of cookstoves to the households in Melijo IDP camp



5.3.3 Estimated costs of and willingness to pay for cookstoves

72 percent of the households reported having received varying amounts of cash transfers to purchase cookstoves. 40 percent of the households received cash transfers to purchase stoves at a cost of between SSP 6 00-6 000 (USD 4.6 - 46.6) and SSP 6 000 - 15 000 (USD 46.1 - 115.2) respectively while 21 percent of the households received cash to purchase cookstoves between SSP 15 000 - 21 000 (USD 115.2 - 161.2). However only 69 percent of the households reportedly purchased stoves. Of these, 31 percent of the households purchased cookstoves between SSP 300 - 1 500 (USD 2.3 - 11.5) and SSP 3 000 - 6 000 (USD 23.0 - 46.1) respectively; while 21 percent and 17 percent of the households purchased cookstoves at over SSP 3 000 (USD 46.1) and between 1 500 - 3 000 (USD 11.5 - 23.0) respectively (see Figure 32).

Figure 32: Places of purchasing cookstoves (a), cash transfer amount received for the purchase of cookstoves (b), and the amount spent on actual purchase of cookstoves in Melijo IDP camp



Households were asked whether they would consider paying more for an improved cook stove of which 31.1 percent were willing. Of those willing to pay more, 50 percent were willing to pay between SSP. 1 000-2 000(USD.7.67-15.3) for the cookstoves, while 33 percent were willing to pay between SSP. 2 000 and 5 000(USD.15.3-38.38) while 17 percent were willing to pay more than SSP 5 000(over USD 38.8) for an improved cookstove.

5.3.3.1 Factors considered in acquisition and use of cookstoves

The desire to pay more for cookstoves was dependent on attributes of the stove that households considered would improve efficiency and effectiveness of the cooking process (see Box 2). Some of the factors considered included (i) stoves that use less charcoal and firewood (ii) stoves that are clean (iii) stoves that cook fast (iv)stoves that looked presentable or aspirational, and (v) cookstoves that were easy to handle. Further, the payment for improved cookstoves was dependent on the type of stove; where, 28 percent of the households were willing to pay more for the traditional cookstoves, while 25 percent and 22 percent were willing to pay more for the FAO stoves and Improved metal stoves respectively.

BOX 2 **Beneficiary impact story at Melijo IDP camp**

Beneficiary impact story: Melijo IDP camp

We sought to find out from beneficiaries of the FAO stove what were the implications and impacts of the use of their stoves on their lives. We engaged a group of women who had received the FAO fuel efficient stoves. They reported that the FAO stove has had a positive impact on cooking and productive use of energy. Participants cited smokeless burning, low selling price, firewood saving, durability and portability as reasons for their preference to using the stove. For instance, they explained that the stove is durable and can last a year on productive use activities such as cooking food in eateries and therefore making the business profitable. It was also viewed as dual purpose since they can use dung as fuel when firewood becomes scarce. For households that buy firewood, they considered the stove effective in reducing the cost of energy as it is fuel efficient. It was however difficult to evaluate the health benefits brought about by the stove despite the fact that the stove was considered safe to use as compared to open fire stove. The group also attributed the stove with ease of use compared to the traditional three stone open fire. From the women participants view point, the low selling price of the stoves and their considerable fuel efficiency reduced the investment and running costs that would otherwise be a strain on the limited household income. The stove was also said to reduce indoor air pollution and reduce drudgery on women through the tedious work of firewood collection. A key lesson from the beneficiaries was the need to incorporate consumer preferences and cultural cooking practices in the design of improved cookstoves. This would enable stoves to meet the energy needs of targeted users and therefore be consistently used.

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5.4 Energy for lighting

This section explores the lighting technologies including sources of lighting and the costs associated with acquisition as documented in the study at Melijo IDP camp.

5.4.1 Types and sources of lighting

Households in Melijo used a number of lighting technologies with some using multiple lighting technologies. Single lighting technologies were mainly tin lamps (cited by 12 percent) and candles (cited by 9 percent). For households using two types of lighting technologies the dominant combination (cited by 12 percent) was candles and kerosene lamps, and the most dominant lighting technology amongst the three was a combination of candles, Pico solar lanterns and solar home systems (cited by 9 percent of the respondents). Majority (43 percent) of the households use two types of lighting technologies, 32 percent use three types of lighting technologies, and 25 percent use one type of lighting technology (see Table 17).

Table 17: Types of household lighting used in Melijo IDP camp

Single source of lighting	25%	Two types of lighting	43%	Three types of lighting	32%
Candle	9%	Candle and kerosene lamp	12%	Candle, solar home systems, pico solar lanterns	9%
Kerosene lamp	4%	Candle, other	7%	Candle, solar home systems, tin lamp	7%
Tin lamp	12%	Candle, pico solar lanterns	5%	Candle, pico solar lanterns, kerosene lamp	4%
		Candle, tin lamp	9%	Candle, pico solar lanterns, tin lamp	4%
		Kerosene lamp, tin lamp	5%	Candle, tin lamp, kerosene lamp	5%
		Tin lamb, pico solar lanterns	6%	Tin lamb, pico solar lanterns, kerosene lamp	3%

Cumulatively, the most popular source of lighting was tin laps, followed by candles among others as presented in Figure 33.

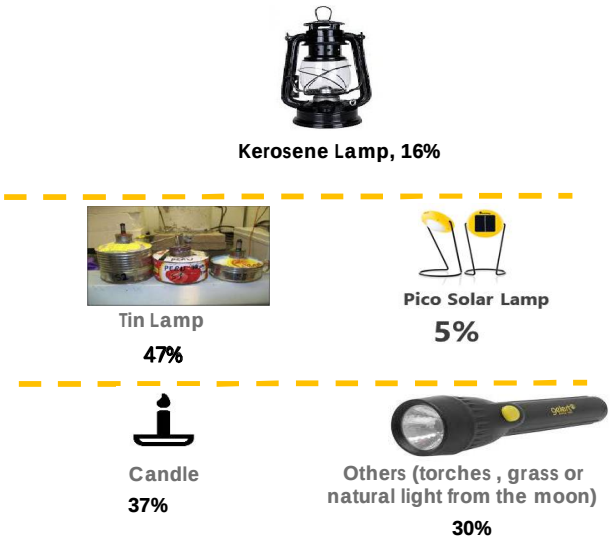


Figure 33: Main sources of lighting in the Melijo IDP camp

5.4.2 Adoption of new lighting technologies

The evaluation reported that 70 percent of the households suffered from lighting fuel stock-outs lasting between 1-5 days, while 18 percent and 12 percent had lighting fuel stock outs lasting between 5-10 days and over 10 days, respectively. To manage the reported cases of stock-outs, 71.4 percent reported the need to change to new lighting technology. Some of the lighting technologies preferred included the use of solar home systems (30 percent); Pico solar /portable lighting system (35 percent), torch lighting (14 percent), and kerosene lamp (11 percent); candle and electric power (5 percent). Moreover, households identified some of the reasons for their preference of new lighting technologies; these included, (i) the sources were cheaper and affordable (27 percent); the sources were clean and environmentally friendly (22 percent); the sources were portable (21 percent); the lighting sources were easy to handle and also manage (14 percent) and, the sources were effective and less risky(fire hazard) at 9 percent and 7 percent respectively.

5.5 Energy for productive use

There was very little productive use of energy reported in the survey. Only 4 percent of the households living in the Melijo region reported to be engaging in a productive energy use activity and this was mostly related to cooking energy use. Of those engaged in productive use, about 60 percent were involved in baking (buns, bread, or cakes). The others were engaging in poultry keeping and trading in charcoal and other household goods facilitated by use of lighting technologies at night . The households reported that 72 percent were able to make between SSP 5000 and 15 000 (USD 38.38-115.15 while 28 percent were able to make above 15 000 SSP(USD 115.15) per month.

Productive energy use in Melijo camp was limited by several factors among them lack of awareness on potential productive use activities, working capital and limited purchasing power among the IDPs.

5.6 Compounding factors for energy access

Beyond energy for cooking, lighting and productive use, this section details other significant compounding factors associated with energy access including the gender contexts in energy access, conflicts in Melijo that could influence energy access dynamics, and implication of energy access on natural resources (especially forests).

5.6.1 Gendered contexts in energy access

5.6.1.1 Responsibilities for and efforts in cooking fuel collection

Collection of firewood was reportedly done by different household members but with varying levels of effort. Children and women bore the biggest burden of collecting firewood representing 66 percent of the people collecting.

Female spouses and male household heads also represented 60 percent and 36 percent of persons in the households collecting cooking fuel, respectively. In 15 percent of the cases, it was reported that all household members including the head, spouse and children were involved in collecting cooking fuel.

The level of effort in collecting cooking fuel was largely determined by time taken and distance travelled to collect cooking fuel. In terms of the number of hours spent in collecting cooking fuel, 68 percent of the households spent 1 to 3 hours to collect cooking fuel in a day, while 24 percent spent 4-6 hours; only 5 percent and 3 percent spent 7 to 9 hours and over 10 hours respectively. Further, on the distance covered in collecting cooking fuel, 60.3 percent of the households covered less than 1km while 20.6 percent and 15.1 percent covered 1 to 3 km and 3 to5 km respectively. Only 4 percent of the households covered more than 5 km to collet cooking fuel.

Generally it could be observed that firewood was relatively accessible to the IDP households in Melijo and thus explaining the high proportion of the households using firewood for cooking. However firewood collection still disproportionately imposes a heavy burden of drudgery on women and children.

5.6.1.2 Energy related conflicts

In the Melijo IDP community there were concerns about energy related conflicts and insecurity during the collection of firewood. In this regard, 30 percent of the households felt insecure with 35 percent having previous experience of violence while collecting cooking fuel. The insecurity was a result of fear of attacks from people, animals, the prevailing bad weather and a combination of these factors. Further, the violence experienced resulted from harassment by the members of the host community including delinquent youths within the area. Cases of snake bites were also reported. Women and girls were most vulnerable to the attacks by virtue of being the ones mostly involved in firewood collection. There is therefore need to consider these gender dimensions and vulnerabilities in the design of energy programming interventions for the community.

5.6.2.3 Implication of energy access on health and natural resources management

As already documented in previous sections, households in Melijo IDP camp largely used traditional firewood-based methods of cooking in their temporary dwellings where most of the residents lived. Households had no concerns about the dangers of indoor air pollution associated with cooking with firewood and lighting with kerosene. Obviously other livelihood and survival concerns took precedence in making cooking and lighting choices. Awareness levels on household air pollution were evidently low. Households were also not able to clearly see the relationships between natural resources

management and household energy demand for cooking, lighting and productive use. The Melijo IDP community had little information on the need for a community woodlot in the region.

Discussions with the households and leadership on how development of woodlots could were generally welcome. However, the community was unable to fully recognise the value of tree nurseries in reforestation; as there was hope that the households would return to the places they lived prior to the South Sudan conflicts *(The analysis was done during a period when South Sudan peace deal was under discussion and a peace accord was expected to be signed in February 2020).* It also revealed a lack of long term policy on environmental sustainability for this community.

Forests are an important resource in South Sudan with an estimated 30% forest cover in the country. The play a key role in the day by day lives of South Sudanese, with greater than 90% of the populace dependent on forests for firewood, food and nutrition and hydrological services (FAO, 2010). Forest-based industries such as sawmilling and furniture enterprises are a major source of off-farm income with agroforestry farming systems contributing to poverty alleviation, sustainable agriculture, and increased crop productivity. However, South Sudan's forests and their related ecosystem services are under threat due to unlawful logging, unplanned and inefficient agricultural practices, and an unregulated charcoal industry, serving the ever growing demand in city centres. FAO is supporting in the advancement of technical approaches in capacity development, monitoring forest cover and working with the government in development of policy and practices relating to the land use. This is in addition to FAO's work at the community though the distribution of fuel-efficient stoves aimed at reducing natural resource depletion in forest in South Sudan.

5.7 Cost of energy

The cost of energy goes beyond the direct pricing set for fuels that is acquired through cash payment, type of technologies available and options in their use. In this section, cost of energy is explored through the implications of energy access, use and payment mechanisms on energy dynamics, based on demographic characteristics, gender and natural resource management in a market-led environment. Market impact on the cost of energy

To establish the impact of the SAFE programme among the served population, an econometric analysis of consumption on clean cooking, forest management, renewable energy in agri-food chains energy products was used. The analysis was based on reduced form expenditure regression model in which the household real expenditure was regressed on the households characteristics and endowments (Glewwe *et al.,* 2002).

The regression model is a log-linear form expressed as:

$$\ln(E_{hcg}) = X_{hcg}\beta_g + \eta_g + \varepsilon_{hcg}$$

Where:

E_{hcg} is the real expenditure for a household h with clean cooking, forest management, renewable energy in agri-food chains in the project c at a location g within the service area. The $1*k$ vector of regressors x_{hcg} includes household's characteristics and endowments while β_g is a $k*1$ vector of parameters (returns) explained in satisfaction, time saved from varying distances from the original main source of energy g. $_g$ is the effects of the household cost of energy while $_{hcg}$ are the idiosyncratic random error terms which may include unpredictable market indicators, economic conditions, the extent of stock-outs, government policies, cultures, market – led assumptions including willingness to switch to alternative energy sources and beliefs of the consumers among others. The model adds to the number of years households lived in the region [43] as part of household characteristics.

In this evaluation, the econometric analysis included expression of the cost of energy on the overall household welfare. This cost was expressed in both direct and indirect costs associated with the acquisition of cook stoves, the market direct and indirect cost of cooking fuel, and lighting technologies

The model was based on a number of assumptions namely:

i. The actual cost of energy for households was estimated at a mean of SSP 720 (USD 5.5) with a minimum of SSP 343 (USD 2.6) and max SSP 1 546 (USD 11.9) per month

ii. The unit cost also took consideration of income made from productive use of energy which was partly used to buy cooking fuel as part of energy. This income was estimated at an average of SSP 2 340 (USD 18) where estimated 30 percent was used to buy cooking fuel, i.e. SSP 780 (USD 6.7).

iii. The cash transfer to households to buy cooking stoves was estimated at a mean of SSP 2 317 (USD 17.8), however, households bought cooking stoves at an estimated mean cost of SSP 998.8 (USD 7.7). Its assumed, part of the savings was used in purchase of energy products,

43 Van de Walle, D. and Gunewardena, D. (2001), Sources of Ethnic inequality in Viet Nam. Journal of Development Economics, 65,177-207. http://dx.doi.org/10.1016/s0304(01)00133-X

iv. South Sudan has no statutory minimum wage, however, estimates in August 2019, showed that the monthly income for unskilled worker was SSP 680 (USD 4.45)[44]. Thus, SSP 23 per day.

v. Estimating the cost of collecting cooking fuel based on number of hours used during the process of collecting fuel, approximated the daily cost of time taken as SSP 6.25, which is translates to an estimated monthly cost of energy at SSP 188 (USD 1.44).

The assumptions (i)-(v) above lead to an estimated direct baseline cost of energy that households spent each month as SSP 1 687 (USD 13)

5.7.1 Implications of the findings in the cost of energy

5.7.1.1 Implications of the demographics on the cost of energy

In the evaluation, considerations for the cost of energy included the number of households in the camp, type of housing and the perception on energy use. The findings indicated that increasing the number of households in the camp would generally increase the cost of energy for the households in the camp by up to USD 4 per month. This is associated with the fact that when there are more people – and therefore demand, the cost (including the price and effort needed to acquire energy) of energy will be higher. On the other hand, changing the housing types from temporary housing to more permanent and self-owned, is likely to reduce the cost of energy by up to USD 5 per month, This is because temporary housing comes with risks, that permanent and owned housing would de-risk including attracting long term investment in energy solutions. At the same time, the findings indicate that adoption of energy for productive use, has the possibility of reducing the overall cost of energy by USD 3 per month, owing to the fact that productive use of energy positively contributes to household income and offsets the general cost of energy.

Essentially, changing the demographic characteristics in the camp, has implications on the energy supply and demand dynamics economic. This calls for an integrated market driven approach that considers the social contexts in the camp and aligns it to the market dynamics. Moreover, further investments would be useful to upgrade the housing conditions to promote the potential of long-term energy investments among the household on energy systems that would reduce the overall cost of energy. At the same time, revisiting programming options that would allow change in perception of households about productively using energy would contribute positively in enhancing livelihood options, while generating income for the IDPs.

44 https://reliefweb.int/report/south-sudan/south-sudan-daily-labor-wage-rate-august-2019

5.7.1.2 Implications of cooking fuel on the cost of energy

The analysis indicate that adoption of additional fuel types is likely to increase the costs of fuel to the households by USD 5, however, if the adopted type of fuel was of a higher quality (cleaner, efficient, safer), the overall costs of energy to the household would be reduced by USD 6 per month. Thus, when the quality of the fuel being provided or purchased is not considered, the benefit that would be derived from having higher quality fuels is lost. Moreover, the analysis determined that the continued use of the current fuels (which is mostly firewood), is likely to progressively increase the overall cost of energy for the households considering the effort in collection, pricing and security/conflicts concern that is associated with firewood collection. In general, the households in the camp need to be facilitated to transition higher quality, resource efficient fuels. Achieving this, however, would require the understanding of the different qualities and alternatives in the market, as well as collective effort in facilitating the provision of the alternative fuels in the market.

5.7.1.3 Implications of cooking fuel stock-outs on the cost of energy

The households in the camp have experience in managing cooking fuel stock-outs, as highlighted in section 0 and 5.3.2. The analysis indicated that a failure to address stock-outs in the camp has a high probability of increasing the cost of energy by USD 2 per month, while addressing the stock-out would reduce the cost of energy by USD 8. This implies that continued stock-outs would reduce the supply, and therefore increase demand forcing an increase in price and effort used to acquire cooking fuel. On the other hand, addressing stock-outs would increase the supply, essentially lowering the prices, the effort required, and reducing the risks associated with fuel collection. At the same time adopting alternative fuel sources that are more efficient and readily available, would further lower the cost of energy by USD 7 per month. Essentially, the potential for managing stock-outs is reliant on developing efficient value chains in fuel markets, and potential to attract private sector actors in the near-term for alternative fuels such as briquettes and charcoal production, accompanied by an effective community of practice aimed at providing both capacity and resource support for the value chain.

5.7.1.4 Implications of cookstoves on the cost of energy

The analysis revealed the importance of user education on cook stove quality and efficiencies. When households acquired cookstoves without information on their efficiency and capacity, they are likely to incur additional costs of energy of up to USD 7 in the given month when the cookstove was acquired. This is attributed to the potential of poor utilization of the stove that is likely to be accompanied by lower use efficiency, therefore higher overall costs. However, with information and capacity to switch to cleaner cookstoves, the analysis reveals that households can reduce their monthly energy expenditure by USD 2. The overall initial investment on stoves was seen as a deterrent to acquisition of cleaner stoves, with the analysis indicating that

when the households pay for their own cookstoves, they may have to incur an additional USD 3 per month, while if the cost is subsidized (e.g. by a donor), the overall cost of energy for the household reduces by USD 2 per month. Objectively therefore, the need for awareness creation and blended financial support in acquiring clean cookstoves is instrumental in reducing the overall cost of energy to the households in the camp.

5.7.1.5 Implications of energy for lighting on the cost of energy

While the analysis indicated that using multiple lighting sources is likely to increase the cost of energy for the household by USD 1 per month, the counter benefits of security light show that it would have a positive overall effect on cost of energy for the households. Nonetheless, whether having additional lighting sources or not, the study indicated that the changing from traditional lighting options to *newer* alternative lighting technologies (including using energy saving appliances) would reduce the cost of energy to the households by USD 5. This would encourage the potential of willingness to pay among the households, through demand creation for effective and efficient lighting solutions.

5.7.1.6 Implications of energy for productive use on the cost of energy

Charcoal production in the region is done using traditional mound kilns, and is one of the main livelihood strategies for the community. Taking this into consideration, the analysis established that investment made by households on productive use of energy, would reduce the cost of energy by SSP 335 (USD 2.57) in a month. This would need a shift in focus to improve efficiency of charcoal production through development of kilns (through charcoal groups), ensuring livelihood strategies are not hampered, while charcoal production is made more efficient.

5.7.1.7 Implications of compounding factors on the cost of energy

The conflicts experienced in fuel collection increased the cost of fuel to households in the camp by USD 6, while reducing the duration of time for fuel collection would reduce the cost of energy by USD 7. Essentially the assumption here is that when security is assured during fuel collection, the persons collecting the fuel – mostly women and children, would feel safer and the overall effort in fuel collection would take shorter, increasing time for other activities in the household, and reducing the overall cost of energy. Moreover, safety in fuel collection means less amount of money spent on buying fuel, thereby allowing higher resource savings. This requires strategic and deliberate cross-level partnerships to promote security, and encourage reduced conflicts in the area.

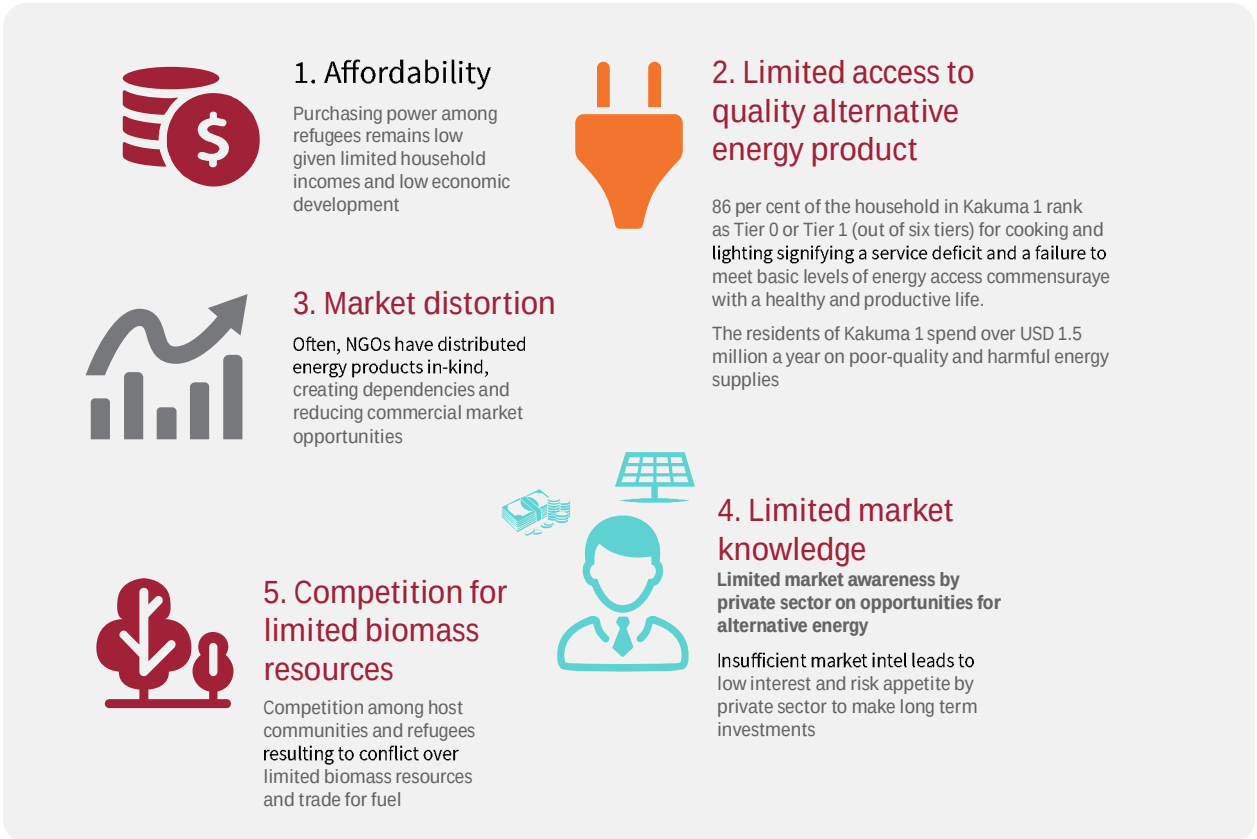
At the same time, adhering to government regulations on natural resources management would require a switch to cleaner energy. However, the enforcement of the regulations without equipping the households with a switch option, is likely to increase their costs of energy by USD 3. In the

event that the households in the camp are able to switch in advance of enforcement, their overall cost of energy would reduce by USD 2. These implies that awareness programmes need to be framed to include and encourage switching to energy options that are accommodated within regulations.

5.7.2 Constraints in energy access

The findings in the analysis brings out the constraints within the current energy ecosystem in the Melijo IDP camp. The constraints include inability to avail adequate energy products to match the demand in the camp. Considering the market dynamics of supply vs demand, availing needed energy products to the households would positively contribute towards access and efficient use. The inadequate availability of the energy products has contributed to products being unaffordable to the households, which meant that the households have limited access to alternative energy options. Moreover, the distortion in the market owing to controlled market and subsidies, has excecated the constraints of a self-organising, supply-demand driven energy market. In addition, the information on the available energy that is shared in the camp is skewed only to the energy products available in the *local* market, excluding information on innovative products not available in the *local* market. The constraints are summarised in Figure 34.

Figure 34: Main energy access and use constraints in Melijo IDP camp



5.8 Market opportunities and programming options

The focus of this section is on opportunities associated with energy access in Melijo, and the possible innovations in energy programming for future energy in emergency portfolio initiatives.

5.8.1 Opportunities in energy access

The evaluation identified key market features to address the general constraints limiting access to and use of energy in the Melijo IDP camp (see Figure 35). The features have been categorised into demand, supply, and supporting function features (for further details, see additional resources section).

Figure 35: Key market features in promoting energy access and use in Melijo IDP camp

Demand features

- Income and livelihoods
- Energy need
- Cost and willingness to pay
- Awareness and information on energy options

Supply features

- Energy provision
- Distribution/supply models
- Off-grid financing models

Supporting features

- Humanitarian approaches
- Policy environment
- Gender dynamics
- Sustainable natural resource management

5.8.2 Demand features

Income and livelihoods: Owing to limited access to alternative sources of energy, the majority of the people depend on biomass, mostly charcoal, and firewood, to meet their cooking energy needs. Moreover, there is a significant existing firewood and charcoal demand, suggesting ability and willingness to pay for alternatives. This provides an opportunity for promoting briquettes produced from biomass waste and char dust – which currently has low demand. At the same time, this offers an opportunity to bridge the supply-demand gap, and reduce the overall cost of energy for the households in the camp.

Energy need: The opportunity to co-create efficient stoves that fit the various cooking needs of the households in order to discourage the use of traditional open fire, would positively contribute to the user's perception on use of cleaner cooking technologies, while also enhancing awareness on adoption of clean cooking. This would also allow for customization of energy products based on the desirability to the end-user in terms of utility, cultural appropriateness, aesthetics, and perceived improvement.

Cost and willingness to pay: The provision of subsidies on energy products, distort the commercial market of these products. Therefore, developing value chains that would allow the fuels, stoves, and lighting technologies to be

locally produced, and therefore making them more affordable – without the subsidies, would encourage potential for payment and reduce the costs.

Awareness and information on energy options: The packaging and messaging of information on energy options is relatively skewed and dependant on the agency, As such, creating local capacity on alternative energy would result in stronger ownership potential of the information, while enhancing the awareness of existing and potential energy options in the camp.

5.8.3 Supply features

Energy provision: The potential to customise energy solutions on site, has a strong potential for encouraging private sector players to co-invest. The co-investment would allow the local producers to establish a local skills pool for development of quality and efficient energy products that are contextually relevant. As such, the focus would be on improving the efficiency of the energy products to fit the context in the camp.

Distribution models: The remote location of Melijo camp, means that the logistics are challenging, resulting in higher prices of energy products. The opportunity lies in cultivating a value chain (including state and non-state actors), that collectively would enhance the efficiency of delivery, and therefore reduce the overall costs. Intertwined with co-investment at the camp, and local production, a market ecosystem would emerge to support long term benefits.

Off-grid financing models: Due to unstable income among the households in the IDP camp, there is a need for subsidization of products and financing to address high upfront costs necessary (smart subsidies to support demand creation and seasonal promotions). For instance, facilitating semi-informal mechanisms such as VSLAs, as a financing intermediary would contribute to liquidity as part of cash-based assistance.

5.8.4 Supporting features

Humanitarian approach: Inviting private sector players to participate in the provision of alternative energy products is likely to promote a market-based approach, and reduce market distortions. Further, linking productive use of energy including within the water-food-energy nexus, would promote stronger sustainability outcomes, and provide inclusive and innovative business case for humanitarian efforts.

Policy: The promotion of interventions that are aligned to government directives would promote the potential for adoption and success, and essentially reduce the effort and pricing in energy access.

Gender dynamics: De-risking fuel collection by establishing woodlots close to the camp, and promoting advocacy for women empowerment and the protection of vulnerable groups would be useful in bridging the gender gap in energy access in the camp. This can further be promoted through providing grants to women FES producers (enfranchisement) to strengthen household incomes with reduced cases of conflicts.

Sustainable natural resources management: Providing a local platform for discussion of energy issues would contribute to curbing firewood dependency and encourage environmentally friendly mechanisms, while promoting awareness on resources management.

5.9 Innovations for energy programming

The innovative programming options that are recommended for the FAO South Sudan Office to spearhead optimal energy provision are provided in six thematic areas provided below. The approaches considered include: building capacity for the development of a market ecosystem to support the delivery of energy services to IDPs; market-based programming and private sector engagement; scaling up community inclusive market-based solutions; multi-sectoral collaboration; community-based solutions-to drive awareness and uptake of clean cooking solutions; and sustainable natural resource management.

5.9.1 Building capacity for the development of a market ecosystem to support the delivery of energy services to IDPs

The use of energy in Melijo IDP camp is characterised by low relevance placed on productive use of energy, and inadequate understanding on alternative energy options. As such capacity building actions would include:

1. Building capacity for the development of a market ecosystem to support the delivery of energy services to IDPs

2. Technical Assistance to humanitarian organizations, county government, private sector, and other market system actors with a focus on universal access to energy

3. Holistic support to sector development including strengthening national RE institutions including sector associations so that they play their rightful role in sector development

4. Strengthening key pillars of sector development (i.e. policy, training, standards, financing, R&D)

5. Energy literacy on productive use opportunities for IDPs and host communities to help drive the uptake of products needed to activate market activity and development of the food and energy nexus

5.9.2 Scaling up community inclusive market-based solutions

Malijo IDP households are still facing regular energy fuel stock-outs. There is therefore need for mechanisms that could develop a robust value chain that will ensure consistency of supply, while at the same time shifting the community's perception on the use of alternative energy products that are contextually relevant. To this end, programming options should consider:

6. Mainstreaming inclusion: Proactively ensuring the inclusion of host and displaced communities to ensure no one is left behind, mainstreaming gender in energy

7. Community models for energy provision e.g. setting up energy centres offering improved cookstoves, high-quality solar PV products, and other energy-related services, such as food preservation, phone, and lantern charging

8. Development of community renewable energy powered information centres to serve as information hubs for disseminating agriculture and climate information

5.9.3 Community-based solutions to drive awareness and uptake of clean cooking solutions

The asymmetrical information available on energy products in the camp, needs a programming approach that would encourage awareness creation, while encouraging uptake of alternative solutions, within the contextual complexities in the camp. This can be done through:

9. Use of community champions and energy ambassadors in the sensitization of local communities on the economic, environmental and health benefits of using clean cooking solutions

10. Integration of awareness through Farmer Field Schools and other local agricultural extension programmes

11. Raising awareness on both the benefits of improved cooking technologies, and efficient cooking practices which can be implemented

5.9.4 Market-based programming and private sector engagement

The need for introduction and scaling of *newer* alternative energy options requires involvement of the private sector including through co-investments to reduce the overall cost of doing business, thereby reducing the cost of energy while promoting a vibrant commercial system. This can be achieved through:

12. Playing a catalytic role for private sector players to enter into the South Sudan market and successfully deploy their products and services in the IDPs camps by de-risking humanitarian energy markets

13. Targeted cash transfers including voucher-based programs to increase household purchasing power for energy products and diversification of livelihoods

14. Support to market assessments for PUE to develop businesses cases including food preservation, food processing and water pumping as measures to contribute to building resilient livelihoods

15. Piloting of financing models that improve access to off-grid energy products by end-users and to help the private sector to absorb some of the initial risks of the nascent energy market in South Sudan

16. Promotion of private sector solar PV micro-grids as mini utilities to serve NGOs and humanitarian actors' compounds in remote locations

5.9.5 Multi-sectoral collaboration

The interventions promoted, go beyond individual institutions and across sectors (e.g. water, agriculture, public health etc.). Continued support to these collaborations would promote a community of practice that collectively enhance the potential for adoption of alternative energy solutions. FAO South Sudan has already been seen to play a strategic leadership role while maintaining its "analytical edge". FAO can therefore play a key role of strengthening collaboration that would be instrumental in promoting energy access and use, through:

17. Working to ensure greater synergy between humanitarian and development programming

18. Aligning objectives & resources around specific market-led solutions and stakeholder mapping of different humanitarian agencies based on capacity

19. Building local knowledge-sharing platforms to share best practice on the application of market-based approaches in humanitarian contexts

5.9.6 Sustainable natural resource management

Promoting sustainability in the management of natural resources, offers a holistic approach that integrates the capacity of the ecosystem to provide (e.g. firewood as a resource) and regulate (e.g. effects of climate variability) human needs. The action points for this would include:

20. Working forums for environmental stakeholders should be established or strengthened. Local participation and active involvement in environmental activities is vital for the sustainability of project activities

21. Promotion of sustainable charcoal production and improved charcoaling technologies to reduce the pressure on forest resources

22. Advocate for the curbing of illegal charcoal trade in South Sudan

23. Integrate national policy guidelines in standard operations procedure within the humanitarian sector

24. Partnering with community-based organizations to promote increased awareness, responsibility, and accountability of local natural resources

Evaluation of SAFE programming in Eastern Africa: **Uganda country report**

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6. Context of the Ugandan report

6.1 Background of the report

Uganda hosts about 1.3 million refugees in 13 districts (UNHCR, 2019). Many of the refugees come from South Sudan and the Democratic Republic of Congo and a few from Botswana, Kenya, and Somalia. In November 2018, 5 740 new refugees arrived in Uganda refugee camps from the Democratic Republic of Congo (3 877), South Sudan (1 387), and Burundi (476). The increased number of refugees resulted in an aggregate number of new arrivals from 1 January 2019, of 91 140(UNHCR,2019). The accommodative nature of the government concerning these refugees is attached on Uganda's refugee policy which is well-known for being advanced and substantial. The current refugee framework presents refugees many rights including freedom of movement, the right to work, the right to access public social services, and access to land (World Bank, 2019). However, the influx in refugees poses significant constraints on services from local governments in host areas, underlining the need for additional investments. The management of the rapid influx of refugees has had an inevitable impact on local economies, as well as the environment, including increased demand for wood to construct houses and energy for cooking and heating (Lahn and Grafham, 2015). It has been identified that more than 90 percent of refugees and local households in rural Uganda rely on firewood for cooking and heating; thus, a growing concern over how the influx in refugee populations would impact the local environment (FAO,2017). The use of the three-stone open fire precedes a range of negative externalities, including deforestation, land degradation, soil erosion, species loss, droughts, carbon dioxide, and black carbon emissions. The impacts on humans are also considerable; including time spent collecting fuel, the risk of conflict with the host communities due to the competition for finite natural resources, exposure to violence, and finally health impacts of indoor air pollution.

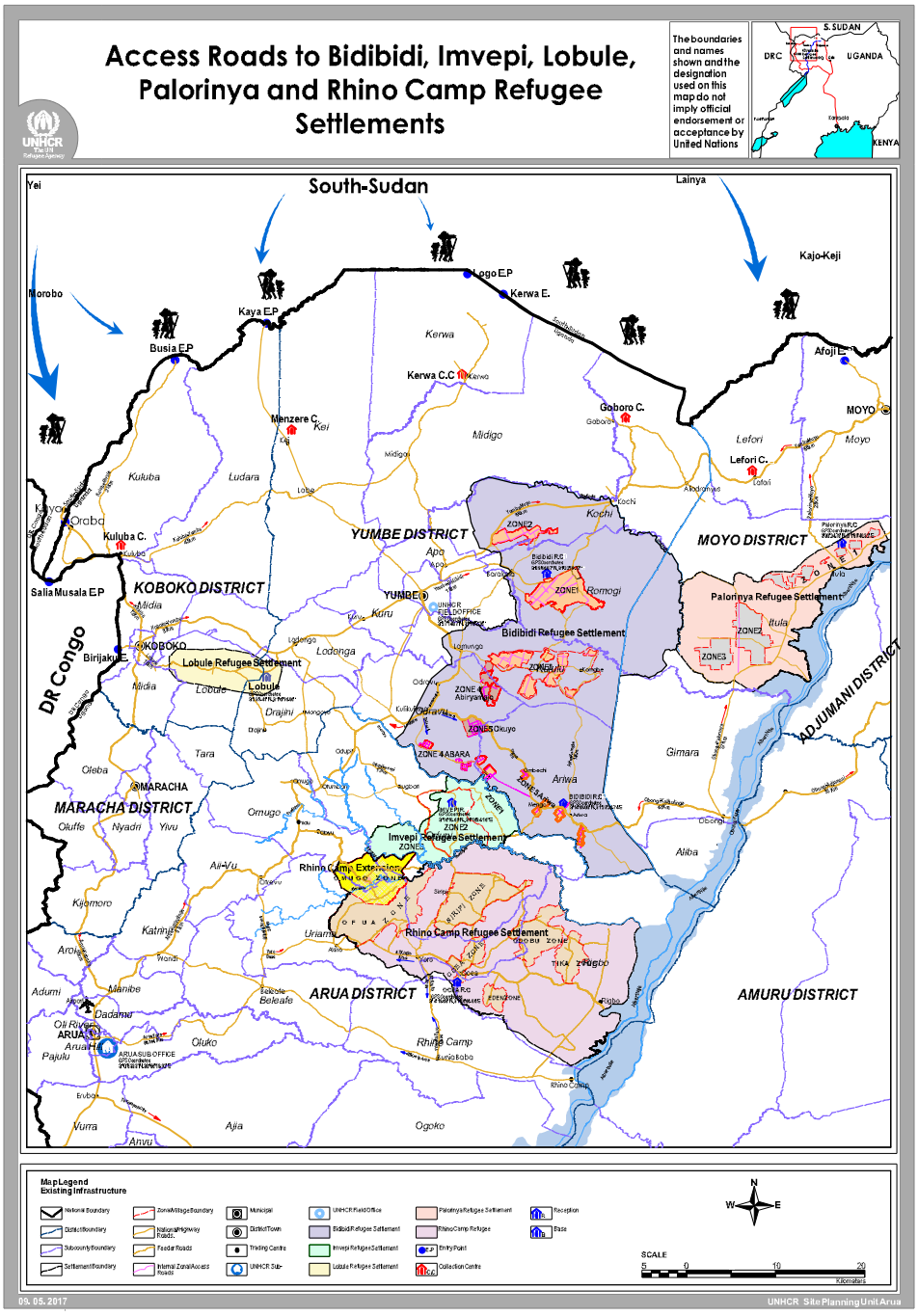
FAO is acknowledging these issues as part of the Inter-Agency Standing Committee (IASC) Task Force on Safe Access to Firewood and Alternative Energy (SAFE) globally. In response to these issues, FAO has distributed energy-saving cookstoves and established woodlots. This is aimed at promoting the sustainable improvement of livelihoods and food security for rural populations in Uganda. These interventions have reduced pressure on the environment by refugees and host communities and promoted energy security. To avert any level of crisis, national and regional governments, aid agencies, and NGOs have long provided humanitarian aid for refugees, addressing immediate needs such as food, water, and shelter. However, the duration of displacement is lengthening for many. In some cases, there is a desire on the part of host countries to repatriate refugees, yet it can be a long and controversial process. The need for sustainable, long-term solutions that mitigate the negative impacts of forcible displacement, uplift refugees, and support host communities is, therefore, becoming more acute.

The SAFE programme evaluation in Uganda was undertaken in the Arua region with data collection carried out in three sites, Imvepi refugee camp, Omugo refugee camp and the Palorinya Refugee camp in the West Nile (see Figure 36). The population of refugees in the Imvepi and Omugo refugee camps is estimated at 55,820, while the Palorinya refugee camps host 165,587 refugees. The sampled population in the three regions was 361 respondents each representing a household.

Figure 36: Focus area of the SAFE evaluation in Uganda

Source: https://data2.unhcr.org/en/documents/download/64450

Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined.



6.2 Characteristics of the households

The following variables were considered in the characterization of the household in the three refugee camps; the demographics (age, sex, and household size), household income, the type of dwelling structure and their perceptions on and use of energy.

6.2.1 Demographics

Of the 361 households in the evaluation, 44 percent (159) were from Imvepi, 42 percent (148) from Palorinya, and 14 percent (54) from Omugo. In the three regions, majority (62 percent) of the respondents were female, only 2 percent being aged less than 18 years, 46 percent aged between 18 and 50 years, and 14% were over 50 years. 38 percent of the respondents were male, most (29 percent) of who were aged between 18 years and 50 years (see Figure 37).

Figure 37: Age and sex of the refugee camps' population in Uganda

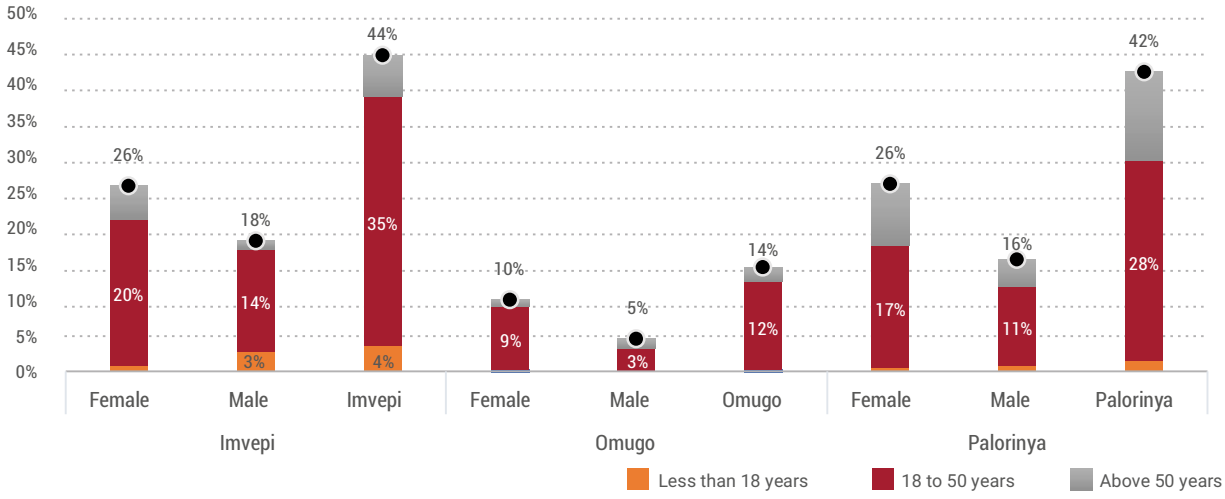
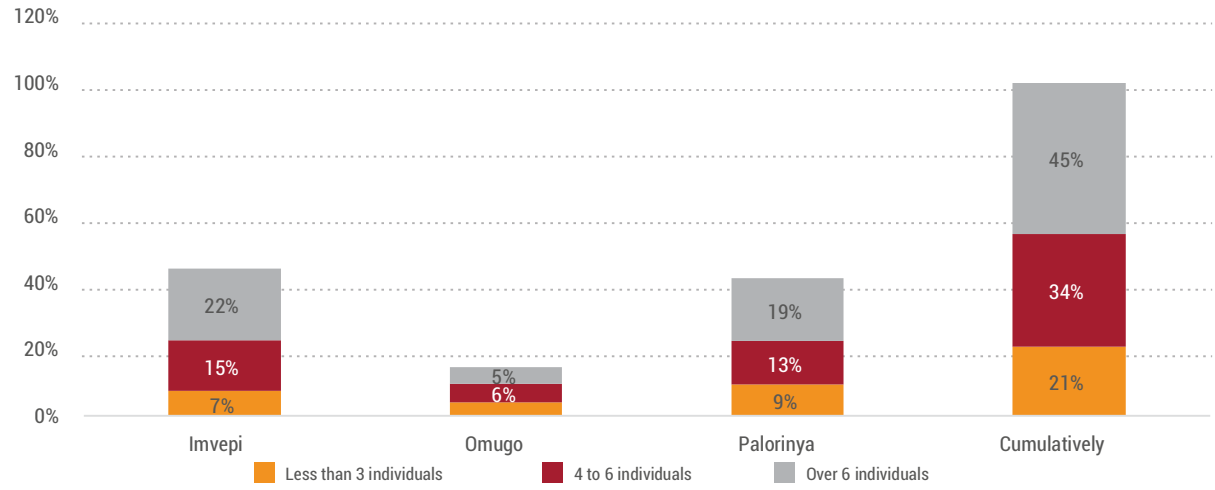


Figure 38: Household sizes and civic status of respondents in the refugee camps

The evaluation also revealed that 21 percent of the households had less than three individuals, 34 percent had 4-6 members and 45 percent had more than 6 members in their households (see Figure38).

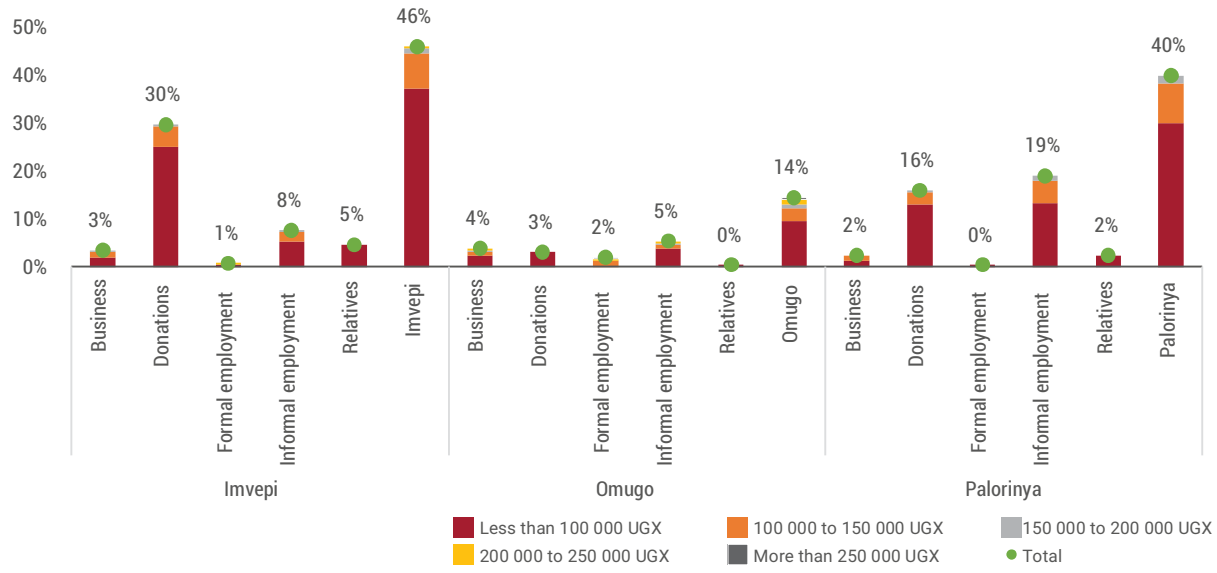


6.2.2 Income

The respondent's income sources varied and was drawn from businesses, donations, formal and informal employment, and from relatives (see

Figure 39). However, across the various regions, majority (76 percent) of the households earned less than UGX 100 000 (USD 26) per month. In Imvepi, many of the households got their income from donations, while in Omugo, the major source of income was from informal employment and businesses. In Palorinya, the main source of income was from informal employment and donations. Some households (less than 1 percent of the sample population) in Omugo received the highest income (more than UGX 250 000 (USD 66) per month) mainly from formal employment.

Figure 39: Sources and amounts of income among the households in the refugee camps



6.2.3 Dwelling

The evaluation indicated that majority (66 percent) of the households owned their housing units, which were mostly (reported by 54 percent) temporary dwellings (see Table 18). UNHCR provided housing to 23 percent of the households, mainly in the form of temporary and semi-permanent dwellings, while the Office of Prime Minister (OPM) in the Ugandan government provided housing for 8.6 percent of the households, mostly from Imvepi (5.5 percent) and Palorinya (3.2 percent) camps. Further, the evaluation found that 85 percent of households in the Imvepi region; 51 percent of households in Omugo, and 69 percent of households in Palorinya regions had stayed in the region for less than 5 years.

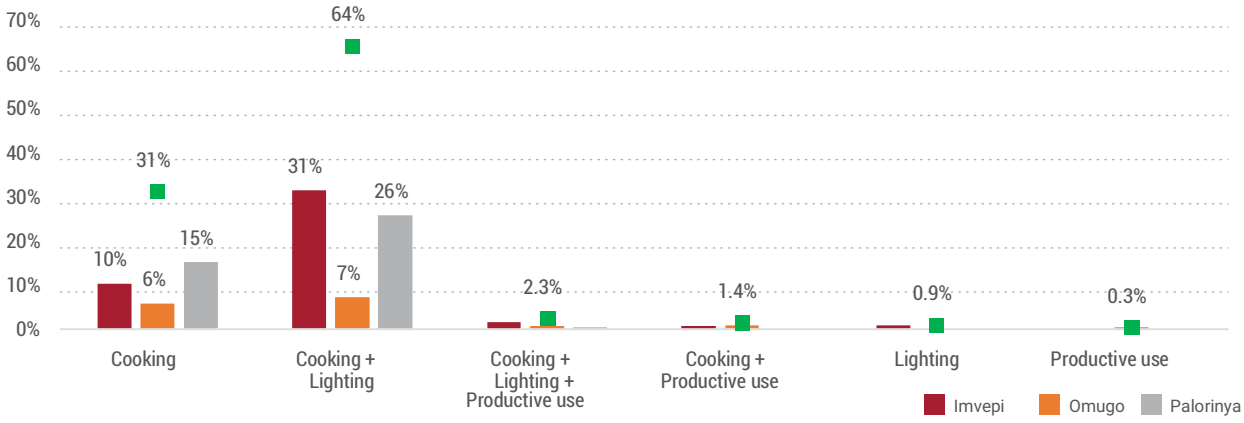
Region	Type of housing	OPM	UNHCR	Owned	Rented	Total
Imvepi	Permanent			0.3%		0.3%
	Semi-permanent	3.2%	6.9%	9.2%		19.3%
	Temporary	2.3%	3.2%	18.4%	0.3%	24.2%
	Imvepi	5.5%	10.1%	28.0%	0.3%	43.8%
Omugo	Permanent			3.5%	1.2%	4.6%
	Semi-permanent		0.6%	1.4%		2.0%
	Temporary		2.6%	4.0%	0.6%	7.2%
	Omugo	0.0%	3.2%	8.9%	1.7%	13.8%
Palorinya	Permanent			4.6%	0.3%	4.9%
	Semi-permanent	3.2%	4.6%	6.6%		14.4%
	Temporary		4.9%	17.6%	0.6%	23.1%
	Palorinya	3.2%	9.5%	28.8%	0.9%	42.4%
	Cumulative	8.6%	22.8%	65.7%	2.9%	

Table 18: Housing ownership among households in the camps

6.2.4 Perception on and use of energy

The most prominent use of energy among the refugee camps was cooking and lighting as cited by 64 percent of the respondents (Figure 40). Cumulatively, 99 percent of the households used energy for cooking, while 67 percent used energy for lighting. Less than 5 percent of the households used energy for productive purposes.

Figure 40: Energy uses in the camp



Households in Uganda did not prioritize productive use of energy. Only 24 percent of the respondents indicated energy for productive use as important (and very important) for their day to day lives, with the households in Omugo attaching the highest importance to energy for productive use. Energy for cooking was reported as very important by 40 percent of the respondents, especially in Palorinya where half of the respondents reported it as very important. Energy for lighting was the second most important use of energy, with more than 20 percent of the respondents citing the same (see Figure41).

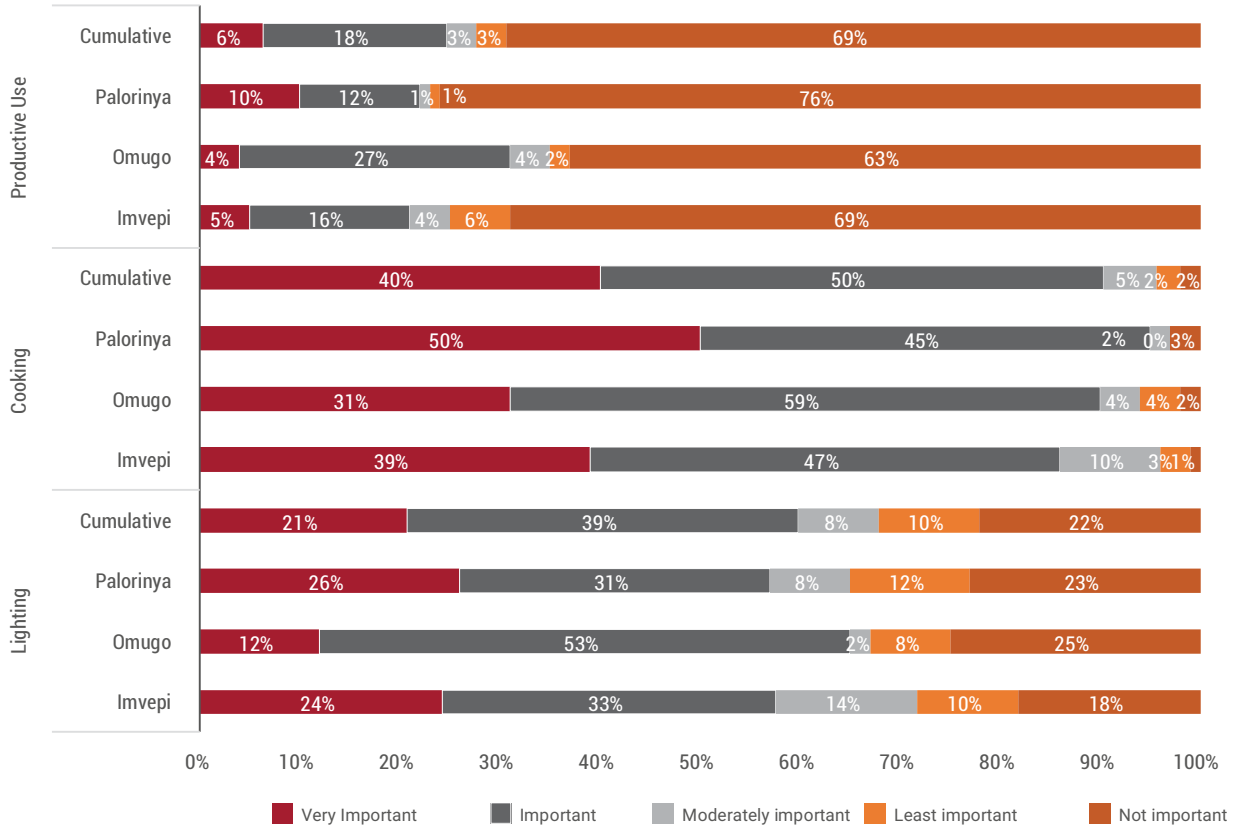


Figure 41: Perceptions on energy among the households in the camp

6.3 Energy for cooking

The section integrates the findings from the study regarding energy for cooking in Imvepi, Omugo and Palorinya refugee camps in Uganda. The section details the findings on cooking fuel, and cookstoves.

6.3.1 Cooking fuel

6.3.1.1 Type of fuels

The main cooking fuels in the camps included firewood, charcoal, briquettes, and LPG. Among these, the most preferred choice as reported by 70 percent of the households was firewood. The second choice in cooking fuels was charcoal, while the other fuels (e.g. briquettes and LPG among others) came as third choices (see Figure 42).

Figure 42: Fuel types preferred by the households in the camp

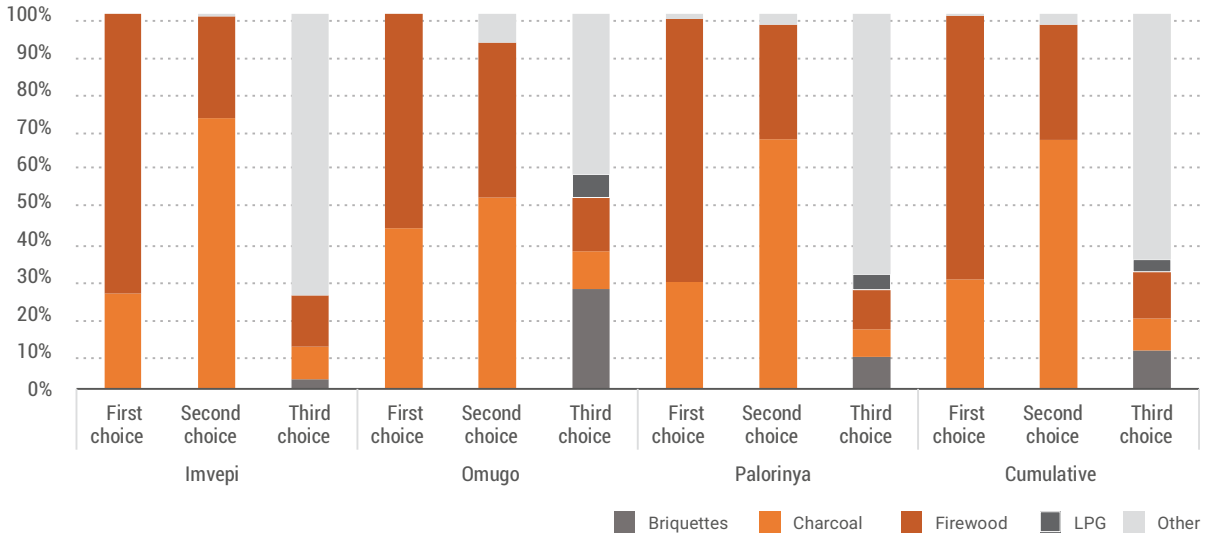


Figure 42: Fuel types preferred by the households in the camp

6.3.1.2. Sources of fuels

The cooking fuels were freely collected from the areas around the camp, as cited by more than half of the respondents across the refugee camps. Figure 43.

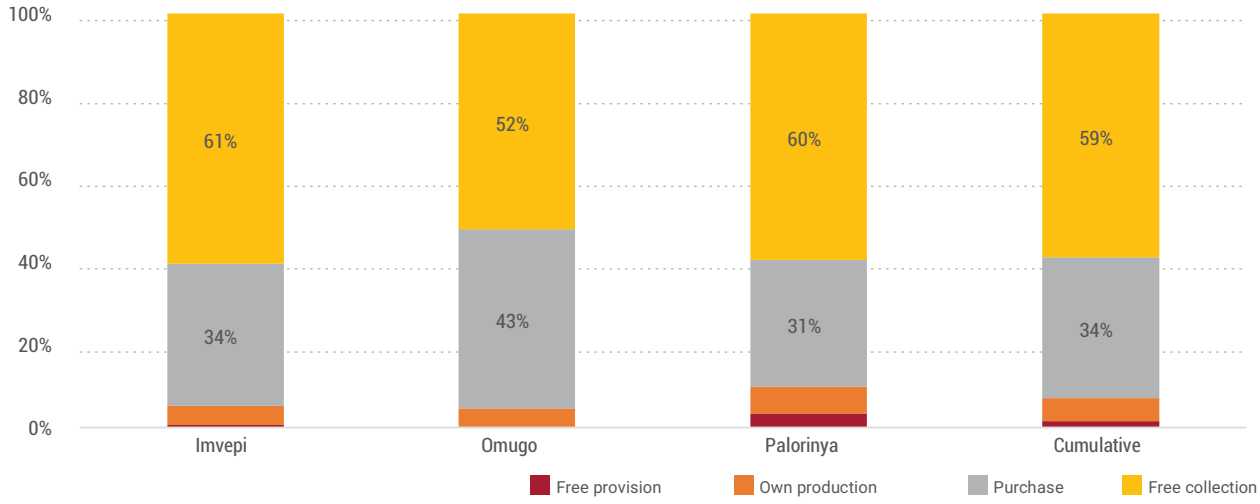


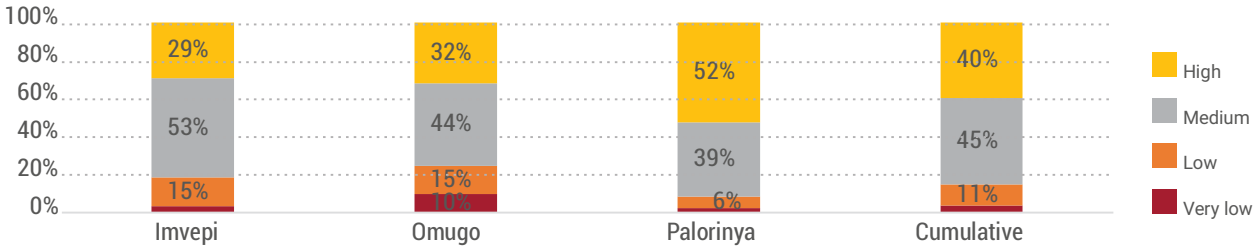
Figure 43: Sources of cooking fuel for the households in the camps

6.3.1.3. The quality of fuel used

There were different perceptions on the quality of the cooking fuel available in the three camps. 40 percent regarded the fuels to be high quality, 45 percent as medium, 11percent as low and 4percent as very low. In Imvepi and Omugo, the quality of fuel (based on burning time and low potential for environmental pollution) was highlighted as medium, while in Palorinya it was reported to be of high quality by more than half of the respondents (Figure 44). Most households associated quality of fuel with the durability of fuel for cooking

before stock out and the heat produced for cooking. They highlighted the species of trees for firewood determined the quality of fuel. For instance, those who purchased firewood from the market, collected firewood from forest or harvested from their planted woodlots perceived the firewood to be of high quality for productive and household use. They were however not sure of the name of the species of trees in English as they had indigenous ways of describing the fuelwood. The quality of charcoal for cooking also was dependant on the species of trees used in production of the charcoal.

Figure 44: Perceived quality of cooking fuels used in the camps



The respondents noted that the choice of cooking fuel was largely determined by availability and cost. 32 percent of the respondents cited availability as the key determinant while 30 percent cited availability in combination with low cost

Table 19: Determinants of choice for cooking fuels in the refugee camps in Uganda

Determinants for the choice of cooking fuel	Percentage of respondents
Available	32%
Low fuel cost and available	30%
Low fuel cost	14%
Low fuel cost and low fuel appliance	4%
Low fuel appliance and available	3%
Low fuel appliance	3%
Low environmental impacts and available	2%
Low fuel cost, low environmental impacts and available	2%
Low fuel cost, low fuel appliance and available	2%
Low environmental impacts	2%
Low fuel cost and low environmental impacts	1%

The choice determinants made firewood to be the most preferred cooking fuel for the households (as shown in Figure 45a). The firewood used by most of the households was obtained from indigenous trees (see Figure 45b).

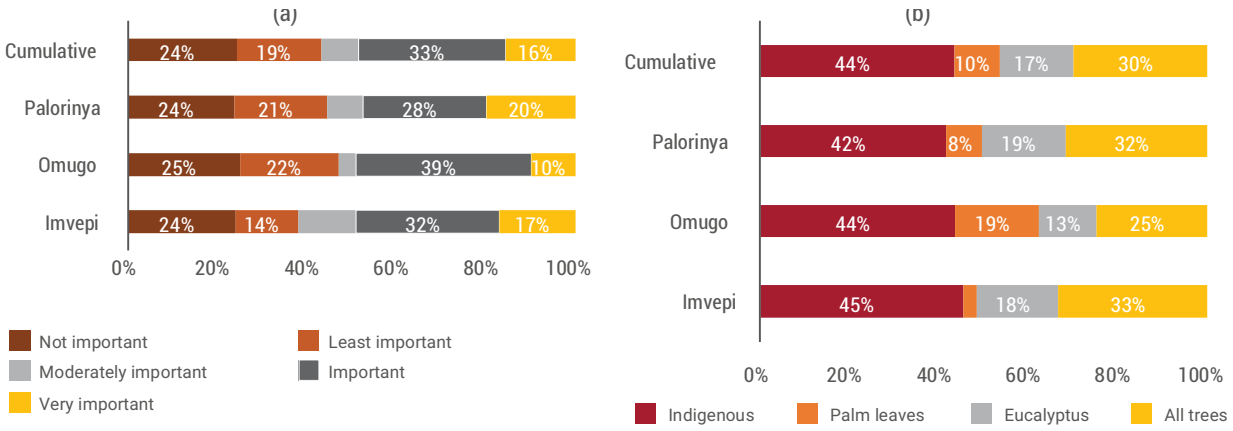
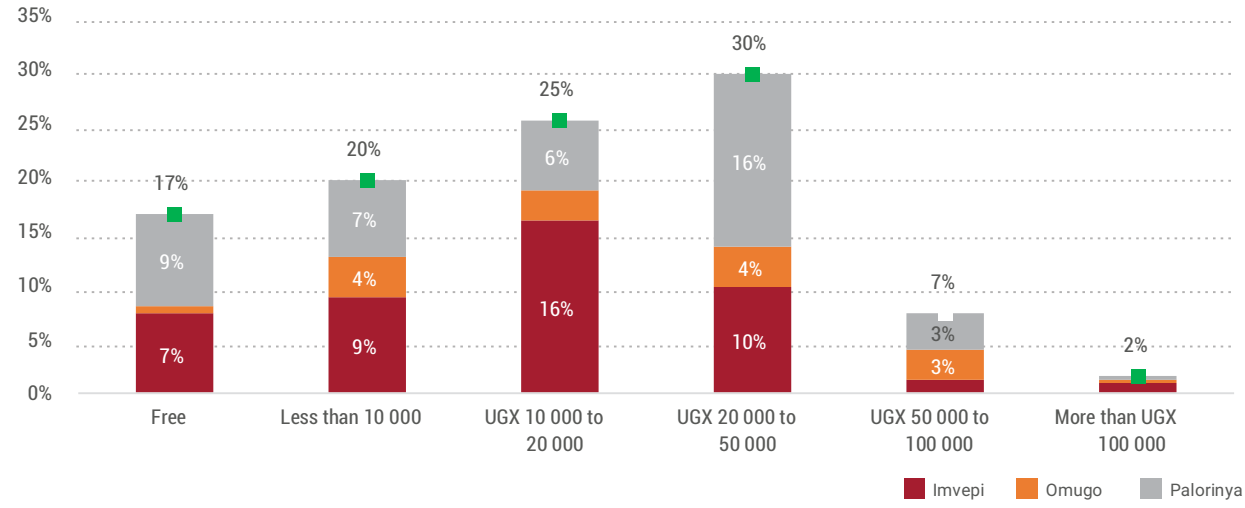


Figure 45: Preferences for firewood (a); and types of wood preferred for firewood

6.3.1.4. Cost and payment for fuels

The evaluation revealed that most (55 percent) households spent between UGX 10 000 and UGX 50 000 (USD 3 to USD 13) per month of cooking fuel, although expenditures varied across camps (see Figure 60). For example, while most households in Imvepi spent between UGX 10 000 and UGX 20 000 (USD 3 to USD 5) per month on cooking fuel, in Palorinya, households spent between UGX 20 000 and UGX 50 000 (USD 5 to USD 13) per month on cooking fuel.

Figure 46: Monthly expenditure on cooking fuel among the three refugee camps



The evaluation established that 38 percent of the respondents would be willing to pay more for alternative cooking fuel. Half of the respondents willing to pay more cited the potential to pay between UGX 1 000 and UGX 5 000 (USD 0.3 to 1.3). In Omugo refugee camp for instance, 71 percent were willing to pay more. Out of this, 42 percent were willing to pay more by between USD 0.3 to 1.3 per month

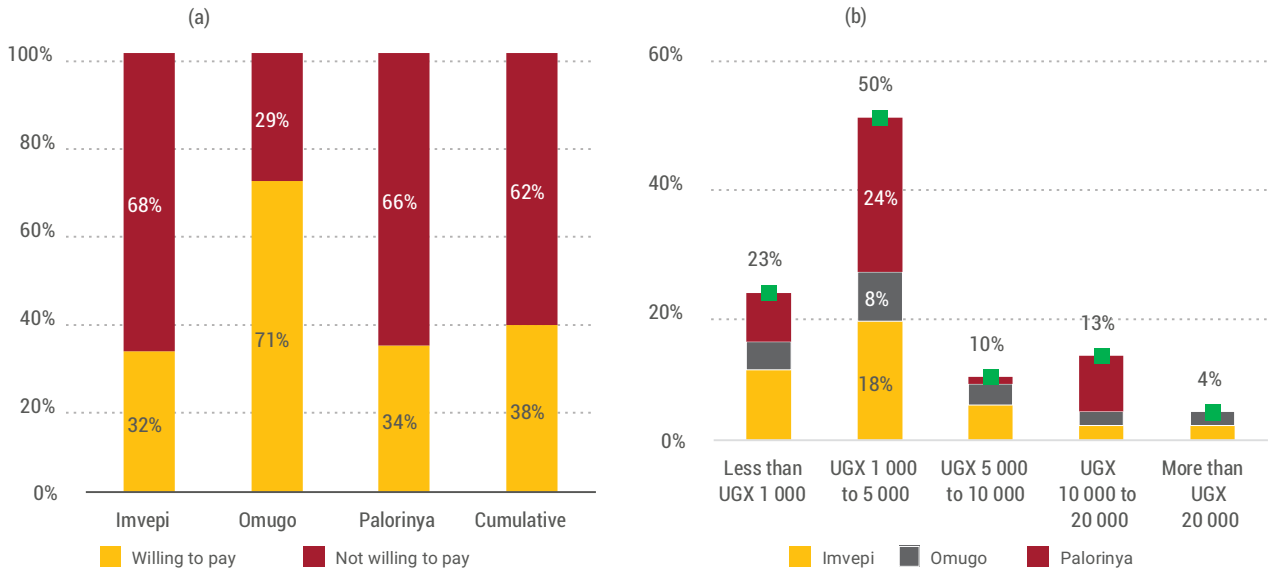


Figure 47: Willingness to pay for an alternative cooking fuel

6.3.1.5. Firewood and charcoal value chains organization in Uganda

From the evaluation, it emerged that charcoal was supplied in the towns near the refugee camps mainly by charcoal transporters. The charcoal business is comprised of suppliers who buy a bag of charcoal at an average of UGX 25 000(USD 7) from producers and resell it at an average of UGX 44 700 (USD 12) per bag to vendors and users. Most suppliers transport the charcoal from the forest and woodlots whose cost is not factored in the market price, hence an economic loss to the supplier. Besides, most charcoal producers utilize the earth mound traditional kilns to produce charcoal and use indigenous tree species which are preferred for their high-quality charcoal.

Small scale suppliers transport the charcoal and firewood to markets with bicycles taking two to three days to arrive there. Some producers also double up as vendors and charcoal suppliers. Profits shares are, however based on a negotiation between distributors and dealers. Organizing, regulating, and structuring the firewood and charcoal value chains can improve distribution efficiency and therefore enhance biomass energy security

Regulatory measures such as the banning of charcoal burning in Uganda have contributed in dealing with illegal charcoal trade. For instance, Arua district banned cutting of trees for charcoal burning following the enactment of the Food Security and Nutrition Ordinance. However, according to key stakeholder's enforcement of the ordinance has failed as trucks with charcoal are still seen transporting charcoal at night.

Selling Charcoal in Arua. ©Practical Action

6.3.2. Cooking technologies in refugee camps in Uganda

6.3.2.1. Types of cookstoves used

The different types of cookstoves sold and/or are in use in the three regions are presented in

21. From the assessment, it was evident that in the three camps, the three stone open fire was still the most commonly used household cooking technology as reported by 28 percent; 26 percent and 27 percent of households Imvepi, Omugo, and Palorinya, respectively. Further, many households in the three camps reportedly built their own stoves, some of which they believed were energy saving. The home- made stoves were used by 25 percent; 15 percent and 16 percent of the households in Imvepi, Omugo and Palorinya regions, respectively. Other cookstoves used in the region included clay stoves, traditional metals stoves, improved charcoal stoves, and the dual-purpose stoves.

The Shielded and Rocket Lorena stoves were the second most used stoves in the refugee camps. The stove is made from locally available materials such as soil, clay, and water. By maximizing the heated surface area and concentrating the heat and smoke, these stoves were said to result in fuel savings of up to 33 percent. The stoves were also said to emit less smoke which was known to cause health problems. Key informant interviews with traders in towns near the refugee camps indicated there was an emerging market for improved cookstoves (ICS) in Uganda featuring multiple producers, distributors, and technology solutions. The stoves commonly found in markets include Uga Stove and all metal stoves presented in Table 20.

Table 20: Commercially available cookstoves in Uganda

Type of stove	Sample photo	Features	Manufacturer	Pricing
Uga stove		Ceramic liner with metal cladding. First Gold Standard registered cookstove project	Ugastove, Kampala	USD 6.5 to 15
Green fit stove		Ceramic part made from six bricks with outer metal cladding		
Eco-smart stove		Ceramic liner with metal cladding. First Gold Standard registered cookstove project	ILF, LIRA	USD 6.5 to 15
All metal stove		All-metal stoves can be made fairly simply using scrap metal, perhaps taken from old oil drums or cooking oil container	Local metal dealers	USD 2

Table 21: Commonly used stoves in the Ugandan refugee camps

The Uga stove and the Eco-Smart stoves were sourced by traders from Kampala where they purchase at wholesale prices and sell them at USD 15. Most of the manufacturers and traders are small scale and can only sell about three stoves per month.

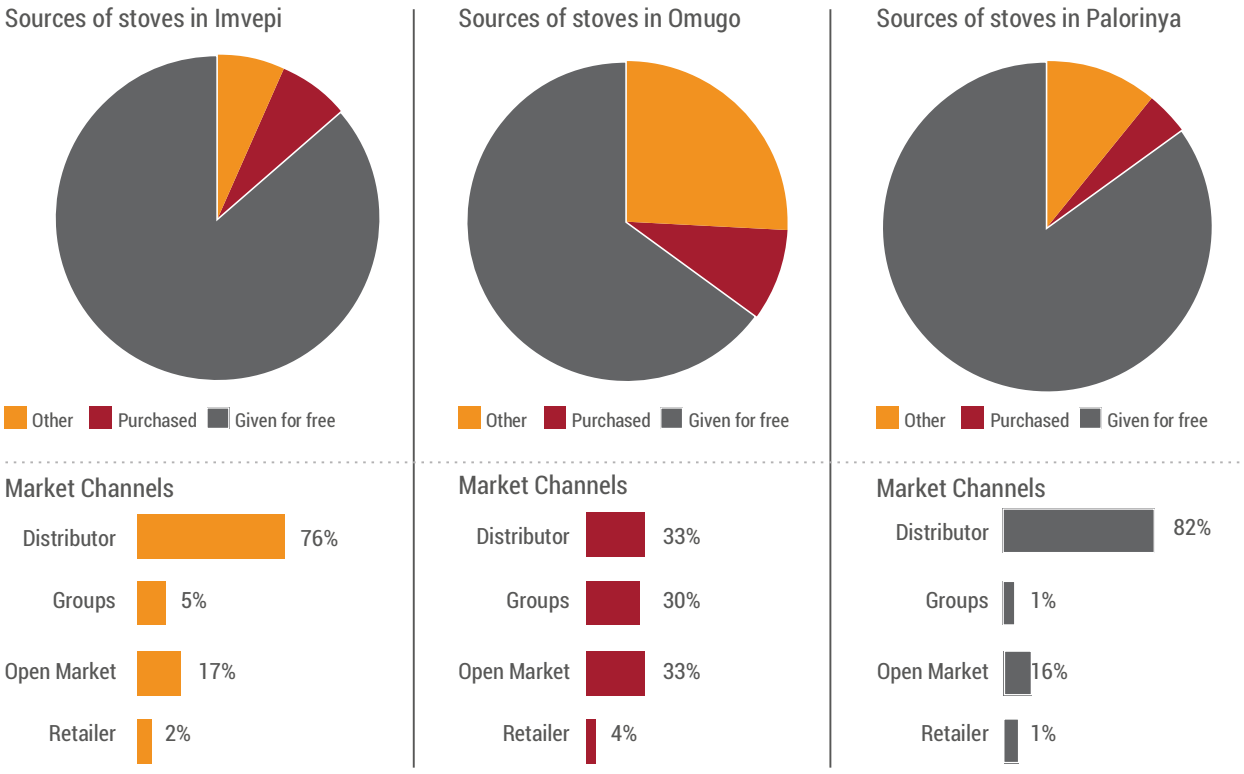
Type of stove	Sample photo	Use in the refugee camps Imvepi	Omugo	Palorinya	Cumulative
Clay stove		11%	7%	10%	9%
Dual purpose		13%	14%	9%	12%
FAO stove		7%	6%	13%	9%
Home build (Lorena stove)		25%	15%	6%	19%
Traditional open fire		28%	26%	27%	27%
Traditional metal stove		10%	19%	5%	15%
Improved charcoal stove		7%	13%	10%	10%

6.3.2.2 Sources of cookstoves

The evaluation found that several households living in the refugee camps purchased cookstoves. The cost of most common cookstove ranged from 2 500 to 12 000 Ugandan shillings (USD 0.7 - 3.3) depending on type of cookstove and place of purchase. In some instances, some households also acquired raw materials to make their own cookstoves. It was noted that the households in the three regions were willing to pay between 2 000 to 150 000 Ugandan Shillings (USD 0.5 to 41) for energy saving cook stoves.

Most refugee households received their stoves through donations as reported by 87 percent of households in the Imvepi region, 65 percent in the Omugo, and 85 percent in Palorinya regions. The stoves were received for free either from UNHCR or other development organizations working in the region. Only a handful, of the households, either purchased their cookstoves or received them from other sources. For those who purchased their cookstoves, most bought from distributors as reported by 76 percent; 33 percent and 82 percent of the households in Imvepi, Omugo and Palorinya regions. The rest bought their cookstoves mostly from open markets (see Figure 48).The market-based acquisitions served 17 percent; 33 percent and 16 percent of households living in Imvepi, Omugo, and Palorinya regions respectively.

Figure 48: Sources and modes of acquiring cookstoves in the refugee camps in Uganda



There are two primary routes to the distribution of cookstoves: via sales outlets such as hardware stores, solar kiosks, through aggregators (community groups and other sales agents), and partnering with local CSO organizations. Evidence from interviews suggests that the latter approach is gaining momentum and is responsible for the greatest increase in sales in the market (see Box 4).

BOX 3 **GIZ ENDEV**

RICE-West Nile (RICE WN) in partnership with GIZ Endev has embarked on the implementation of the refugee pilot energy access through a revised approach to household stove dissemination in Rhino and Imvepi Camp refugee settlement. Through this project, solar energy and dual cook stoves were distributed in solar kiosks which were constructed through the support of GIZ...Initial products in the kiosks were also provided through GIZ support and shop owners would re-order and restock additional products once their stock runs out. RICE is involved in management of the kiosk in Imvepi while in Rhino camp the kiosks are managed by a youth group. The shop owners and managers also sell soft drinks to attract consumers to the products. Other shop owners have utilized the energy products for productive use for instance using solar system for powering a fridge. They also have installed computers for printing services to demonstrate productive use of energy for income generation. The project utilizes a market-based approach in distribution of clean cooking and solar products. Some of the marketing strategies adopted to attract customers include roadside shows. It is observed that the quality of products is a key determinant in driving sales. For instance, the international life product was popular because of its attractiveness. The communities in these regions are also impulsive buyers therefore, with the right market approach such as utilizing music entertainment during market days more sales can be realized. Some of the refugees who receive free stoves resell it in the market at UGX10,000 (USD 2.7) whilst the actual value of the stove is UGX 30,000 (USD 8). To curb the resell of the stove, serial numbers have been emended and monitored on usage.

BOX 4 **WWF CLEAN ENERGY PROJECT**

Spearheaded by the Worldwide Fund for nature (WWF), the clean energy project is a private, public partnership initiative applying the civil society organization model with the aim of increasing access to renewable energy products such as home solar systems and energy saving stoves. RICE-West Nile in partnership with WWF is implementing the clean energy project in six districts of West Nile sub region. RICE-WN works in partnership with sixteen Civil Society Organizations (CSOs) spread throughout West Nile. The CSOs acquire the products from WWF at a subsidized rate and they make a profit margin upon selling. The margin received is mainly to cover administrative costs for the CSO as it is part of their social and environmental mission to support local communities to access clean products that are environmentally friendly. Spearheaded by the Worldwide Fund for nature (WWF), the clean energy project is a private, public partnership initiative applying the civil society organization model with the aim of increasing access to renewable energy products such as home solar systems and energy saving stoves. In the region, Rice West Nile is the lead organization implementing the project through a consortium of 16 civil society organizations

covering the six districts of Arua, Nebbi, Maracha, Koboko, Moyo and Adjumani. The CSOs however reported that they were unable to beat their sales target because compared with the rival products in the open market, the communities considered their prices prohibitive. For instance, whereas the highest priced product, the SP3 system (which comes with four bulbs with additional provision for extra two bulbs) is sold at UGX 800 000 (USD 218) under the project, it was noted that some competing companies offer clients additional items such as radio receivers and television sets at such prices. As a result, only 509 solar systems were distributed. This was considerably lower than the 1 428 target set. Additionally only 698 cook stoves were sold where the organization's target was 1 546. The project implementers resolved to adopt a group sales approach but also appealed to RICE-West Nile and WWF to provide additional funding for marketing and awareness creation.

6.3.2.3 Estimated costs of and willingness to pay for cookstoves

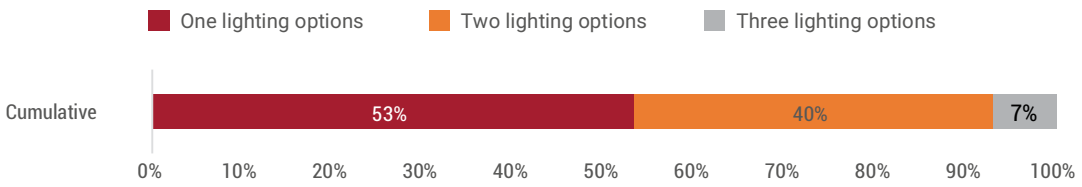
The model estimate found that if a refugee household was willingness and able to pay more for an energy-saving cookstove it was likely to reduce the household cost of energy by UGX 5 879 (USD 1.6) per month. However, the willingness to pay for energy-saving cookstove was likely to drive up the cost of cookstoves by UGX 1 913 (USD 0.5) per stove. In addition, households acquiring an energy-saving cookstove considered aspects such as the extent of energy saving, levels of reduction in environmental pollution and speed in cooking. When these factors are adopted; the household was likely to reduce the cost of energy by UGX 7 737 (USD 2) per month per household. It was also noted that there existed models for paying for cookstoves in instalments; however most refugees in the camps prefer one off cash payments as compared to instalments since most of them receive UGX 31 000 (USD 8) per household member per month from WFP.

6.4 Energy for lighting

This section explores the lighting technologies, sources of lighting and the costs of lighting as documented in the refugee camps in Uganda.

6.4.1 Types and sources of lighting

The households in Imvepi and Palorinya mostly use one lighting source as cited by 54 percent and 69 percent of the respondents, respectively. On the other hand, more than half of the households in Omugo have more than two lighting technologies (see Figure 49). Cumulatively, most of the households in the refugee camps in Uganda have one lighting option.



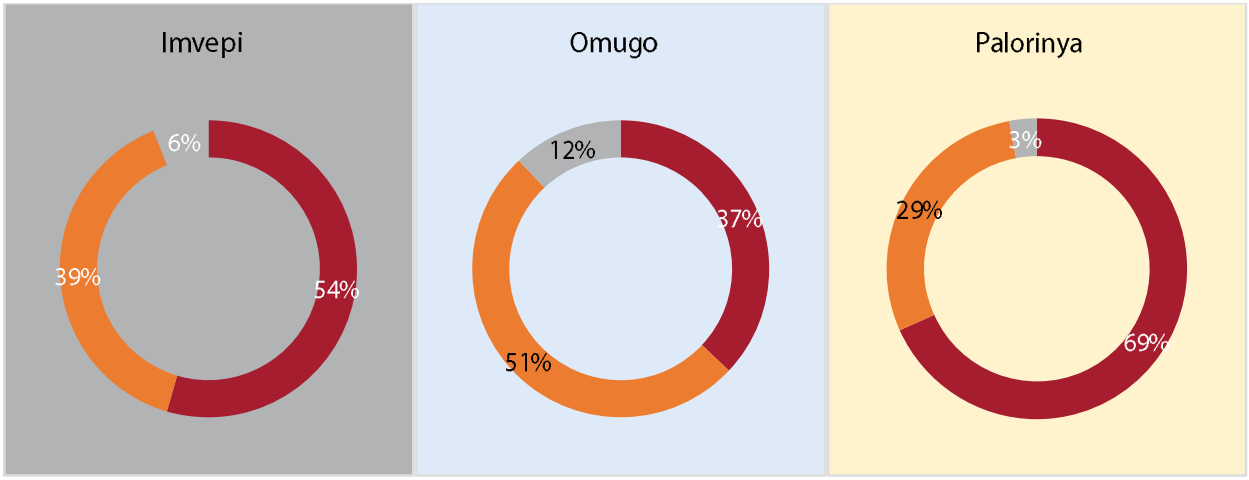


Figure 49: Lighting technologies stacking in the three refugee camps in Uganda

Majority (47 percent) of the households use the pico-solar lantern, with some households stacking several lighting options (see Table 21). In Imvepi, 60 percent of the households use pico-solar, and 19 percent stack lighting technologies. Whereas in Omugo and Palorinya 50 percent and 32 percent of the households are using pico-solar lanterns, respectively.

Table 22: Types of lighting used the refugee camps in Uganda

Type of lighting	Imvepi	Omugo	Palorinya	Cumulative
Pico-solar lantern	60%	50%	32%	47%
Solar home systems	3%		4%	3%
Stacking lighting options	19%	31%	20%	23%
Candle	2%	3%	6%	4%
Kerosene lamp	2%	11%	9%	7%
Tin lamp	4%		2%	3%
Others	12%	5%	34%	17%

Majority (75 percent) of the households reported to have acquired their lighting technology from UNHCR, while 19 percent said they got the lighting technologies from the Danish Refugee Council (DRC). Only 3 percent purchased their lighting options. The trend is similar across the refugee camps, except Omugo where World Vision reportedly provided lighting technologies (see Figure50).

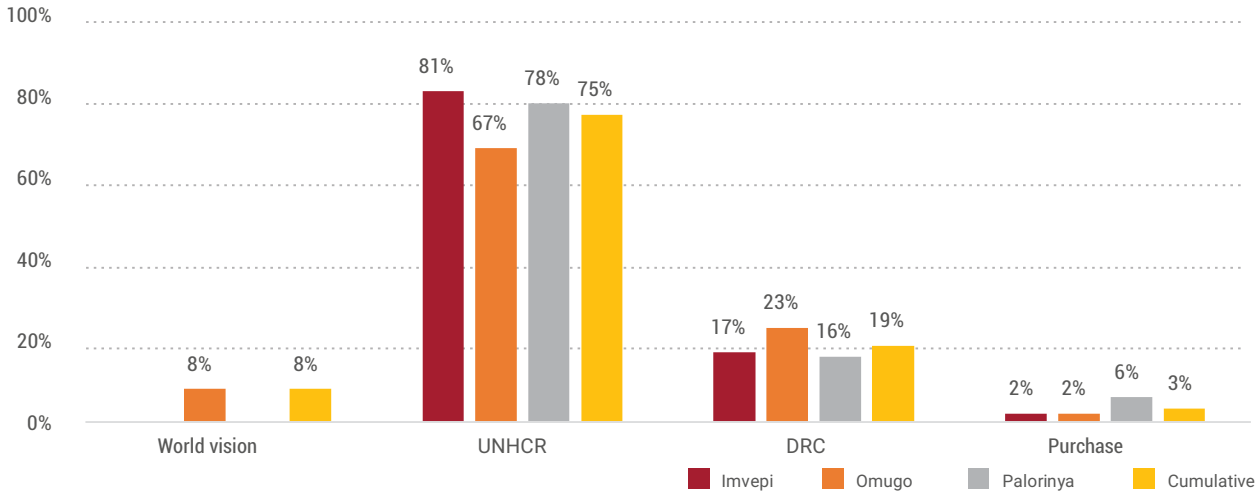


Figure 50: Sources of lighting in the three refugee camps

6.4.2 Adoption of new lighting technologies

The analysis carried out in the three regions revealed high levels of willingness to adopt new lighting technologies. It was established that 59 percent of the households in the Imvepi region, 76 percent of households in the Omugo region, and 71 percent of the households living in Palorinya regions were willing to adopt new lighting technologies. The households noted that; they could adopt new lighting sources if the technologies met the following criteria: (i) ability to provide adequate light (ii) rechargeable(iii) ability to support business (for productive use) (iv) solar adaptability (v)affordability (vi) durability (vii) easy to use (viii) multi-function(e.g. lighting and phone charging), and (ix) energy saving.

6.5 Energy for productive use

The productive use of energy is one way of improving livelihoods through promoting economic activities that depend on energy (see Box 3 Impact story). The evaluation found that households were engaging in trade in energy products and others in productive use activities. About 27 percent of households used energy for productive purposes. The activities included eateries operated by 15.6 percent of the households while another 5.2 percent were involved in making local brews. 6.2 percent sold firewood as a business. The income related assessments revealed that, 15 percent of the households that engaged in income generating activities made below UGX 20 000(USD 5.28) per month. 9 percent made between UGX 20 000-50 000 (USD 5.28-13.19) per month and 3 percent made between over UGX. 50 000 (USD 13.19) in a given month. Further, the overall cost of energy from productive use associated with cooking fuel and energy for lighting increased the cost of energy by only UGX 222 (USD 0.1) per month for each household engaged in productive activities. In addition, the overall cost of fuel in a household that incorporated energy for lighting, cooking, and productive use increased by UGX 4 112 (USD 1.12).

BOX 5

A GOOD STOVE MAKES GOOD BUSINESS: AN IMPACT STORY ON PRODUCTIVE USE OF ENERGY IN COOKING

Deep in the heart of Uganda lies the Imvepi Refugee Settlement, a refugee camp that was opened back in 2017. The camp currently accommodates roughly 95 000 refugees and among them is Phiona, a 30 year old woman who has been living in the camp for the last three years. Phiona is one of the industrious refugees who despite her refugee status has been fortunate enough to start a small hotel business within the camp helping her earn a living. For Phiona to keep her business running she heavily relies on firewood, a commodity that is becoming increasingly difficult to come by. Uganda is among the largest refugee hosting countries in the World. By 2016 it was estimated that the country was hosting over 510 000 refugees from various countries. This therefore puts pressure on amenities and resources shared between refugees and host communities. Imvepi Refugee Settlement is located in Arua District in the north-western part of Uganda. The district is generally dry with several areas exhibiting low ground water making the use of firewood an unreliable source of energy.

When she set up her business, 8 months ago, Phiona started off with a locally improved cooking stove which only used charcoal. The buying price for the stove was UGX 25 000-35 000(USD 6.80-9.51). "Using this cooking stove was difficult for me. I would spend an estimated UGX 7 000 (USD 2) per day of fuel," says Phiona. A few months into the business she was introduced to the FAO cooking stove by one of the other refugees and after trying it out for herself she went on to purchase two FAO cooking stoves. After using the FAO cooking stoves Phiona says that she has seen a tremendous improvement in her consumption of firewood and is making financial savings. "Before purchasing the FAO stoves, I used firewood for UGX 30 000 (USD 8.15)and a bag of charcoal worthy UGX 70 000 (USD 19.03) which lasted me only 3 days. Now with the FAO stoves, I use the same firewood and the bag of charcoal for 5 days," narrates Phiona.

The FAO cooking stoves have been embraced by many looking for a sustainable wood fuel use, though some of its users have highlighted challenges they are experiencing with the current model of the stove. Phiona says that despite the inner part of the FAO stove being metal she finds it too week and as such it does not last for more than two months due to the bulk cooking she undertakes within her hotel business. "Most of us using the FAO stoves have improvised bicycle scram as a replacement. The bicycle scram reduces heat loss hence the utilization of lower fuel in my business. In addition, the use of firewood with the FAO cooking stoves produces charcoal which is used to warm food for my customers; hence creating a lot of saving for me," says Phiona.

Her customer base is growing with her clientele emanating from the staff working with the development partners and organizations supporting the households within the refugee camps. "Between Monday and Thursday, I service between 30-150 customers daily. In addition, the cost of my fool is between UGX 20 000-UGX 30 000 (USD 5.44-8.15)per plate," states Phiona. Asked how she lights her hotel premise, Phiona says she bought solar lighting equipment from one of the refugees which were initially provided by UNHCR, but she highlights that she is looking forward to purchasing a larger solar system for her business. Most of the refugees living within the camp are unaware of any environmental regulations, lack information of mitigation of climate change and how it affects them. They experience prolonged dry spells, drought, erratic rains,

strong winds and increased air temperatures. Their main concern is the scarcity of wood fuel. "I use charcoal because for me it is cheaper, and I walk long distances in search of dry wood around the area. My only fear is that all big trees are gone, and soon the area will be a desert," says Phiona.

Phiona however, she says that she sees a brighter future ahead due to the presence of organizations that work and live among the refugee community are often seen to plant trees especially in areas near water points.

6.6 Compounding factors for energy access

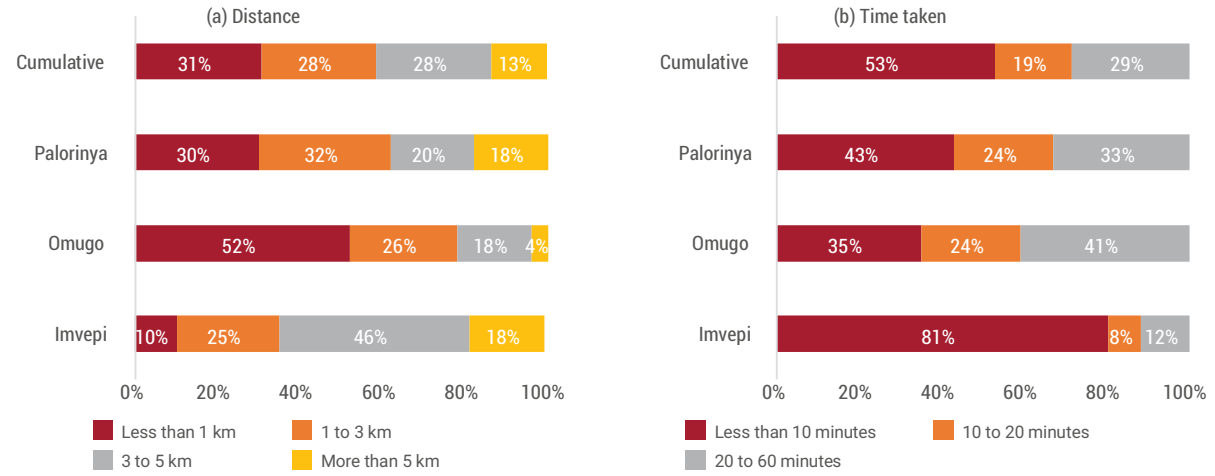
Beyond energy for cooking, lighting and productive use, this section details other significant compounding factors associated with energy access including the gender contexts in energy access, and implication of energy access on natural resources (especially forests).

6.6.1 Gendered contexts in energy access

6.6.1.1 Responsibilities for and efforts in cooking fuel collection

The distance travelled and the number of hours spent while collecting firewood was used to determine the overall cost of energy (see Figure 51). 46 percent, 25 percent, and 18 percent of households living in the Imvepi region revealed that it took them between 3-5 km, 1-3 km, and more than 5km respectively to collect wood fuel. In addition, 52 percent; 26 percent and 18 percent of households living in Omugo region covered less than 1 km; 1-3 km and 3-5 km to collect cooking fuel; while 32 percent, 30 percent, 20 percent and 18 percent of the households in Palorinya region covered 1-3 km; less than 1 km; 3-5 km and more than 5 km to collect cooking fuel respectively. It was further noted that 81 percent of the households in the Imvepi region took between 0-10 minutes to collect cooking fuel while 41 percent, 35 percent and 24 percent of households in the Omugo region took 20 minutes to one hour; 0-10 minutes and 10-20 minutes respectively. In addition, only 43 percent, 33 percent, and 24 percent of the households in the Palorinya region took 0-10 minutes; 20 minutes to one hour and 10-20 minutes to collect cooking fuel, respectively.

Figure 51: Effort for collection of cooking fuel in (a) distance and (b) time taken to collect the fuel



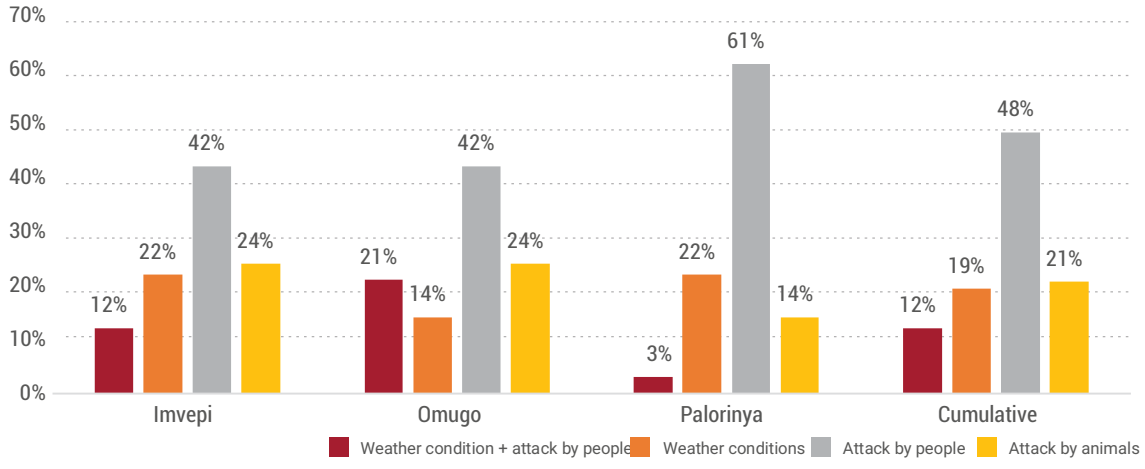
It was further identified that household headship and gender influenced the degree and nature of energy use within households. Whereas women and girls tend to be primarily responsible for fuel collection, men tend to be in charge of finances taking decisions on how it can be spent. Among the respondents in Imvepi, 40 percent of the decisions on the use of energy were made by household heads while 42 percent of the decisions were made by their spouses, and 17 percent of the decisions were made by children. In the Omugo region, decisions on the choice of energy by household heads constituted 38 percent, while a combination of spouses and children accounted for 58 percent of the share of decision making on energy use. Further, in Palorinya region the decision on the choice of energy use was taken by household heads (48 percent) and their spouses (44 percent). The decision by household's heads or their spouses on the type of energy used was found to reduce the cost of cooking fuel, as decisions were characteristically made to maximise the limited resources available for energy purchase.

6.6.1.2 Energy related conflicts

Competition between locals and refugees for scarce resources (wood fuel, animal fodder, and water) could easily result in conflict and resentment. Where tensions are high, firewood collection becomes a dangerous endeavour. A number of households in the three regions experienced violence while collecting firewood. It was reported that 56 percent of households in the Imvepi region, 24 percent of households in the Omugo region, and 40 percent of households living in the Palorinya refugee camps experienced some levels of violence. Women and children were forced to walk long distances in insecure environments to gather fuel for cooking.

The findings in the evaluation showed that 42 percent of the households in Imvepi and Omugo, and 61 percent of households in Palorinya experience conflicts associated with attacks from people. Another 24 percent of the households in Imvepi and Omugo, and 14 percent of households in Palorinya were attacked by animals. Cumulatively, the highest conflicts experienced by the households in the refugee camps cited by 48 percent, was attack from other people (Figure 52).

Figure 52: Conflicts experienced by households in the three refugee camps



6.6.2 Energy access sustainable natural resources management and climate change

Due to a high refugee population density in settlements and surrounding areas, environmental degradation has become a matter of concern. The ecosystem loss due to refugee settlement was estimated at USD 90.7 million for 2016/17, constituting about 28 percent of the total public cost on refugee protection and management in Uganda (FAO,2017). The contributing factors to ecosystem loss include land degradation, deforestation, loss of vegetation cover, and water contamination, among others. The need to conserve the environment and enhance sustainable forest management was critical given the increasing number of refugees in Uganda.

Climate change and environmental management appeared not to be of great concern to the refugees, as demonstrated in the high use of wood fuel for cooking and in productive activities. During the evaluation, only 21 percent of the households in Imvepi, 14 percent of the households in Omugo, and 23 percent of households in Palorinya refugee camps expressed their concern about their use of energy and its effect to the environment. Despite the low concern on the environmental impact and emerging climate change effects; the community expressed their willingness to engage in climate change adaptation activities if engaged. The willingness to adopt new models of energy use in line with climate change adaptation and mitigation measures was reported by 90 percent of the households living in Imvepi; 89 percent of the households in Omugo and 88 percent of households living in the Palorinya refugee camps, respectively.

6.6.3 Natural resources and humanitarian response

When asked whether their life has improved, the respondents provided different opinions depending on their countries of origin and the quality of the humanitarian response they received. Energy access initiatives in Imvepi, Omugo, and Palorinya refugee camps have been heavily supported by various development partners including FAO, World Vision, DRC, and UNHCR. These entities provided cook stoves and lighting systems in Northern Uganda. Given the increased need for humanitarian assistance as a result of influx in refugee populations in Uganda, the various actors continue to be attracted to the humanitarian energy sector. Coordinating and managing these actors in order to minimize duplication and maximize synergies remains an uphill task. The FAO support to the refugee camps in the region has been enhanced from provision of cook stoves to provision safety nets. The later includes training and capacity development in food security which included the provision of poultry; support towards green vegetable farming; provision of beans, semis, and cowpeas among other support. In addition, the cook stoves found in the region are mostly the mud stoves, and small improved cook stoves and FAO designed stoves adopted by households. It was observed that the inclusion of stakeholders at the community level in the support planning process ensures even distribution of the commodities.

6.6.4 Forest management

Deforestation is by far the most observable effect associated with refugees. Trees have been cut down due to increased fuel and construction needs, land for settlement, and increased commoditization of forest resources by refugees as a quick-short term income-generating activity. Such high demands on the environment can easily lead to complete depletion of above-ground biomass. Mitigation interventions such as massive tree planting and the use of energy-efficient cooking technology are therefore key to addressing this challenge.

6.6.5 Policy support

The Ugandan government has developed various polies and frameworks that seek to address the impact of the increasing number of refugees in the camps on the forests and natural resources by adopting clean energy technologies. These include:

1. The Uganda refugee management strategy – that steers for self-reliance amongst refugees, therefore supporting market systems approach to energy access.
2. Uganda Comprehensive Refugee Response Framework (CRRF) that aims to mainstream energy efficiency and climate change mitigation across sectors especially through the implementation of sustainable cooking energy[45]
3. Sustainable Energy Refugee Response Plan – This will be established within the CRRF and aims to enable access to modern, affordable, sustainable, and reliable energy access technologies
4. Ban on charcoal burning.

However, for successful implementation of the said objectives, sensitization, and awareness as well as enforcement measures are required.

6.7 Cost of energy

The cost of energy goes beyond the pricing set for fuels, technologies and use options. In this section, cost of energy is explored through the implications of energy access, use and payment mechanisms on energy dynamics.

6.7.1 Market impact on the cost of energy

To establish the impact of the SAFE programme among the served population, an econometric analysis was carried out. This analysis proposed a relationship between various factors relevant to energy access, household expenditure on energy and the cost of energy. These included *inter alia*

45 World Vision, Practical Action, 2019. *Cooking Energy Assessment in the Bidi Bidi Settlement Yumbe District, Uganda*

demographic factors namely, the household size, the uptake of clean cooking and the number of years spent in the camp. The factors also included the various uses of energy, gender aspects and natural resource management. The analysis was based on a reduced form expenditure regression model in which the household real expenditure was regressed on the household characteristics and endowments. (Glewwe *et al.,* 2002).

The regression model is a log-linear form expressed as:

$$\ln(E_{hcg}) = X_{hcg}\beta_g + \eta_g + \varepsilon_{hcg}$$

Where:

E_{hcg} is the real expenditure for a household h with clean cooking, forest management, renewable energy in agri-food chains in the project c at a location g within the service area. The $1*k$ vector of regressors x_{hcg} includes household's characteristics and endowments while β_g is a $k*1$ vector of parameters (returns) explained in satisfaction, time saved from varying distances from the original main source of energy g. $_g$ is the effects of the household cost of energy while $_{hcg}$ are the idiosyncratic random error terms which may include unpredictable market indicators, the extent of stock-outs, government policies, cultures, market –led assumptions including willingness to switch to alternative energy sources and beliefs of the consumers among others. The model adds to the number of years households lived in the region [46] as part of household characteristics.

Some of the assumptions that were applied to estimate the cost of energy included the following:

1. The actual cost that households spent on energy was estimated at a mean of UGX 17 464 (USD 4.6) with a minimum of UGX 7 000 (USD 1.8) and maximum of UGX 60 000 (USD 15.79) per month. This is approximately 23 per cent of the average household disposable income.

2. The unit cost for energy also took into consideration the income made from productive use of energy. It was assumed that part of this income would be used to purchase cooking fuel. This income generated from productive activities was estimated at an average of UGX 67 874 (USD 17.9) where an estimated 5 per cent was used to purchase cooking fuel, i.e. UGX 3 393.7 (USD 0.9) in a given month.

46 Van de Walle, D. and Gunewardena, D.2001. *Sources of Ethnic inequality in Viet Nam. Journal of Development Economics*, 65,177-207. http://dx.doi.org/10.1016/s0304(01)00133-X

3. The cash transfer to households to purchase cook stoves was estimated at a mean of UGX 47 724.39 (USD 12.6), However, households however spent an estimated UGX 10 829 (USD 2.9) to purchase of energy products,

4. In 2017, Uganda = adopted a minimum wage of UGX 130 000 (USD 34.2). This meant that the estimated hourly income for Uganda is USD 0.14[47],[48].From the analysis, the average income for households in the refugee camps was estimated at UGX 75 427 (USD 19.9) which translated to an hourly rate for the households in the refugee camps at USD 0.083.

5. The analysis also revealed that the daily average time spent in collecting cooking fuel was 22.5 minutes. This resulting to a monthly economic cost of collecting cooking fuel of UGX 3533 (USD 0.93)

6. .The households were willing to pay a mean of UGX 5 928 (USD 1.6) to purchase energy products.

7. Further, the average number of energy stock-outs was estimated at 5.4; which meant that households purchased energy during those days; the monthly cost of energy due to stock-outs was estimated at UGX 3 856 (USD 1).

The estimates (ii), (iii) and (vi) lead to the estimated direct baseline cost of energy for households per month of UGX 18 078 (USD 5)

6.7.2 Implications of the findings on the cost of energy

6.7.2.1 Implications of the demographics on the cost of energy

From the analysis, it emerged that increasing the number of households in the camps, as well as increasing the income that the households receive, would increase the cost of energy by USD 0.74 and USD 1 per month, respectively. It follows that when income is increased, the investment in additional appliances for instance would increase the overall cost of energy. At the same time, when there are more people – and therefore demand, the cost (including the price and effort needed to acquire energy) of energy will be higher. At the same time, the choice by the households to have alternative and more efficient energy systems would reduce the cost of energy for that household by USD 2 per month. This can be explained by the fact that, even with the higher initial energy product costs, the long-term benefits of alternative efficient energy tend to reduce the household costs associated with treating respiratory illnesses (resulting from the use of inefficient cook stoves), as well as the effort needed to collect/accumulate fuels.

47 https://wageindicator.org/salary/minimum-wage/uganda/archive-before-2019/minimum-wages-in-uganda-with-effect-from-01-07-2017

48 https://www.parliament.go.ug/news/3160/parliament-passes-minimum-wage-bill

6.7.2.2 Implications of cooking fuel on the cost of energy

The analysis indicated that using more than one cookstove (stacking) would increase the fuel (and therefore the energy costs) by USD 3 per month. This is because efficiency mechanisms may not be achieved when using multiple stoves – for instance, the probability of heat loss is higher. However, providing more affordable cookstoves would reduce the fuel and energy costs by USD 0.34 per month. The adoption of the *right* cooking fuel for a stove accompanied by the pre-requisite knowledge of its optimum use would reduce the cost of energy by USD 0.4 per month. These calls for interventions that will not only provide efficient energy technologies, but also the needed information that would allow the households to use the stove efficiently and with the right fuels.

6.7.2.3 Implications of cookstoves on the cost of energy

The study established that the household cost of energy reduced by USD 0.31 when provided with the FAO stove in comparison with an estimated monthly cost of energy increase of USD 5 per month associated with the use of inefficient stoves. At the same time, when households were aware of the benefits and characteristics of the stoves, they were likely to reduce their cost of energy by USD 1 per month, emphasizing the need to build the capacity of households on energy saving stoves, as well as promoting peer community leaning through local learning networks.

6.7.2.4 Implications of energy for lighting on the cost of energy

The primary analysis revealed that switching to alternative cleaner lighting technologies resulted in reduced energy costs of up to USD 1 per month whereas the cost of not switching to cleaner lighting technology was an additional USD 2 per month. The analysis indicated that changing from traditional lighting options to newer cleaner lighting technologies (including using energy saving appliances) would reduce the cost of energy to the households.

6.7.2.5 Implications of energy for productive use on the cost of energy

The monthly cost of fuel taking into account energy for lighting, energy for cooking, and productive use "if not utilized within efficient and effective appliances" was found to increase by up to USD 1 per month, Utilising energy for productive use however, reduces the overall cost of energy by USD 0.01. This therefore necessitates the promotion of a market driven approach to encourage and empower vulnerable groups in the camp to venture into energy entrepreneurship to enhance their incomes, while reducing their costs of energy.

6.7.2.6 Implications of compounding factors on the cost of energy

Reducing the potential for violence during collection of fuel was demonstrated to reduce the household cost of energy by USD 1 per month, On the other hand, the willingness to adopt clean and environmentally

friendly cookstoves and fuels would reduce the cost to the environment and therefore the overall cost of energy to households by USD 2 per month. Consequently, the need to promote awareness and provide alternative efficient and clean energy solutions whose fuel sources can be safely obtained is crucial to the refugee camps in Uganda.

6.8 Market threats, opportunities and programming options

The assistance from FAO and other humanitarian organizations has had a significant impact on the Decentralised Renewable Energy sector in Uganda. The distribution of energy-saving stoves has significantly promoted sustainable livelihood and food security in Uganda. Specifically, the stoves have had a massive impact on the cost of fuel for cooking, lighting, and for productive use. This is evidence that continued support and distribution of energy products will continue to improve livelihoods in Uganda and across the region. While communities in Imvepi, Omugo, and Palorinya are welcoming to refugees, there is an increasing concern from host communities over their increasing numbers and the shortage of resources. This calls for urgent action to address not only the humanitarian concern but also the developmental concern posed by refugees. Their increasing presence continues to strain resources like forests, water, and land leading to a negative environmental impact and with a possibility for fuelling conflict with host communities.

The utilization of a market-based approach in the distribution of fuel energy and cookstoves has been hampered by numerous bottlenecks in the value chain. A good example is where people received the FAO stoves and were reported to have resold them at a higher value. The approach to distribution of stoves therefore needs to include a level of user tracking to ensure that they reach the people primarily for use rather than ending up in a secondary market. Before the market matures, support from development organizations is still needed to build a robust distribution model and ensure no one is left behind.

Despite the existence of massive free land for planting trees, programs to enhance tree planting in the region are insufficient, . The current forest cover cannot sustain the demand for firewood and charcoal both for home and productive use. Support organizations should extend their services to sensitization of local communities on the benefits of reforestation, as they encourage the use of alternative sources of energy. The Office of the Prime Minister works with local communities to enhance reforestation, and this should receive a boost from civil society organizations and other key stakeholders. Firewood and fuel remain the dominant source of energy for cooking, lighting, and productive use in the local communities. Due to costs associated with other methods, analysis suggests that people may not be

willing to shift to alternative green sources. Support organizations should shift from addressing the issue from a humanitarian perspective but view it as a development issue. This could be done through encouraging displaced people and their host communities to engage in free enterprise. Where significant gains can be made in shifting from firewood and charcoal to alternative sources of energy both for lighting, cooking, and productive use.

6.8.1 Constraints to energy access and market features

6.8.1.1 Constraints to cooking and lighting energy access

Access to cleaner technologies and fuels in Uganda refugee camps is constrained by the following factors:

1. **Levels of affordability by the households**: The purchasing power among refugees is limited by the low-income levels and over-dependency on donations and remittances which limits their ability to afford energy products.

2. **Limited access to clean energy products**: The public sector supported distribution systems, through the Office of the Prime Minister (OPM) which is only able to provide limited access. The private sector led channels are also limited in terms of reach and distribution capacity.

3. **Market distortion:** The "free" access to cooking fuel, lighting technologies, and cookstoves do not allow for market chain actors to facilitate access to energy provision in the camp in a commercially viable manner. Market distortion will continue to persist due to disparity between "who pays" and "who consumes".

4. **Limited market information/knowledge**: The existence of information asymmetry between various actors ranging from government, humanitarian organizations, civil society, private sector, and energy users leads to inefficiencies and impaired market development. This is compounded by limiting user beliefs and cultural practices especially the ability to meet the cooking habits of different communities,

5. **Low margins among suppliers:** The renewable energy business is often characterised by high production costs and low margins (in an effort to keep prices affordable to often poor end users). Low margins tend to limit investment and development of commercially viable distribution models especially for serving the hard to reach areas where refugees in East Africa live.

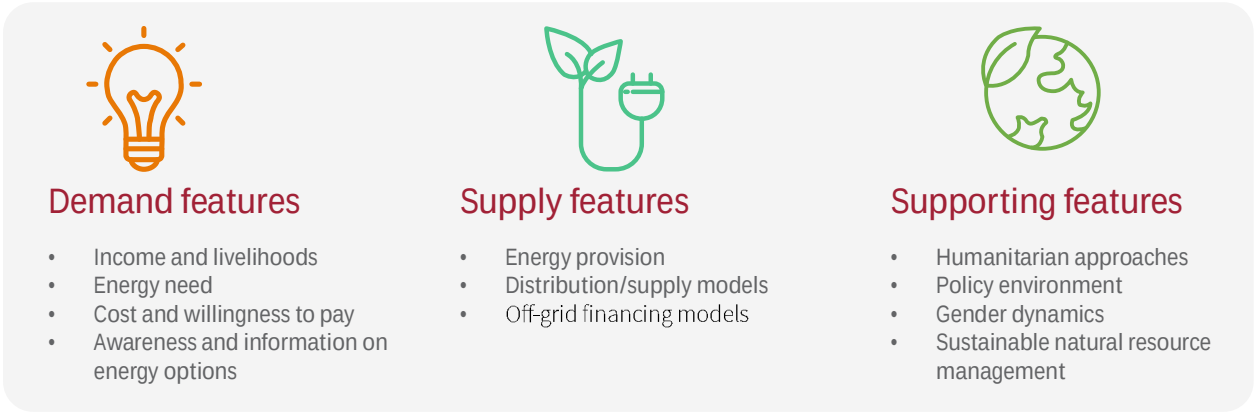
6. **Quality of products:** Due to price sensitivity entrepreneurs often end up trading more in low quality and uncertified energy products. This is counterproductive as it often gives even the good products a bad name. this has been experienced mostly with the proliferation of cheap solar products in the market

7. **Limited access to financing:** This includes both working capital for entrepreneurs as well as financing for end users. This is compounded by the fact that not many financial institutions have established a strong presence in the refugee camps. While some FIs see the need for financing for the various energy providers, there is limited evidence on how profitable these are. For example, household ICS are often not seen as a good venture for FIs to finance end users (with pricing ranging from $10 - $30).Additionally, the loan ticket sizes for these products do not justify the expenditure financial institutions incur for example on boarding costs, visiting client's residence, etc. Specific to the bigger impact investors, the financing needs of RE product providers is smaller than their investment ticket sizes (not less than $100,000), which limits investment in these businesses, especially indigenous companies.

6.8.1.2 Key market features

The evaluation identified key market features to address the general constraints limiting access to and use of energy in the refugee camps in Uganda (see Figure 53). The features have been categorised into demand, supply, and supporting function features (for further details, see additional resources section).

Figure 53: Key market features in promoting energy access and use refugee camps in Uganda



6.8.1.3 Demand features

Income and livelihoods: There is still a heavy reliance on humanitarian assistance by the refugee community, however the liberal approach by the Uganda government, provides opportunities for the refugees to earn extra disposable income. The extra income may give some of the refugees the ability to purchase alternative energy products both in cash as well as engaging in other payments models such as PAYGO and hire purchase.

Energy needs: The ability to collect firewood for free by refugees releases their scarce resources to buy and in trade in other commodities that they need – including energy technologies and alternative fuels. Energy needs are also being increasingly met through the introduction of new products by the private sector based on the desirability to the end-user in terms of utility, cultural appropriateness, aesthetics, flexible payment structure and perceived improvement. These include the PAYGO systems and the industrially produced cook stoves.

Cost and willingness to pay: The dependencies created by free distribution of energy technologies, leads to distortion to the market. However, refugees are also beginning to consider the recurring costs of lighting and cooking and therefore showing willingness to pay for energy efficient technologies.

Awareness and information on energy options: Community sensitization and awareness creation campaigns have been conducted to increase energy adoption of solar and clean cooking among households but with little emphasis on productive uses of energy. Awareness creation efforts should therefore include energy literacy and promotion of strategies to increase adoption of productive energy use.

6.8.1.4 Supply features

Energy provision: Despite the availability of proven technologies and demand in the off-grid market, there is low penetration of clean energy products in the humanitarian market. This indicates potential to attract private sector providers especially those involved in solar, improved cookstoves and briquettes production. This would however require incentives to de-risk private sector investment in these often-considered high risk markets.

Distribution models: There are already established channels for the common energy products (e.g. charcoal and firewood) through a network of transporters, distributors, and retailers in the market. On the other hand, cookstoves and lighting technologies are mostly distributed through groups (e.g. CBOs) and private sector partners. These distribution structures could support entry of other energy products with relative ease.

Off-grid financing models: The emerging models of cash-based assistance for refugees improve purchasing power liquidity and give refugees an element of choice. This can act in favour of financing for energy products. In addition, existing semi-formal financing mechanisms such as VSLAs, have the capacity to support the penetration of clean energy products by easing the access to finance challenge.

6.8.1.5 Supporting features

Humanitarian approach: There is need for a long-term strategy of integrating humanitarian energy into existing market systems as emphasized in the Uganda Refugee Response Plan and Uganda Refugee Management Strategy that all seek to enhance self-reliance by refugees. Consequently, there is need to progressively embed the humanitarian energy interventions into the market-based approach through capacity building, technical assistance, and other market incentives.

Policy: The most prominent opportunity in Uganda lies in aligning intervention measures with the country's national and regional policy priorities and plans. With the "open-door-policy" for refugees promoted by the national government, and active involvement by the government in provision of assistance there is relative ease to align energy access programmes with government priorities and plans. The soon to be developed Sustainable Energy Refugee Response Plan that will be established within the Comprehensive Refugee Response Framework will be a key policy document to be consulted.

Gender dynamics: Energy poverty disproportionately affects women in the refugee settings of Uganda. Therefore, humanitarian energy programmes need to have energy development embedded into opportunities that would not only promote benefits for women, but also ensure their economic empowerment such as through energy entrepreneurship.

Sustainable natural resources management: The potential of reducing net effect of traditional energy systems (e.g. use of traditional open fire) on the environment lies with adoption of clean energy technologies. With the FAO land and forest resource-use management plan that supports energy needs and contributes to food security and nutrition, and the Uganda's NDP II (2015/2016-2020/2021) that seeks to manage settlement land efficiently and sustainably and conserve the natural environment in and around the refugee settlements; embedding community-based natural resource management (CBNRM) in policy would be a win-win-win opportunity for promoting energy access in emergency situations.

6.8.2 Innovations for energy programming

The options proposed for implementation by FAO and partners working in humanitarian energy in Uganda include: building capacity for the development of a market ecosystem to support the delivery of energy services to refugees and host communities; scaling up community inclusive market-based solutions; community-based solutions-to drive awareness and uptake of renewable energy technologies; market-based programming and private sector engagement; ; multi-sectoral collaboration; and sustainable natural resource management.

6.8.2.1 Building capacity for the development of a market ecosystem to support the delivery of energy services to refugees and host communities

There are clear signs of an emerging market economy in the humanitarian setting in Uganda as earlier demonstrated in this report (see key market features).As such there is need for capacity building to support the development of a market ecosystem that will promote long term sustainability in energy service delivery. Such actions would include:

1. Technical assistance to humanitarian organizations, local government, private sector, and other market system actors
2. Awareness creation and behaviour change campaigns to promote the uptake of new products and distribution models. This includes promoting energy literacy through Farmer Field Schools and other extension programmes
3. Financial assistance for vulnerable populations through subsidies, results-based financing, and tariff concessions to refugees
4. Promoting energy literacy on productive use opportunities for refugees and host communities. This would help drive uptake of products needed to drive market activity and along the food and energy nexus

6.8.2.2 Scaling up community inclusive market-based solutions

While promoting the market-based approaches in the camp settings in Uganda, there is need to ensure such approaches incorporate local communities' needs capacities and cultural practices. To this end, programming options should therefore consider:

5. Mainstreaming inclusion: Proactively ensuring the inclusion of host and displaced individuals in all their diversity across the program cycle
6. Community models for energy provision e.g. Setting up energy kiosks equipped with improved cookstoves, 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
7. Support alternative energy options that are locally available and economically, technically, and culturally appropriate for the end-users
8. Distribution through cash or voucher-based programmes leveraging VSLAs and community groups as this would allow refugees to choose their preferred stoves/lighting solution. However, vouchers need to be delivered so that they do not disincentive other energy consumers to pay for products and services.

6.8.2.3 Community-based solutions to drive awareness and uptake of renewable energy technologies including cooking solutions

A distinctive feature of this intervention is the comprehensive involvement of refugees and host communities in designing and implementing support services like affordable microfinance and education and training. We see the adoption of renewable energy technologies as being dependent on a complex network of facilitating factors, such as awareness, availability, affordability and appropriateness. The success in achieving an energy shift will depend on the ability of different actors (energy companies, humanitarian organizations, civil society organisations and policy makers) to develop and deploy dynamic capabilities to enable local ownership and adoption of the process by, and with, refugees and host communities. Some of the interventions will include:

9. Assisting renewable energy technology firms to understand and to respond to the needs of end users and local communities in conditions of fragility, conflict and violence
10. Devise, together with local communities, robust social marketing approaches to encourage uptake of renewable energy
11. Leveraging on humanitarian and development support to provide the crucial link between upstream technological advances(eg higher tier cooking solutions) and downstream user acceptance through social and behavior change communication
12. In raising awareness on the benefits of improved cooking technologies, it is also important to include sensitization on efficient cooking practices which can be easily adopted together with the improved cookstoves

6.8.2.4 Market-based programming and private sector engagement

The integration of affordable and quality energy products in humanitarian contexts requires both public and private sector participation. The private sector actors provide fundamental support in the adoption and provision of multiple energy system options, promoting competition and innovation in energy technologies and relevant supporting services. The programming options that will help to attract private sector engagement include:

13. Reduction of the “free access/provision” of energy products. This could be substituted with cash transfers and social protection mechanisms that will increase household purchasing power for energy products and diversification of income livelihood
14. Development of models that will catalyse the deployment of private sector players in refugee camps; establishment of a Water –Energy –Food (WEF) nexus framework that integrates the engagement of the private sector for energy needs that are directly related to food preservation, food processing,

the reduction of food losses as well as water access. This could contribute to building resilient livelihoods in protracted crises while reducing potential for conflicts with local host communities through efficient resource management.

15. The programming options should focus on creation of innovative financing models to facilitate households to acquire energy products from the private sector. The financial models should also support the private sector actors to access financing such as working capital and that will also serve to mitigate the risks associated with servicing displaced populations.

16. Introduction of a quality assurance process for market actors to ensure that energy products are sourced sustainably and are of the right quality. This is critical in building consumer confidence - a critical factor in ensuring increased adoption of clean technology.

6.8.2.5 Multi-sectoral collaboration in developing energy programmes

A multi-sectoral approach will require enhanced synergy and the integration of energy programmes in various thematic areas implemented in the refugee camps. The multi-sectoral approach to energy programming will also enhance the W-E-F nexus if. Activities within this programming option could include:

17. The integration of clean energy access in household welfare programming. This would require the UNHCR and the OPM to develop a framework directing all humanitarian organizations to integrate clean energy programming in their core activities.

18. Adoption of market led solutions by stakeholders and humanitarian agencies engaging in energy and related sectors -where applicable collaboration in funding and development of energy access programmes. The maximization of available resources will help optimise the utilization of clean energy products in refugee settings.

6.8.2.6 Sustainable natural resource management

Sustainable natural resources management play a critical role in ensuring availability of vital resources in the longer term, preserving the environment as well as reducing the potential of conflict between host communities and the refugees. The government through the OPM and Ministry of Lands and that of Natural Resources Management need to develop policy interventions around natural resources protection, conservation, and governance. These policies may be adopted to specific humanitarian contexts. The innovative programme may incorporate the following activities:

19. The establishment and strengthening of technical working forums for environmental stakeholders including government actors, humanitarian organization and community-based organizations. Local participation and active involvement in environmental activities by displaced and host communities is vital for the sustainability of the proposed initiatives

20. The OPM, UNHCR, FAO and CBOs among other actors working in the area should develop a detailed mapping of settlements, existing and planned interventions to track progress and avoid losses if the same land is targeted for multiple purposes such as tree growing and farming

21. The mapping process discussed in (ii) should allow for agro-forestry that facilitate access to fruit trees to increase livelihood incomes for refugees

22. Integration of national policy guidelines in standard operations procedure and established community of practice (COP) within the refugee environment to enhance tree cover and manage deforestation

23. Increasingly recognizing the role of CSOs as key players in forest management and renewable energy access and integrating them in the development and implementation of activities. CSOs play a vital role in mobilizing and organizing host communities and advancing linkages with refugee communities. They therefore provide an opportunity in partnership to enhance advocacy and awareness efforts in forest management.

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Additional report resources

Table 23: Demand features for promoting energy access and use in the refugee camps in Uganda

Key Demand features characteristics	Demand features market implication
Income and livelihoods	
1. Reliance on international assistance 2. The income range for the majority refugee is USD 2.27 per month 3. Have more than one source of income due to engagement in a variety of income activity	1. Disposable income for consumer goods 2. Increase in household income by 10 percent would decrease monthly energy spending by UGX 2 807 (USD 0.77) 3. Opportunity for access to energy through hire purchase-staggered purchase and part-payment of the technology or subsidized by development partner 4. Significant existing market-based activity means demonstrated ability to pay
Energy need	
1. Energy is mainly used for cooking and lighting 2. Preference to use firewood and charcoal in households for cooking 3. Willingness to pay and adopt lighting sources for security reasons 4. Lorena stove is the commonly used stove with most households having two stoves Preference for energy-saving dual-purpose stoves reported	1. Spend on fuels is usually less for host community as they can collect firewood freely 2. Trade of food commodities to access fuel 3. FES and Efficiency fuel would reduce HH cost of energy by UGX 1 800(USD 0.49). 4. Introduction of appropriate energy products by private sectors and PAYG companies based on the desirability to the end-user in terms of utility, cultural appropriateness, aesthetics, and perceived improvement) 5. Advanced dual-purpose energy-saving stoves (Tier 3 & 4) That decrease energy spending by over 50 percent will have strong traction 6. Obtaining FES would reduce the cost of cooking fuel by UGX 7 795 (USD 2.12) per month
Cost and willingness to pay	
1. NGOs have distributed energy products in-kind, creating dependencies 2. Households incur significant recurring costs in cooking and lighting	1. Market distortions hindering scale of commercial models 2. Alternative fuel utilized with the right FES would reduce the cost of fuel by UGX 9 308 (USD 2.53) per month 3. Recurring fuel costs are made up primarily of charcoal purchases, making charcoal saving stoves the highest viable products 4. Efficiency saving from Quality fuel and energy savings estimated at USD 0.26-0.51 by 54 percent of HHs

Awareness and information on energy options	
1. Community sensitization and awareness creation campaigns have been conducted to increase energy adoption of solar and clean cooking among households with little emphasis on productive uses of energy	1. Market awareness strategies on productive use opportunities for refugees and host communities would increase the adoption of productive use of energy 2. HHs awareness of existing energy options and knowledge of alternative cooking fuel would reduce the cost of energy for cooking by UGX 2 873 (USD 0.78) per month for the household. 3. The efficiency measure on the utilization of cooking fuel and cookstoves; if not adjusted to alternative clean energy, would increase the cost of energy by UGX 2 024 (USD 0.55) per month.

Table 24: Supply features for promoting energy access and use in the refugee camps in Uganda

Key supply features characteristics	Supply features market implication
Energy provision	
1. Low market penetration of Improved solar system and Cookstoves 2. FAO distributed energy-saving cookstoves among 700 refugee and 300 host families 3. NGO briquetting program has been small scales such as Oxfam and DRC but successful in generating demand and additional income for livelihoods purposes 4. Only low-tier solar is available in the common market; high-end solar is only available in specialty shops 5. Suppliers' lack of understanding of customer demand and segmentation in the area and the resulting inability to market product	1. The solar market is already existent; competition and additional actors could drive down prices 2. Obtaining energy-saving and efficient cookstoves would reduce the cost of cooking fuel by UGX 7 795 (USD 2.12) per month per household. 3. Beneficiaries of FAO stoves reduced the cost of energy by USD 0.31. With training on stove use, cost of energy-reduced by USD 0.33 per month 4. Strong potential to attract private sector actors in the near-term for cookstoves and briquette production. Market model to acquire stove reduces cost by USD 2.12 5. De-risking the private sector to enhance access of product for productive use of energy for agriculture production 6. Convectional Supply of stoves will increase the cost of fuel by USD 0.30.
Distribution models	
1. The charcoal and firewood are distributed through transporters who resale in the marketplace 2. Distribution of cookstoves and solar products through CBOs, private partners and offer the products at a subsidized rate by development partners	1. Energy trade demonstrates the ability to pay for fuels and lighting sources due to upfront payments without financing mechanisms. A switch to reduce the cost of energy by USD 0.61 2. Due to low market penetration, some sensitization of consumers is necessary. 3. Perceived impact on utilization and market access for clean energy would reduce the cost of energy by UGX 3 066 (USD 0.83) per month.

Off-grid financing models	
1. The upfront cost of energy products is a barrier to purchase with most transactions cash-based. 2. Mobile money as a payment option is constrained by the poor quality of service, low availability of agents to serve a dispersed population and increased transaction costs 3. The cost of cookstove ranged from 2500 to 12,000 Ugandan shillings (USD 0.68- 3.26) depending on household income, type of cookstove, and place of purchase	1. Due to unstable income among refugees, there is a need for subsidization of products and financing to address high upfront costs necessary (Smart subsidies to support demand creation and seasonal promotions) 2. The need to shift to more cash-based assistance can allow for the potential for more market-based interventions to be explored and scaled up 3. The semi-formal mechanism, such as VSLAs, as a financing intermediary. However, the need to facilitate the VSLAs with adequate liquidity to purchase stock in bulk 4. The need to shift to more cash-based assistance can allow for the potential for more market-based interventions to be explored and scaled up; this would reduce the cost of energy by UGX 3 066 (USD 0.83) per month.

Table 25: Supporting features for promoting energy access and use in the refugee camps in Uganda

Key supporting features characteristics	Supporting features market implication
Humanitarian approach	
1. The gradual shift from in-kind food aid distribution to cash-based assistance to build financial inclusion and self-reliance 2. NGOs such as WWF, DRC, RICE-WN, are leading the implementation of several energy interventions in refugee settlements in Uganda 3. Short terms projects not capable of meeting long term impact and sustainability of energy interventions due to funding cycle	1. The need for a more long-term strategy of integrating refugees into market systems as emphasized in the Uganda Refugee Response Plan and Uganda Refugee Management Strategy will enhance self-reliance 2. There is a need to progressively embed the humanitarian energy interventions into the market system approach through capacity building, technical assistance, and other market incentives such as RBF 3. The adoption of the theory of change and the making Markets Work for the Poor (M4P) will enhance market systems in humanitarian setting and reduce the cost of energy by (USD 1.35) per month
Policy	
1. Uganda operates an open-door policy for refugees where refugees are allowed freedom of movement and are entitled to work and allocation of land 2. Uganda has made progress in advancing self-reliance from refugees specifically; Uganda National Refugee Policy and Uganda Refugee Management Strategy	1. Aligning interventions with government policy, to achieve clean fuel & ICS targets, is necessary for sustained adoption across the market. 2. The analysis of the cost of energy switch which brings together costs are computed from the quantity of energy use, the time spent in cooking and related efficiencies would cumulatively reduce the cost of cooking fuel by UGX 8 954(USD 2.43) per month

Gender dynamics	
1. Distance traveled to collect firewood (1- 5 km) a day. Time is taken per day to collect firewood (10 mins – 60 minutes 2. Some of the challenges experienced while collecting firewood include hostility from the host community with refugees been chased, attacks by animals and bad weather conditions	1. Women who collect firewood are vulnerable to gender-based violence; also increased tension with host communities 2. Reduction cooking fuel collection time by 1 hour and distance by 1 km; would reduce by the cost of energy by USD 0.63 and USD 0.12 resp 3. Need to promote opportunities for women economic empowerment through energy .empowering women to be not just consumers but also providers of energy services 4. Alternative means of acquiring energy for cooking would likely increase the cost by USD 0.19 per month
Sustainable natural resource management	
1. One of the main drivers of degradation is the demand for wood as fuel and to produce charcoal, which is used by both displaced and local populations. 2. FAO has developed a land and forest resource-use management plan to support energy needs and contribute to food security and nutrition 3. Uganda's NDP II (2015/2016-2020/2021) seeks to manage settlement land efficiently and sustainably and protect and conserve the natural environment in and around the refugee settlements;	1. By curbing firewood demand, clean cooking technologies can reduce environmental degradation and related resource tensions with local communities. 2. Community-based natural resource management (CBNRM) is the most sustainable environmental protection strategy in the long-term 3. Enhancing and supporting existing policy, legal, institutional frameworks for continued implementation 4. Use of quality cooking fuel and utilization of FES would reduce the cost of energy by USD 2.03) per month

Table 26: Demand features for promoting energy access and use in Melijo IDP camp

Key demand features characteristics	Demand features market implication
Income and livelihoods	
1. At least 85 percent of the country's population depends on farming, fishing or herding to meet their food and income needs. 2. High food prices as a result of shortages, currency devaluation, and high transport costs due to insecurity along major trading routes 3. The average income for majority refugee is USD 153.54 per month 4. Charcoal production is one of the main livelihood strategies using traditional kilns	1. A lack of financial and physical access to food real labor incomes and the relative price of livestock falling dramatically 2. Owing to limited access to a reliable source of energy, the majority of the people depend on biomass, mostly charcoals, and firewood, to meet their pressing energy needs 3. Significant existing charcoal demand means demonstrated ability to pay for charcoal and improved charcoal stoves.

Energy need	
1. 50 percent of households depend on Wood fuel (mainly firewood and charcoal) for cooking. Energy used mainly for cooking and lighting 2. Consumption patterns for fuel: Firewood: 1 unit of firewood equivalent to 10 sticks per day. 50 percent of the households cooked twice a day 3. Cultural significance of the three stones. Low awareness level and adoption of improved cookstoves 4. The cooking culture necessitates the use of more than one stove per household. Different stoves are used for different pot sizes to allow a variety of meals to be cooked	1. The heavy reliance of firewood and charcoal presents an opportunity for briquette production using waste from char dust and biomass (grass) 2. Design and development of stove models (co-creation with communities) that fit the various cooking needs of the household to discourage the use of 3-stone fire (eg UNHCR co-creating a stove design with refugees) 3. Introduction of appropriate energy products based on the desirability to the end-user in terms of utility, cultural appropriateness, aesthetics, and perceived improvement) 4. Obtaining FES would reduce the cost of cooking fuel by USD 3.48 per month. Use of more than one stove would reduce the cost of cooking fuel by 34.05
Cost and willingness to pay	
1. NGOs have distributed energy products in-kind, creating dependencies. 2. Households incur significant recurring costs in cooking and lighting. The cost of lighting has been estimated to be between about US USD14 - US USD 30 per household per year. The retail cost of charcoal is between 100-200 (USD 0.8-USD 1.5) SSP with 70kg bag costing 15700 SSP(USD121) 3. There is a willingness to purchase improved cookstoves by 31 percent of households	1. Market distortions hindering scale of commercial models 2. Recurring fuel costs are made up primarily of charcoal purchases, making charcoal saving stoves the highest viable products. 3. Alternative fuel utilized with the right FES would reduce the cost of fuel by USD 6.88 per month
Awareness and information on energy options	
Community sensitization and awareness creation campaigns have been conducted to increase energy adoption of solar and clean cooking among households with little emphasis on productive uses of energy	Create local capacity for production as opposed to external capacity from consultants increases uptake to cascade the technology for user HHs awareness of existing energy options and knowledge of alternative cooking fuel would reduce the cost of energy for cooking by USD 3.48 per month for the household. The efficiency measure on the utilization of cooking fuel and cookstoves; if not adjusted to alternative clean energy, would increase the cost of energy by USD 9.92 per month

Table 27: Supply features for promoting energy access and use in Melijo IDP camp

Key Supply features characteristics	Supply features market implication
Energy provision	
1. Low market penetration of cookstoves and briquettes while charcoal trade is rampant 2. FAO has distributed energy-efficient stoves in South Sudan. UNHCR distributed solar lamps to support household lightning 3. There is a high premium for alternative sources of lighting (kerosene, candles, low-quality dry-cell based light-emitting diode (LED) lanterns) due to poor distribution networks 4. Price is a key determinant for the purchase of energy products 5. The electricity generation is intermittent and comes almost entirely from imported diesel for generators. Electricity found only in Nimule town used for productive use and lighting	1. Design and develop locally produced stoves that fit Refugees & host community context to cut transportation costs 2. Beneficiaries of FAO stoves reduced the cost of energy by USD 1.93. With training on stove use, cost of energy-reduced by USD 3.41 per month 3. Strong potential to attract private sector actors in the near-term for cookstoves and briquette production 4. Profiling local producers to establish local skills pool and training them to improve on stove quality 5. Focus on improving the efficiency of charcoal production through the development of kilns (through charcoal groups)
Distribution models	
1. Different transportation companies providing trucking services, clearing services and several manufacturers supplying Juba markets and Uganda, via retail outlet/ distributors in Nimule	1. Refugee camps are in remote locations where markets are far. This increases production and transportation costs and further the final commodity price in the market. 2. Perceived impact on utilization and market access for clean energy would reduce the cost of energy by USD 3.56 per month
Off-grid financing models	
1. The upfront cost of energy products is a barrier to purchase with most transactions which are cash-based. 2. Mobile money as a payment option is constrained by the poor quality of service, low availability of agents to serve a dispersed population and increased transaction costs 3. Most of the households are unbanked with limited access to financial services.	1. Due to unstable income among refugees, there is a need for subsidization of products and financing to address high upfront costs necessary (Smart subsidies to support demand creation and seasonal promotions) 2. The need to shift to more cash-based assistance can allow for the potential for more market-based interventions to be explored & scaled up 3. The semi-formal mechanism, such as VSLAs, as a financing intermediary. However the need to facilitate the VSLAs with adequate liquidity to purchase stock in bulk 4. Banking services are mostly limited to foreign exchange, bank transfers, and remittance services are a hindrance to the private sector and households can hardly access finance

Table 28: Supporting features for promoting energy access and use in Melijo IDP camp

Key Supporting features characteristics	Supporting features market implication
Humanitarian approach	
1. NGOs such as FAO, UNHCR are leading the implementation of several energy interventions in refugee settlements in SS 2. Short terms projects not capable of meeting long term impact and sustainability of energy interventions due to funding cycle 3. Most humanitarian - using a diesel-powered generator to power their offices	1. Provide enabling environment for private sector involvement in alternative fuel and stove programs that are market-driven 2. Mainstreaming energy programs across the phases of humanitarian response to build stronger sustainability efforts across the various lifesaving sectors – WASH, Food, shelter, health, etc 3. The strong business case for humanitarian agency to adopt renewable energy delivery models for lighting and powering their institutions and community services such as schools, boreholes and health facilities
Policy	
1. The UN in South Sudan has developed an UN-wide Peacebuilding Plan 2018–2021, that will strategically channel resources and guide activities 2. Governance and administrative systems a challenge	1. Aligning interventions with government policy, to achieve clean fuel & ICS targets, is necessary for sustained adoption across the market 2. The long-term goal of the GOSS is to heavily invest in hydropower generation. The potential for hydroelectric power is anticipated to be concentrated on the stretch of Nile between Nimule and Juba
Gender Dynamics	
1. Refugees collected cooking fuel 3-4 times a week and spent 1-3 hours while collecting cooking fuel 2. Some of the challenges experienced while collecting firewood include hostility from the host community with refugees been chased, Gender-based violence (34.7 percent) and bad weather conditions	1. Reduction cooking fuel collection time by 1 hour and distance by 1km would reduce the economic cost of cooking energy by USD 13.38 per month 2. Advocacy for women empowerment and protection of vulnerable groups & Establish (woodlots) close to the camps to reduce protection risks 3. Providing grants to women FES producers (enfranchisement) to strengthen household incomes with reduced cases of gender-based violence
Sustainable natural resource management	
1. The natural vegetation is savannah with low tree cover, mainly shrubs that also suffer the long dry season of over 6 months throughout the year. This means natural tree regeneration capacity is quite low due to short rain season, subsistence farming and livestock disturbance 2. FAO supported the government in the development of the forest policy protecting natural resources and alternative energy option like briquette	1. By curbing firewood demand, clean cooking technologies can reduce environmental degradation and related resource tensions with local communities 2. Local governance at the country level, Payam level, and Boma level to provide a common platform for discussion of energy access issues between the refugees and the host community 3. Enhancing and supporting existing policy, legal, institutional frameworks for continued implementation (forest policy)

In Eastern Africa, displacement settings resulting from protracted conflicts and drought are often established in fragile, sparsely forested ecosystems where both host and displaced populations struggle to gain access to sustainable energy. This poses multi-faceted risks to people and the environment, encompassing forest degradation, poor nutrition, heavy workloads, protection risks for women, health risks and unsustainable livelihoods.

Under the Safe Access to Fuel and Energy (SAFE) programme, FAO has contributed to improving resilience and livelihoods for refugees and internally displaced people in 14 countries through four types of activity: clean cooking, forest management, renewable energy in agri-food chains and policy support. This publication evaluates FAO's energy-in-emergency portfolio in Kenya, Uganda and South Sudan to define innovative programming options for efficient energy access within the humanitarian settings of these three countries.

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