

Energy Access Baseline Study *in* Uganda's Refugee- Hosting Areas



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About the Study

This report was produced by IFC's Forced Displacement Program in collaboration with EED Advisory and financed by the Dutch Partnership on Inclusive Jobs and Education for Host Communities, Refugees, and Other Forcibly Displaced Persons (PROSPECTS). The study aims to provide insights into the energy market in Uganda's refugee-hosting areas and to identify opportunities to expand access to renewable energy. It examines both the demand and supply sides of energy solutions for lighting, cooking, and productive uses. It also explores the renewable energy regulatory environment and outlines potential opportunities and interventions to foster a more conducive market for private sector participation.

The Forced Displacement Program is part of IFC's Fragile and Conflict-Affected Situations (FCS) Africa Program, based in Nairobi, Kenya. Its goal is to sustainably improve the economic livelihoods of forcibly displaced people and their host communities in Sub-Saharan Africa through private sector approaches. The program is active in Ethiopia, Kenya, Egypt, and Uganda.

The PROSPECTS Partnership is a multi-year collaboration between five agencies: IFC, the World Bank, the United Nations High Commissioner for Refugees (UNHCR), the International Labour Organization (ILO), and the United Nations Children's Fund (UNICEF). The partnership aims to transform the way governments and stakeholders, including the private sector, respond to forced displacement crises. Specifically, it seeks to enhance the enabling environment for the socioeconomic inclusion of forcibly displaced people; improve access to education and protection services for refugees and host communities; and strengthen the resilience of host communities through inclusive socioeconomic development.

Note: The market research for this study was conducted in 2020 and finalized in 2022. Since then, (a) the government of Uganda has banned the burning, sale, and storage of charcoal; and (b) the market size has changed in dollar terms.

Acknowledgements

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EED Advisory developed the household and business survey sampling methodologies and questionnaires, conducted data analysis, and prepared a draft report. The EED Advisory team was led by Winnie Musivo, Joyce Irungu, Brian Kinuthia, Daniel Wanjohi, and Murefu Barasa. Makerere University's Centre for Research in Energy and Energy Conservation—including Patrick Masendi, Eileen Lara, and Mary Suzan Abbo—facilitated data collection and provided local context insights. IFC's Forced Displacement team guided the project at inception: Polina Lenkova on methodology and questionnaires; Gerald Owachi and Muhammad Taif UI Islam on study scope and content.

Drafts of the report were reviewed by Polina Lenkova, Gerald Owachi, Muhammad Taif UI Islam, and Awena Lebeschu. The team extends deep appreciation to Federico Querio (Senior Energy Specialist, World Bank) for peer reviewing the draft and providing valuable feedback.

The final report was peer reviewed by Bernadette Medefo Tabeko (IFC), Pauline Deschryver (IFC), Deea Ariana (World Bank), Joseph Kapika (World Bank), Declane Kabuzire Centenary (World Bank), Yabei Zhang (World Bank), Francesco Bisleti (Africa Enterprise Challenge Fund), and Julius Magala (United Nations Capital Development Fund).

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Glossary

Anchor load/client/customer: Electricity users with a continuous predictable demand and the ability to pay.

Base camp: A refugee settlement's administrative center, hosting the Office of the Prime Minister, United Nations agencies, and nongovernmental organizations.

Briquettes: Compressed fuel pellets made from compacting or carbonizing plant waste or sawdust.

Charcoal: A cooking fuel produced by burning wood or other organic matter in a low-oxygen environment.

Cookstove: The typical or accepted term for a small kitchen stove used to cook food. The report covers the following types (see Annex 3 for images):

- **Manufactured stoves:** Also known as **branded** stoves. Standardized cookstoves with a distinct product name that are **manufactured** or **imported** by formally registered entities. These stoves are typically more fuel efficient than artisanal ones and have a warranty. They include **firewood stoves** and **charcoal stoves**.
- **Ceramic charcoal stove:** A stove that uses charcoal as fuel. It usually has a metal exterior with a ceramic internal liner.
- **Gasifier:** A stove that creates its own gas from burning solid biomass. It consists of a down-draft channel and two burners.
- **Kerosene wick stove:** A stove that uses a wick to draw kerosene fuel from the fuel tank to the burner.
- **Liquefied petroleum gas:** Manufactured gas (propane, butane) that is commonly stored under pressure and made available to the consumer in cylinders for cooking.
- **Metallic charcoal stove:** A traditional metallic charcoal stove that does not include a ceramic or clay liner or any other component to help with fuel or thermal efficiency.
- **Mud stove:** A traditional cooking stove made of clay or mud.
- **Open fire stove (contained and movable):** A basic cooking stove usually made of unsecured bricks with an open area to feed firewood through.
- **Open fire stove (immovable with ceramic lining):** A cooking stove usually cemented on the ground with an inner ceramic lining and an open area to place the firewood in.
- **Rocket Lorena stove:** A fixed two-pot rest stove with an efficient fuel conversion chamber and a chimney.
- **Three-stone open fire:** The most basic form of cooking solution that uses stones to support a cooking appliance, and firewood.

Energy access: An end user's ability to obtain or receive a supply of energy.

Energy service: Functions performed using energy to obtain or facilitate desired end services or states.

Forcibly displaced person: A person forced to move, within or across borders, due to armed conflict, persecution, terrorism, human rights violations and abuses, violence, the adverse effects of climate change, natural disasters, development projects, or a combination of these factors.

Improved cookstoves: Cookstoves that are more fuel efficient, which allows for fuel savings. They often emit fewer emissions and are safer than traditional cookstoves, but may not qualify as clean cooking solutions. Also called “energy-efficient cookstoves.”

Layaway model: A purchasing agreement where a retailer agrees to hold merchandise secured by a deposit until the price is paid in full by the customer.

Net metering: An electricity billing mechanism whereby consumers who use grid-tiered solar PV and supply the excess generated electricity to the grid only pay for the energy they consume.

Pay-as-you-go: A financing mechanism that allows customers to make a down payment on a solar product and continue paying in pre-agreed installments over time, typically through mobile money. If the customer stops paying, the manufacturer could automatically switch off the product.

Pico-PV: Solar photovoltaic (PV) products with a low power output (basic solar lanterns, solar lanterns with mobile charging, and multi-light solar lighting systems with mobile charging), usually less than 11 Wp.

Plug-and-play system: Portable and easy-to-install solar systems.

Productive use of energy: Commercial consumption of energy services to produce goods or provide services such as irrigation and welding.

Refugee: A person who has been forced to flee their home because of war, violence, or persecution, often without warning, and who has rights to specific protections under international law once they obtain refugee status.

Savings and credit cooperative organization: A savings group owned, governed, and managed by its members, who may share an employer, church, labor union, or social fraternity, or live/work in the same community.

Solar home system: A stand-alone photovoltaic system consisting of one or more solar PV modules (11 Wp and higher), at least one battery, and a charge controller.

Village savings and loan association: A group of people who meet regularly to save together and take small loans from those savings.

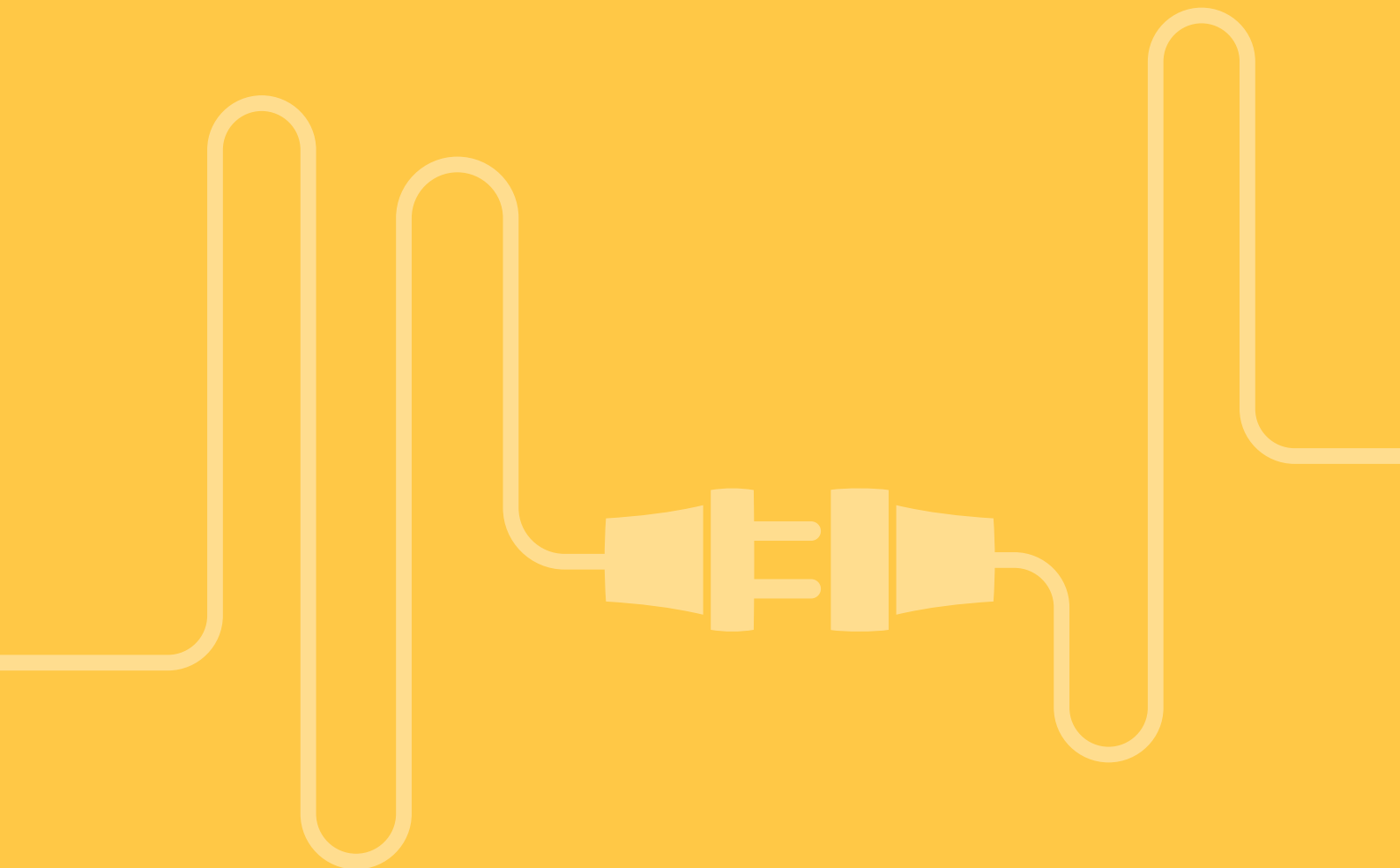
Watt peak (Wp): The capacity of a solar installation—the maximum electrical capacity that a solar cell can yield under ideal circumstances.

Acronyms and Abbreviations

EAC	East African Community
ERA	Electricity Regulatory Authority
IFC	International Finance Corporation
kW	Kilowatt
LPG	Liquefied petroleum gas
MEMD	Ministry of Energy and Mineral Development
MW	Megawatt
NGO	Nongovernmental organization
PAYGo	Pay-as-you-go
PROSPECTS	Dutch Partnership on Inclusive Jobs and Education for Host Communities, Refugees and Other Forcibly Displaced Persons
PV	Photovoltaic
REA	Rural Electrification Agency
SACCO	Savings and credit cooperative organization
UN	United Nations
UNBS	Uganda National Bureau of Standards
UNHCR	United Nations High Commissioner for Refugees
VAT	Value-added tax
Wp	Watt peak

Executive Summary

UGANDA HOSTS THE
LARGEST NUMBER OF
REFUGEES IN AFRICA.
IN APRIL 2022, THERE
WERE ABOUT
1.55 MILLION REFUGEES
IN THE COUNTRY.



Executive Summary

Introduction

Uganda hosts the largest number of refugees in Africa. In April 2022, there were about 1.55 million refugees in the country, most of whom were hosted in refugee settlements across 12 districts. Uganda's progressive refugee management approach focuses on integrating refugees with their host communities. Refugees are allowed to work and establish businesses and are allocated small plots of land for cultivation.

Energy access, however, remains a challenge for refugees and their host communities. This stems from high electrification costs in refugee-hosting areas due to insufficient enabling infrastructure, and low household disposable incomes. The average monthly income of refugee and host households surveyed was \$35 and \$57, respectively, with households spending 15 percent of their monthly income on average to meet their energy needs.

Access to finance is a key challenge in expanding energy access from off-grid sources. While bank account ownership is generally low, mobile money services are widely used by both refugees and hosts (54 percent among host communities and 45 percent among refugees). Furthermore, both refugees and host communities are members of informal savings groups (48 percent among host communities and 31 percent among refugees), which are a leading source of credit in both communities.

Household access to energy for lighting

Solar energy lighting and torches are the main lighting sources for refugees and host communities. Only 2 percent of host households and 1 percent of refugee households are connected to the national grid. The main source of energy for lighting is pico-PV products, at 33 percent, closely followed by non-rechargeable torches

(31 percent) and solar home systems (17 percent). Kerosene lamps are mainly used by host households (10 percent).

Among pico-PV products, multi-light systems with mobile charging have the highest uptake, at 14 percent penetration among both refugees and host communities. Single-light solar lanterns are especially prevalent among refugees (14 percent), while solar home systems are more prevalent among host communities (12 percent).

Household access to energy for cooking

Both refugees and host communities depend on firewood and charcoal to meet their cooking needs. Firewood is the main source of energy for cooking for 85 percent of the households across the districts, whereas charcoal is the main cooking fuel for 14 percent of households. Host communities are slightly more likely to use firewood as their primary cooking fuel than refugees, while the inverse is true for charcoal. Many of the refugee households using charcoal are restricted from accessing forests by host communities. The majority of households use the most basic cooking technology—76 percent of host households and 46 percent of refugee households use three-stone open fires, with refugees also using mud stoves (41 percent). The vast majority of households made their stoves themselves.

Businesses' access to energy for lighting and productive use

The predominant business activities in the study areas are not energy intensive. Over half of the surveyed businesses stated that they did not use any electrical appliances for productive uses. Moreover, 46 percent of the surveyed businesses had access to electricity from the grid, followed by solar energy (39 percent). Solar home systems were the most common solar product,

and a rather significant percentage of businesses (21 percent) reported using large-capacity solar systems. The ownership of generators was at 9 percent.

Institutions

The day schools and health centers surveyed mainly use solar systems for lighting their administration blocks and firewood for cooking on traditional three-stone open fires. UNHCR field offices are connected to the grid and use a back-up diesel generator, while nongovernmental organization offices in the refugee settlements tend to connect to generators through shared distribution or rely on solar power.

Market size of existing energy sources

Over \$26 million is spent per year on charcoal for cooking in the refugee-hosting districts, and over \$13 million is spent on firewood. Pressure on wood resources is expected to increase, presenting opportunities for private companies to provide energy-efficient charcoal stoves and alternative cooking fuels such as briquettes, ethanol, and liquefied petroleum gas.

The estimated \$13 million spent annually on dry-cell batteries and kerosene for lighting could be diverted to pico-PV products. Increased adoption of solar lanterns by households using torches and kerosene could also help them save on mobile-phone-charging costs. Finally, the value of the pico-PV market is about \$10.6 million, part of which could be diverted to buying better-quality energy sources such as solar home systems. Refugees and host communities have expressed a desire for appliances such as radios and TVs (at 45 percent and 53 percent respectively). The private sector could tap into this market through suitable consumer financing models.

Energy policies

Over the past two decades, the Ugandan government has introduced national policies and electrification strategies to increase universal access to sustainable energy. National energy policies include the Draft National Energy Policy (2019), which will replace the Energy Policy (2002); the Renewable Energy Policy (2007); and the Electricity Connections Policy (2018–2027).

The management and planning of the government's rural electrification program is housed under the Rural Electrification Agency (REA), which is now embedded as a department within the Ministry of Energy and Mineral Development (MEMD). REA partly relied on the Rural Electrification Strategy and Plan to oversee on-grid and off-grid investments.

To address the high grid connection costs faced by households, the Ugandan government developed the national Electricity Connections Policy, launched in 2018, which fully subsidizes the connection cost for no-pole and one-pole service connections. As of 2020, 250,000 households and businesses had benefited from subsidized connections.

The Draft National Energy Policy proposes policy actions to stimulate solar PV use through private sector engagement. The growth of the solar sector has surpassed the government's estimates. Despite impressive growth, the solar PV industry still faces fiscal challenges, including import duties, withholding tax, and industrial levies, as solar PV-related products are imported. These increase the cost of the final product. Exemptions apply to solar panels, but do not apply to most other products and components.

MEMD recently finalized the Sustainable Energy Response Plan for Refugees and Host Communities (2021–2025), which aims to increase access to clean energy (clean cooking and on-grid and off-grid electricity) in refugee-hosting areas.

Barriers to engaging the private sector

Barriers that the private sector faces when operating in the refugee-hosting districts include poor infrastructure, limited consumer financing options, lack of after-sales services, prevalence of substandard products, occasional distribution of free solar lanterns and stoves to refugees, and lack of anchor loads for mini-grid development. Low-quality products are likely to damage customers' perception of solar products because of their poor performance. The distribution of free products such as solar lanterns and cookstoves is likely to distort the market, further complicating the engagement of the private sector.

Key recommendations

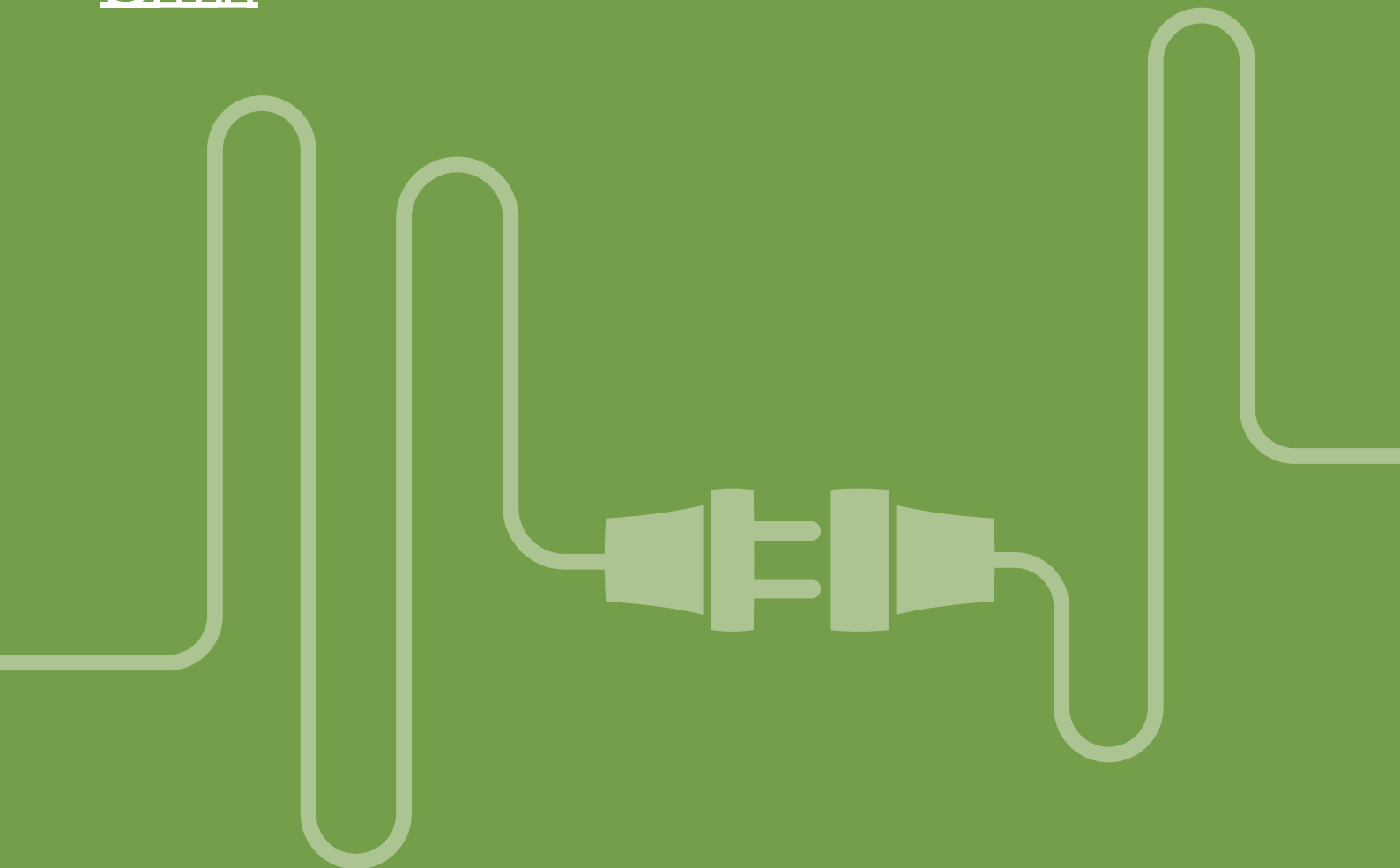
To increase private sector engagement in the refugee-hosting districts, the following interventions are proposed:

- Promote the use of energy-efficient stoves and alternative fuels. Consumers need to be educated on the benefits of energy-efficient stoves, which could significantly reduce households' recurrent expenditure on wood fuel and ease the associated environmental impacts.
- Promote only quality-verified products and support enterprises trading in those products. The companies should offer a warranty on all solar products.
- Help local enterprises trading in solar products and energy-efficient stoves to become investment ready and train them to take advantage of the funding opportunities available from the Uganda Energy Credit Capitalisation Company and the UN Capital Development Fund.
- Capacitate financial institutions serving refugee-hosting areas to develop energy loans that are tailored for the energy sector. Encourage these financial institutions to develop green financing strategies.
- Encourage private companies to work with village savings and loan associations to market solar products and energy-efficient stoves.
- Encourage humanitarian agencies to provide cash transfers to refugees to buy solar equipment and cookstoves instead of occasionally distributing such products for free.
- Incentivize suppliers of solar products and energy-efficient cookstoves who offer credit to establish and expand operations to serve the refugee settlements and host communities.
- Support the government in setting up a fund for mini-grids to offer both an affordable and business-viable tariff and ensure simplification of the mini-grid approval process.
- Strengthen the supply chain for energy products by setting up local energy inventory hubs to make energy products more accessible to local solar and stove distributors at the district level.
- Increase productive use of energy through partnerships between energy providers and companies involved in the manufacturing and agricultural value chains.
- Consider the environmental impact of e-waste produced by solar products and promote interventions to recycle batteries and other components.

Introduction

1

THE UNITED NATIONS
HIGH COMMISSIONER FOR
REFUGEES ESTIMATES THAT
THERE ARE **70.8 MILLION**
FORCIBLY DISPLACED
PEOPLE GLOBALLY,
29.5 MILLION OF WHOM
ARE REFUGEES.



Introduction

1.1 Background

The United Nations High Commissioner for Refugees (UNHCR) estimates that there are 70.8 million forcibly displaced people globally, 29.5 million of whom are refugees.¹ Since the late 1990s, the average time refugees spend in exile is estimated to be between 10 and 15 years.² UNHCR refers to these extended stays as protracted refugee situations, where refugees find themselves in an intractable state of limbo. Their lives may not be at risk, but their basic rights and essential economic, social, and psychological needs often remain unfulfilled. A refugee in this situation is often unable to break free from enforced reliance on external, and often inadequate, humanitarian assistance.³ Thus, there are increasing calls for governments to adopt sustainable approaches complemented with development support that also benefits refugee-hosting communities.

An increasing number of studies demonstrate the role that the private sector can play in fostering more sustainable approaches to refugee situations. For example, the IFC study “Kakuma as a Marketplace”⁴ estimated the value of the economy of the Kakuma camp in Kenya and its hosting community at \$56 million based on household consumption and the camp’s 2,100 refugee-owned businesses. The study demonstrated that regardless of their circumstances, refugees are not just recipients of aid; they are also entrepreneurs, consumers, employers, and employees. It also provided compelling evidence that private sector engagement can enhance refugees’ self-reliance and integration with host communities.

Based on these insights, IFC set up the Kakuma Kalobeyi Challenge Fund, which provides grants and technical assistance to companies willing to set up or expand their operations in refugee-hosting areas, as well as enable refugee and host community entrepreneurs to grow their businesses.

In a separate initiative, IFC, in partnership with the Bridgespan Group, identified five critical pathways to private sector engagement with refugees and host communities:⁵

- **Sharing capabilities** such as technology or technical expertise to provide access to humanitarian assistance, education, or financial services.
- **Extending services** by adapting existing business models to sell goods or services to refugees.
- **Enabling employment** by providing job training and/or entrepreneurship support to refugees.
- **Integrating into value chains** by hiring refugees directly and/or working with smaller enterprises that hire refugees through sourcing or subcontracting work.
- **Building a business** that sells goods and services tailored to refugee populations.

In 2019, the government of the Netherlands announced the launch of the Dutch Partnership on Inclusive Jobs and Education for Host Communities, Refugees and Other Forcibly Displaced Persons (PROSPECTS). This Partnership is a unique multi-year program that brings together five agencies (IFC, the International Labour Organization, the World Bank, UNICEF, and UNHCR) to devise collaborative and innovative approaches for inclusive job creation and education in contexts characterized by forced displacement. A core aspect of PROSPECTS is engaging with private sector actors to develop solutions that benefit refugees and host communities.

This study was carried out under PROSPECTS to identify opportunities for the private sector to provide energy solutions in Uganda’s refugee-hosting districts in line with the UN’s Sustainable Development Goal 7,

¹ UNHCR. 2020. Figures at a Glance. <https://www.unhcr.org/figures-at-a-glance.html>. Retrieved on May 21, 2020.

² Devictor, X., and Do, Q. 2016. How Many Years Have Refugees Been in Exile?

³ UNHCR. 2004. Protracted Refugee Situations. Executive Committee of the High Commissioner’s Programme, Standing Committee, 30th Meeting, UN Doc. EC/54/SC/CRP.14, p. 2.

⁴ IFC. 2018. Kakuma as a Marketplace.

⁵ IFC. 2019. Private Sector & Refugees: Pathways to Scale.



which seeks to ensure access to affordable, reliable, sustainable, and modern energy for all—including displaced people⁶—by 2030.

Improving long-term energy access for people living in protracted refugee situations is critical to achieving human protection and dignity, and lays a foundation for entrepreneurship.⁷ However, providing energy services in situations of forced displacement is often not a primary goal of humanitarian responses due to competing needs.⁸

Numerous barriers limit the private sector from entering such markets, including lack of information about the market size and its strength, lack of funding to de-risk their entry into this nascent market, and lack of strong local partners. The aim of this study is to provide data on energy access among refugees and their host communities, and the opportunities and challenges of engaging private sector companies in providing energy for lighting, cooking, and productive uses.

1.2 Uganda's refugee approach

Uganda hosts the most refugees in Africa and is ranked third globally.⁹ As of April 2022, Uganda hosts about 1.55 million refugees in 12 districts,¹⁰ which are mainly located in the West Nile and Southwest regions of the country (see Figure 1). Refugees live in designated settlements, though there is a substantial population of urban refugees in Kampala. They are allocated small plots of land under a national policy that aims to promote self-reliance.

Uganda's progressive refugee management approach focuses on integrating refugees with their host communities. The Refugee Act (2006) enables refugees to participate in gainful employment, move outside the refugee settlements, establish a business, and access social services including health and education facilities available to host communities. This legislation was reinforced by Uganda's adoption of the Comprehensive Refugee Response Framework/Global Compact for Refugees, which guides refugee-related planning and activities in the country and identifies the private sector as a key actor.

6 UNITAR. 2018. The Global Plan of Action for Sustainable Energy Solutions in Situations of Displacement: Framework for Action. United Nations Institute for Training and Research, Geneva.

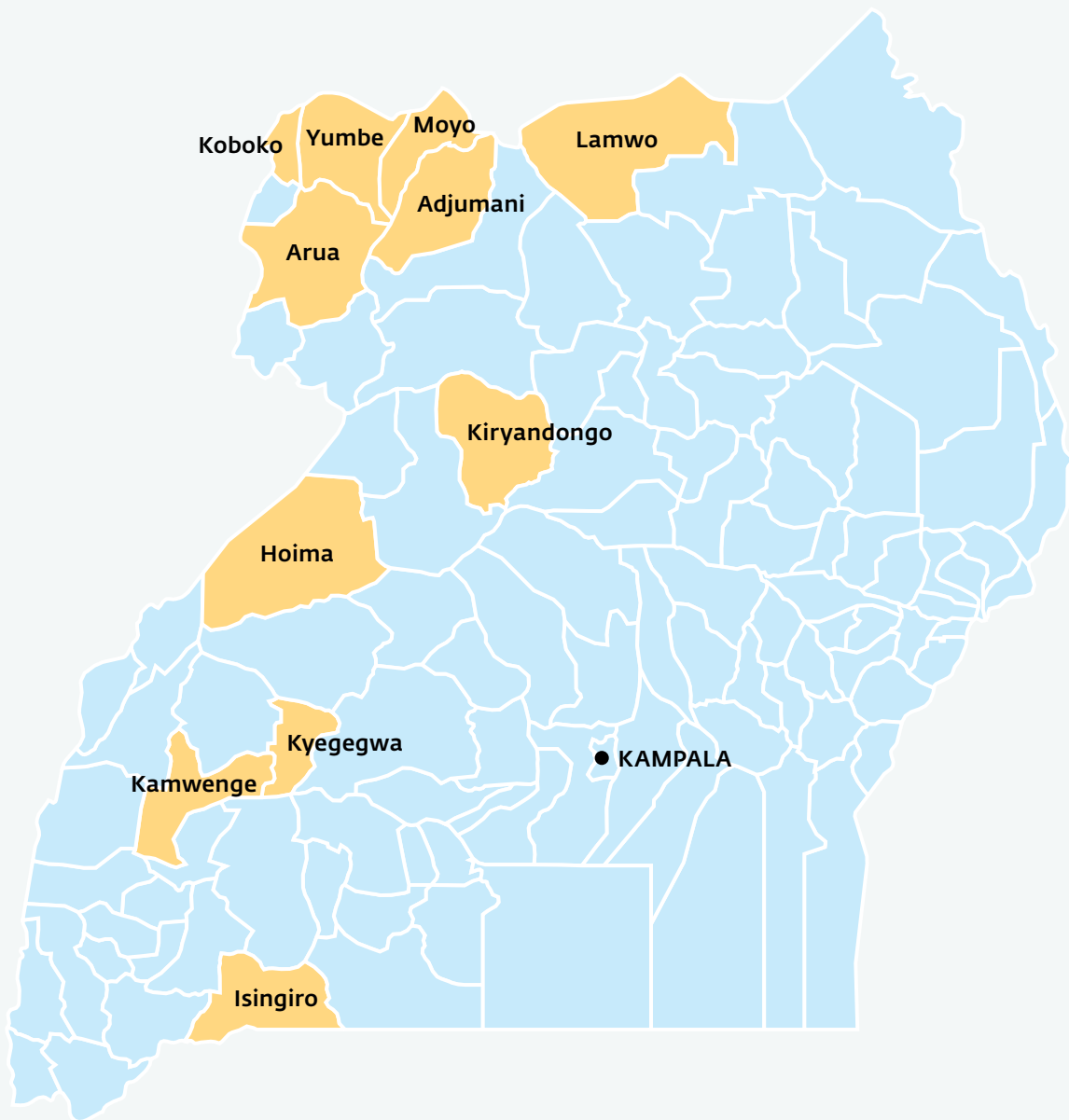
7 Lahn, G., and Grahnam, O. 2015. Heat, Light and Power for Refugees: Saving Lives, Reducing Costs. Moving Energy Initiative, Chatham House.

8 Practical Action. 2020. Ensuring Refugee Camps in Rwanda Have Access to Sustainable Energy. Rugby, UK: Practical Action Publishing.

9 <https://www.unhcr.org/refugee-statistics/>.

10 As fieldwork was conducted in 2020, the study uses the district names and boundaries in use in 2020.

FIGURE 1: Uganda's refugee-hosting districts

**Legend**

District

Capital city

The Uganda Refugee Response Plan (2020–2021) aimed to increase access to quality renewable energy products following a market-based approach, promote the use of energy-efficient stoves, and train local artisans to make good-quality energy products. The plan also intended to conduct energy audits of UNHCR’s base camps, health centers, and schools to support their adoption of solar energy, but did not mention extending the national grid.

The Ministry of Energy and Mineral Development recently finalized the Sustainable Energy Response Plan for Refugees and Host Communities (2021–2025), which aims to increase access to clean energy (clean cooking and a combination of on-grid and off-grid electricity) for household, commercial, agricultural, and industrial users, and other institutions

working in the rural, peri-urban, and urban areas where refugees live.¹¹ The plan emphasizes strengthening coordination and management of energy programs targeting refugees and their host communities.

In line with this plan, the Ugandan government, with support from the World Bank, plans to implement the Electricity Access Scale-Up Project, which will target vulnerable and marginalized groups and other beneficiaries, including refugees and host communities.¹² The proposed project will increase access to energy for households, commercial enterprises, industrial parks, and public institutions across the country through on-grid and off-grid solutions. The government will decide whether to extend the national grid/mini-grids or to deploy solar home systems based on a cost-benefit analysis and local energy demand.

¹¹ The ministry is collaborating with the Office of the Prime Minister, the Comprehensive Refugee Response Framework Secretariat, REA, UNHCR, GIZ, the World Bank, and other key stakeholders. Once the plan is finalized, a dedicated secretariat will be established within the ministry to lead its coordination and implementation.

Source: Ministry of Energy and Mineral Development. 2020. Sustainable Energy Response Plan for Refugees and Host Communities in Uganda 2021–2025, Inception Report.

¹² Ministry of Energy and Mineral Development. 2020. Electricity Access Scale-Up Project; Vulnerable and Marginalized Groups Framework.



1.3 Purpose of the study

This market assessment aims to identify opportunities for private sector engagement in energy solutions for lighting, cooking, and productive uses in Uganda's refugee-hosting districts. The study investigates the demand and supply dynamics, the regulatory environment, and barriers, and outlines proposed interventions and recommendations.

1.4 Methodology

The study is based on quantitative and qualitative primary data and secondary sources. The primary data collection took place in July and August 2020. It involved a survey of 2,327 households across 11 refugee-hosting districts; a survey of 149 businesses; key informant interviews with local distributors, development partners, and nongovernmental organizations (NGOs); and 10 focus group discussions.

This study treated the districts that host refugee settlements as the host communities. Proportional stratification was applied to allocate the number of surveys per district and per household type (refugee versus host community). Because host communities accounted for 77 percent of the combined population and refugees 23 percent, a sample size of 1,700 host community households and 503 refugee settlement households was used. The sampling frame for the household survey was based on a methodology developed by the EED/Stockholm Environment Institute team in collaboration with geographic information system experts at the National Autonomous University of Mexico while carrying out the Sustainable Energy for All/World Bank Multi-Tier Energy Access Tracking Framework Global Survey 2016–2018 in Kenya. The survey targeted household heads or respondents most knowledgeable about the household purchases.

A total of 149 local enterprises were interviewed, of which 87 were owned by members of the host community and 62 by refugees. The proportion of businesses surveyed per district (see Annex 1) was determined based on the total refugee and host community populations. A key consideration in identifying business respondents was whether the location and structures were permanent or at least semi-permanent, with a specific focus on businesses within a market center.

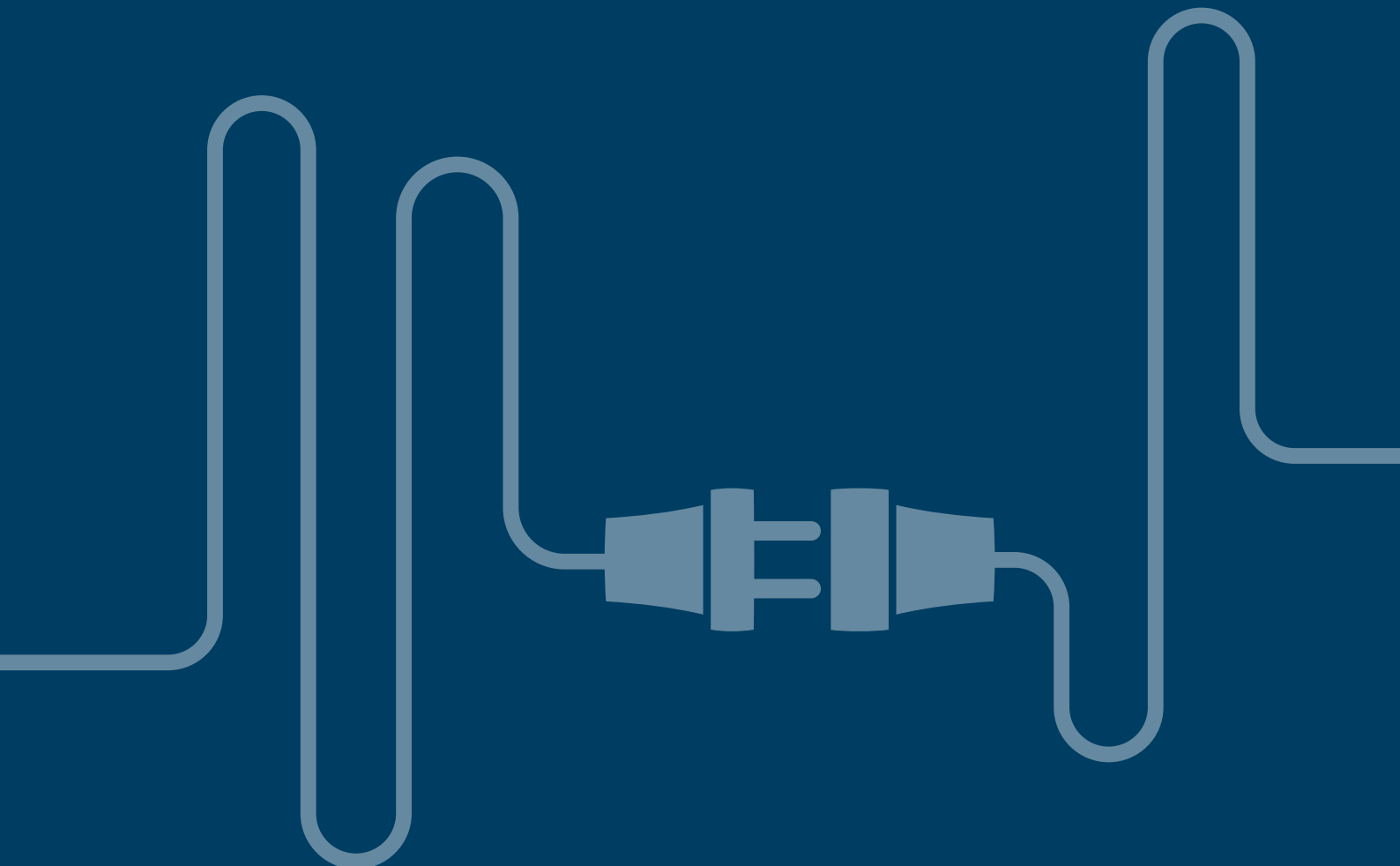
1.5 Study limitations

The survey was carried out during the COVID-19 pandemic and a majority of the responses were gathered when restrictions on movement and economic activity were in place, which would not be the case in a business-as-usual scenario. The results were therefore affected by the impacts of the pandemic on the communities surveyed. For example, over 63 percent of households reported a drop in income, with a majority (46 percent) being from host communities. During key informant interviews, businesses noted that their sales plummeted during the pandemic period due to extended lockdowns, movement restrictions, and general loss of income across the population.

Socioeconomic Characteristics of the Refugee-Hosting Districts

2

ON AVERAGE,
REFUGEES EARN A
THIRD LESS THAN
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IS THE MAIN SOURCE
OF EMPLOYMENT
FOR BOTH GROUPS.



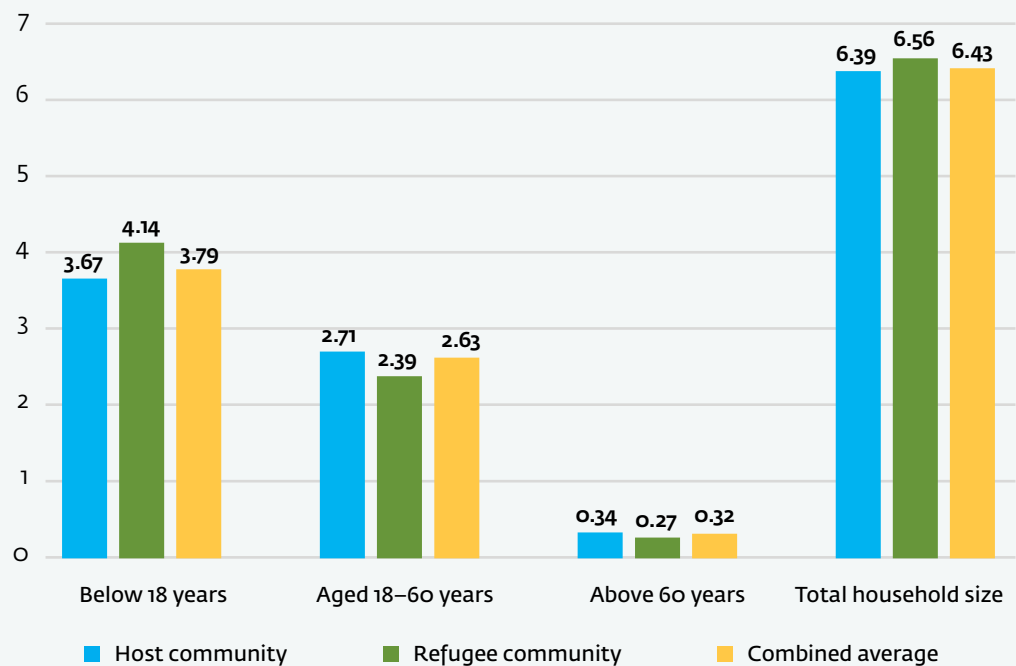
Socioeconomic Characteristics of the Refugee-Hosting Districts

2.1 Household composition

The data on household composition, as shown in Figure 2, reveals a large average household size but little notable differences between host communities and refugees.

Across both communities, the average household comprises six members (including four children), compared to the national average of 4.7 members per household.¹³ The average age of respondents was 39.

FIGURE 2: Household composition by size and age of host and refugee communities



¹³ Uganda Bureau of Statistics. 2016. National Population and Housing Census 2014: Main Report.



2.2 Education levels

The survey shows low education levels overall, with only a third of household heads having attended primary school. Generally, the level of education is lower among refugees than in the host communities, as shown in Table 1. Among refugees, the share of uneducated household heads was 43 percent compared

to their host community counterparts at 28 percent.¹⁴ At the district level, Yumbe had the highest percentage of uneducated household heads, followed by Arua, Isingiro, and Kyegegwa. Any intervention must consider the significant number of people with very limited to no education to tailor effective skills development efforts for the target population.

TABLE 1: **Education level of household heads**

Education level	Host community (n = 1,711)	Refugee community (n = 616)	Total (n = 2,327)
Not educated	28%	43%	31%
Some form of primary schooling	36%	29%	34%
Completed primary school	15%	6%	12%
Some form of O-levels	8%	9%	9%
Completed O-levels	6%	5%	6%
A-levels (some form and completed)	2%	3%	2%
Technical/vocation training (post-primary and high school)	1%	1%	1%
College diploma and above	3%	3%	3%

¹⁴ This is largely consistent with the World Bank's 2018 refugee and host community survey, which found 34 percent of household heads lacked formal education among refugees, and 19 percent among host communities.

2.3 Occupation and income profiles

Agriculture is the main source of employment and income for both refugees and their hosts. Members of both communities tend to be smallholder farmers, though the percentage is much higher among the hosts. Only 29 percent of refugee respondents declared being self-employed in agriculture, probably because only 35 percent of the refugee households interviewed owned land. In contrast, 60 percent of hosts were engaged in independent agricultural activities, and 90 percent of host households said they owned land. A significant number of refugees work as casual/day laborers (13 percent) or do unpaid housework (17 percent), with the percentage especially high in Adjumani district.

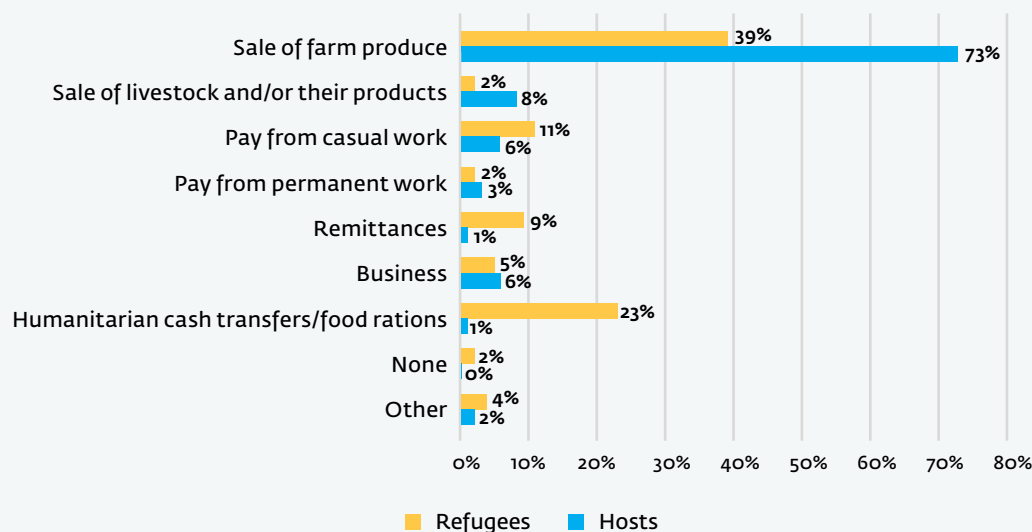
On average, refugees earn a third less than the hosts do. The average monthly income in a refugee household was 128,202 Ugandan shillings (\$35), compared with 210,041 Ugandan shillings (\$57) for a host community household.¹⁵ Selling crops contributed the most to household income for both host communities and refugees (64 percent of households), although host households were significantly more likely to report this as their primary source of income than refugees. Refugees were more likely to report humanitarian cash transfers/ food rations or remittances as their primary income source than hosts. Some refugees resell their food rations to gain income.

Figure 3 illustrates the main activities that contribute to refugee and host households' incomes.

TABLE 2: **Primary occupation of respondents**

Income activity	Host community (n = 1,711)	Refugee community (n = 616)	Total (n = 2,327)
Self-employed, agriculture/livestock	60%	29%	52%
Employee, farm	13%	9%	12%
Casual/day laborer	7%	13%	9%
Employee, non-farm	2%	3%	2%
Self-employed, non-farm business enterprise	5%	6%	6%
Self-employed non-farm independent contractor, technician, professional, etc.	2%	1%	2%
Assistance in family enterprise/retired/pensioner/too old to work	2%	2%	2%
Unpaid intern/free labor/voluntary work/job seeker	1%	1%	1%
Housework (unpaid)	3%	17%	7%
Student	2%	7%	3%
Other	3%	11%	5%

¹⁵ The exchange rate used throughout the report is \$1 = 3,674 Ugandan shillings.

FIGURE 3: **Largest contributors to household incomes (n = 2,327)**

2.4 Access to finance

Access to finance is a key challenge in expanding energy access in rural areas from off-grid sources. Commercial bank account ownership is generally low (at 9 percent overall), with the same percentage of respondents using a savings and credit cooperative organization (SACCO) account. However, the number of refugees who own a bank account is increasing as humanitarian aid transitions from food rations to cash transfers, which are facilitated by Equity Bank and Post Bank. This presents opportunities for formal financial institutions to expand their offering of useful and affordable financial products, including ones that could finance the purchase of energy products.

Mobile money services are widely used by both refugees and hosts (at 52 percent overall: 54 percent among host communities and 45 percent among refugees). In Uganda, refugees can register a SIM card using a valid refugee registration document or an attestation letter issued by the Office of the Prime Minister.¹⁶ There is thus an avenue for mobile phone-enabled payments for buying energy products on credit.

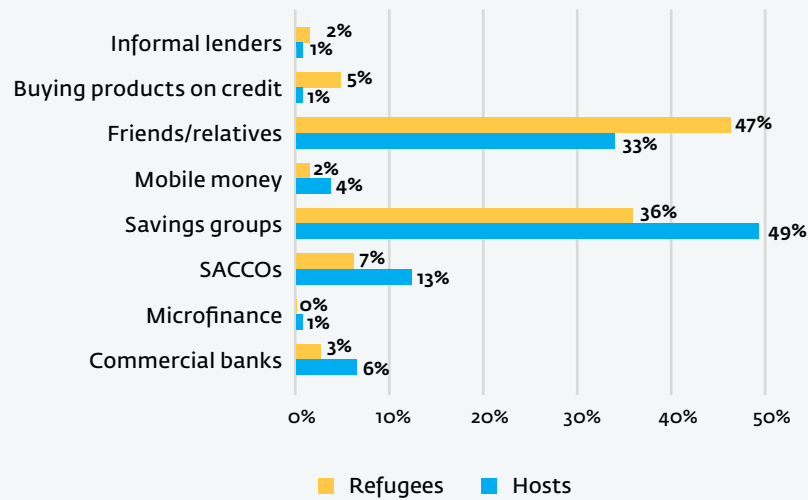
Informal savings groups are common, with 43 percent of respondents saying they were members (48 percent among host communities and 31 percent among refugees). Companies could engage with these groups to market clean-energy products.

About a third of respondents said they borrowed money in the 12 months prior to the study. Figure 4 shows the preferred credit options used by these respondents. The main sources of credit for refugees are friends and relatives (52 percent) and local savings groups (38 percent). For host communities, local savings groups constitute the primary credit option (52 percent), followed by friends and relatives (40 percent). In focus group discussions in Isingiro, both refugees and host communities indicated their preference for savings groups, describing them as flexible and tailored to their members' needs.

On average, only 6 percent of respondents use commercial banks for credit (7 percent for host communities and 5 percent for refugees). This low figure could be because of low bank account ownership, lack of credit history, inconsistent income sources, and laborious and lengthy credit applications that often require collateral that many low-income earners may not have. Other fringe sources of credit include mobile money services, suppliers, and private capital lenders.

¹⁶ UNHCR. 2019. UNHCR Welcomes Uganda Communications Commission Directive to Improve Refugees' Access to SIM Cards, August 20, 2019. <https://www.unhcr.org/afr/news/press/2019/8/5d5ba4274/unhcr-welcomes-uganda-communications-commission-directive-to-improve-refugees.html>.

FIGURE 4: **Credit options used by host and refugee households who borrowed money in the last 12 months**



2.5 Gender

Almost 58 percent of all survey respondents were female. This figure was higher in the refugee households, as shown in Table 3. However, most of the households (62 percent) were headed by men, at 67 percent for the host communities and 46 percent for the refugee households. Among refugees, women headed 54 percent of households, compared to 33 percent for host communities. This is likely because there are more female than male refugees, as women and children are usually the first to flee violence.

The average monthly household income varies significantly depending on the household head's gender. The survey found that male-led households made about \$58 every month, whereas female-led households made \$40. The gap is smaller in refugee communities (only a \$7 difference between male- and female-headed households, compared to \$19 in host communities). In the household survey, women-headed households reported owning smaller land plots than male-headed households did, and women were more likely to end up in low-paying jobs such as domestic work. Given that agriculture is a main source of revenue, lack of access to land can affect a household's disposable income.

TABLE 3: **Gender split of respondents and household heads**

Gender	Respondent		Head of household	
	Host community (n = 1,711)	Refugee community (n = 616)	Host community (n = 1,711)	Refugee community (n = 616)
Male	46%	34%	67%	46%
Female	54%	66%	33%	54%

Education levels in female-headed households are significantly lower than in male-headed households. About 50 percent of female household heads were uneducated, compared to 21 percent of male household heads. Notably, 9 percent of male heads had completed A-levels or above, with 4 percent having completed a college diploma or higher. On the other hand, only 3 percent of female household heads had completed A-levels or higher, and only 1 percent had completed a college diploma or higher.

Male respondents were more likely to report owning an account with formal financial services providers but were as likely as women to be part of local savings groups. While the differences are rather small for bank account ownership (12 percent for men versus 7 percent for women) and SACCOs (10 percent for men and 8 percent for women), there is a clear disparity in mobile money account ownership (64 percent for men and 44 percent for women). Importantly, men and women are equally likely to be members of informal savings groups (42 percent for men and 45 percent

for women), with a slight difference in the host communities (45 percent for men and 51 percent for women).

2.6 Appliances owned by households

The household survey shows low ownership of electrical appliances or devices. A mobile phone is the most common device (66 percent), followed by a radio (42 percent) and a TV (6 percent). Host communities are twice as likely to own a radio than refugee communities. About a quarter of the population did not report owning any electrical appliance, with a higher percentage among refugees (33 percent). There is demand for electrical appliances, especially radios and TVs, among both populations: 45 percent of people mentioned radios and 53 percent mentioned TVs as their high-priority appliances. However, the survey did not investigate consumers' ability to pay for these devices. The majority of households (56 percent) own only one mobile phone per household, and only 15 percent of households own more than two mobile phones.

TABLE 4: Appliances owned by households

Appliance/device	Host community (n = 1,711)	Refugee community (n = 616)	Total (n = 2,327)
Mobile phone	68%	60%	66%
Radio	50%	21%	42%
TV	7%	3%	6%
Music system/woofer	6%	2%	5%
DVD player	2%	1%	1%
Refrigerator	1%	0%	1%
Computer	1%	0%	1%
None	20%	33%	23%

2.7 Profile of businesses

Entrepreneurial activities account for a large share of the income of both host and refugee populations. Nearly two-thirds (64 percent) of the 149 businesses surveyed sell tangible goods, while the rest are in the service industry. The most common entrepreneurial activity among the surveyed

businesses is retail, with 34 percent of all interviewed businesses being general shops. Notably, 14 percent of all interviewed businesses reported stocking solar products, mainly solar lanterns, despite only one identifying itself as a solar kiosk. Furthermore, energy-efficient cookstoves were sold by only six of the interviewed shops across the refugee-hosting districts.

TABLE 5: **Main entrepreneurial activities of interviewed businesses¹⁷**

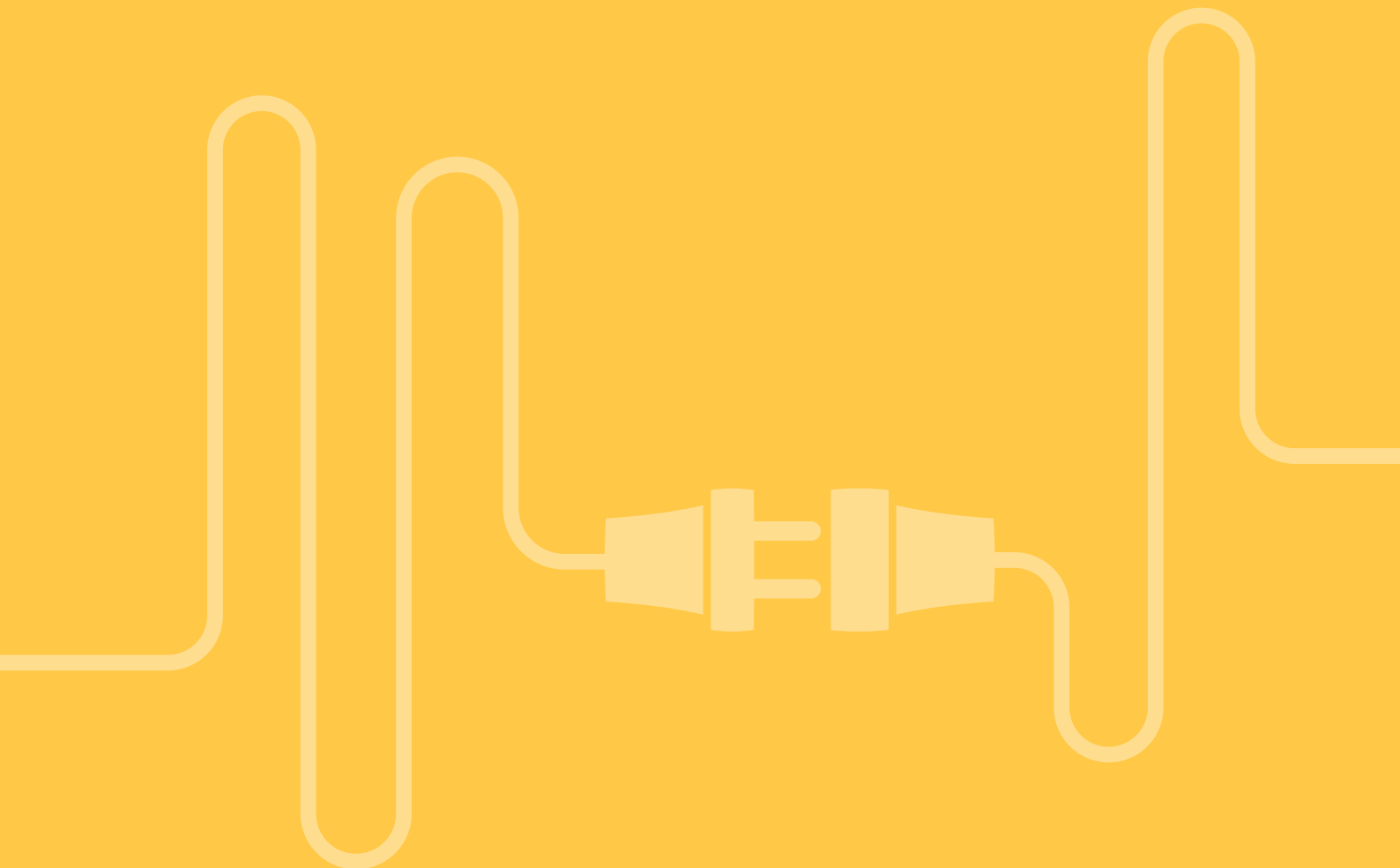
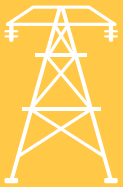
Main entrepreneurial activity or business type	Businesses
Kiosk/general shop	34%
Food and beverages (such as bars, restaurants, and fast-food places)	12%
Barber/salon	11%
Electronics shop	10%
Cybercafé/printing shop	5%
Phone-charging point	5%
Posho mill	5%
Chemist	3%
Agrovet	3%
Cinema hall	2%
Tailoring shop	2%
Fuel pump	1%
Mobile repair shop	1%
Solar kiosk	1%
Welding	1%
Brick making	1%
Carpentry	1%
Dairy/milk shop	1%
Garage	1%

¹⁷ The business data presented is not representative of the entire business community in the refugee-hosting districts due to sample limitations.

Energy Use and Demand

3

ONLY **2 PERCENT** OF
HOUSEHOLDS ACROSS
THE REFUGEE-HOSTING
DISTRICTS ARE
CONNECTED TO
THE NATIONAL GRID.



Energy Use and Demand

3.1 Households

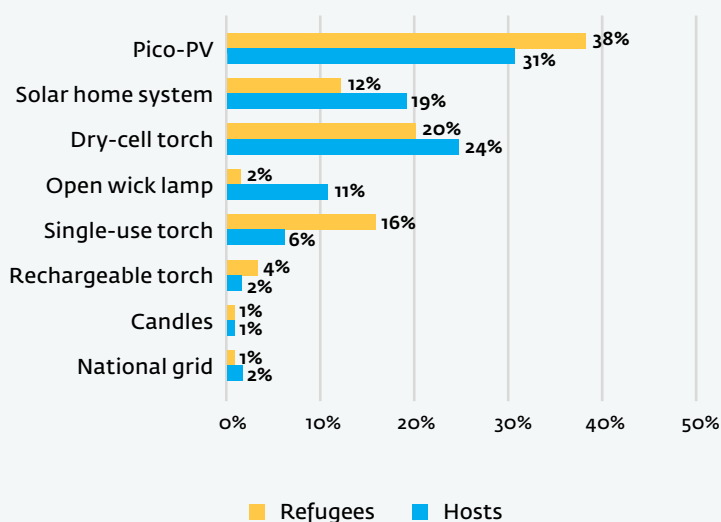
Lighting

Sources of lighting

Only 2 percent of households across the refugee-hosting districts are connected to the national grid. The highest connection rates are found in Kikuube (7 percent) and Adjumani (6 percent), as shown in Table 6. Grid electricity is only present in the major towns in the refugee-hosting districts as well as in the base camps of settlements that house government, humanitarian, and development organizations. As a result, households primarily rely on solar energy and non-rechargeable torches.

The energy sources for lighting with the highest uptake in both host and refugee communities are pico-PV and non-rechargeable torches, at 33 percent and 32 percent respectively. These are followed by solar home systems (17 percent) and kerosene lamps (10 percent). Among pico-PV products, multi-light systems with mobile charging have the highest uptake, at 14 percent penetration among both refugees and host communities. Single-light solar lanterns are especially prevalent among refugees (at 14 percent for refugees and 9 percent for host communities), while solar home systems and open wick kerosene lamps (tadooba) are more prevalent in host households (at 19 percent and 11 percent respectively) than in refugee households (at 12 percent and 2 percent respectively).

FIGURE 5: Main sources of lighting among households



The findings by district are generally consistent with the overall findings. The main sources of lighting energy across the districts are pico-PV products, except for Isingiro, Kamwenge, Kiryandongo, and Kyegegwa, which also show a comparable uptake of solar home systems. This likely indicates a stronger ability to pay in these districts. Households in Koboko, Moyo, and Yumbe, on the other hand, seem to rely mainly on torches, so there is potential to upgrade households in these districts to solar lanterns. Similarly, there is a high prevalence of kerosene lamps as the main lighting source among households in Arua, Isingiro, and Kikuube.

These households could transition to using solar products as a cleaner energy source.

The relatively higher prevalence of pico-PV products among refugees could also be explained by donations from UNHCR and affordable prices compared to solar home systems. While UNHCR's support generally does not cover energy, refugees receive a basic solar lantern when they arrive in Uganda as part of their settlement package. UNHCR normally procures solar products in bulk for distribution to refugees.

18 Sample size: n = Adjumani (162), Arua (442), Isingiro (265), Kamwenge (222), Kikuube (191), Kiryandongo (154), Koboko (131), Kyegegwa (175), Lamwo (74), Moyo (66), and Yumbe (342).

TABLE 6: Main source of lighting per district¹⁸

Main source of lighting	% of households using this lighting source per district										
	Adjumani	Arua	Isingiro	Kamwenge	Kikuube	Kiryandongo	Koboko	Kyegegwa	Lamwo	Moyo	Yumbe
Pico-PV	36	38	28	37	27	31	31	34	46	23	29
Solar home system	6	9	30	23	25	31	8	34	4	4	7
Dry-cell / single-use torch (non-rechargeable)	33	28	15	22	23	25	58	21	30	45	56
Rechargeable torch	3	1	2	3	2	2	0	2	9	11	1
Rechargeable battery (car, motorcycle)	3	1	0	1	2	4	1	0	3	8	2
Candles	1	0	6	0	1	1	0	1	1	2	1
Open wick lamp (tadooba)	2	18	15	9	13	6	1	2	0	2	2
Hurricane lamp (with glass cover)	2	3	2	0	0	0	0	1	0	0	0
Firelight (firewood/grass)	8	2	0	0	0	0	1	0	7	6	2
Generator	0	0	0	1	0	0	0	0	0	0	0
National grid	6	0	2	4	7	0	0	5	0	0	0

Highest percentage per district

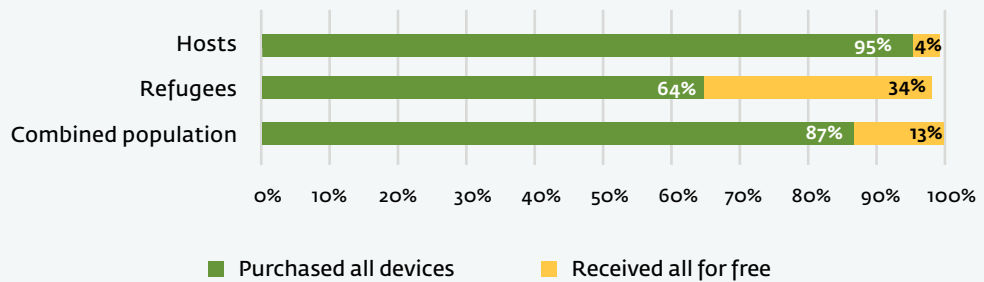
Acquisition of solar lighting products

The vast majority of host households paid for the solar product they own, as did a significant portion of refugees. As shown in Figure 6, among those who reported owning solar products, 95 percent of host households had purchased the products, compared to 64 percent of refugee households. It is more common to receive a lower-capacity product for free. About half of refugees who own single-light systems (with or without mobile charging) received their products for free, while the share goes down to 27 percent for multi-light

systems. It is uncommon for refugees to receive a solar home system as a donation.

Households mainly buy their solar lighting products with cash, as reported by 92 percent of respondents. On average, a pico-PV product costs between \$19 for a single-light system and \$40 for a multi-light system. The average price of a hurricane lamp was reported as \$3.83, with an additional monthly expenditure of \$2.24 on kerosene. The average monthly spend on grid electricity for a household was reported as \$6.03 per month.

FIGURE 6: Acquisition of solar products by households (n = 934)



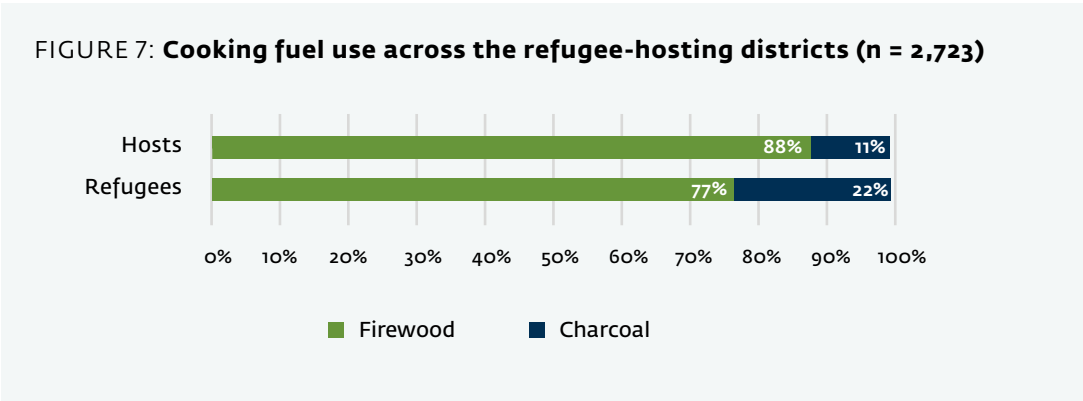
Energy for cooking

Main cooking fuels

Both refugees and host communities depend on firewood and charcoal to meet their cooking needs. The historical reliance on wood fuel is influenced by its easy access, cultural preference, and no or low cost, compared to most cleaner energy alternatives. Firewood is the main energy source for cooking for 85 percent of households across the districts, whereas charcoal is the main cooking fuel for 14 percent of households. In terms of charcoal usage as the main fuel, Adjumani has the highest use at 30 percent, followed closely by Kyegegwa at 27 percent, and Isingiro at 16 percent. Figure 7 compares the use of firewood and charcoal as the

main energy source in host and refugee households. Other cooking fuels such as plant biomass, kerosene, liquefied petroleum gas (LPG), and woodchips are used by less than 1 percent of households.

Host communities are slightly more likely to use firewood as their primary energy source for cooking than refugees, while the inverse is true for charcoal. The majority of households collect rather than buy their firewood. However, charcoal is generally commercially traded. Refugee households often use charcoal as host communities restrict their access to forests to collect firewood. Firewood collection by refugees has often led to conflicts with host communities and exposed women and children to gender-based violence.



Acquisition of cooking fuels

Firewood and charcoal are bought or collected/produced, with no significant differences between how refugees and host communities acquire them (see Figure 8). Among surveyed host households, 88 percent collected firewood, 10 percent purchased it, and 2 percent both collected and purchased it. Among refugee households, 85 percent collected firewood, 13 percent purchased it, and 2 percent both collected and purchased it. Women were mainly tasked

with collecting firewood (in 70 percent of all households), followed by female children (in 14 percent of households), men (8 percent), and male children (8 percent).

It is much more common for refugees to buy charcoal and for host communities to produce it: 54 percent of host households and 67 percent of all refugee households purchased charcoal, while 43 percent of host households and 29 percent of refugee households produced their own charcoal, as shown in Figure 9.

FIGURE 8: How households acquire firewood (n = 2,327)

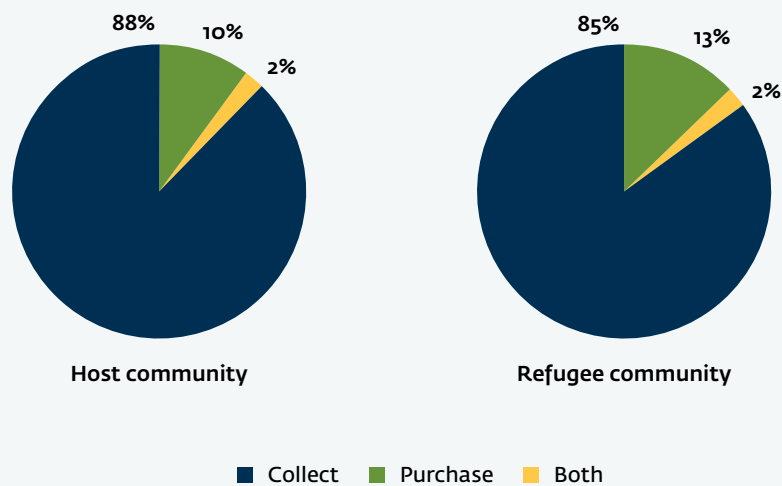
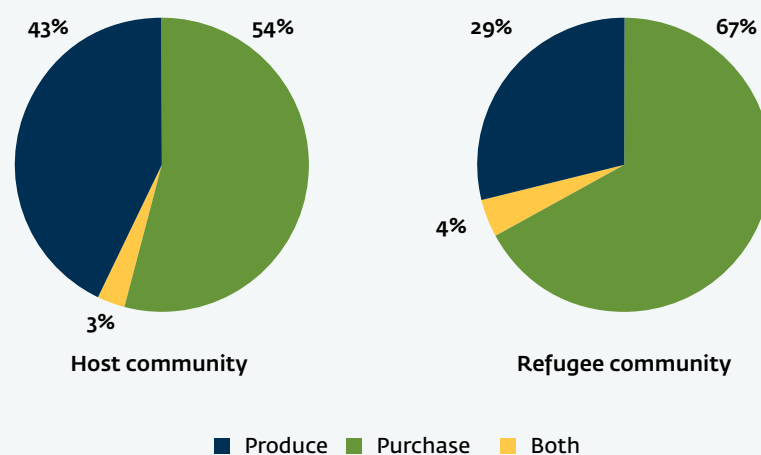


FIGURE 9: How households acquire charcoal (n = 522)



Refugees and hosts who buy their cooking fuels spend substantial amounts of money every month. Households reported spending \$2.66 on average on charcoal weekly, which translates to \$11.60 monthly, and \$2.30 on firewood, which translates to \$10 monthly. This expenditure alone makes up 22 percent of the monthly household income on average.

The use of LPG as a main cooking fuel was only reported in one instance in Kiryandongo. Uganda's LPG supply market is dominated by over 10 medium- to large-sized companies, including OiLibya, Lake Gas, Kobil, Wana Energy Solutions Gas, Oryx Energies, Mpishi, Hashi, Mogas, Hass Gas, PET Gas, and RAMCO Gas. The larger players are more focused on the urban market, where they have developed distribution infrastructure such as petrol stations, which are not present in rural trading centers, resulting in high distribution costs and inconsistent supply. Awareness of the use of LPG is low, as reflected in the focus group discussions, where it was not suggested as a potential area of intervention. The ability to increase uptake of LPG in a bid to move households away from firewood and charcoal depends on making the upfront cost to buy equipment (LPG cylinder and appliances) more affordable to consumers.

Cookstoves

The majority of households use the most basic cooking technology: 76 percent of

host households and 46 percent of refugee households used three-stone open fires (a self-built stove made of stones that support a pot). These are commonly used due to their adaptability to multiple fuel types (including firewood, crop residues, dung, and leaves), and flexibility for use with different pot sizes. However, such stoves often use much firewood, generate much smoke, and pose health and safety hazards.¹⁹ Manufactured charcoal stoves, which tend to be fuel efficient, were owned by only 5 percent of host and 7 percent of refugee households (see Table 7). About 18 percent of the respondents who declared owning a stove owned more than one.

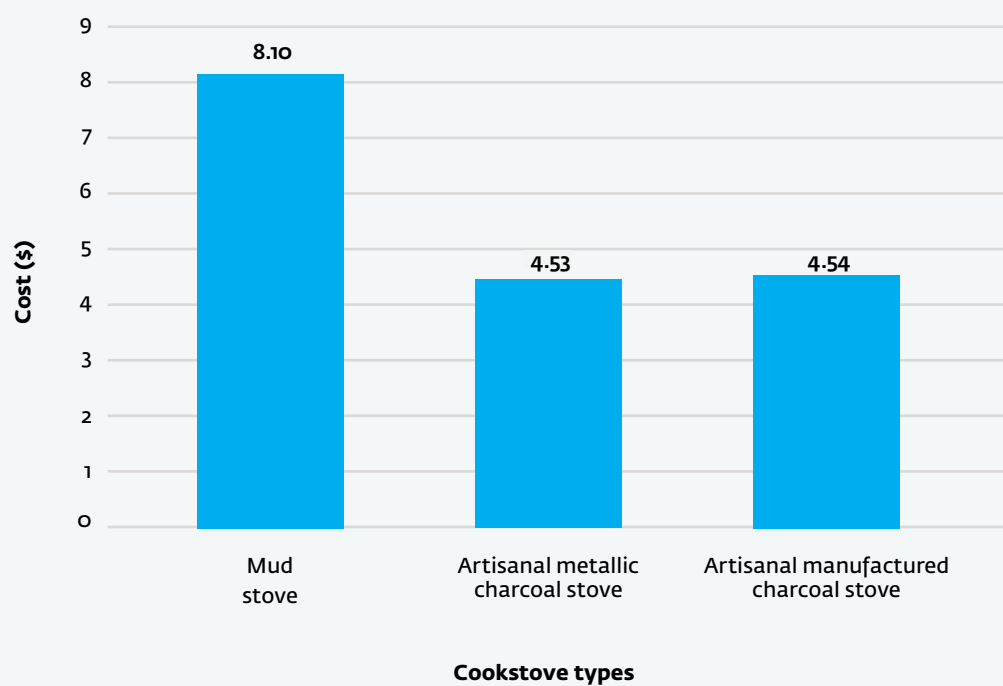
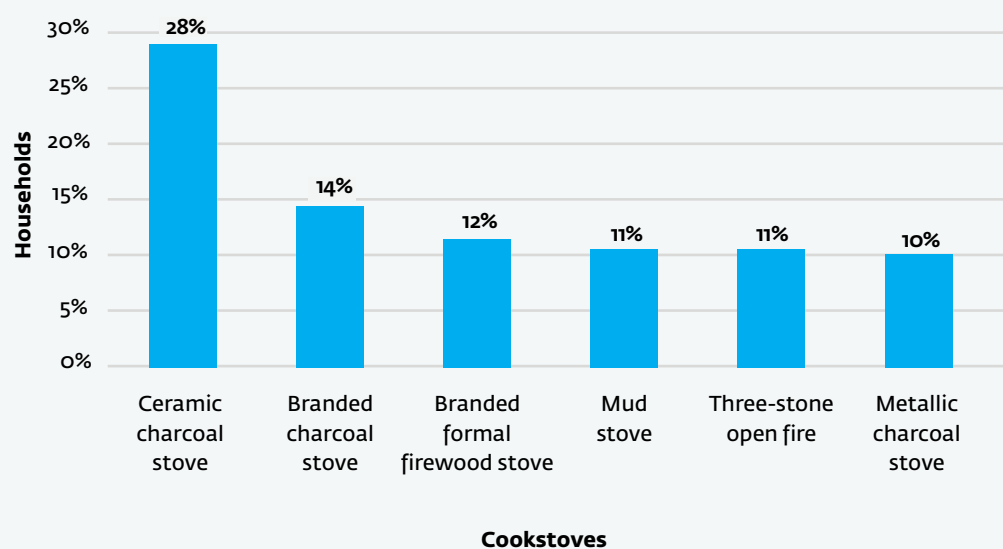
Both refugees and hosts tend to make their own stoves rather than buy them. Only 6 percent of respondents had purchased their stoves, whereas 90 percent had made the stoves themselves. The remaining 4 percent had received stoves for free. The purchased stoves mainly included metallic charcoal stoves, manufactured charcoal stoves, and mud stoves, with costs ranging from \$4.50 to \$8 (see Figure 10).

The Rocket Lorena stove is among the most accessible good-quality stoves in the refugee-hosting areas. UNHCR and its partners trained local artisans to build these stoves to promote the use of energy-efficient cooking technologies.

TABLE 7: **Cookstove types owned by households**

Cookstove type	Households (%)		
	Host	Refugee	Total
Three-stone open fire	76	46	68
Mud stove	19	41	25
Metallic charcoal stove	8	8	8
Open fire, contained and movable	7	7	7
Manufactured charcoal stove	5	7	5
Manufactured woodstove	2	4	2
Open fire, immovable with ceramic lining	1	3	2
Others	2	7	3

¹⁹ USAID. 2007. Fuel Efficient Stove Programs in IDP Settings—Summary Evaluation Report, Uganda.

FIGURE 10: **Average prices of purchased stoves (n = 35)²⁰**FIGURE 11: **The six most preferred stoves**

²⁰ The sample size was specific to respondents who reported the stove as their main stove used.

TABLE 8: **Stoves ranked by preference of host and refugee households**

Cooking appliance	% of host households	Ranking	% of refugee households	Ranking
Ceramic charcoal stove	26	1a*	31	1a
Manufactured charcoal stove	14	2a	15	2a
Manufactured firewood stove	13	3	10	4a
Three-stone open fire	12	4a	8	6
Mud stove	11	5	14	3a
Metallic charcoal stove	10	6a	9	5a

*a indicates stoves with a preference rate of 10 percent or higher for the second-most preferred cooking appliance. Images of the different stoves are provided in Annex 3.

Among respondents, the most preferred stove was a ceramic charcoal stove, at 28 percent, followed by the branded charcoal stove at 14 percent (Figure 11, Table 8). Both communities preferred the same six stoves, but with a slight variation in ranking. The ranking and preference rate for the 6 kilogram LPG cylinder stove (not shown) was comparatively low. The preference exercise indicates a leaning toward stoves that use either charcoal or firewood. The amount of firewood saved (and therefore cost savings) by using these stoves is low. Three of the stoves (ceramic charcoal stove, mud stove, and metallic charcoal stove) are produced locally by artisans, so respondents' familiarity with them could have influenced their choice.

Furthermore, the majority of respondents (74 percent) indicated that they did not own their preferred stove. Two key factors preventing them from owning their preferred stove were unavailability of these stoves in the local market and high price. When asked if they were aware of any financing programs for buying a cookstove, only 6 percent of respondents stated that they had heard of any.

Stoves produced by artisans vary in quality and performance as they are not standardized. This implies a need for artisans to be trained and supported in acquiring the technical tools needed to produce

quality products. Improved cookstoves are sometimes perceived as a luxury item in Uganda, with consumers lacking awareness about the cheaper improved stoves available on the market.²¹ Similarly, awareness about briquettes as a cooking fuel is relatively low countrywide.²² Briquettes could be cheaper than charcoal, saving households money by using them for cooking fuel.

Payment models

As stated in the previous section, the vast majority of households use a cookstove they made themselves, with only 6 percent of respondents reporting purchasing their stoves and 4 percent receiving the stove for free (mainly refugees who reported receiving one from UNHCR or local NGOs). Almost all households (97 percent) who paid for their cookstove, did so in cash.

Solar lighting products were also mainly bought through upfront cash payments. Of the 87 percent who reported paying:

- 92 percent paid cash up front.
- 7 percent paid in cash installments using the layaway model, where a retailer agrees to hold merchandise secured by a deposit until the price is paid in full by the customer.
- 1 percent used the pay-as-you-go (PAYGo) model, which allows

²¹ World Bank. 2019. Uganda Clean Cooking Behavioral Diagnostic. ESMAP paper.

²² Ibid.



customers to make a down payment on a product and continue paying in pre-agreed installments over time.

- 1 percent paid using a loan (obtained from a local savings group, from a solar product supplier, or through a personal loan).

More refugee households (12 percent) reported paying cash installments for solar lighting products compared to host households (5 percent). Use of PAYGo and loan options were low, at less than 2 percent, and were reported only in host communities. Key informant interviews with enterprises selling pico-PV products revealed a preference for cash payments due to the fluctuations or seasonality of customers' incomes and suppliers only accepting cash payments, with only a few offering credit options.

Channels to enable PAYGo models are, nevertheless, available, as 55 percent of the host and 46 percent of the refugee respondents indicated owning a mobile money account. In addition, at least 51 percent of the host communities and 39 percent of refugees use mobile money accounts to buy goods and services, meaning that mobile payment services would not be new to them.

3.2 Businesses

The surveyed businesses predominantly engage in small-scale, non-energy-intensive activities. These included food and beverage sellers/restaurants, general retail shops, barbershops and salons, cybercafé/printing shops, chemists, phone-charging points, posho mills, electronics shops, solar kiosks, cinema halls, garages, welding, and fueling pumps.

Income-generating electrical appliances owned by businesses included phone-charging units (20 percent), shavers (10 percent), hairdryers (3 percent), hair straighteners (3 percent), printing machines (7 percent), posho mills and fuel pumps (5 percent), sewing machines (2 percent), and welding machines (3 percent). In addition, businesses owned other electrical devices such as radios and TVs. A majority, 58 percent of businesses, however, said that they did not use any appliances for productive use.

Across the 11 refugee-hosting districts, 46 percent of the surveyed businesses had access to electricity from the grid, followed by solar energy (39 percent). Solar home systems were the most common solar product. A rather significant percentage

of businesses (21 percent) reported using large-capacity solar systems (see Table 9). The larger-capacity systems were owned by phone-charging points, video halls, barbershops and salons, and general shops. Nine percent of businesses owned generators, while 6 percent used other energy sources including paraffin lamps and torches as their main source of energy. Alarming, 7 percent of the surveyed businesses lacked access to any energy source.

It is salient that 15 percent of the businesses connected to the grid also owned a generator, and 22 percent owned a solar home system, indicating that the grid connection is insufficient to meet the needs of these businesses. In fact, about 30 percent of the grid-connected businesses mentioned that the electricity demand from the devices they use is not met by the grid.

TABLE 9: **Capacity of solar technology used by businesses**

Solar product used by the business	Ownership
Pico-PV	17%
Solar home system (11–20.99 Wp)	3%
Solar home system (21–49.99 Wp)	5%
Solar home system (51–99.99 Wp)	7%
Solar home system (>100 Wp)	21%



3.3 Public institutions and humanitarian agencies

To understand energy sources for lighting and cooking, interviews were conducted with primary schools, health centers, and vocational training institutions, although these are not a representative sample, as shown in Annex 1.

Lighting

In refugee settlements, UNHCR subsidizes the cost of installing solar systems in schools, health facilities, and community centers. In host community areas, the government supports public institutions with help from development partners. In both cases, grant support is key.

Most of the surveyed schools are day schools and use solar PV primarily for lighting their administration blocks. Only one school was connected to the grid and raised concerns about the high monthly electricity charges. One of the surveyed schools did not have any source of lighting. The electrical energy from solar systems is not enough to power information and communication technology services. Of the five health centers surveyed, four used solar systems for lighting, and one was connected to the grid, in Adjumani district.

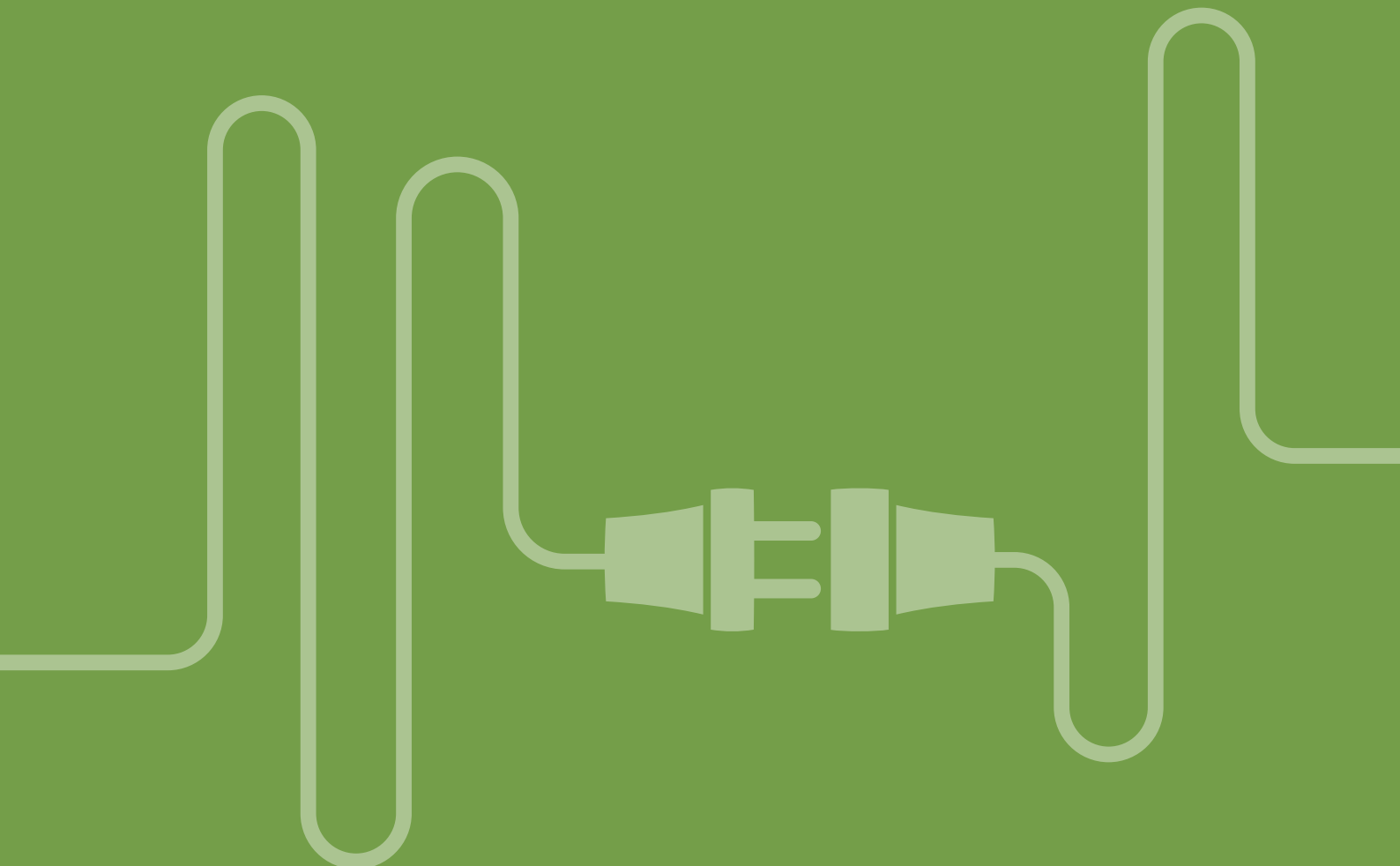
It is worth noting that the district offices of the Office of the Prime Minister were connected to the grid. However, moving further into the refugee settlements, some offices, such as those in Lamwo, Moyo, and Yumbe, used generators or solar technology for their lighting needs. In Kikuube, the Office of the Prime Minister office was connected to the grid and had a generator as a back-up. NGO offices in the settlements were either connected to generators on a shared-connection basis with nearby offices or reliant on solar energy.

UNHCR offices in settlement base camps are connected to the grid, but also use a diesel back-up generator. To reduce its carbon footprint from using diesel generators, UNHCR aims to transition to solar energy to power its compounds, premises, and offices. The UNHCR Green Fund, established in 2020, aims to finance solar power generation projects at 10 UNHCR field sites in Ethiopia, Kenya, and Uganda. Each project size will range from 60 kW to 500 kW, with a total capacity of up to 1,800 kW. In 2021, UNHCR issued a tender to attract renewable energy providers via multi-year power purchase agreements.

Cooking

The surveyed primary schools use firewood for cooking, which is either purchased by the school or brought by students on request. All six interviewed primary schools reported that it is difficult and expensive to procure firewood, with the cost of firewood per term (three months of school) ranging from \$81 to \$325 to cater for the entire school. In addition, the fuel-efficient Rocket Lorena stove has been abandoned by two of the schools, which reverted to using three-stone open fires due to complaints that the Rocket Lorena cooks slowly and produces much heat within small spaces. However, a challenge with the three-stone open fire is that the firewood produces a lot of smoke, making cooking difficult.

LOCAL STOCKISTS
SOURCE SOLAR
PRODUCTS FROM
KAMPALA AND
STOVES FROM LOCAL
ARTISANS AND
KAMPALA.



Energy Supply

4.1 Supply chain for energy suppliers

Pico-PV and solar home systems

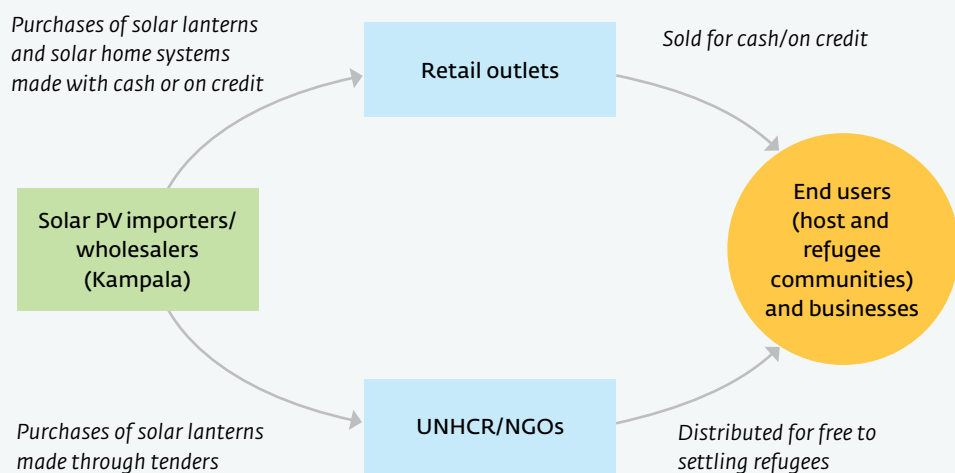
Solar products are sold through local stockists and dealers. These suppliers source their products from Kampala and have to cover long distances over poor road networks to reach their destinations, adding to the final cost of products. Figure 12 outlines the solar product supply chain.

Cooking fuel and stoves

Most stoves are produced by local artisans; however, a fair number are sourced from Kampala. They are then distributed to local stockists or sold directly to end users. Several stove producers work closely with NGOs or

development agencies, such as GIZ and SNV, which provide hubs for the inventory and help the producers promote their stoves. Due to their bulk, stoves are prone to damage during transportation. There are costs associated with the damage, especially for clay-lined stoves, which are commonly produced in Kampala and are popular for saving fuel. This could help explain the limited distribution network in refugee-hosting districts. Branded stoves such as BURN, Envirofit, and SolarNow are slowly being supplied to the districts. However, the upfront cost of these stoves is high for the target group, so a suitable consumer financing mechanism is critical to ensure affordability.

FIGURE 12: **Supply chain of solar home systems and solar lanterns in Uganda**



Source: EED Advisory.

Improved stoves and briquettes for cooking: Pilot project in refugee-hosting areas

Mandulis Energy is partnering with the Food and Agriculture Organization and UNHCR to distribute and sell its KyaKula brand non-carbonized briquettes and cookstoves in refugee settlements and the surrounding host communities in Adjumani, Kiryandongo, and Lamwo.

It has already reached 7,700 families among refugees and host communities. The circular economy model uses briquettes made from crop residues and gasifier cookstoves, which leave the customer with biochar. Mandulis Energy plans to buy back the biochar and pass it on to the commercial cement industry.²³

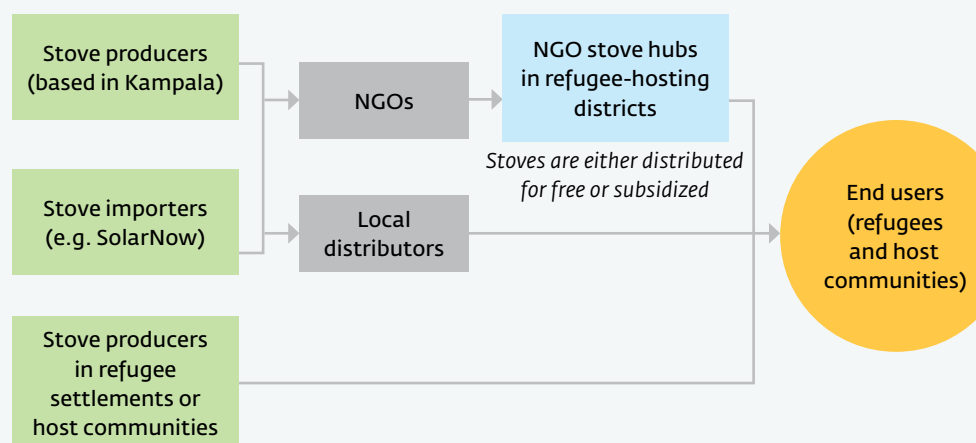


²³ Key informant interview with Mandulis Energy.



Figure 13 shows the supply chain for stoves in refugee-hosting districts.

FIGURE 13: **Stove supply chain in Uganda's refugee-hosting districts**



Source: EED Advisory.

4.2 Supplier mapping

Several private companies working in the energy space in the refugee-hosting districts were identified during fieldwork. These companies are either energy-focused or provide energy devices as part of their catalogue of goods. The payment models offered are listed in Table 10. Interviews with these companies revealed a preference for cash because of inconsistent credit

repayments. The list of companies is not exhaustive and comprises mainly solar PV suppliers and, to a lesser extent, cookstove makers. NGOs were noted to be key distributors of clean-energy cookstoves.

Table 11 provides a non-exhaustive list of financial institutions with a presence in the refugee-hosting districts and the offerings available to the communities.

TABLE 10: **Private companies working in the energy sector in the refugee-hosting districts**

	Private energy company	Offerings	Payment models	District
1	Fenix Power International (now called ENGIE Energy Access)	Solar lighting systems, charcoal stoves	Cash, PAYGo	Arua, Kampala
2	Village Power	Solar home systems (15–120 Wp)	Cash, credit	Arua, Kampala
3	Village Energy	Solar home systems (120 Wp and above), solar water heaters, streetlights	Cash, loan through commercial bank	Arua
4	SoloGrid	Solar panels (100 Wp), solar lanterns	Cash, credit sales	Arua
5	FRES Solar Uganda	Solar lighting systems	Cash	Isingiro
6	Raising Gabdho Foundation	Briquettes, improved cooking solutions, cooking baskets	Cash, installments	Kampala
7	Power Trust Uganda Ltd	Solar panels, batteries, inverters, water heaters	Cash, supplier credit, PAYGo	Kampala
8	Gerald Eirahan Electronics	Solar devices: ADH, Stom, Solar Premium	Cash	Adjumani
9	Cheap Smile Electronics	Solar devices: ADH Solar, Mira Cozy, Ase Solar, Sunshine Solar panels	Cash, supplier credit	Adjumani
10	Orungo Electronics	ADH, Stom, Miracozy, Sunday, Ase	Cash, supplier credit	Adjumani
11	BrightLife Solar Uganda	Solar home systems (6 Wp, 10 Wp)	Credit, cash	Kiryandongo
12	Smart Technologies Uganda	Sunshine Solar panels (10 Wp)	Cash	Kiryandongo
13	Afro Light	Sunshine Solar panels (15 Wp – 150 Wp)	Credit	Kiryandongo
14	SolarNow	Polycrystalline solar panels (50 Wp – 275 Wp), solar systems	Cash, supplier credit	Adjumani
15	BURN Manufacturing	Improved cookstoves	Cash, credit	Kampala
16	Ugastove	Biomass and charcoal cookstoves	Cash	Kampala

TABLE 11: Financial institutions in the refugee-hosting districts that provide loans

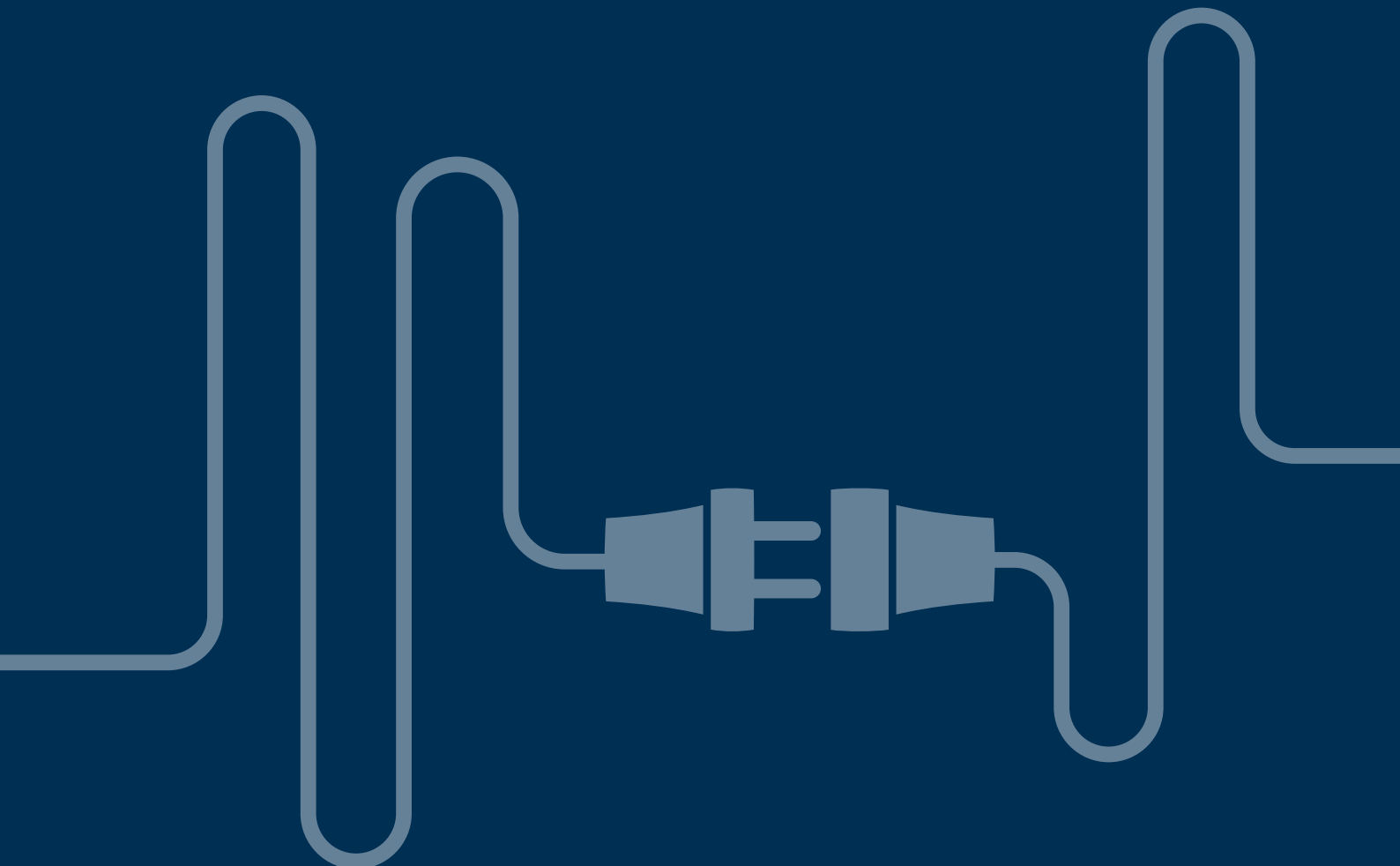
	Financial institution	Offerings	District
1	BRAC Microfinance	Solar loans	Arua
2	Centenary Bank	General loans	Arua
3	Kitgum Cooperative Savings and Credit Society	Credit services for solar products	Lamwo
4	Palabek Traders Cooperative Savings and Credit Society	Loans to buy energy-saving stoves	Lamwo
5	Moyo Cooperative Savings and Credit Society	Loans to acquire solar devices and training on briquette making	Moyo
6	Alpha Cooperative Society	Loans to acquire solar devices and energy-saving stoves	Yumbe
7	Post Bank	Loans to acquire solar devices	Arua
8	Bakayuki Quick Services	Loans	Kamwenge



Legal and Regulatory Frameworks

5

OVER THE PAST TWO DECADES, THE GOVERNMENT HAS INTRODUCED NATIONAL POLICIES AND STRATEGIES TO INCREASE ACCESS TO SUSTAINABLE ENERGY.



Legal and Regulatory Frameworks

5.1 Laws, policies, and strategies governing the renewable energy sector

The main law governing the mainstream electrical power sector, including solar PV, is the Electricity Act (1999). The Act provided for the establishment of an independent Electricity Regulatory Authority (ERA) with a mandate to regulate the generation, transmission, sale, export, import, and distribution of electrical energy in Uganda. The Act is supported by various statutory instruments that led to the establishment of several institutions, such as the Rural Electrification Agency (REA) with a mandate for rural electrification. REA works with multiple independent power producers that generate electricity supplied to the grid. Effective October 2020, REA was embedded as a department within the Ministry of Energy and Mineral Development (MEMD). MEMD is responsible for formulating policy for Uganda's energy sector and overall sector management.

Over the past two decades, the government has introduced national policies and electrification strategies intended to increase universal access to sustainable energy. National energy policies include the Draft National Energy Policy (2019), which will replace the Energy Policy (2002); the Renewable Energy Policy (2007); the Nuclear Power Roadmap Development Strategy (2015); and the Electricity Connections Policy (2018–2027). The Draft National Energy Policy aims to provide reliable, affordable energy services; promote renewable and alternative energy sources; and increase energy efficiency.

The Electricity Connections Policy prioritizes access to electricity through grid connections, but identifies high connection and in-house wiring costs as a major barrier. To achieve a 60 percent national electricity access rate, the Electricity Connections Policy has adopted a subsidy approach to financing. The policy has

two guiding objectives: increase the average number of connections from 70,000 to 300,000 connections annually, and increase demand on the main grid by 500 megawatts (MW) by 2027.²⁴ To achieve these objectives, several strategies have been put in place:

- Subsidizing connection charges (\$160 for a no-pole service connection per household) for eligible customers within the low-voltage distribution network. Households are only required to pay \$11 as an inspection fee.
- Densifying the grid.
- Prioritizing areas to be electrified while ensuring equitable distribution of services across the country (this will involve identifying areas with high population density near or within the distribution network that can be connected under the scheme, to lower the unit cost per customer).²⁵
- Using off-grid solutions for customers who lack grid access and where extending the grid is not financially feasible.

As of 2020, over 250,000 households and businesses had received connections. The policy was suspended in July 2020 because of the government's failure to pay \$25 million to Umeme (the power distributor) for 105,412 connections made by May 2020.²⁶ In March 2021, the policy was resumed.

Uganda's second Rural Electrification Strategy and Plan (2013–2022) aimed to increase rural electrification to 26 percent by 2022, through 1.28 million new grid connections and 140,000 additional installations of solar PV systems and mini-grid distribution service connections.²⁷ Uganda has achieved the target, with about 33 percent of the rural population having benefited from access to electricity through on-grid and off-grid sources as of 2020.²⁸ MEMD is now developing a National Electrification Strategy, which

²⁴ REA. 2013. Rural Electrification Strategy and Plan 2013–2022.

²⁵ Ibid.

²⁶ Ibid.

²⁷ Ibid.

²⁸ World Bank data.

emphasizes the use of appropriate and cost-effective technologies, productive uses of electricity, and energy efficiency.

MEMD also recently finalized a Sustainable Energy Response Plan for Refugees and Host Communities (2021–2025), developed in collaboration with the Comprehensive Refugee Response Framework Secretariat, REA, UNHCR, the World Bank, and GIZ. The plan aims to increase access to clean energy (clean cooking and on-grid and off-grid electricity) for household, commercial, agricultural, and industrial users, and other institutions working in the rural, peri-urban, and urban areas where refugees live.

Other non-electrical energy laws and policies include the Petroleum Act (2013), which operationalizes the National Oil and Gas Policy (2008), and the Biofuels Act (2018), which regulates the production, storage, and transportation of biofuels and their blending with petroleum products. As energy is cross-cutting in nature, other policies and plans that support the sector mandate include the Uganda Gender Policy (2007), the National Climate Change Policy (2015), and the Environment and Social Safeguards Policy (2018).

The study does not review grid-related regulations because it does not cover private sector involvement in the grid space.

5.2 Focus on solar PV

The Electricity Act (1999) highlights the role of solar PV in improving energy access in “isolated settlements that cannot be economically connected to the grid.” The law mainly focuses on grid connection. However, there are a number of policies and plans that aim to stimulate the growth of the solar sector.

The Renewable Energy Policy of Uganda introduced the rural and urban poor electricity access program, which proposes using solar PV to support productive use for rural and dispersed settlements. The Draft National Energy Policy proposes policy actions to stimulate the growth of solar PV use through private sector engagement, including:²⁹

- **Net metering:** Developing a framework for integration and net metering of rooftop solar PV to the grid.
- **Local manufacturing of solar PV systems:** Establishing renewable energy credit facilities and sales promotion funds for manufacturers.
- **Incentives:** Promoting solar PV and other renewable energy resources through tax incentives and appropriate pricing policies.

In 2021, the Uganda National Bureau of Standards (UNBS) adopted quality standards for plug-and-play solar products and solar home systems up to 350 Wp. This was an important milestone toward strengthening the national quality assurance framework for solar products in the country.

The solar sector has been growing beyond the government’s estimates. For example, the Rural Electrification Strategy and Plan 2013–2022 estimated that a total of 130,000 solar home systems would be sold by 2022,³⁰ but the reported sales grew from 380,000 per year in 2016 to 400,000 in 2019.³¹ This clearly demonstrates how central solar home systems have been in advancing the electrification of underserved households in Uganda.

Despite such impressive growth, the solar PV industry faces fiscal challenges. These include import duties, value-added tax (VAT), withholding taxes, and infrastructure levies, which drive up the product costs, as solar PV-related products are imported. Solar PV modules are subject to 6 percent withholding taxes, whereas spare parts of solar home systems and inverters, batteries, light-emitting diode lights, solar-powered radios, and TVs are subject to all three taxes.³²

Previously, the government adopted exemptions on all solar products to encourage increased private sector participation in the off-grid solar market.³³ However, due to limited capacity of border officers to distinguish between solar and non-solar components, importers of non-solar energy products also reportedly benefited from these tax exemptions, prompting the East African Community (EAC) to remove these exemptions.³⁴

²⁹ MEMD. 2019. Draft National Energy Policy.

³⁰ Ibid.

³¹ Uganda Off-Grid Energy Market Accelerator. 2020. Off-Grid Energy in Uganda Market Map.

³² Uganda Solar Energy Association. 2019. Handbook on Solar Taxation.

³³ Economic Consulting Associates for DFID, Energy Africa—Uganda. 2018. Fiscal Policy Options for Solar Home Systems: Final Report.

³⁴ Ibid.

5.3 Focus on cooking solutions

The Draft National Energy Policy recognizes the country's excessive reliance on firewood and charcoal for cooking compared to alternatives and their adverse effect on the environment. To reduce forest depletion, the draft policy aims to promote cleaner fuels and technologies for cooking such as LPG and biogas. It also mentions the need to increase the use of more efficient solid biomass alternatives, such as briquettes, and provide incentives to companies that manufacture energy-efficient firewood and charcoal stoves.

The clean cooking subsector falls under the Directorate of Energy Resource Development in MEMD. This subsector spans biomass, stoves, and associated fuels—charcoal, firewood, and biogas. LPG and petroleum fall under the Directorate of Petroleum. Biomass stoves are largely produced locally, although a significant number are imported.

The main fiscal laws affecting biomass stoves are the Finance Act (2016), which guides VAT and other national taxation at the country level, and the EAC Customs Management Act (2004), which guides the importation of goods into EAC countries, as described in the EAC's Common External Tariff (2019):

- In Uganda, all stoves are subject to 18 percent VAT.
- Imported stoves manufactured outside of the EAC are subject to import duties of 10 percent, while those manufactured within the EAC are not.
- Import duties on metals used for the cladding of improved cookstoves is the greatest material cost, representing up to 80 percent of the stove price. Under the Common External Tariff, the Ugandan government requested a duty remission rate of 0 percent for metal sheets imported specifically for manufacturing stoves. However, to benefit from this remission, a company must be registered as a stove manufacturer with the Uganda Revenue Authority. Because many stove producers are small companies that buy their raw materials from the general importers of metal sheets, it is difficult for them to enjoy the waiver.

Uganda did not have mandatory stove standards and testing during the study, but was piloting standards with targeted enterprises before deciding whether standardization should be mandatory. Charcoal is a dominant improved cooking fuel, and any policy that affects the charcoal market has a knock-on effect.



There is currently no direct tax on charcoal as a commodity, as the industry is largely informal, but traders are subject to fees to operate their businesses.

LPG is an imported product, so is subject to international fluctuations in price as well as import duties. The current import duty is 7 percent and the import license commission is 2 percent. In 2020/21, the government exempted LPG from 18 percent VAT to improve its uptake.

5.4 Focus on mini-grids

Most mini-grids are developed and operated by private sector developers but are effectively organized as public-private partnerships, where the generator equipment is owned by a private developer who is also responsible for construction costs.

REA typically funds mini-grid distribution infrastructure through the Rural Electrification Fund, so that it retains ownership of the distribution network that is leased to developers and ensures the infrastructure is produced to national grid standards. This arrangement ensures that if the developer exits, the distribution lines are in place and could be used by another developer. The fund provides support in various forms: REA may reimburse the

developer for distribution costs or may directly construct distribution infrastructure in coordination with the developer. According to one of the developers, this in-kind support is crucial to the cost-effectiveness of mini-grid projects.

ERA is mandated to regulate mini-grid projects in terms of licensing, retail tariffs, and enforcement of technical standards. REA, a semi-autonomous entity within MEMD, is responsible for planning and coordinating rural electrification in Uganda. Both institutions work in close consultation to review and approve projects.

All mini-grids are subject to electricity sector and non-electricity sector approvals. ERA oversees the electricity sector while the National Environment Management Authority leads in the non-electricity sector. In addition, the Directorate of Water Resources Management must be consulted if hydropower generation is needed.

ERA adopts a dual approach to licensing based on the project size:

Projects greater than 2 MW: These are subject to a full licensing process. Part V and VI of the Electricity Act (1999)³⁵ outline the licensing process including the timeline, requirements, and rules for

³⁵ Government of Uganda. 1999. Electricity Act. <https://www.uegcl.com/publications/acts-policies/>.



obtaining a license. The approvals are obtained through the existing licensing process for an independent power producer, which involves two steps:

- Apply for a permit to carry out a feasibility study and other preparatory work that is required to apply for a license.
- Apply for a license to generate and sell electricity.

Projects less than 2 MW: These are governed by the Electricity Isolated Grid System Regulations (2020) after the repeal of the Electricity (License Exemption) Isolated Mini-grids System Order (2007). The regulation has two bands:

- Less than 0.5 MW: Register a generation station for commercial purposes, as outlined in schedule 1 of the regulations.
- Between 0.5 and 2 MW: Apply for an exemption certificate, as outlined in schedule 3 of the regulations.³⁶

Exemption is a two-stage process, as follows:

- The developer undertakes a feasibility study and acquires the necessary approvals from the National Environment Management Authority (and the Directorate of Water Resources Management for hydropower projects) for a given site.
- License exemption is granted on approval and the developer is granted rights to generate, distribute, and sell electricity in a given area.

ERA is updating the regulations to help reduce the cost of compliance and to better tailor them to mini-grids.³⁷ The National Environment Management Authority, in coordination with MEMD, reviews the environmental assessment and approves the project for ERA to issue a license. If the project involves hydropower, it must also be reviewed and approved by the Directorate of Water Resources Management. A mini-grid may go through a partial or a full environmental impact assessment depending on the project's size, location, type, and potential environmental impacts.

Each of the following evaluations has varying levels of rigor: environmental project brief, environmental impact review, and environmental impact assessment.

Tariffs

ERA regulates retail services for mini-grids in the same manner as it regulates national grid distribution operations. The developer submits a proposed tariff to ERA for review, amendments, or approval. According to the 2020 regulations, tariffs are calculated according to principles stipulated in the Electricity Act, taking into consideration the following:³⁸

- Operation and maintenance costs
- Capital recovery
- Expenses
- Taxes
- Subsidies or grants received
- Reasonable return on equity that reflects risks faced by the holders of an exemption certificate
- Any other costs approved by the authority.

Previously, tariffs were adjusted because of changes in the following: inflation, exchange rates, fuel price, energy demand, and any cost approved by the authority. The current regulations state that tariffs will be adjusted on submission of applications for tariff adjustment accompanied by evidence to justify the change. The decision is made within 45 days of receiving a complete application.

In theory, tariffs must be cost-reflective, but in practice they are often close to the national grid tariff. This is because costing electricity tariffs is politically challenging, especially when charging poorer people a rate higher than the national tariff, or charging customers who live near each other different rates. A village that is grid-connected may be located near to one that relies on a mini-grid. Moreover, where mini-grids exist, the consumers' ability to pay is often low, so charging high rates could prevent electricity access for many.

³⁶ Government of Uganda. 2020. Electricity Isolated Grid System Regulations 2020.

³⁷ GET.transform. 2022. Uganda's New Off-Grid Regulations Presented to Stakeholders, January 31, 2022.

³⁸ Government of Uganda. 2020. Electricity Isolated Grid System Regulations 2020.

Opportunities for Private Sector Involvement

6

MARKET SIZE



KEROSENE

\$2.9 million



BATTERIES

\$10.1 million



PICO-PV PRODUCTS

\$10.4 million



FIREWOOD

\$13.3 million



CHARCOAL

\$26 million



Opportunities for Private Sector Involvement

Average monthly household spending

TOTAL ENERGY NEEDS FOR LIGHTING AND COOKING

\$7.50

Average per energy source



KEROSENE

\$2.24



DRY-CELL BATTERIES

\$2.20



FIREWOOD

\$10



CHARCOAL

\$11.60

6.1 Potential market size

The market is split into lighting, improved cooking solutions, and mini-grids and grid extensions (the grid is not covered here), as discussed in detail below. According to the household survey, households spend \$7.50 on average each month on their energy needs for lighting and cooking, which is about 15 percent of their average monthly income.

Lighting market

The main lighting solutions reviewed are kerosene lamps, pico-PV, and torches. An estimated \$13 million is spent annually on dry-cell batteries and kerosene for lighting, which could be redirected to pico-PV products.

Kerosene lamps

About 10 percent of the population (predominantly the host community) uses kerosene as their main energy source for lighting (tadoobas and hurricane lamps). The district with the highest proportion of households that use kerosene is Arua, at

21 percent, followed by Isingiro, at 17 percent. The average monthly spend on kerosene is \$2.24. This significant amount suggests that kerosene users could be potential candidates for converting to solar lanterns or solar home systems through an innovative intervention.

The potential annual spend that could be diverted from kerosene use for lighting to solar lanterns across the districts was calculated as follows:

- Monthly expenditure per household on kerosene for lighting (household survey): \$2.24
- Number of households using kerosene: 110,852 (based on the percentage of households using kerosene—10 percent, and UBOS/UNHCR data on household numbers as of 2020)
- Annual kerosene expenditure in refugee-hosting districts = Monthly kerosene expenditure * no. of households using kerosene * 12 months

A hypothetical example of converting an end user from using kerosene to using a solar lantern

A household spending \$2.24 per month (rounded up to \$3 in case of additional charges) on kerosene would need five months to pay for a basic solar lantern costing \$15. However, innovative financing could be structured to allow a consumer to pay a deposit of two months (\$6) instead of the equivalent amount spent on kerosene. This would reduce the time needed to pay for a solar lantern to about four months. As a result, the customer would acquire a good lighting source and would no longer incur the monthly expenditure on fuel.

As most of these customers do not have collateral, it is imperative that credit be

extended to individuals belonging to an informal savings group such as a village savings and loan association that provides a peer guarantee. A PAYGo mechanism where the lantern automatically switches off if the customer defaults could also be considered to reduce the credit risk to the seller. However, customers would need to be made fully aware of what such a commitment would involve. In addition, the providers should consider offering a flexible repayment schedule, such as aligning it with agricultural production cycles, rather than requiring regular payments of equal value.

The current market size for kerosene is about \$2.9 million per year, assuming that the kerosene price stays constant. If kerosene is completely replaced by a solar lantern within the household,³⁹ the maximum potential convertible market value that can be redirected to solar lanterns is \$2.9 million; however, suitable consumer financing models need to be offered, as mentioned above. It is important to note that the rise in the kerosene price may make the fuel less affordable to many, strengthening the case for the uptake of solar lanterns.

In addition to saving money on monthly kerosene supply, kerosene users are likely to save on mobile-phone-charging costs. Those who pay to charge their phone spend \$0.14 per charge on average. With an average of 1.7 mobile phones per household and 9.4 charges per month, this translates to \$26.50 per household per year that could be saved on mobile phone charging.

Pico-PV products

About 31 percent of all households use pico-PV products as their primary source of lighting. During the key informant interview with Power Trust, a supplier of solar products, it was revealed that end users would like radios and TVs, which corroborates the survey findings that about half of respondents mentioned radios and TVs as their high-priority appliances. This desire has created an appetite to upgrade from solar lanterns to solar home systems to power these electrical appliances. Households that use solar lanterns understand and enjoy the benefits of the technology and solar lantern users are the most likely buyers of solar home systems. There is also potential to upgrade single-light users to multi-light systems.

The current market size for pico-PV products is \$10.4 million and was calculated as follows:

- Average price of a pico-PV system (household survey): \$32
- Number of households that bought their pico-PV products: 323,624 (based on the percentage of households using pico-PV as their main lighting source—33 percent, and discounting for those that received their product for free—15 percent)
- Current market size for pico-PV = Price of pico-PV * number of households that bought a pico-PV product

Not all pico-PV users will want to upgrade to solar home systems. Indeed, the household survey shows that about half (48 percent) of the pico-PV users say that their product adequately meets their needs. Furthermore, pricing is a barrier, given the relatively low incomes in both communities. Thus, the convertible market value is likely to be up to half the pico-PV market size. Suitable consumer financing models and possibly subsidies would need to be offered to help low-income households buy solar home systems.

Torches

About 33 percent of all refugee and host community households use various types of torches as their main source of lighting. This average goes up to 61 percent of households in Moyo and 58 percent in both Yumbe and Koboko. Therefore, about 400,000 households in the refugee-hosting districts serve as potential consumers of pico-PV products. Based on a rather high average expenditure on dry-cell batteries (\$2.20 monthly), there is strong potential to upgrade these users to solar products.

The current market size for dry-cell batteries was calculated as follows:

- Annual expenditure on batteries in Uganda among those who used torches as the main source of lighting: \$26 (household survey)
- Number of households using torches: 389,875 (an estimate based on the household survey and UBOS/UNHCR data on household numbers as of 2020)
- Market size for dry-cell batteries = Annual expenditure * number of households

Thus, the total annual expenditure on batteries in refugee-hosting areas is up to \$10.1 million. In addition, households incur costs to replace their torches from time to time, depending on the lifetime of the torch. Similar to kerosene users, torch users could be upgraded to a pico-PV product through a suitable consumer

³⁹ The survey did not investigate the average number of kerosene lanterns per household. It is understood that one solar lantern is unlikely to completely replace kerosene use.

financing model. Households using torches are also likely to realize yearly mobile-phone-charging savings of \$26.50.

While an additional market for pico-PV products could come from candle users, the data from the household survey indicates that these households also have the lowest disposable income and spend the lowest amount of money on lighting per month when compared to users of all other products. This suggests a possible correlation between low income and candle use, which in turn could signal that candle users cannot afford solar products. Households using primarily candles for lighting earn on average about \$28.60 per month and tend to spend only about \$1.20 per month on candles for lighting. These households represent about 1 percent of the population.

Improved cooking solutions

Charcoal and firewood are the primary cooking fuels in the refugee-hosting areas. About 14 percent of all households use charcoal as their main source of cooking fuel, 82 percent of which buy the charcoal they use. Households' average monthly spend on charcoal is \$11.60, which translates to an aggregate of \$26 million per year. While more households use firewood as the main cooking fuel (85 percent), the majority of them collect their firewood and only 8 percent buy it. With the monthly spend

on firewood averaging \$10, households using firewood as the main cooking fuel together spend about \$13.3 million annually. Households that reported making monthly purchases of firewood or charcoal to meet their cooking needs also spend a higher-than-average percentage of their income on energy needs—22 percent.

There is potential to significantly reduce the amount spent on charcoal and firewood (\$39 million) by promoting the use of energy-efficient stoves. Solutions include efficient charcoal stoves, which could halve the monthly charcoal expenditure, and alternative fuels for cooking such as briquettes, ethanol, biogas, and LPG. Cleaner cooking fuels, if made accessible through consumer financing and supply to refugee-hosting areas, could protect the refugee-hosting areas from deforestation as well as significantly reduce indoor air pollution and the ensuing risk of respiratory illnesses.

Mini-grids

Uganda has high potential for mini-grids. Given the abundance of renewable energy resources across the country, both solar and hydro mini-grids are expected to play a vital role in electrifying unserved regions. As of 2019, there were at least 16 mini-grids operating in the country, with many more at different stages of development.⁴⁰ The majority of the mini-

⁴⁰ UOMA. 2020. Off-Grid Energy in Uganda.

⁴¹ Ibid.



grids are highly subsidized and only about 20 percent of the capital accessed is in the form of debt, because of uncertainty about the projects' financial sustainability.⁴¹

The ABC strategy lens was used to assess the viability of the private sector's potential participation in mini-grid development as follows:

- **A—Anchor consumers:** These consumers have a predictable daytime load profile requiring continuous delivery to assure a certain amount of energy uptake. Examples include agro-processing plants or telecommunications towers.
- **B—Businesses/social institutions:** These are commercial establishments for whom power is a critical input for expanding operations or improving productivity. They should not be far from each other to reduce the distribution cost. They include schools, hospitals, and local small businesses such as cybercafés, movie theaters, salons, and barbers.
- **C—Community members:** These are household consumers with low power use. In addition, the host community population density may be low. While the population density in refugee settlements is high, refugees' incomes are relatively low and inconsistent, driving up the demand risk for mini-grid developers.

A preliminary conclusion is that existing loads do not seem sufficient to spur significant interest from private mini-grid developers based on the three criteria above. The financial viability of each potential project needs to be carefully assessed based on the landscape of private sector companies and humanitarian actors operating at a local level. At the time of the study, the field team did not find enough evidence for energy-intensive activities in the surveyed refugee-hosting areas. However, proper mapping of private sector players with substantial energy demand would be needed

to assess the viability of a mini-grid in a specific geographic location. Furthermore, it would be important to investigate the demand for electricity from humanitarian organizations operating in refugee-hosting areas to determine whether they could become anchor loads for mini-grids. The feasibility of mini-grids will likely remain subject to the availability of appropriate funding to reduce the cost of the tariff and make the investment financially viable.

Strategic partnerships formed between development partners, mini-grid developers, and relevant government agencies such as MEMD could also explore ways to increase the loads, but this may be a long-term approach. For example, the Ministry of Agriculture could assess opportunities in agricultural value addition and processing where electricity is a core input.

6.2 Barriers to private sector engagement and mitigation measures

This study revealed several hurdles that the private sector would face in operating in the refugee-hosting districts. The challenges are as follows:

Poor infrastructure. The road networks around settlements are in poor condition. During a key informant interview, a technician from an electronics shop in Adjumani relayed that delivery of stock to the store is hampered by poor road conditions. This is exacerbated by the remoteness of the settlement's location. The cost of transporting goods is transferred to the customers, making the products more expensive.

Proposed mitigation: In the short term, development partners could support the private sector in setting up inventory hubs where the suppliers could store their products for local distributors to access easily.

This could be done on a cost-sharing basis between the suppliers, reducing the cost per unit and taking advantage of the economy of scale. For example, GIZ, through its Energising Development program, has been supporting approved stove distributors with inventory hubs to address the challenge of poor road infrastructure. In the long term, the development of road networks in refugee-hosting areas would be needed, which the Ugandan government could implement with financing from development partners.

Limited consumer financing options.

Almost all households acquired the solar product or cookstove they own in cash, with only 3 percent mentioning some form of consumer financing. Enterprises are wary of extending credit as they fear consumers will default on repayment because their incomes are low and seasonal.

Proposed mitigation: Support financial institutions to develop special financial products related to renewable energy for suppliers of energy products and consumers. The Uganda Energy Credit Capitalisation Company could also be encouraged to provide affordable credit lines to financial institutions as well as suppliers and consumers of energy in refugee-hosting areas.⁴² The study data shows a high rate of membership in savings groups among both hosts and refugees. Energy product suppliers should be encouraged to partner with village savings and loan associations to market quality-verified products. Members could access the products on credit from the group.

Lack of after-sales services for solar products (both solar home systems and pico-PV). While solar lanterns are widely present in the refugee-hosting districts, an issue that came up across the focus group discussions was the lack of repair shops for lanterns. Moreover, solar home systems were found lacking in operating infrastructure

for sales and after-sales services. The expectation is that a portion of solar lantern users, especially among businesses, will upgrade to solar home systems, which has a higher potential for productive uses. A focus group discussion with the host community in Yumbe revealed their hesitation in taking up new solar PV products due to a lack of service and maintenance points.

Proposed mitigation: Local electrical technicians and local youth more broadly could be trained to repair various types of solar products. This will increase confidence in and uptake of solar products by consumers, while creating an added income stream for the local youth. All suppliers of energy products should offer a warranty on their products, including solar lanterns, solar home systems, and improved cookstoves.

Low-quality products. There have been instances where pico-PV products and solar home systems did not work as expected or stopped functioning completely within a short time because the products were substandard. This experience lowers consumer confidence, dampening demand.

Proposed mitigation: Development partners working in refugee-hosting districts should promote only quality-verified solar products with a product warranty. The development partners should educate enterprises on how to identify and buy quality-verified versus non-quality-verified products. The products should comply with the standards laid out through Lighting Africa's Verasol program, supported by the World Bank Group. With UNBS adopting quality standards, the focus should also be on enforcing these standards for solar PV products.⁴³

Distribution of free products (solar lanterns and stoves) to refugees. There is a risk that the distribution of free products by humanitarian agencies could distort the

⁴² The Uganda Energy Credit Capitalisation Company (UECCC) is a government institution tasked with providing financial, technical, and other support to renewable energy projects in the country. It also administers the Uganda Energy Capitalisation Trust, which pools resources from the government and development partners to develop renewable energy projects. Source: UECCC website.

⁴³ UNBS is the entity responsible for enforcing quality standards in Uganda. Regarding solar home systems, UNBS approved quality standards for plug-and-play solar systems in 2021 and is developing quality standards for component-based solar systems.

market. About 15 percent of the population has received such products free of charge (mainly among refugees). While the majority of respondents purchased the products they own, the distribution of free products may affect the perception of their value among refugees and raise the expectation that these products should be given out for free in the future. Private companies may also be reluctant to expand to refugee-hosting areas as they may be concerned about competing with free products.

Proposed mitigation: Humanitarian agencies could implement cash transfer programs to allow refugees to buy their lighting and cooking products from local suppliers, instead of receiving free solar products or cookstoves. The agencies should ideally educate consumers on quality-verified products or have a pre-approved list of vendors from whom refugees could buy a solar product or cookstove using their cash transfers.

Difficulty in charging cost-reflective tariff (mini-grids). For mini-grids, the main challenge is finding the right balance between commercial viability and the ability and willingness of consumers to pay. The regulation of mini-grid tariffs and connection fees usually depends on the size of the project. However, this does not apply to existing mini-grids in Uganda as most are highly subsidized. Moreover, the set tariff level is often not cost-reflective and often depends on what the customer is able to pay, which at times is below the minimum needed to make the mini-grid economically viable. These relatively low tariff levels, combined with uncertain and often prolonged development processes, discourage investors.

Proposed mitigation: The government should explore allowing mini-grid operators to charge a rate that reflects costs. However, where the government identifies an area that should be electrified but the national grid is not a possibility, a special fund should be set up to lower the risks to the investors for a fixed period of time. This will allow the mini-grid to acquire the critical amount of electrical energy at the approved rate that will make the project financially viable.

Lack of coordination among development partners operating in refugee-hosting areas. Development partners have different renewable energy policies and projects in place, which are often not coordinated with other development partners and existing private sector actors. This is likely to discourage private sector investments.

Proposed mitigation: More engagement is needed through renewable energy working groups under the Comprehensive Refugee Response Framework for development partners to share information and coordinate their activities, to ensure that duplication is avoided and resources are efficiently used.

6.3 Proposed interventions

This section outlines possible intervention models that could be used to help overcome the challenges encountered by consumers and the enterprises providing the products and services. The survey demonstrated that as much as \$13 million is spent in refugee-hosting areas on torches and kerosene for lighting annually, and \$26 million is spent on charcoal and \$39 million on firewood for cooking. Thus, there is a considerable market for solar products and improved cookstoves if existing bottlenecks are addressed.

Consumer financing models

The average monthly income of a host household is \$57, while that of a refugee household is \$35—both of which are close to or below the national poverty line (\$1.90 per day). Low household incomes were one of the barriers cited in focus group discussions in Arua and Isingiro for uptake of renewable energy products.

Innovative consumer financing models are thus needed to accelerate the uptake of products. The PAYGo model has been adopted in other regions of the country but is nascent in the refugee-hosting districts. Lack of data on local energy demand, mobile money familiarity, and product affordability, as well as uncertainty over access to settlements and local workforce availability dissuaded investment in refugee-hosting areas.⁴⁴

44 Green Powered Technology for USAID Power Africa. 2020. De-risking Pay-As-You-Go Solar Home Systems in Uganda Refugee Settlements Project, Final Report.

A possible solution is implementing a challenge fund competition that would allow companies offering solar products and improved cooking solutions on credit to reach new customers in the refugee-hosting areas. Companies working on a PAYGo basis need to ensure that their customers fully understand what the proposed commitment involves, especially when working through agents that earn commission from sales.

Another option is for energy product suppliers to use village savings and loan associations as avenues to sell energy products, with members co-guaranteeing

each other. This mechanism can address the affordability barrier and the consumers will have an advantage in negotiating for competitive prices or credit terms, quality products, and after-sales service support with solar home system companies.

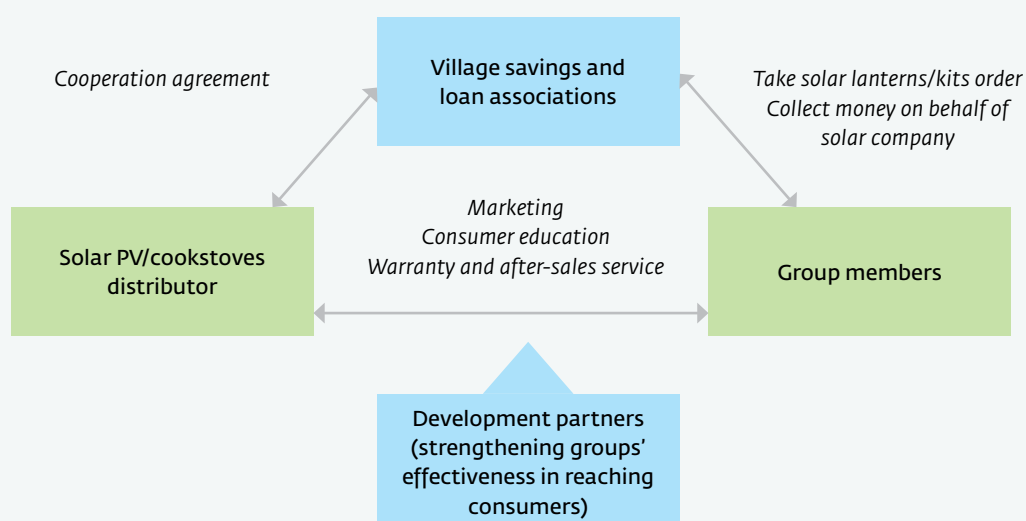
Figure 14 shows a consumer group lending approach where the group enters into an agreement with an energy product supplier and agrees on the payment terms with them. The group takes energy product orders from its members and the minimum agreed amount of money, which is then transmitted to the supplier to provide the goods ordered.

An example of a pilot PAYGo project in Kiryandongo and Rwamwanja refugee settlements

In 2019, Green Powered Technology won a grant from USAID to lower the risk of using PAYGo in disseminating solar home systems in Kiryandongo and Rwamwanja refugee settlements and host communities. The project is being implemented by three solar home system companies: BrightLife, Fenix International, and SolarNow. The aim of the project is to prove the viability of

using PAYGo to de-risk sales to refugee communities. The project employs refugee and host community members as sales agents. The target is to sell 10,000 solar home systems. While refugees were slightly inexperienced with long-term credit, repayment rates among refugees have generally been in line with rates the companies observed in their wider portfolios.⁴⁵

FIGURE 14: **Group lending model**



⁴⁵ USAID Power Africa. 2020. Advancing Energy Access in Refugee Settlements: Lessons Learned from Three Pay-As-You-Go Solar Home Systems Providers in Uganda.

Enterprise financing and strengthening business capacity

Local enterprises selling solar products and cooking solutions have strong potential to increase their customer reach. To that end, they need access to finance, links to suppliers of quality-verified products, and technical assistance to scale up their operations. For it to be successful, enterprise finance structuring should address the demand and supply dimensions of the business: first, the ability of the enterprise to secure affordable financing that is structured appropriately in relation to how the enterprise interacts with its suppliers and, second, how the enterprise sells its products to the consumers—either on a cash or credit basis.

From the survey, it is evident that consumers have low purchasing power. Enterprises thus need to be supported to devise mechanisms that would enable them to sell energy products without running into cashflow challenges. Appropriate enterprise

financing models should go beyond financing to strengthening the business systems and structures so that businesses are able to prudently use the funds received.

The Uganda Energy Credit Capitalisation Company was set up to address this challenge, among other reasons. During discussions, the company revealed that most of the businesses lack books of accounts, good corporate governance, and business plans, and fail to meet due diligence requirements. The company is collaborating with three banks (Centenary Bank, Post Bank, and Stanbic Bank) to provide working capital loans to solar companies, mainly to import solar home systems.⁴⁶ The company is also working in partnership with the Uganda Solar Energy Association to improve the investment readiness of solar enterprises. Other initiatives that support enterprises exist—such as the Renewable Energy Challenge Fund Uganda—that go beyond financing as it is evident that financing alone is insufficient.

⁴⁶ Uganda Energy Credit Capitalisation Company. 2021. Solar Loan Program, June 19, 2021. <https://www.ueccc.or.ug/programs/solar-loan-program/>.



The CleanStart program, under the auspices of the UN Capital Development Fund, aims to enhance access to energy in underserved areas and refugee-hosting districts, and provide financing and technical assistance to solar and cookstove manufacturers and suppliers operating in these areas. The program has a pipeline of 22 enterprises in solar and cooking solutions. The combination of financing and technical assistance could provide relief to the renewable energy enterprises as sourcing appropriate financing has been a challenge. However, the financing and assistance need to be tailored to the operating environment of the enterprises to address the challenges they face.

Institutional intervention

There is a need for sustainable interventions for both schools and health centers in refugee-hosting areas. Off-grid energy solutions could play a significant role in addressing the energy deficit, but substantial budget is required for installing the solar system, as well as for operational expenses and maintenance. A potential program should not focus solely on the procurement and installation of solar systems; it should also carefully consider the long-term sustainability of operating these systems. For such interventions to be successful, strong buy-in and alignment is required from the Ministry of Health, the Ministry of Education and Sport, and MEMD. An integrated results-based financing program is a possible vehicle for addressing the above challenges.

Results-based financing tackles wastage effectively as the institution only pays for the results delivered, as per the contract terms. The approach has the potential to incentivize stronger focus on the action necessary to improve access to clean, efficient, and adequate energy for health centers and schools. As a result, a well-designed results-based financing program is a prerequisite for any intervention. To ensure the program's success, the following building blocks need to be in place:

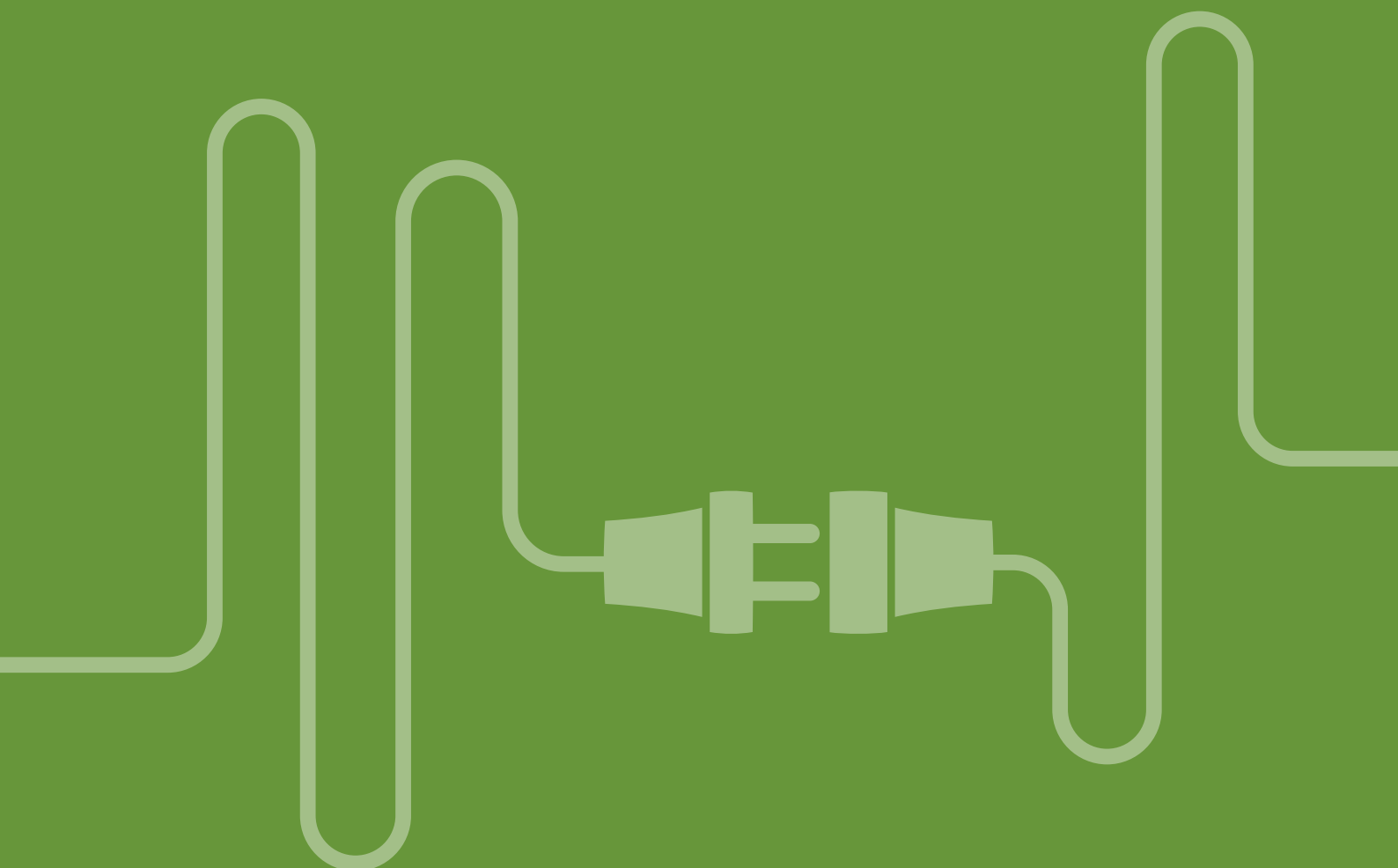
- Stakeholder buy-in for the program. The Ministries of Education and Health should support the initiative and be aligned with the Ministry of Energy in facilitating the delivery of appropriate energy to the institutions.
- Capacitated enterprises supplying the technology solutions. This capacity may need to be developed.
- Systems necessary for the smooth running of results-based financing, such as disbursement and procurement being compatible with this financing approach and advance payment for future results.
- Enterprises with the necessary capacity to deliver products. This includes technical, results management, pre-financing, and delivery capacity.
- A capacitated fund manager to manage the contract, verify results, and disburse funds.
- Monitoring systems and feedback mechanisms between the program and stakeholders on progress and necessary adjustments.
- Mechanisms to ensure the sustainability of the initiative beyond the life of the program. For example, system operation and maintenance, and training technicians and identified staff to troubleshoot the system.

A potential program should not focus solely on the procurement and installation of solar systems; it should also carefully consider the long-term sustainability of operating these systems.

Conclusions and Recommendations

7

THE SOLAR LIGHTING MARKET HAS STRONG POTENTIAL TO DEVELOP FURTHER IN THE REFUGEE-HOSTING DISTRICTS.



Conclusions and Recommendations

7.1 Conclusions

The solar lighting market has strong potential to develop further in the refugee-hosting districts, as both refugees and the host community rely on solar products to meet their lighting needs. Pico-PV products are most common (at 33 percent), while 32 percent of households rely on non-rechargeable torches, 17 percent use solar home systems, and 10 percent use kerosene. Despite humanitarian agencies occasionally distributing free products to refugees, two-thirds of refugees declared having purchased the solar products they use.

Households spend \$10.1 million on replacement batteries for torches and \$2.9 million on kerosene for lighting annually—spending that can be redirected to buying solar products.

Households spend over \$2 per month on powering dry-cell torches and kerosene lamps. There is a strong case for transitioning a large number of households to using solar lanterns, especially ones with a mobile-phone-charging function, which would lead to further savings for households. Offering suitable consumer financing (such as purchases on credit with monthly charges of about \$2) could make solar products more affordable for torch users.

The survey showed that firewood and charcoal are almost the only cooking fuels used in the refugee-hosting districts. The reliance on wood fuel leads to significant environmental degradation and reduces the amount of fuel available in the future. Both communities mainly rely on inefficient stoves, which use significant amounts of firewood or charcoal. Households that regularly buy their firewood and charcoal spend on average \$10.60 and \$11.90 respectively. This is a significant amount when weighed against the average household income in the area (\$57 for hosts

and \$35 for refugees). The available stoves are self-made or produced locally by artisans but lack standards that will guarantee cleaner and more efficient performance. There is strong potential to transition households to using more energy-efficient stoves, which would lead to significant savings on fuel purchases, as well as alleviate the adverse environmental impacts.

A structured program is needed that will address various challenges facing the solar and cookstove markets. Such challenges include low product standards, lack of awareness of product quality, weak supply chains, and skewed financial systems that fail to accommodate the poor and the vulnerable. In particular, private companies should promote quality-verified products and offer a warranty on all products, including solar lanterns, solar home systems, and improved cookstoves. Similarly, educating consumers on the benefits of improved cookstove use, while emphasizing significant fuel savings, should be an integral part of companies' entry or expansion strategies in refugee-hosting areas.

Refugees are viewed as a risky credit demographic by suppliers as it is difficult to determine their creditworthiness based on asset ownership. The existing adoption levels of solar products indicate that the supply value chains are somewhat established but that more support is needed to ensure that refugees have financial access to these products. Increasing the presence of the private sector will necessitate financing incentives to help them get established and operate, and gather market intelligence for serving refugees. There is strong potential to use mobile money—over half of all respondents reported owning a mobile money account. Mobile money has proven to be an ideal platform for consumer transaction and credit systems, especially for low-income households. Furthermore,

opportunities exist for companies selling quality-verified solar products and cookstoves to engage with local savings groups to market and sell quality-verified solar products on credit. This would also help companies to reach more women, many of whom are members of savings groups.

Productive use of energy needs to be scaled up to increase energy consumption in the area. A majority of respondents in the business survey mentioned that they did

not use any appliances for productive use. Although agriculture is the main activity in communities, there was no evidence of intensive agricultural activities powered by renewable energy. Partnerships are needed between agricultural value chain actors and energy services providers to set up energy-intensive agribusiness operations that will create energy demand. Easing access to appliances such as water pumps or refrigerators for businesses could similarly increase the demand for electricity.



7.2 Recommendations

This section sets out key recommendations for IFC to support and catalyze the entry of the private sector to build a market-based economy in the refugee-hosting districts. These are not stand-alone recommendations, and some must be addressed simultaneously to realize the benefit.

Demand-side interventions

Promote the use of energy-efficient stoves and alternative fuels. Consumers need to be educated on the use of energy-efficient stoves, which have strong potential to significantly reduce households' recurrent expenditure on wood fuel and reduce the associated environmental impacts. Shifting consumer preference for these cookstoves to an alternative such as LPG and ethanol will require a major emphasis on additional benefits such as health as well as building a supply chain to make the technology and fuels more accessible. Projects promoting relatively cheaper fuels such as briquettes and biogas should also be prioritized as they have the potential to reduce the burden of buying charcoal and firewood on household incomes. Switching to alternative fuels will also reduce safety risks to women and children, who are primarily responsible for collecting firewood.

Promote the use of quality-verified solar products. Resentment toward poor-quality solar products is likely to lower demand. All marketed solar products (both solar lanterns and solar home systems) should follow the minimum quality standards (such as Verasol or UNBS) and must come with a warranty. UNBS is responsible for adopting and enforcing quality standards in Uganda and has already introduced relative standards for solar products. Development partners could thus partner with UNBS to educate consumers on the benefits of buying quality-verified products and how to distinguish between quality-verified and non-verified products.

Strengthen productive uses of energy to increase the demand for power.

Extending the grid or mini-grid is very expensive due to low power consumption in refugee-hosting areas and low ability to pay. Most of the population derives their livelihood from farming or farming-related activities. To increase the demand for power, businesses would need to have easier access to productive equipment and energy-efficient appliances, which they could buy either in cash or on credit. For productive uses of energy to be realized at scale, strategic partnerships are needed between the energy providers and agencies involved in the agricultural value chains (such as the milk industry, oil presses, and egg incubation) and the ICT sector to assess and develop the untapped potential. Introducing solar-powered drip irrigation and solar-powered cool chains should also be considered as it would strengthen local agricultural production and facilitate the transportation of fresh produce to the markets.

Supply-side interventions

Support energy enterprises trading in solar products and improved cookstoves to become investment ready. Companies need to be capacitated to set up systems and structures for keeping records and managing finances, marketing, leadership, and governance to be investment ready. This should be done through training tailored to each enterprise's needs.

Strengthen the supply chain for energy products. The refugee-hosting districts have poor road infrastructure, and some are in remote locations. Development partners could support the main suppliers of solar products and cookstoves, the majority of whom are based in Kampala, to set up inventory hubs to make the energy products more accessible to local distributors, and ensure that the suppliers can run the hubs on their own as they grow the market. Dispatching large consignments in one go

will reduce the cost of the products and bring their price closer in line with those being traded in Kampala or other major towns with good infrastructure.

Promote clean-energy alternatives for cooking. Development partners could encourage the private sector to set up the necessary infrastructure to pilot clean-energy cooking initiatives. This could include setting up or strengthening ethanol and LPG supply chains. The upfront cost of buying the appliances and cylinders is a key barrier to adoption, so consumer education on the benefits of using alternative fuels is needed. A possible approach could involve offering LPG as a service where consumers are charged for the gas consumed through a PAYGo model. Such models are being applied in Kampala by Wana Energy Solutions as well as in Kenya by Envirofit and PAYGo Energy in partnership with Safari Supa Gas. Due to the costs involved in setting up the infrastructure (including the cylinders, smart meters, and bulk LPG tanks), capital support is critical to realize uptake. Overall, innovation should be encouraged so that private companies develop new approaches to make the products more accessible and affordable to the population.

Access to finance

Strengthen consumer financing mechanisms. Refugees are viewed as a risky credit demographic by suppliers as it is difficult to determine their creditworthiness based on asset ownership. Few people have commercial bank accounts; however, use of alternative accounts such as mobile money and savings groups such as village savings and loan associations is fairly strong in the refugee-hosting districts. This presents an opportunity for development partners to support the private sector by lowering the risks of their investment. Potential interventions could include incentivizing

suppliers who offer credit to establish and expand operations to serve the refugee settlements; offering smart subsidies on products; offering guarantee mechanisms; and strengthening the lending platforms that the communities already have confidence in, such as informal savings groups and savings and credit associations. Another option is to set up a challenge fund competition on access to clean energy in refugee-hosting areas. Consumers purchasing products on credit need to be made fully aware of what the commitment would involve. In addition, providers of energy loans should consider offering a flexible repayment schedule, such as aligning it with agricultural production cycles and therefore household incomes.

Work with informal savings and credit groups to market quality-verified solar products. These groups are a key source of loans for 45 percent of host community members and 33 percent of refugees. Women, in particular, are often part of such groups. Based on the survey, they have lower access to formal financial services. Suppliers of quality-verified energy products could use these groups as an avenue to market and sell their products, while the groups themselves could provide loans to their members to acquire these products.

Capacitate financial institutions to develop energy loans. Development partners could help financial institutions develop energy loans that align with the energy sector. To develop an effective training package, the needs of financial institutions must be better understood and addressed by the training, such as improved understanding of the business models of solar companies. Financial institutions could also be encouraged to develop green financing strategies to facilitate the provision of energy loans.

Mini-grid extension

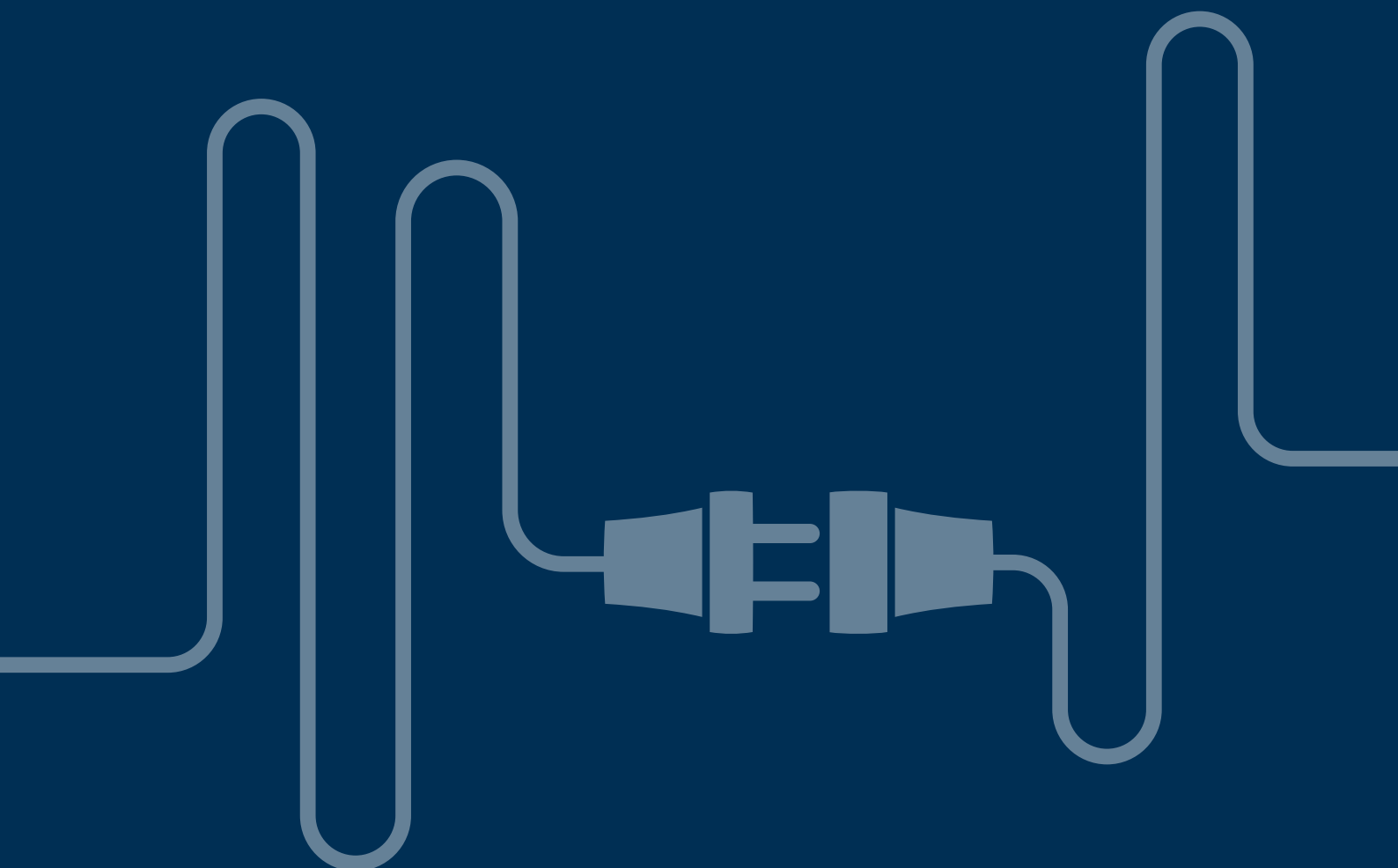
Set up a fund for mini-grids with government support. Mini-grids in Uganda often do not charge a cost-reflective rate. Therefore, development partners could help the government to set up a special fund to incentivize mini-grid investors. The fund would provide financing until a critical amount of electrical energy is reached and the mini-grid becomes self-sustaining. Ideally, humanitarian organizations could become anchor loads for mini-grids.

Consider the environmental impact of e-waste produced by solar products. As the solar market continues to develop in the refugee-hosting areas, the amount of e-waste produced by discarded products is expected to increase significantly. It will be necessary to promote interventions to recycle the products' batteries and other components, possibly bringing in private companies that run recycling programs in other parts of Uganda.

Other

Strengthen coordination among the players in the refugee-hosting districts. Many actors work in the energy space in the refugee-hosting districts, from NGOs and the private sector to UN bodies; however, there is minimal coordination to ensure that a strong market is developed. An example of this is the distribution of solar lanterns and cookstoves for free or at highly subsidized rates. Humanitarian agencies should be encouraged to become anchor loads for potential mini-grids, which could also expand access to electricity for nearby residential areas.

Annexes



ANNEX 1: Businesses, Schools, and Institutions Interviewed

Businesses interviewed

District	Number of businesses	Host businesses	Refugee businesses
Adjumani	12	11	1
Arua	32	14	18
Isingiro	19	13	6
Kamwenge	13	6	7
Kikuube	20	8	12
Kiryandongo	11	11	0
Koboko	6	2	4
Kyegegwa	8	7	1
Lamwo	5	5	0
Moyo	4	0	4
Yumbe	19	10	9
Total	149	87	62

Schools and institutions interviewed

Name of institution			Location		
Schools			Health centers		
1	St Josephine Nursery School	Maaji, Adjumani district	1	Ayiri Health Centre 3, Maaji	Adjumani district, Ukusijoni Sub-county
2	Bright International Primary School	Nakivale, Kigali base camp	2	Kibengo Health Centre	Nakivale
3	Nakivale Primary School	Kakoma	3	Panyadoli Health Centre 3	Kiryandongo
4	Koozi Primary School	Kityaza (host community of the Nakivale settlement)	4	Nyakadoti Health Centre 2	Kiryandongo
5	Arnold Primary School	Kiryandongo	Government offices		
6	Bidong Primary School	Kiryandongo	1	District local government office	Yumbe
7	Panyadoli Vocational Training Institute	Kiryandongo			

ANNEX 2: Screening Categories of Renewable Energy Projects

Screening category	Definition	Types of energy projects
1	Projects normally exempt from an environmental impact assessment	Solar PV <10 kW Stand-alone wind turbine <100 kW Household biogas unit Household generator <5 kW Power substations <100 kVA Single-phase power distribution lines Triple-phase power distribution lines <1 km
2	Energy projects for which adequate mitigation measures must be determined either directly or through an environmental impact review	Hydropower <500 kW Stand-alone wind turbine >100 kW Wind farm <15 machines Stand-alone gasifier <50 kW Stand-alone generator <500 kW Cogeneration <500 kWel Power substations <1,000 kVA Triple-phase power distribution lines <10 km Commercial energy farming <50 ha (crops only for energy) Industrial charcoal production <3,000 tonnes/year
3	Energy projects requiring a full environmental impact assessment	Wind farm >15 machines Hydropower ≤ 500 kW Gasifier >50 kW Thermal power generation Cogeneration projects >500 kW Electric power transmission lines Triple-phase power distribution lines >10 km Power substations >1,000 kVA Geothermal power projects (starting with appraisal drilling) Petroleum exploration and production (starting with appraisal drilling) Petroleum storage facilities (storage tanks) Petroleum refinery Petroleum pipeline Commercial petroleum transportation Petrol station construction Commercial energy farming >50 ha (crops only for energy) Industrial biodiesel/ethanol production Landfill gas extraction Natural gas extraction Natural gas transportation Large-scale natural gas storage

ha = hectare, km = kilometer, kVA = kilovolt-ampere, kW = kilowatt, kWel = kilowatt-electric

ANNEX 3: Images of Cookstove Options



Burn
(example of a
manufactured
improved
firewood stove)



Ceramic Jiko
(ceramic
charcoal
stove)



**Contained
and
movable
open fire**



Envirofit
(example of a
manufactured
improved
charcoal stove)



**Firewood
stove**



Gasifier



**Immovable
open fire with
ceramic lining**



**Kerosene
wick stove**



Meko (LPG)



**Metallic
charcoal
stove**



Mud stove



**Rocket
Lorena**



**Three-stone
open fire**

ANNEX 4: Images of Lighting Options



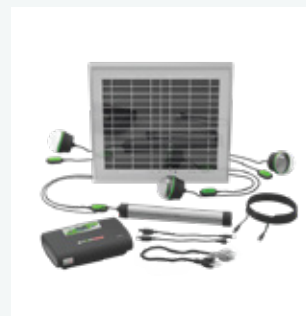
Candle



Hurricane/
kerosene
lamp



Open
wick lamp
(tadooba)



Solar home
system



Solar
lantern



Solar lantern
with mobile
phone
charging



Torch

Photo Credits

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Hut with solar panel: © Warren Parker / Shutterstock

Interior

ASIGMA Advisory: page 14.

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Annex 3: Images of Cookstove Options

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Three-stone open fire: © Clean Cooking Alliance / <https://www.lowtechmagazine.com/2014/06/thermal-efficiency-cooking-stoves.html>

Annex 4: Images of Lighting Options

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