A ROADMAP FOR ENERGY ACCESS IN DISPLACEMENT SETTINGS: KENYA

unitar
United Nations Institute for Training and Research

GPA
GLOBAL PLATFORM FOR ACTION

SNV

Acknowledgements

Acknowledgements

The authors would like to thank all participants of the READS Kenya workshop for their valuable input:

Brian Oiro, Chantal Mugisha, Charles Nyadero, Christine Uluma, Francis Anno, Francis Kariuki, Hassan Ahmed, Hussein Abdirahaman, Iten Simon Lokol, Jackline Achola Paul, Japheth Mutungi, John Eporon, John Njogu, Joseph Imuton, Karlijn Groen, Kassim Abdi, Kennedy Odhiambo, Kevin Ayieng, Kelvin Kiamba, Mbonimpa Isaie, Misia Daniel, Mohamud Omar, Nicodemus Njogu, Odhteng Akway, Paul Onana, Ranisha Basnet, Raphael Basemi, Sarah Erupe, Simon Kiarie, Thomas Kemei, Vasco Hamisi, Wilkista Akinyi

Authors: Philip Sandwell, Megan Täuber, Nyayow Deng Chuol

SNV: Karlijn Groen and John Njogu

Peer reviewers: Karlijn Groen, John Njogu, Paul Quigley, Wilkista Akinyi, Dr. Francis Ekiru, Joelle Hangi, Elif Gül Demir, Arielle Ben-Hur

Design: Élise Taponier

GPA Coordination Unit support: Sadiq Zafrullah, Mariana Soto, Mark Gibson, Sarah Rosenberg-Jansen, Thomas Fohgrub

Suggested citation: Philip Sandwell, Megan Täuber and Nyayow Deng Chuol (2023) A Roadmap for Energy Access in Displacement Settings: Kenya. UNITAR. Geneva, Switzerland.

Donor: IKEA Foundation

IKEA Foundation

Acknowledgements

About the GPA

The **Global Platform for Action on Sustainable Energy in Displacement Settings** (GPA) is the global initiative to promote actions that enable sustainable energy access and use in displacement settings. The GPA strives to remove barriers to energy access in humanitarian settings by providing a collaborative agenda for energy, development, and humanitarian partners to deliver concrete actions of Sustainable Development Goal 7 (SDG 7) for displacement contexts. It promotes and contributes to the humanitarian sector's transition to renewable energy, which will increase efficiency and reduce costs and carbon emissions. Hosted by the United Nations Institute for Training and Research (UNITAR), the GPA Coordination Unit galvanises collective action towards the GPA's realisation.

About the READS Programme

The **Roadmaps for Energy Access in Displacement Settings (READS) Programme,** funded by the IKEA Foundation and implemented by the GPA Coordination Unit at UNITAR, will produce a "roadmap report" for each of the ten countries in its scope. The roadmap reports take stock of the state of energy access in displacement settings in each country with a focus on identifying gaps and high-impact project opportunities to increase sustainable energy access for displacement-affected communities.

These reports consolidate existing data and are informed by workshops with in-country stakeholders to develop and refine the research, including representatives of communities which have been affected by displacement, energy companies, humanitarian and development organisations, and governmental authorities, among others. The roadmap reports present project concepts that have been prioritised by local partners as being the most impactful areas for sustainable energy interventions in displacement contexts. Each roadmap report is produced in partnership with an organisation working in displacement contexts in the focus country.

About the READS Kenya Partner

SNV is a not-for-profit international development organisation, working in Energy, Agriculture and Water, Sanitation & Hygiene. Founded in the Netherlands in 1965, it has built a long-term local presence in more than 25 countries in Asia, Africa, and Latin America. In Kenya, SNV has been at the forefront of national development, facilitating support to the private, public, and non-governmental organisations for improved access to energy, water and agricultural goods and services for underserved populations within rural, peri-urban as well as urban areas and displacement settings. Within the energy sector, SNV is a facilitator of commercially viable markets for renewable energy to enhance energy access for households and MSMEs. By ensuring energy access and facilitating progress in market development, gender equality, security, health, education and climate change mitigation, our energy projects have directly improved the lives of millions of people around the world. SNV is a member of the GPA's Steering Group.

About the IKEA Foundation

The **IKEA Foundation** is a strategic philanthropy that focuses its grant making efforts on tackling the two biggest threats to children's futures: poverty and climate change. It currently grants more than €200 million per year to help improve family incomes and quality of life while protecting the planet from climate change. Since 2009, the IKEA Foundation has granted more than €1.5 billion to create a better future for children and their families. In 2021 the Board of the IKEA Foundation decided to make an additional €1 billion available over the next five years to accelerate the reduction of greenhouse gas emissions.

Table of Contents

Abbreviations

CRRF	*Comprehensive Refugee Response Framework*
DRC	*Democratic Republic of the Congo*
DRS	*Department of Refugee Services*
EAC	*East African Community*
EPC	*Electric pressure cooker*
EPRA	*Energy and Petroleum Regulatory Authority*
ESDS	*Energy Solutions for Displacement Settings*
FAO	*Food and Agriculture Organization of the United Nations*
GISEDP	*Garissa Integrated Socio-Economic Development Programme*
GIZ	*Deutsche Gesellschaft für Internationale Zusammenarbeit*
GOK	*Government of Kenya*
GPA	*Global Platform for Action on Sustainable Energy in Displacement Settings*
ICT	*Information and communication technology*
IFC	*International Finance Corporation*
INEP	*Integrated National Energy Plan*
KCB	*Kenya Commercial Bank*
KCJ	*Kenyan Ceramic Jiko*
KEREA	*Kenya Renewable Energy Association*
KES	*Kenyan Shilling*
KETRACO	*Kenya Electricity Transmission Company*
KISEDP	*Kalobeyei Integrated Socio-Economic Development Programme*
KKCF	*Kakuma Kalobeyei Challenge Fund*
KNES	*Kenya National Electrification Strategy*
KOSAP	*Kenya Off-Grid Solar Access Project*
KPLC	*Kenya Power and Lighting Company*
KRA	*Kenya Revenue Authority*
KW / KWP	*Kilowatt / kilowatt-peak*
KWH	*Kilowatt-hour*

Abbreviations

LOKADO	*Lotus Kenya Action for Development Organization*
LPG	*Liquefied petroleum gas*
MBEA	*Market Based Energy Access*
MFI	*Microfinance institution*
MOEP	*Ministry of Energy and Petroleum*
MTP	*Medium Term Plan*
MW / MWP	*Megawatt / megawatt-peak*
NEMA	*National Environmental Management Authority*
NGO	*Non-governmental organisation*
O&M	*Operations and maintenance*
PAYGO	*Pay-as-you-go*
PEPCI-K	*Piloting Electric Pressure Cookers in Kalobeyei*
POC	*Population of Concern*
PUE	*Productive uses of energy*
PVOC	*Pre-verification of conformity*
RBF	*Results-based financing*
RE4R	*Renewable Energy for Refugees*
READS	*Roadmaps for Energy Access in Displacement Settings*
REREC	*Rural Electrification and Renewable Energy Corporation*
RISE	*Regulatory Indicators for Sustainable Energy*
RRDO	*Relief, Reconstruction and Development Organization*
SDG 7	*Sustainable Development Goal 7*
SHS	*Solar home system*
UN	*United Nations*
UNHCR	*Office of the United Nations High Commissioner for Refugees*
UNITAR	*United Nations Institute for Training and Research*
USD	*United States Dollar*
VAT	*Value-added tax*
VSLA	*Village Savings and Loans Association*
WFP	*World Food Programme*

Overview of common energy terms in displacement settings

Energy technologies for electricity and cooking, and the terms used to describe them, can vary between countries, contexts, and organisations. The descriptions used in this report aim to conform with the most commonly-used definitions in displacement contexts but may differ from those used by other organisations.

TERM	DESCRIPTION
MULTI-TIER FRAMEWORK (MTF) FOR ACCESS TO ELECTRICITY	*Access to electricity is categorised across seven attributes: capacity, availability, reliability, quality, affordability, formality, and health and safety.* *Each attribute falls in a range from Tier 0 (no access) to Tier 5 (full access). The MTF was developed by the Energy Sector Management Assistance Program (ESMAP) at the World Bank to better categorise access beyond a simple binary comparison of "access or no access".*
SOLAR LANTERN	*Solar lanterns are an off-grid technology usually composed of a small solar panel, battery, and LED light integrated into a single unit.* *Solar lanterns can typically provide a few hours of light from a single charge and may have a USB connection for charging phones.* *Suitable for a single user or household, solar lanterns typically provide Tier 1 electricity access.*
SOLAR HOME SYSTEM (SHS)	*A solar home system (SHS) is an off-grid technology kit usually composed of a solar panel, battery, LED lights, switches and control systems, and often appliances.* *The size and services provided by a SHS can vary but typically offer several hours of electricity per day for lighting, phone charging, and appliances such as radios. SHS are used by both households and businesses, and sometimes by community facilities.* *SHS usually offer between Tier 1 and Tier 3 electricity access and can be acquired through upfront purchases or PayGo models.*
MINI-GRID	*Mini-grids are decentralised electricity networks which can operate independently of the national grid. They typically serve a community with tens to hundreds of connections.* *Mini-grids have a power source (usually solar or diesel), battery storage and a distribution network to supply electricity to customers, as well as power control systems.* *Mini-grids can be designed to provide any level of electricity access and usually provide Tier 1 to Tier 3. Customers could include households, businesses, community facilities, or other users. Customers typically pay fixed tariffs for electricity consumption, or daily rates.* *"Mini-grid" often refers to systems with capacities ranging from tens to hundreds of kilowatts, but generically could refer to smaller systems (also known as pico- or nano-grids) or larger ones, perhaps also with a connection to the national grid.*
STANDALONE SYSTEM	*A standalone system can provide electricity independent of the national grid, either fully off-grid or as a backup power source. Any type of electricity generation could supply a standalone system, but these are usually powered by diesel or solar with battery storage.* *Standalone systems typically refer to those which supply buildings, compounds, or operational purposes such as water pumps, but could include any off-grid system such as a mini-grid.*
NATIONAL GRID	*The national grid is the main electricity infrastructure of a country. It provides power through high-voltage transmission and distribution lines and is supplied by large-scale generation, such as power plants.* *The national grid can provide up to Tier 5 electricity access but, especially in remote areas and displacement contexts, its electricity supply may be unreliable or unavailable.*
OFF-GRID OR DECENTRALISED SYSTEM	*An off-grid or decentralised system can operate independently of the national grid network.* *The term "off-grid solar products" usually refers to consumer-focused systems, such as solar lanterns and SHS, whilst "decentralised systems" usually refers to larger systems such as mini-grids and standalone systems.*
PRODUCTIVE USES OF ENERGY (PUE)	*Productive uses of energy (PUE) include any applications of energy for businesses, income generation, or economic activity. This could include appliances or machinery to make work easier or more efficient, or to make new activities possible.* *PUE usually refers to electricity, but it also includes energy for cooking and other applications.*

Overview of common energy terms in displacement settings

TERM	DESCRIPTION
MULTI-TIER FRAMEWORK (MTF) FOR ACCESS TO COOKING	*Access to cooking is categorised across six attributes: exposure to harmful pollutants, energy efficiency, convenience of acquiring fuel and using the stove, safety, availability of fuel, and affordability.* *Each attribute falls in a range from Tier 0 (no access) to Tier 5 (full access). The MTF was developed by the ESMAP at the World Bank to better categorise access beyond a simple binary comparison of "access or no access".*
TRADITIONAL COOKING SYSTEMS	*Traditional forms of cooking include the use of simple stoves (such as open fires, three-stone fires, or mud stoves) and biomass fuels (such as firewood and charcoal). Traditional cooking systems are sometimes referred to as "basic" stoves and fuels.* *These cooking systems usually have high emissions and low efficiencies but are generally the cheapest and most accessible.*
CLEAN COOKING	*Clean cooking systems meet international standards for emissions at the point of use. These can include energy efficient or so-called modern forms of cooking including electric cooking, liquefied petroleum gas (LPG), and high-performing biomass stoves, such as some which use pellets.*
IMPROVED COOKSTOVES (ICS)	*ICS include a wide range of stoves which provide advantages over traditional stoves but generally do not reach higher tiers of access. ICS can use a variety of biomass fuels including firewood, charcoal, pellets, or briquettes.* *ICS can be produced locally or shipped from other locations and are generally lower-cost than other manufactured stoves.*
MODERN COOKING	*Modern cooking refers to stoves and fuels which meet Tier 4 standards across all attributes. These include LPG, biogas, electricity, and ethanol cooking systems.*
LPG STOVES	*Liquefied petroleum gas (LPG) stoves are clean cooking systems which use canisters of LPG as fuel. LPG stoves offer higher-tier cooking solutions but generally have high upfront costs and rely on LPG supply chains.* *LPG is a fossil fuel but is considered clean at the point of use.*
ELECTRIC COOKING	*Electric cooking includes several technologies. Energy-efficient electric pressure cookers (EPCs), slow cookers, and rice cookers are appliances which use electricity to heat a pot and are particularly well-suited to foods which require slower cooking, such as beans. These appliances can be powered by on- or off-grid systems but generally require a reliable supply of electricity.* *Electricity-assisted cooking stoves use electricity to improve the efficiency of cooking with biomass, for example using fans powered by solar panels to increase the airflow over the fuels. This can enable the stove to reach higher temperatures and efficiencies than traditional cooking systems, and it usually uses off-grid power.*
PRIMARY AND SECONDARY COOKING SYSTEMS	*Households may use more than one type of stove or fuel to meet their cooking needs. The primary stove and fuels are the most used ones, whilst the secondary stoves and fuels are used less frequently.*
STOVE STACKING	*Stove stacking describes a situation where a household has access to multiple forms of cooking systems. This is usually in reference to having an improved or clean cooking system but continuing to use a traditional cooking system. This could be due to various reasons, such as to cook different kinds of food, convenience, preferences, fuel shortages, or many other reasons.*

Executive Summary

Globally, over 100 million people have been forcibly displaced from their homes. Amongst those living in camps and settlements, more than 80% rely on cooking with firewood over open fires whilst over 90% lack access to electricity. Sustainable Development Goal 7 (SDG 7) calls for universal access to affordable, reliable, sustainable, and modern energy for all by 2030 – including communities affected by displacement. Rapid progress is required to achieve this ambitious goal.

The Roadmaps for Energy Access in Displacement Settings (READS) Programme aims to support the achievement of SDG 7 in ten countries, including in Kenya. The country hosts a total population of concern (PoC) of 588,724 people, of which 511,467 (87%) are refugees and 77,257 (13%) are asylum seekers. The term 'refugees' is used to include all People of Concern throughout this report for brevity.

This report summarises the status of energy access in displacement settings in Kenya with a focus on Kakuma and Kalobeyei due to the relative availability of relevant resources. It provides an overview of the stakeholders working towards SDG 7 and presents opportunities for high-impact projects to support increased access to sustainable energy for displaced people and host communities.

Energy access in displacement settings in Kenya

Household access to electricity and clean cooking

Most households in Kakuma and Kalobeyei, where 43% of Kenya's displaced population lives, have limited access to lighting and electricity services. Common sources of lighting include solar lanterns (29% of households), solar home systems (SHS) (16%), or private electricity providers (11%, usually using a diesel or solar mini-grid), although torches (13%) and mobile phones (11%) are also used. SHS distributors such as Bboxx, Sun King and d.light provide systems for both domestic users and business customers.

Three solar mini-grids operate in Kakuma and Kalobeyei: host community-owned company Yelele (7 kWp in Kalobeyei Village 3) and refugee-owned company Okapi Green Energy (20 kWp in Kakuma Sub-Camp 3) provide power to more than 50 customers each, whilst Renewvia's 541 kWp system in Kalobeyei Villages 1 and 2 is the largest mini-grid in East Africa and serves over 2,700 connections. There are also many diesel generator mini-grids providing power, but these businesses charge high tariffs which have recently increased further due to the rise in fuel prices.

The expansion of electricity access encounters several challenges. These include the perceived high costs and low quality of off-grid solar products, the high costs associated with unregulated diesel mini-grids, a scarcity of qualified local technicians and spare parts, and the limited coverage of solar mini-grids which currently charge different tariffs.

There are several opportunities to address these obstacles: on the supply side, efforts are already underway to expand the coverage of solar mini-grids. It was announced in May 2023 that Renewvia secured funding of up to $4.2 mil- ››

Executive Summary

lion to increase the capacity of their system from 541 kWp to 2.4 MWp, enabling them in the future to serve up to 19,000 customers in and around Kakuma. In addition, their partnerships with Okapi Green and Yelele present further opportunities to improve their reach. Electricity provision by the diesel mini-grids could also be enhanced by improving their wiring infrastructure, introducing metering systems, and potentially transitioning to solar power.

On the demand side, instalment payments or PayGo systems can reduce the financial burden associated with acquiring solar lanterns and SHS. These payment schemes must be accompanied by stringent product standards, warranties, and repair services to ensure product quality and customer satisfaction.

Present access to clean cooking in displacement settings in Kenya is also very limited. In Kakuma and Kalobeyei 92% of people rely on firewood as their primary cooking fuel, while charcoal use is also common. Most households use basic firewood and charcoal stoves stoves that they received for free or have built their own clay stoves. Local companies, like Usafi Green Energy and Sunken, also produce charcoal cookstoves within the camps, with demand significantly outweighing the available supply. Alternatives to biomass fuels are not widespread and the use of LPG is very limited owing to its high upfront cost. However, some projects, such as SNV's Piloting Electric Pressure Cookers in Kalobeyei (PEPCI-K), have piloted the use of electric pressure cookers with promising results.

Increasing access to cleaner forms of cooking in Kakuma and Kalobeyei faces several challenges, including a limited supply of raw materials for local cookstove production, high fuel costs, and substantial upfront investments required for multipurpose, LPG, or electric cooking solutions. These barriers can be addressed by assessing how best to scale up non-biomass cooking solutions, strengthening supply chains for raw materials to produce charcoal stoves locally, and improving the way charcoal is sourced and produced. For households, mechanisms such as results-based financing, improved access to credit, end-user subsidies, and flexible repayment methods can contribute to enhancing access to clean cooking along with awareness raising campaigns and cooking demonstrations that involve all household members. ››

Three solar mini-grid companies provide connections to households, businesses, and social institutions. Recent collaborations between them and new funding opportunities promise to scale up access to sustainable and reliable electricity.

Executive Summary

Businesses and productive uses of energy

Kakuma has a thriving economy with more than 2,500 businesses and access to energy can play a vital role in their success. A GIZ survey found that electricity access amongst businesses had increased from 9% to 47% between 2021 and 2022, whilst a separate SNV survey from 2020 reported that 73% of businesses wanted to obtain or increase their levels of access. The study also showed that mini-grids are the most commonly-used electricity source by businesses for high-power applications such as refrigerators or audio systems (34% using diesel mini-grids, 4% using solar mini-grids), but smaller off-grid solar systems are used for lighting and/or phone charging (43% of businesses). For restaurants and other cooking businesses, 96% use basic firewood or charcoal stoves but 58% expressed an interest in transitioning to alternative improved cookstoves, such as higher tier biomass stoves, LPG or e-cooking.

Increased access to productive uses of energy is limited mostly by the relatively low availability of energy technologies and low awareness of appliances. Increasing the reach of mini-grids could provide a reliable source of high-quality power necessary for many businesses, especially for manufacturing or internet and communications services. In addition, SHS have the potential to extend business operating hours or provide basic services like phone charging. Promoting and showcasing products, along with running sensitisation campaigns, can contribute to increasing familiarity and understanding of productive use appliances.

Social institutions and public lighting

Social institutions and community facilities (such as schools, clinics, and community centres) generally have better access to energy than households or businesses. Many rely on individual diesel generators for electricity, but standalone solar systems are also common – Lutheran World Foundation, for example, implemented these for 24 schools in Kakuma and five in Kalobeyei – as are connections to mini-grids. In terms of public lighting, 350 solar streetlights were installed around public facilities in Kalobeyei and 900 in Kakuma camp in 2016, but the overall coverage remains low. For cooking most social institutions rely on firewood and charcoal, however SNV's EnDev Market Based Energy Access (MBEA) Project has conducted a pilot initiative involving electric pressure cookers in four schools, powered by standalone solar systems or a mini-grid.

Sustaining access to electricity for social institutions faces significant challenges, primarily in the operation and maintenance of the systems, limited funding for upkeep, a scarcity of skilled labour, low community engagement, and the risk of vandalism. To ensure long-term access, connecting these community facilities and public lighting systems to mini-grids could provide a more reliable electricity source in the long term. Fostering community cooperatives and offering training and certification opportunities could increase local involvement and expand the pool of qualified technicians to maintain these systems. ››

Executive Summary

Humanitarian operations

Humanitarian operations typically have access to reliable and high-quality electricity to deliver essential services to displaced people. In Turkana the electricity supply in humanitarian compounds is generally sourced either from connections to the KPLC grid or from diesel generators. UNHCR is currently in the process of transitioning its compound to solar power. Solar power has already been implemented for 18 out of the 22 boreholes in Kakuma and Kalobeyei. While organisations may have limited internal capacity for designing, installing, and operating such systems, collaboration with the private sector can overcome these challenges and ensure the long-term performance of solar infrastructure.

Energy access in Dadaab

There has been less work done to increase energy access in the Dadaab camps in Garissa County compared to Kakuma and Kalobeyei in Turkana. The geographical challenges and limited accessibility of the camps pose significant obstacles to transporting people, raw materials, and goods, which increases costs and hinders potential linkages with suppliers and organisations operating in other parts of Kenya. The understanding of the situation on energy access in Dadaab is limited due to the scarcity of research and data, however a 2016 study revealed that 61% of households rely on battery torches for lighting, spending KES 230 ($2.30) per month, while 98% use firewood as their primary cooking fuel.

Substantial research and investment are needed to improve sustainable energy access in Dadaab. Previous projects have primarily relied on free distribution models due to a lack of private sector engagement. However, with appropriate support, a transition to market-based approaches similar to those implemented in Turkana could be possible. Establishing stronger connections with external actors beyond Dadaab will be crucial to increase private sector participation. This may involve de-risking financing to facilitate the establishment of supply chains and outlets in the camps, thereby improving access to sustainable energy products and services. ››

Substantial research and investment are needed to improve sustainable energy access in Dadaab. Learning from the work undertaken in Kakuma and Kalobeyei could help to accelerate the uptake of sustainable energy solutions.

Executive Summary

Energy access in urban settings

More than 90,000 displaced people live in Nairobi and other urban areas in Kenya. Compared to those living in camps, urban refugees are more dispersed, often limiting the direct support they receive from humanitarian organisations, especially if they lack proper documentation. In general, however, their access to energy is relatively high compared to camp settings.

Urban areas have high access to the national grid and 83% of households use pre-paid meters. Most urban refugee households rely on traditional cooking methods such as three-stone fires or low-tier biomass cooking solutions, especially charcoal stoves. Some families also use LPG stoves if they can afford them. The high upfront costs were viewed as the main barrier to transitioning to cleaner alternatives. ››

Over 90,000 displaced people live in Nairobi and urban areas in Kenya.

BARRIER	OPPORTUNITY
High costs of improved cookstoves, off-grid solar products, mini-grid tariffs, and productive use appliances	Instalment payments, flexible repayment mechanisms, customer subsidies, savings groups, easier access to credit
Limited private sector engagement	Provide funding through results-based financing schemes and grants to establish shops, outlets, storage facilities, and stove manufacture in displacement settings
Low awareness of sustainable energy technologies and their benefits	Product showcases and demonstrations, cost-value comparisons, awareness raising campaigns supported by influential figures, and end-user training
Lack of qualified local technicians, maintenance for energy technologies, and spare parts	Certified training and capacity building which provide recognised qualifications, establishment of hubs with trained technicians for basic repair and maintenance services, inclusion of warranties and expansion of after-sales services, supply chain development for spare parts

Executive Summary

Stakeholders in Kenya

The Government of Kenya's Department of Refugee Services manages the national refugee response, overseeing services such as registration. UNHCR manages the refugee camps and villages and also runs projects focused on livelihoods, agriculture, and education, which are further supported by several implementing partners. National, county, and sub-county government organisations oversee their specific mandates whilst humanitarian and development organisations run interventions across a range of focus areas, including energy. Refugee and community groups play a key role in engaging with community members and representing their needs, including for energy interventions.

Several refugee-led companies and organisations work in the domain of energy provision in Kakuma and Kalobeyei. These range from refugee-led solar mini-grids (such as Okapi Green, Yelele) to local cookstove manufacturers (Sunken, Usafi Green) as well as waste recycling organisations (Fradi, Faulu Productions) and social enterprises working on improving internet connectivity (Kakuma Ventures). Private sector engagement is increasing in Kakuma and Kalobeyei, including both local and international companies providing off-grid solar products, SHS (Bboxx, Sun King, Solaria), and connections to solar or diesel mini-grids. The recent expansion of Renewvia's solar mini-grid, initially supported by GIZ and then the Kakuma Kalobeyei Challenge Fund, has provided the opportunity for thousands of new customers to access electricity. Many of these have been supported by training and market development assistance led by NGOs, such as under SNV's EnDev MBEA project.

Opportunities to improve access to sustainable energy

There is huge potential to improve access to sustainable energy for displacement-affected communities, i.e. refugees and host communities, in Kenya. National policies towards increasing the self-reliance of refugees and their economic integration into host communities, and favourable policies towards sustainable energy projects, together offer a strong foundation for improving access to electricity and clean cooking solutions. Particularly in Kakuma and Kalobeyei, private sector engagement – supported by coordinated actions with humanitarian and development organisations, government partners, and the communities themselves – has demonstrated the potential for market-based programming. Small local cookstove companies and large solar mini-grid projects alike have helped to initiate improved access to energy, but these need further scale-up and, additionally, replication in Dadaab where fewer projects have taken place.

The READS Programme, in partnership with SNV, hosted an engagement workshop in Kakuma, Kenya in March 2023 which brought together stakeholders working on energy in displacement settings in Kakuma, Kalobeyei and Dadaab. During a co-design session, participants established the foundations for high-impact project concepts to improve access to sustainable energy. These concepts were subsequently developed and refined, drawing upon previous work in Kenya and other displacement settings, to showcase potential investment opportunities and serve as a starting point for future support. A summary of these project concepts is shown in Table 1. ››

Executive Summary

TABLE 1

High-impact project concepts to increase sustainable energy access with estimates of their potential reach, duration, budget, and scalability.

PROJECT	NAME	REACH	DURATION	BUDGET	SCALABILITY
1	*Improved charcoal stove production*	*100,000 households*	*3 years*	*$1 million*	*Moderate*
2	*Scaling electric pressure cookers*	*6,000 households, businesses and social institutions*	*3 years*	*$1 million*	*Moderate*
3	*Household lighting solutions in Dadaab*	*10,000 households*	*3 years*	*$500,000*	*High*
4	*Solar mini-grid expansion in Kakuma and Kalobeyei*	*15,000 connections*	*3 years*	*$5 million*	*High*
5	*Feasibility study for solarising private diesel-based electricity provision*	*N/A*	*1 year*	*$300,000*	*Moderate*
6	*Block mini-grids for community groups*	*300 connections*	*3 years*	*$600,000*	*Moderate*
7	*Public lighting through community compounds*	*400 streetlights*	*3 years*	*$1.4 million*	*Moderate*

Improving access to sustainable energy will require a coordinated effort and a shared vision between all stakeholders working in displacement contexts. Based on the findings in this report, the READS Programme has outlined a roadmap for energy access in displacement settings in Kenya with short (2023-2024), medium (2025-2027) and long term (2028-2030+) goals. These include scaling up solar mini-grid capacities, improving local cookstove production, increasing the use of electric cooking, expanding the reach of solar streetlights, and promoting productive uses of energy for businesses.The challenge is huge: achieving access to affordable, sustainable, reliable, and modern energy for refugees and host communities by 2030 will require more projects, activities, partners, coordination, and investment than ever before. Fortunately, the projects and stakeholders already working in Kenya offer an excellent foundation to scale up sustainable energy access in displacement settings in pursuit of achieving SDG 7. ●

01

Setting the scene

Setting the scene

In Kenya's refugee-hosting counties, Turkana and Garissa, energy access for both refugee and host communities is limited. The majority of households rely on traditional, low-tier charcoal and firewood stoves for cooking, and the escalating prices of charcoal and firewood impose a significant financial burden. Collecting firewood from the local environment has led to severe environmental degradation and can expose people to risks of assault, as well as contribute to tensions between communities due to scarce resources. Moreover, cooking over basic and inefficient stoves can cause or worsen health issues, particularly impacting women and girls who typically bear the responsibility of cooking.

Electricity access is also low in and around Kenya's refugee camps. Although off-grid solar products, such as solar lanterns and solar home systems (SHS), can provide households with basic lighting and electricity services, their uptake is limited by high prices. Additionally, solar minigrids have been introduced – and continue to grow – alongside existing diesel-based systems, offering power to businesses and social institutions like schools and clinics. However, these solutions are often hindered by limited coverage or insufficient capacity.

The private sector, supported by humanitarian and development actors, is driving a growing market for energy products and services in displacement settings, catering to both cooking and electricity needs. While this presents a solid foundation for future endeavours, there remains a pressing need for significant efforts to address the scale of energy requirements in these contexts and provide sustainable energy for all.

Addressing the challenge of achieving universal access to sustainable energy in displacement settings requires coordination at all levels – from global to local [1]. International targets for energy access are met through implementation on the ground with each country, region and community needing its own consideration and planning to reach this shared goal. At present the amount of research and evidence to support this objective, however, does not match the scale of the challenge and is typically disparate and hard to find.

Acknowledging this, the READS Programme aims to provide a country-level overview of sustainable energy in displacement settings, and a focus on individual settlements and communities where possible. With the Programme working across ten countries, Kenya – alongside Rwanda and Uganda – is amongst the first to be featured in a READS Roadmap Report.

A goal of the READS Programme is to identify new opportunities for high-impact projects to increase sustainable energy access by consolidating the existing knowledge on sustainable energy in displacement settings. This includes published literature – such as government policies, programme output reports, datasets, academic papers, and press releases – but also the experiences and expertise of practitioners working on project implementation and, most importantly, of community members. ››

Setting the scene

In support of this the READS Programme hosted a workshop in Kakuma, Kenya in March 2023 to engage with these stakeholders. Participants included representatives of communities which have been affected by displacement, the private sector, humanitarian organisations, and governmental authorities, among others. As the literature and workshop focus primarily on experience in the Turkana County, with limited representation from Garissa County and refugees living in urban settings, the READS Programme invited participants working in Dadaab and undertook seven key informant interviews with urban refugees in Nairobi to also represent these areas.

Using published literature, the knowledge and experiences shared during this workshop, and primary qualitative research, the READS Kenya Roadmap Report highlights the most pressing gaps, barriers, and opportunities for sustainable energy in displacement settings, as well as the roles of the stakeholders involved. It also provides a spotlight for potential high-impact projects, co-designed in the workshops by stakeholders from different types of organisations, which could rapidly and radically improve sustainable energy access if they received support and investment.

The energy needs of each community, household, business, or institution will vary, as will the most effective ways of addressing them. This report aims to be as broad as possible in covering different kinds of energy access, and as comprehensive as possible in each topic, but is inherently limited by the nascent nature of research on sustainable energy in displacement settings and the uniqueness of each context. The authors hope that further research – perhaps focusing on specific areas of energy access, settlements, or the impact of new projects – can build on this report by diving deeper into these areas and promote a greater uptake of sustainable energy in displacement contexts.

©GIZ

At the READS workshop, stakeholders shared their experience through co-designing potential high-impact sustainable energy projects.

02

Forced displacement in Kenya

National overview

The Republic of Kenya is home to around 55 million people and its geography, climate and population density vary widely across the country. Kenya is classified as a lower middle income country [2] and is a unitary presidential republic, with the incumbent president William Ruto in office since September 2022 and its 47 semi-autonomous counties having devolved responsibility for functions such as agriculture, transport, and planning and development, including for energy. The political, economic and social stability is relatively high in Kenya, particularly considering ongoing conflicts in neighbouring Somalia and South Sudan [3].

Kenya has a total population of concern (PoC) of 588,724, of which 511,467 (87%) are refugees and 77,257 (13%) are asylum seekers [4]. As shown in Table 2, most refugees are from Somalia (55%) and South Sudan (31%) whilst most asylum seekers are from the Democratic Republic of the Congo (DRC, 28%), Burundi (21%), Somalia (19%) and Ethiopia (16%); groups from each country are present in each PoC status. For brevity, the term 'refugees' is used to include all People of Concern throughout this report.

Turkana County in northwest Kenya hosts 254,962 displaced people (43%), the majority of whom originate from South Sudan. Most people live around the town of Kakuma, the headquarters of the west district of the county, in two main locations: Kakuma Refugee Camp, which is composed of four sub-camps, and Kalobeyei Integrated Settlement, which is composed of three villages [6]. For convenience, these locations are commonly referred to as "Kakuma" in aggregate. Garissa County in eastern Kenya hosts 240,984 displaced people (41%), almost exclusively from Somalia. Displaced people living in Garissa County are centred around the town of Daadab in a complex comprised of three refugee camps: Dagahaley and Ifo, in Lagdera district, and Hagadera in neighbouring Fafi district [7]. As with Kakuma, these sites are often collectively referred to as "Dadaab". The capital Nairobi is home to 92,778 refugees and asylum seekers (16%), mostly people from DRC, Somalia, and Ethiopia. Most urban-based displaced people are resident in Nairobi but also in other towns and cities around Kenya. A breakdown of the populations in each location is given in Table 3 with the locations shown in Figure 1.

The refugee contexts in Kenya will continue to be influenced by political developments and the humanitarian situations in Somalia and South ››

TABLE 2

The population of Kenya [5], the populations of concern and their countries of origin as of 31 March 2023 [4].

		PEOPLE	%
POPULATION	RURAL	39,318,626	72
	URBAN	15,667,080	28
	TOTAL	***54,985,706***	***100***
REFUGEES	SOMALIA	281,319	48
	SOUTH SUDAN	157,402	27
	DRC	33,766	6
	ETHIOPIA	21,847	4
	BURUNDI	8,392	1
	SUDAN	5,756	1
	OTHERS	2,985	1
	TOTAL	***511,467***	***100***
ASYLUM SEEKERS	DRC	21,653	28
	BURUNDI	16,434	21
	SOMALIA	14,761	19
	ETHIOPIA	12,077	16
	SUDAN	4,822	6
	OTHERS	7,510	10
	TOTAL	***77,257***	***100***

National overview

Sudan, the countries of origin for the majority of refugees in Kenya; despite being protracted displacement situations, new entrants to Kakuma and Dadaab continue to arrive. The fragile political situations and ongoing conflicts in other countries in the region, including in DRC, Ethiopia, and Sudan, as well as the climate crisis, will continue to impact the situation in Kenya. Whilst these situations are ongoing, voluntary repatriations have also been taking place: for example, around 85,000 Somali refugees returning home in the first months of 2022 [9]. ●

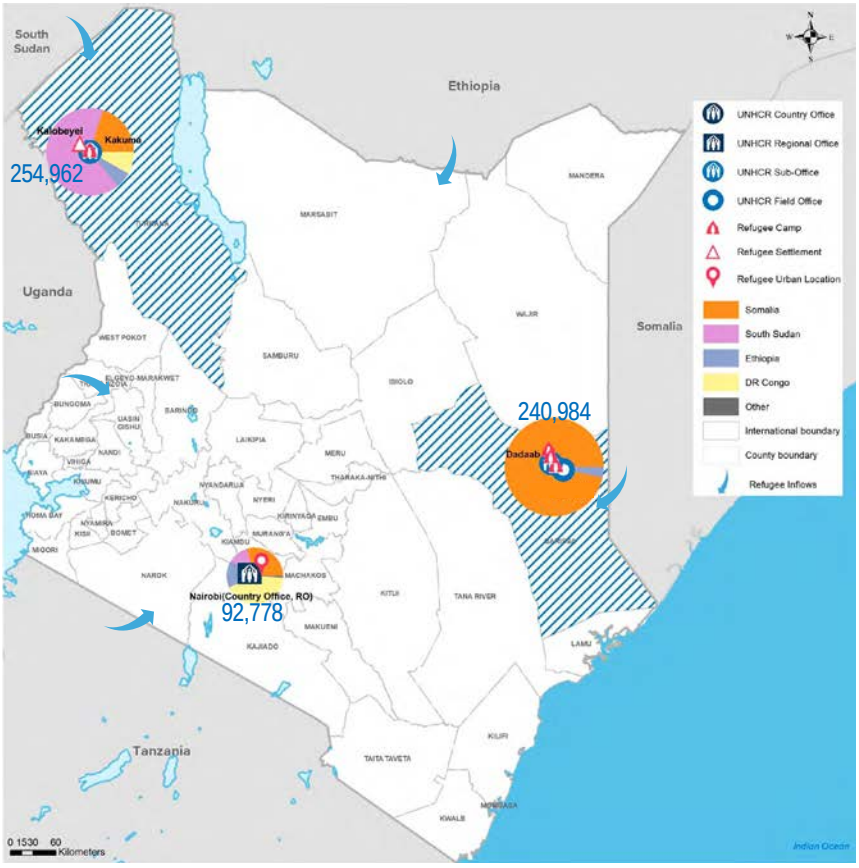
TABLE 3

The PoC by county and location [4].

COUNTY	LOCATION	POC
TURKANA (KAKUMA)	*Kakuma Refugee Camp*	*201,579*
	Kalobeyei	*53,383*
GARISSA (DADAAB)	*Hagadera Refugee Camp*	*82,955*
	Dagaheley Refugee Camp	*79,028*
	Ifo Refugee Camp	*79,001*
NAIROBI	-	*92,778*

FIGURE 1

Figure 1: Map of Kenya with the locations of refugee settlements and a breakdown of the population of concern as of 31 March 2023 [8].



Policy frameworks for displaced populations

Kenya has had an "encampment policy" since the 1990s under which refugees are required to live in official camps and face legal restrictions to their right to work and move [10]. Formal refugee legislation emerged through the Refugee Act (2006) which embraced the existing encampment policy and allowed for the establishment of institutions to manage refugee matters [11]. This continued the requirement for refugees to live in the camps, however many refugees live in Nairobi and other urban areas, although they face a precarious legal situation which impacts their economic inclusion and exposes them to harassment from officials [12].

The Refugee Act grants refugees the right to employment, however in practice there are limitations. Restrictions on freedom of movement are a great challenge for entrepreneurs as they need to book an appointment to obtain written approval from Department of Refugee Services (DRS) to leave the camp, a process which can take a long time. Movement passes tend to be valid for 21 days with some exceptions made for businesses and students granting them a longer duration. Refugees are allowed to obtain work permits, seek and gain employment, and start a business. However, the online process to obtain work permits is very slow and often incurs informal charges, such as bribes. Other requirements, such as presenting an offer letter from a potential employer with a supporting document showing that the refugee candidate has unique skills that no other Kenyan candidates have, further impede refugees from gaining employment, as does the requirement to possess a Kenya Revenue Authority (KRA) certificate which refugees are not eligible for.

Refugee and host community businesses are required to acquire a license from the local municipality, adding costs to starting economic activities. Refugee-led businesses tend to experience higher levels of police harassment and pay bribes more frequently than local Turkana people. Some entrepreneurs reported not receiving their license even after paying for it or being defrauded by people posing as government officials. There are discrepancies between government level and council level policy implementation: refugees in Nairobi, for example, generally have an easier time acquiring official business licenses, as county-level officials tend not to discriminate between refugees and Kenyans, as long as the fees are covered, although widespread police harassment presents a burden for them as well [13]. Refugees in Kakuma are also not allowed to own land or livestock because of concerns of fuelling tensions with nomadic Turkana people and other refugees, which limits their ability to invest. Nightly curfews due to concerns about armed robbery and theft pose further limitations on economic activity outside the camps [13].

Many refugees lack official means of identification because of the time-consuming processes to obtain it, which further hinders them from gaining access to employment and other services such as education and microfinance. Consequently, many refugees work in the informal sector and have restricted access to services [12].

The creation of the new Huduma-Biashara centre in Kakuma, an initiative by the Turkana County Government and supported by the Kakuma Kalobeyei Challenge Fund (KKCF) and UNHCR, which opened in May 2023, is a welcome development. Its aim is to boost access to County Government and business services for Kenyans and refugees. According to the Governor of Turkana, the new centre will make it faster, cheaper and easier to access government services such as registering a business, applying for permits, and requesting small business loans [14]. ●

CRRF and Refugee Act of 2021

In recent years, the Government of Kenya (GoK) has taken steps to improve the economic inclusion of refugees by signing onto the Comprehensive Refugee Response Framework (CRRF) process and publishing a CRRF document that outlines progressive goals [12]. In addition, efforts have been made to localise the Global Compact for Refugees through the Kalobeyei Integrated Socio-Economic Development Programme (KISEDP) and Garissa Integrated Socio-Economic Programmes (GISEDP). These government-led programmes are aligned with Local County Integrated Development plans, demonstrating a shift toward the inclusion of refugees in local and national planning processes. They focus on both refugees and host communities and aim to foster local economic and private sector development [15]. Most notably, the conception of the Kalobeyei Integrated Settlement in 2015, a joint initiative of the Turkana County Government and UNHCR, marks a significant shift towards greater self-reliance for refugees and increased interaction with host communities. It was designed to benefit both refugees and hosts based on market principles and is intended to endure even after refugees return to their countries of origin [10]. Kalobeyei Integrated Settlement aims to provide a better enabling environment for livelihoods by setting aside land for agricultural use, creating designated zones for businesses, and facilitating a cash-based economy [12]. As a model, it exemplifies the CRRF by supporting host communities, improving self-reliance, and using longer-term orientated development approaches. Kalobeyei settlement opened in 2016 and is home to 53,383 people [4].

In February 2022 the new Refugee Act (2021) came into force. It included significant changes to policy on refugee economic inclusion, integration, refugee status determination, and the ability of refugees to contribute to Kenya's national and local economy [15]. The Act recognised the rights of refugees to gain employment, stipulating that refugees "shall have the right to engage individually or in a group, in gainful employment or enterprise or to practice a profession or trade where he holds qualifications recognized by competent authorities in Kenya." In theory, this should promote greater access to the labour market. However, similar barriers remain because the Act requires refugees to have their qualifications recognised by the Kenyan National Qualifications Authority, a long and complex process, also requiring refugees to make the lengthy journey to relevant offices in Nairobi. Many refugees were not able to take their diplomas or certifications with them from their countries of origin meaning that in some cases they are required to undergo additional testing [16].

Under the new Act, refugees are required to reside in "designated areas" [15]. There is uncertainty as to what this means in practice as it does not give clarity on the extent of freedom of movement nor on whether the encampment requirements have been eased [17]. Additional uncertainty also pertains to the future of Kakuma and Dadaab refugee camps, following announcements in previous years that they would be closed. The further unbundling of the definition of "designated areas" will be critical for the economic inclusion of refugees, and refugee rights advocates are working to lift the requirement to live in camps [16].

A further change under the new Act is that refugees whose country of origin is within the East African Community (EAC)[1] would receive the option to give up their refugee status and use their status as EAC citizens instead [15]. This would give them the right to live and work anywhere in Kenya: although they would still need a work permit, it would eliminate the need for a movement permit. Giving up their refugee status is not a small decision, as it means losing other forms of assistance and protection, however this policy does offer important opportunities for refugees from EAC countries [18]. The policy change is not relevant for non-EAC citizens, however, including the refugees from Somalia which constitute 56% of refugees in Kenya. At the time of writing, the implementation of this policy was still being refined. ●

1 The EAC is a regional intergovernmental organisation to promote cooperation among its seven member states: DRC, Tanzania, Burundi, Rwanda, South Sudan, Uganda, and Kenya.

Refugees “shall have the right to engage individually or in a group, in gainful employment or enterprise or to practice a profession or trade where he holds qualifications recognized by competent authorities in Kenya” under the Refugee Act (2021), but many limitations remain.

Access to finance and cash assistance

Access to finance plays a critical role in enabling access to energy, as high upfront costs are amongst the most significant barrier for households to adopt improved energy solutions. The ability of a household to obtain credit, make transactions using mobile money, and save, all play a crucial role in improving their quality of life and livelihoods. A socio-economic study in 2019 showed that only 11% of refugee households had access to a regular bank account. Male-headed households and households which had been displaced before 2008 were more likely to have access to a bank account or mobile banking services [19]. Many refugees struggle to open a bank account due to requirements of providing a work permit and/or KRA PIN [20].

Still, banks have been expanding their services in Kakuma refugee camp and Kalobeyei settlement, and UNHCR estimated that 41,600 bank accounts were opened between 2020-21. In partnership with Equity Bank, UNHCR supports Kalobeyei residents to open bank accounts to access cash assistance. Bank account holders can redeem their cash at the bank either through ATMs or agents [21]. WFP also started working with Equity Bank in 2019 to pilot unrestricted cash transfers in Kalobeyei which have since been expanded to Kakuma. Having transaction records enables bank account holders to take out loans with collateral: Equity Bank lends to refugees under a guarantee facility from development financial institutions, allowing the bank to mitigate some of the risk associated with lending money to people with limited formal financial history. However, it remains difficult for refugees to access credit facilities due to this lack of collateral and the formal documentation needed as part of credit-related due diligence processes [11].

There are several forms of financial services available to refugee and host communities, however informally or semi-formally organised saving groups like Village Savings and Loans Associations (VSLAs) and *chamas*, which provide simple savings and loan facilities to their members, remain the primary source of credit services. Equity Bank offers access to credit to both hosts and ››

Banks have been expanding their services in Kakuma and Kalobeyei but it remains difficult for refugees to access credit facilities.

Access to finance and cash assistance

refugees through its own mobile SIM application; this does not require collateral but has a limit dependent on the transaction history. Regular bank loans are usually not accessible for refugees due to low asset ownership and therefore lack of collateral [21].

Mobile money access is limited and varies across gender and year of displacement, with only 43% of refugees having an account in 2019, mostly M-PESA, compared to 73% of the national population. SIM card registration for refugees requires the official refugee ID [22]. Sharing of one mobile phone among multiple family members to do mobile money transactions is common, further reflecting low access. Remittances also play a role, with refugees who have been displaced longer reporting having more higher-income relatives and receiving more remittances.

Since 2015, a programme called Bamba Chakula (known as BC, and "get your food" in Swahili) has been operating in Kakuma as a transitional arrangement from in-kind assistance to cash-based assistance [23]. Refugees are given a proportion of their assistance through BC in mobile money and refugee- and host-run shops are contracted by the programme. This has the goal of nurturing the local food market and increasing choice for refugees. The programme was initially introduced to all registered refugees in both Kakuma and Dadaab; it was rolled out particularly quickly in Kalobeyei settlement, under its strong position to be used to pilot various innovative, market-based approaches. An electronic voucher system, a form of restricted cash assistance, was used as opposed to direct cash because of Kenya's "know-your-customer" policies; these changed and meant that refugees were not able to use their refugee IDs to open mobile money or bank accounts due to security concerns. Other cash-for-fuel and cash-for-shelter programmes exist that make use of limited-use mobile money accounts which are disabled outside the camp [11]. While the digitalisation of these forms of assistance represents some progress, their benefits are limited due to the restrictions.

Specific examples of financial inclusion programmes which promote energy access exist in Kakuma and Kalobeyei. They include EcoMoto, a loan programme by Equity Bank in partnership with MicroEnergy Credits with the objective of providing clean energy financing for end-users [24]. Another example is the Spark Access to Finance Project which provides loans to individuals. Repayments are made to a local community cooperative or VSLA, in this case the Turkana West and Integrated Savings Cooperative [25]. Approximately 70% of all loans relate to energy access and small businesses can borrow up to KES 200,000 ($1,420)[2]. These initiatives play a crucial role in enabling better access to energy solutions for households and businesses. ●

2 The exchange rate between the Kenyan Shilling (KES) and United States Dollar (USD, $) has changed from around 100 KES per 1 USD in 2018 to around 140 KES per 1 USD in 2023. Where possible, both KES and USD values are taken from the original sources; if not, a conversion rate of 140 KES per 1 USD is used.

Income levels

A study by the Center for Global Development in 2021 found that 58% of refugees in Kalobeyei live below the poverty line [12]. Across the Kakuma-Kalobeyei area, an average household has a monthly income of KES 10,000 ($93), with half of households earning a consistent monthly income. Significant differences in average income persist between host communities and refugees in Kakuma, with residents of Kakuma town earning about KES 17,900 ($166) per month, three times more than refugees in Kakuma camp.

By contrast, the income of host community households in Kalobeyei town is not significantly different to that of refugees in Kalobeyei settlement. The study found that, in general, host community members in Kalobeyei were not better off than refugees: while 62% of host community members were employed (compared to only 37% of refugees), 78% lived below the national poverty line; this is a higher proportion than both refugees (58%) and the national average (37%). Refugees living in Nairobi earn more than those living in camps but significantly less than the average Nairobian: host community members in areas with a high concentration of Somali and Congolese refugees had a median monthly income about $180 and $130 respectively, while for refugees it was $50 and $30 lower.

Meanwhile, a study by the International Finance Corporation (IFC), using data collected in 2020, found that a quarter of households in Kakuma and Kalobeyei rely on self-employment or business as their main source of income: 16% of surveyed respondents are in full-time employment, while 12% are in part-time employment or casual labour. It found that 15% of households, all of which are refugees, depend on grants from NGOs or donor agencies as their main source of income, and 14% reported having no source of income [26].

Another study highlighted differences in type of employment between refugees from different countries of origin and between hosts [13]. Over half of the surveyed refugees from South Sudan and DRC who were employed were hired by the UN or other humanitarian organisations, usually paid minimal "incentive pay" rather than full wages due to restrictions on formal employment. Humanitarian assistance is estimated to provide 58% of formal jobs in the refugee camp, while in Kakuma host town 79% of formal employment is offered by Kenyans [11]. Somali refugees were more likely to have their own business and be self-employed. Over 40% of Turkana host community members sell firewood or charcoal, an economic activity that is prohibited for refugees to avoid fuelling tensions between the two groups.

In urban areas, meanwhile, refugees are less likely to have an economic activity than host communities, and tend to earn less than hosts: for Somali refugees average earnings were KES 15,000 ($106) per month compared to KES 20,000 ($142) per month for the local host community, and for Congolese refugees this was KES 7,000 ($50) per month compared to KES 12,650 ($90) per month [13].

As in the broader Kenyan population, COVID-19 had a negative effect on incomes in the Kakuma-Kalobeyei area: 68% of refugees living in Kakuma saw their revenue decline, compared to 34% of host community households in Kakuma town. The difference between hosts and refugees was not as pronounced in Kalobeyei settlement [26].

COVID-19 had a negative effect on incomes in Kakuma, with 68% of refugees and 34% of hosts experiencing a revenue decline.

03

National energy context of Kenya

©GIZ

National policy overview

Kenya's national policies are guided by its Vision 2030. This outlines the country's long-term strategy for environmentally responsible economic, social, and political development [27] with its implementation conducted through Medium Term Plans (MTPs) which give additional focus to key development areas such as food security, affordable housing, and healthcare.

To achieve these wider development objectives, Kenya acknowledges the importance of affordable, reliable, and sustainable energy. The country has high geothermal, hydropower and solar resources and aims to increase generation capacity by around four times between 2013 and 2024. Universal access to electricity is amongst the Government's energy targets, with strategies for both on- and off-grid access [28], as is universal access to clean cooking. The Government also has a target for a 2.785% annual reduction in energy intensity, and for 80% of its total final energy consumption to come from renewable sources for both power and heat [29].

Overall Kenya offers a very supportive environment towards sustainable energy compared to other countries in Sub-Saharan Africa [30] (see Table 4). The support offered by its policies towards energy access, both for electricity and cooking, is both high and well above the regional and global averages. Its renewable energy and energy efficiency policies are also relatively progressive compared to other countries in the region.

Kenya has a range of policies governing its national energy landscape which feed into the overall national development objectives under Vision 2030 and the MTPs [28]:

- The Energy Act (2019), which consolidated laws on energy and the roles of the national and county governments, and also established several agencies [31],
- The National Energy Policy (2018), which summarised the national situation and provides short- and long-term policy recommendations for various energy-related themes [32],
- The Kenya National Electrification Strategy (2018), which aims to provide a roadmap towards universal electrification [33],
- The Bioenergy Strategy (2020-2027), which focuses on the sustainable production and use of biomass resources across the energy sector [34], and
- The Kenya National Energy Efficiency and Conservation Strategy (2020), which outlines actions to improve energy efficiency and reduce GHGs by 30% by 2030 [35]. ››

TABLE 4

RISE Pillars[3] for Kenya and the regional and global averages [27]. Scores indicate the relative maturity of the regulatory environment ranging from mature (67 to 100), developing or improving (33 to 66) and early-stage (0 to 33).

RISE PILLAR	KENYA	SUB-SAHARAN AFRICA	GLOBAL
OVERALL	73	38	61
ELECTRICITY ACCESS	85	51	53
CLEAN COOKING	83	35	37
RENEWABLE ENERGY	65	43	51
ENERGY EFFICIENCY	58	24	48

3 Regulatory Indicators for Sustainable Energy (RISE) is a set of indicators, aggregated across four pillars, which assess a country's policies and regulatory support (0-100) towards sustainable energy.

National policy overview

Access to electricity in Kenya has risen from just 19% in 2010 to 42% in 2015 and 71% in 2020 [5] (see Table 5). The country has achieved near-universal access to electricity in urban centres and, whilst rates in rural areas lag behind, around two thirds of households have access to power. Government policies have, until recently, mostly focused on electrification via on-grid solutions, but a favourable environment for the private sector has led to Kenya attracting the most private investment in off-grid solar of any country in Africa [36].

Rates of access to clean fuels for cooking[4] are much lower than for electricity: just under half of urban households have access, and only one household in twenty in rural areas. Despite these relatively low rates, the residential cooking sector in Kenya is considered one of the most developed in East Africa, in terms of both the number of users and the available cooking solutions on the market [39].

A high proportion of Kenya's final energy consumption comes from renewable sources[5]. This is most owed to the high usage of biomass by households, which is equal to the regional average and well above that of the world overall. Renewable generation constitutes 80% of Kenya's electricity provision and is composed of a mix of geothermal (45% of total generation), hydropower (32%), solar (1%), bioenergy (1%) and wind (0.4%)[6] [40].

4 "Clean cooking" is not yet clearly defined for the Kenyan context [37] but the World Health Organization defines solar, electric, biogas, natural gas, liquefied petroleum gas (LPG) and alcohol fuels as clean at the point of use for particulate and carbon monoxide emissions [38].

5 Total energy demand includes all energy use across different sectors of society including households (64% of final energy use), industry (8%), and transport (negligible) and other uses (28%) [40]. Biomass for cooking is classified as "renewable" but in reality is often not regenerated through planting replacement sources.

6 Kenya has around three times more installed capacity of wind compared to solar, but generated only 51 GWh from wind compared to 78 GWh from solar in 2020 [40].

TABLE 5

Selected SDG 7 indicators for Kenya and the regional and global averages [5].

SDG 7 INDICATOR		KENYA	SUB-SAHARAN AFRICA	GLOBAL
ACCESS TO ELECTRICITY (%)	*Total*	*71*	*48*	*91*
	Rural	*63*	*29*	*83*
	Urban	*94*	*78*	*97*
ACCESS TO CLEAN COOKING (%)	*Total*	*20*	*18*	*70*
	Rural	*5*	*6*	*49*
	Urban	*45*	*35*	*87*
RENEWABLE ENERGY (% FINAL CONSUMPTION)	-	*68*	*68*	*18*

Kenya Vision 2030 aims to transform the nation into a newly industrialising middle-income country, providing a high quality of life to all its citizens.

Government agencies

The Ministry of Energy and Petroleum (MoEP) has overarching responsibility for the Kenyan energy sector. Its core functions include developing energy policies, regulation, rural electrification, the promotion of renewable energy, and the development of hydropower and geothermal resources [28]. Under the devolved administrative structure, Kenya's 47 county governments are responsible for preparing county-level energy plans for MoEP [33]. County electrification offices can provide inputs into the feasibility and prioritisation of potential projects, and some county governments also support rural electrification projects via supplementary funding.

MoEP also oversees several semi-autonomous agencies with specific roles within the energy sector, including [41]:

- Kenya Electricity Generating Company (KenGen), the largest power-producing company in the country, supplying around 60% of the electricity consumed in Kenya [28] and majority-owned by the GoK,
- Kenya Electricity Transmission Company (KETRACO), a state-owned entity for planning, constructing and operating the country's high-voltage transmission network,
- Kenya Power and Lighting Company (Kenya Power or KPLC), majority-owned by the government, which is responsible for transmission infrastructure[7], has a monopoly on distribution, and oversees agreements between KenGen and independent power producers, and
- The Rural Electrification and Renewable Energy Corporation (REREC), responsible for implementing and managing the Rural Electrification Programme and working with county governments to develop rural electrification master plans.

In addition, the Energy and Petroleum Regulatory Authority (EPRA) was established in 2019 [42]. As well as overseeing energy and petroleum in Kenya, it also designs and implements national energy efficiency programmes[8] and enforces standards and labelling programmes [43, 44]. EPRA also requires that large industrial, commercial and institutional buildings develop energy management plans [35], with the power to issue fines to enforce energy reductions [45].

Government agencies are supported in engaging with the private sector and NGOs by industry associations. These include the Kenya Renewable Energy Association (KEREA), an independent non-profit which aims to grow and promote the renewable energy sector amongst government agencies, companies, the general public and other stakeholders [46]. The Clean Cooking Association of Kenya performs a similar function in championing clean cooking solutions through market development and capacity building, drawing on its partnerships with MoEP and a range of international NGOs [47]. ●

7 Kenya Power continues to operate transmission infrastructure that was built before the establishment of KETRACO.

8 Most appliances are certified against standards set by the Kenya Bureau of Standards, with refrigerating appliances certified against IEC standards. Appliances are given a rating, out of five, and labelled for customer information with a list of approved products on the EPRA website.

Electrification policies and the national grid

Kenya's national electrification policy has historically focused mainly on grid electrification where possible. Between 2013/14 and 2019/20 the number of Kenya Power customers increased by 4 million, with an impressive growth rate of 16% per year[9], but rural areas still lagged behind. To address this the Kenya National Electrification Strategy (KNES) committed the GoK to achieving universal access to electricity by 2020, later modified to 2022 [28], to be achieved via a least-cost pathway which determined that [33]:

- 2.7 million connections should be made through grid intensification and densification[10],
- 269,000 connections should be made through grid extension,
- 35,000 connections should come from 121 new mini-grids, and
- 1.96 million connections should be provided via standalone SHS.

The investment plan estimates that this will cost more than $2.7 billion over five years. The vast majority is assigned to grid infrastructure, with around $450 million for SHS and just $33 million for mini-grids. An Integrated National Energy Plan (INEP) is designed by MoEP, following submissions from each county government, and is reviewed every three years [49]. Donors and multilateral agencies are also providing financing and technical support to scale up sustainable energy [36]:

- The Green Climate Fund provides financing for the African Development Bank's LEAF programme which aims to unlock commercial and local financing for distributed renewable energy projects,
- The Africa Enterprise Challenge Fund's RE-ACT SSA project, funded by Sida, aims to increase energy access for off-grid households through results-based finance (RBF), and
- The European Union is funding technical assistance programmes for sustainable energy and energy efficiency projects.

Kenya's grid tariff structure is split into on- and off-peak usage periods[11], with costs per unit (1 kWh) dependent on the type of customer [50]. Domestic customers are split into "lifeline" and "ordinary" categories (consumption below and above 10 units per month respectively), whilst businesses and industry are also categorised by consumption. Tariffs are periodically assessed and were between KES 15-22 ($0.12-0.18) in 2022 [51]. MoEP is in favour of a uniform national tariff for both grid and off-grid customers and so subsidies for the different modalities are required to achieve this. Under the connections assumed by the KNES, a nationwide annual subsidy of $3.4 million would be required for mini-grids and $16.5 million SHS to offer the same tariffs as the grid[12] [33].

For mini-grid developers, the regulatory body EPRA offers a detailed tool for calculating cost-reflective and subsidised tariffs based on the technical details of the system, equipment costs and financing, and the electricity used by different customer type [52]. The results of these calculations are required to be submitted during the mini-grid approval process.

9 This was made possible through, amongst others, the Last Mile Connectivity Project from Kenya Power which had similar elements to the KNES with regards to grid connections [48].

10 Densification via installing additional transformers for households with 600 metres of existing infrastructure, intensification via extending lines up to 2 km to connect more customers.

11 Off-peak periods are 22.00-06.00 on weekdays, 14.00-08.00 on Saturdays and holidays, and all day on Sundays.

12 Considering the number of households expected to be connected under each option, this equates to an annual subsidy per connection of around $95 for mini-grids and $15 for SHS.

Kenya's drive towards universal electrification is now providing specific support for remote and rural areas of previously underserved counties.

Off-grid solar products

Whilst the private market for off-grid solar products is mature, most of the sales have historically been concentrated in the wealthier and more densely populated counties [36]. The Kenya Off-Grid Solar Access Project (KOSAP) aims to increase access to energy services in 14 underserved counties of Kenya, including Turkana and Garissa, under implementation by MoEP, Kenya Power, and REREC [53]. The project has four components, shown in Table 6, with an implementation period of 2018-2023. In addition to the overall national-level project steering committee and management, it also uses county-level working groups to support implementation.

Off-grid solar products have benefitted greatly from a favourable tax environment [36]. Solar products have been exempt from value-added tax (VAT) since 2014, although in 2016 import duties and sales taxes on some solar products and related appliances were introduced to conform with measures applied across the East Africa Community. In 2020 the VAT exemptions were removed on solar products but, after extensive lobbying by the off-grid lighting sector, these were reintroduced in 2021. VAT remains in place on appliances such as solar refrigerators and water pumps. The GoK has adopted international standards for off-grid solar products and an estimated 98% of products sold were quality-verified[13] in the first half of 2021 [36]. Kenya uses a system of pre-verification of conformity (PVoC) which ensures that all solar products entering the country meet the national standards. Kenya also has relatively well-developed regulation for e-waste: the National Environment Management Authority oversees the general waste management, whilst the Kenya Solar Waste Collective – composed of seven companies and three sector advisors[14] – provides a forum for coordinated activities towards the responsible management of solar e-waste specifically. ●

13 Amongst GOGLA and Lighting Global affiliates, certified according to IEC TS 62257-9-8 (standalone systems up to 350 W) and verified by Verasol. Systems above 350 W must comply with a range of other IEC standards.

14 The seven companies are Azuri, BBOXX, d.light, ENGIE Energy Access, Greenlight Planet, M-KOPA, and TOTAL; the three sector advisors are GOGLA, KEREA and Sofies.

TABLE 6

Summary of the four KOSAP project components [53, 54].

No.	NAME	DESCRIPTION	FUNDING
1	MINI-GRIDS FOR COMMUNITY FACILITIES, ENTERPRISES, AND HOUSEHOLDS	*Implement 120 mini-grids, each serving 100 to 700 customers, under a public-private partnership between Kenya Power and an energy service company. Power purchase agreements and maintenance contracts of 7-10 years will be used. Customers will be Kenya Power customers and pay the usual tariff.*	*$40 million*
2	STAND-ALONE SOLAR HOME SYSTEMS AND CLEAN COOKING SOLUTIONS FOR HOUSEHOLDS	*(a) Provide incentives for SHS companies to expand to underserved counties, aiming to reach 1.1 million people across 250,000 households. (b) Support the transition from low-efficiency stoves to cleaner, improved stoves through the sale of 150,000 units. Both subcomponents will be implemented through RBF and debt facilities.*	*$48 million*
3	STAND-ALONE SYSTEMS AND SOLAR WATER PUMPS FOR COMMUNITY FACILITIES	*(a) Utilise private sector contractors to supply, install, and maintain solar systems in more than 1000 schools and clinics under a performance-based long-term service delivery. (b) Supply, install and maintain solar pumping systems for 380 boreholes through private sector delivery, with regular payment for maintenance services, under supervision by REREC.*	*$40 million*
4	CAPACITY BUILDING	*Enhancing the capacity of KOSAP implementing organisations (such as on project development, procurement, management and implementation) and county governments (energy management, tariff rates and cost recovery requirements, environmental and social management).*	*$20 million*

Mini-grids and standalone systems

Mini-grids in Kenya were previously regulated under frameworks developed in 2012. EPRA updated these in 2021 by publishing new draft mini-grid regulations covering all systems with capacities up to 1 MW, alongside a series of public consultation activities [55]. A developer must submit an expression of interest to implement a mini-grid project, apply for tariff approval, apply for a license to operate the generation and distribution infrastructure, and publish public notices about the project to determine any objections before their license is approved by EPRA. Each part of the process, and some intermediary steps, is stated to take between 15 and 60 days.

Once operating, developers are required to maintain a minimum level of system performance[15] and comply with environmental and safety reporting obligations [55]. In the event of the grid arriving at the project site, the operator can choose to interconnect the mini-grid to the main grid if the distribution system meets the required technical standards; this would allow the mini-grid developer to buy and sell power from the grid, subject to additional licenses and approvals[16].

Whilst these draft regulations offer greater clarity for mini-grid developers, a point of concern is that 30% of a project's planned connections must be in place before a license is issued by EPRA [56]. This has the intention of ensuring that systems are built in a timely manner and meet electrification targets, but introduces a significant risk to investors over whether the license will be approved – either increasing the cost of financing, or potentially obstructing it altogether. Furthermore, regarding grid extension to a mini-grid project site, there is uncertainty around how a developer can choose the interconnection or compensation options, and the resulting relationship between them and other parties. As of 2022, the consultations and draft regulation developments were ongoing.

15 This is not universally defined in the draft regulations and can vary between projects.

16 Operators are also permitted to remove their distribution assets or sell them to the distribution licensee, or receive compensation if the project has met the strategy requirements of the KNES or INEP.

Mini-grids must comply with environmental and safety standards, as well as providing a minimum level of system performance.

Clean cooking policies

Kenya aims to achieve 100% access to clean cooking by 2028, two years ahead of its goal of 2030 laid out in its Sustainable Energy for All Action Agenda [34], but despite having one of the most mature cooking sectors in East Africa, Kenya's rate of clean cooking is still well below this ambitious target [39]. Several policies overlap different parts of the residential cooking sector but there is a lack of a single overarching strategy to direct the nationwide transition to clean cooking. To address this, in 2023 MoEP began leading a multi-partner imitative to develop a new Kenya National Clean Cooking Strategy [57].

Many recent strategies aim to address cooking issues through sustainable biomass resource management. Under the National Energy Policy (2018) and Energy Act (2019), MoEP and devolved county governments are required to develop plans for the management of bioenergy resources including fuelwood, charcoal, and biofuels. Meanwhile the Bioenergy Strategy [34] outlines the MoEP's overall planning in the short- and medium term[17]. With the longer-term goal to increase the number of households and institutions using clean cooking, behaviour change campaigns have been used to increase public awareness of cleaner solutions [58].

17 Short-term (2020-2022) focuses include on enhancing policy and regulatory frameworks, mapping bioenergy resources, and enhancing bioenergy feedstocks); medium-term (to 2027) focuses include strengthening research capacity, transitioning to clean cooking fuels and technologies, and mobilising financing for bioenergy development.

The KOSAP project, shown in Table 6, aims to use RBF to support the sale of 150,000 cookstoves in 14 underserved counties [53]. The Promotion of Climate-Friendly Cooking in Kenya, implemented by GIZ in collaboration with SNV and the Ministries of Energy and Health, aims to strengthen the market for improved cookstoves and increase their uptake in rural and remote areas [39]. Private sector initiatives include the Kenya Biogas Programme and the National Biomass Briquette Programme, which aim to increase sustainability in their respective sectors. The latter initiative ended in 2022 but the long-term impact of one of its key aims, to develop a sustainable briquette sector for domestic use [59], remains uncertain.

Kenya's fiscal policies have provided an uncertain tax environment for clean cooking. Between 2016 and 2020 import duties on solid biomass stoves have been reduced, raised, and reduced again; duties on energy efficient cookstoves and VAT charges on LPG and clean cookstoves have similarly fluctuated since 2016 [39]. These measures have generally supported the transition towards cleaner cooking but have introduced risks for investors. A brief VAT increase on LPG was reported to have led to its substitution with charcoal and firewood, especially by low-income households [60].

Biomass cookstoves produced in Kenya are subject to mandatory standards [61]. Emissions, thermal performance, safety, and durability ››

The domestic cooking sector in Kenya is influenced by strategies for energy access, biomass resource management, and varying tax regimes. These changes in policy can create uncertainty which can slow the uptake of clean cooking.

Clean cooking policies

are referenced against international standards whilst additional requirements are in place to ensure the quality of the finished products against corrosion and for clear and consistent labelling. Kenya also has standards in place for ethanol-fuelled cooking appliances, and for ethanol fuels for cooking, and EPRA enforces LPG regulations to ensure conformity and the safety of LPG users[18] [39]. Whilst these standards are in place, enforcing them is a very different prospect.

Using electricity for cooking is a nascent area in Kenya but could offer great potential for scale-up. At present very few households use electricity as their primary source of cooking energy but a small number are using electric pressure cookers (EPCs) for the preparation of foods that require boiling for a long time, such as beans, alongside other stoves [62]. Kenya Power has launched its Pika Na Power ("cooking with electricity") programme, which aims to expand the uptake of induction stoves and other electric options. Market research of first-time users found that customer experiences were generally positive [63]. Whilst the cost of electric cooking is estimated to be cheaper than other options on a long-term basis, the upfront cost of appliances can be relatively high[19] [64]. ●

18 Regulations introduced in 2009 established licensing requirements and standardised cylinder and valve sizes for interchangeability; reforms in 2019 introduced licensing for every business location and resolved some issues from the previous regulations.

19 A survey of appliances available in Nairobi found that EPCs, ovens, induction stoves and microwaves cost around $50-200, whilst smaller appliances such as kettles and hotplates were around $10-50 [64].

©EnDev and SNV

04

Energy needs in displacement settings

©GIZ

Electricity access for households

Most of the previous work and literature relevant to energy in displacement settings focus on Kakuma and Kalobeyei. Amongst these, studies conducted by SNV in 2020 offer insights into market-based energy access [65] and access to energy for businesses [66] whilst a comprehensive energy report published by the International Finance Corporation (IFC) in 2022, based on surveys conducted in 2020 of 1,051 households and 159 businesses, was conducted with the aim of supporting private sector market entry [26]. Furthermore, the READS workshop was held in Kakuma with participants representing a variety of organisations, with a few working in Dadaab.

To supplement and complement these sources and others, the READS programme conducted primary qualitative research interviews to gain first-hand insights into the energy needs and priorities of displaced people. Thirteen households and eight business owners were interviewed about electricity access and clean cooking, with most participants based in Kakuma 1 and some from Kakuma 2, 3, and Kalobeyei villages.

The situation for refugees elsewhere in Kenya is less well-studied. To gain an insight into energy access for urban refugees, the READS programme conducted seven interviews with displaced people living in the capital Nairobi. Where possible, information relating to Dadaab has been included, mostly from relatively older resources and the reflections shared by READS workshop participants based in Garissa. Reflecting the differences in circumstances, this section focuses primarily on energy access in Kakuma and Kalobeyei, whilst urban settings and Dadaab are presented separately to highlight their specific situations.

Electricity access for households

While significant progress has been made in increasing electricity access throughout Kenya, household electricity access – especially in rural areas and refugee camps – is still very limited. Kenya's refugee camps are not connected to the national grid network and so households mostly rely on off-grid solar systems and power from private electricity suppliers, most of whom are unregulated. Solar lanterns are used by 29% of households as the primary source of lighting (for example shown in Figure 2 below), compared to 16% which use a SHS and 11% which receive electricity from a private service provider [26]. Other commonly used primary lighting sources are dry-cell torches (13%) and mobile phones (11%). A KPLC diesel mini-grid was established in Kakuma town in 2018, but only 8% of households there had a connection.

Efforts have been made to provide sustainable and reliable electricity to refugees and host communities, most notably through the develop- ››

FIGURE 2

A small solar lantern commonly used by residents.

©Nyayow Deng Chuol/GPA/UNITAR

Electricity access for households

ment of solar mini-grids[20]. There are currently three main mini-grid operators in the Kakuma/Kalobeyei area:

- Renewvia operates a solar-hybrid system, serving Kalobeyei Villages 1 and 2, which is the largest mini-grid in East Africa with a capacity of 541 kWp and over 2,700 connections [67],
- Yelele Limited, a host community-owned and refugee-led company, operates a 7 kWp solar mini-grid which serves Kalobeyei Village 3 with 50 connections in 2021 [68], and
- Okapi Green Energy, another refugee-led company, runs a 20 kWp solar mini-grid in Kakuma Sub-camp 3 with around 60 connections.

A midline assessment report by GIZ's ESDS project found that there had been a significant increase in electricity access in Kalobeyei settlement, from 4.6% in 2021 to 46% in 2022. This compares with 18.6% in 2021 and 43% in 2022 in Kalobeyei Town and 2% in 2021 and 7% in 2022 in Kakuma town [69].

Many off-grid solar companies have shops that sell their products and services around the camp and in Kakuma town. These include Solaria, Bboxx, Sun King, and Green Innovation Ventures Limited (see Section 5); Okapi Green also operates energy kiosks where refugees can purchase solar lanterns and SHS. Off-grid solar systems are a viable option for most refugee households as they are cost effective and provide a reliable source of electricity for lighting and charging household devices. Households interviewed as part of the READS research shared that solar products including torches, lanterns, televisions, and SHS (see Figure 3) were easily accessible in shops around the camp, although not all households are able to afford them. The price for a solar lantern ranges between KES 1,400-3,850 (around $10-30). Common SHS have a capacity of around 60 W and cost between KES 9,000-12,000 ($65-90) to purchase upfront [26].

Diesel generators are also a common power source for households in the Kakuma refugee camp, although very few households have their own generator [26]. Instead, a network of informal diesel-operating businesses provides electricity to households, businesses, and community facilities. There are no metering systems and so their clients typically make fixed monthly payments of KES 1,500 ($10.65), which are paid through cash or mobile money. Due to high fuel prices the generators provide power during specific hours of the day, usually from 19.00 to midnight, with electricity unavailable at other times. According to one of the diesel operators, when the fuel prices were lower, they had used the generator for longer hours, including during the day from 6.00 to 15.00 and then again from 18.00 to 01.00.

FIGURE 3

Different sizes of solar home systems installed on roofs in Kakuma camp.

©Nyayow Deng Chuol/GPA/UNITAR

20 More information about these companies, and a case study on the Renewvia mini-grid, is given in Section 5.

I prefer using solar for electricity compared to generators. This is because solar provides electricity for longer hours and is affordable.

– Solar power user in the camp

Diesel generator mini-grids in Kakuma Camp

Diesel generator operators face high fuel prices and pass these on to end users as high monthly fees. During the READS workshop in Kakuma Camp, several diesel generator operators shared that they view solar mini-grids as an effective way to provide electricity and in principle would be willing to switch to solar. Owing to the upfront costs to install solar mini-grids, however, the operators felt that it was not a commercially viable opportunity without substantial grant funding.

All the generator operators that were interviewed requested funding opportunities that would help them switch to operating solar mini-grids. They also shared that the profit they earn from operating generators is not always sufficient to cover expenses, let alone save enough upfront capital to make the transition to solar power.

When asked about the harmful effects of emissions from the generators, and if it was a consideration for them, the diesel genset operators acknowledged the negative effects of their business but compared their livelihood to other common high-emission activities, such as driving vehicles. First and foremost the potential transition to solar power was seen as a wise financial decision, but reducing the environmental impact would also be a welcome benefit. ●

> I have eight employees, two work at the main switch meter and six work in the community fixing electricity. All employees are paid monthly despite the [high cost of] fuel challenge. Some of the profit also goes into repairing and servicing the generator. I am slowly incurring losses due to these expenses.
>
> – Diesel generator operator in Kakuma

If I was to receive funding to purchase [equipment for a solar] mini-grid, I would do it. The high fuel prices mean that using generators will soon be out of business.

– Diesel generator operator in Kakuma

Barriers to household electricity access

AVAILABILITY BARRIERS

Kakuma camp does not have a connection to the national grid – the network extends only to Kakuma town – and nor do the Dadaab camps. While great progress has been made in increasing access to reliable, affordable electricity through the recent expansion of the Renewvia mini-grid, its reach is still limited to two villages in Kalobeyei settlement. The other mini-grid operators partially cover Kakuma Sub-camp 3 and Kalobeyei Village 3. Off-grid solar companies also have relatively modest operations compared to the size of the displaced population and potential market. Restrictions on access to mobile money accounts, such as a three-month limit on M-PESA accounts opened using a refugee ID, could affect the uptake of solar products which rely on PayGo models which have been implemented successfully elsewhere in Kenya.

Informal diesel generators bridge the gap for some customers without a solar mini-grid connection. However, they use relatively basic electricity systems with limited capacity to serve an increasing demand for power from the influx of refugees and growing number of businesses. The supply of electricity is inconsistent, only available for a few hours in the evening, and dependent on fluctuating diesel prices. In addition, the generation and distribution practices are not always safe: electricity distribution lines pose safety risks to residents in the area due to poor connections and low-hanging, entangled wiring systems [26].

For both solar and diesel-based solutions, the lack of availability of spare parts and technicians for repair and maintenance services presents a significant barrier. The diesel generator operators, in particular, reported often not being able to find local technicians or spare parts, and having to seek support from neighbouring towns such as Lokichar, Lodwar, and Eldoret, or sometimes as far as Kisumu. These maintenance costs get passed on to customers [26].

OPPORTUNITIES

Planned partnerships between Renewvia with community-led mini-grid operators Okapi and Yelele is an exciting development. It offers a great opportunity to significantly expand the reach of their networks, and in doing so increase access to electricity services, as well as to harmonise the quality and pricing of electricity provision. It is also a great example of an international corporation partnering with community-led enterprises and benefiting from their respective strengths.

Diesel generator operators have also voiced their interest in transitioning to solar-based solutions, if they were to receive adequate funding, which could also improve and expand electricity provision. In the interim, these businesses could be supported through grants and technical support to gain access to higher-quality generators, solar equipment to begin hybridising their power supply, and improved wiring to increase efficiency and decrease hazards.

Using RBF schemes to incentivise off-grid solar companies to invest in the camps, such as through setting up shops or permanent outlets, could further improve the availability of high-quality products. This could grow and sustain a larger market for their products and services, matching the supply of off-grid solutions to the large market potential. Addressing the current restrictions to ensure displaced people have access to mobile money accounts would be an important enabler in improving the uptake of solar products. ››

Barriers to household electricity access

All off-grid solar products should be certified by official standards, such as those of Verasol or the Kenya Bureau of Standards, and come with warranties, with the latter supported by companies investing in training technicians in repair and maintenance services. These trainings could be supported by NGOs to create a wider pool of local technicians for both solar and diesel solutions, whilst supply chains for spare parts should also be strengthened as part of this measure. An e-waste management framework should also be developed to ensure the safe disposal of electric products and parts which cannot be refurbished or reused on site, potentially in partnership with waste management organisations such as the Waste Electrical and Electronic Equipment (WEEE) Centre which operates in Kakuma and Kalobeyei.

AFFORDABILITY BARRIERS

Many households are not able to afford access to a reliable electricity source. Mini-grid connections and tariffs, both for solar and diesel systems, differ and can be far more expensive than the national grid tariff or the tariff that is charged by the Renewvia mini-grid (50 KES/kWh for households and 76 KES/kWh for businesses charged by Yelele compared to 20 KES/kWh and 25 KES/kWh by Renewvia, although both systems are subsidised by grant funding). This discrepancy in tariffs poses challenges to households who pay more and has resulted in tensions between customers living in different zones. Furthermore, the diesel system customers pay higher tariffs for a far less reliable source of electricity. While high quality off-grid solar products are available in the markets, the upfront costs of SHS present a financial barrier to most households [26]. While solar companies offer a variety of smaller, cheaper solar lanterns with PayGo schemes, some customers still considered the products too expensive and cited inflexible repayment schedules as a further barrier to uptake. This may reflect low awareness among customers of more affordable options.

Financial issues also affect suppliers. A lack of external private investment impacts the ability of companies to maintain a sustainable permanent presence inside the camps which would allow them to provide products to a greater number of customers. Suppliers also struggle with high transportation costs for relatively bulky items like SHS [26].

OPPORTUNITIES

Certain customer segments, like those paying for electricity provided by the network of diesel generator operators or those connected to the Yelele mini-grid, already pay substantial amounts for electricity but the value for money is often low. Harmonised mini-grid tariffs, which leverage grant funding to offer affordable rates, could be encouraged to ensure customers connected to different mini-grids pay similar or the same tariffs to avoid potential tensions. The cost of this would be need to be assessed in relation to other potential electrification options and the resulting tariffs would be subject to regulatory approval. RBF schemes which support the establishment of off-grid solar companies in the camps should also be considered and could be coupled with end-user subsidy schemes to make them more accessible for poorer households. The financing should be provided to companies in tranches and should come with a phase-out plan once the company has established itself sufficiently in the camp. Instalment payments, flexible repayment mechanisms, and pay-as-you-go metered systems will also play key roles in reducing upfront costs of off-grid solar products. ››

Barriers to household electricity access

ACCEPTABILITY BARRIERS

There are variations between the quality of off-grid solar products. This can depend on where people get them: amongst households with solar lanterns in Kakuma, for example, 42% of surveyed respondents had purchased theirs while 43% had received theirs for free from an NGO. Some cheaper products are available on the market which have significantly lower output capacities, and these variations in quality influence the perception of off-grid solar products generally: surveyed customers voiced concerns about the quality of their solar lanterns, saying they are too fragile and that they perform poorly in rainy weather [26].

OPPORTUNITIES

Relatively high rates of access to solar lanterns indicate widespread familiarity with the products, and this can support further growing the market. To improve their reputation, currently affected by lower quality products, regulations on standards for off-grid solar products need to be enforced systematically, as well as requirements for warranties and the provision of repair and maintenance services. This also applies to the currently unregulated private electricity suppliers to enhance the quality and safety of their electricity provision. Coordination between market development activities and free distribution initiatives is essential to not hamper market development efforts.

BARRIER	OPPORTUNITY
Mini-grids only serve small areas and charge different tariffs	Expand systems into new zones and harmonise tariffs
Poor quality of some solar lanterns and low levels of consumer trust	Strict standards enforcement and inclusion of warranties Expansion of repair and maintenance services
Off-grid solar products are considered too expensive for many households	Instalment payments, flexible repayment mechanisms and PayGo systems RBF schemes for companies and end-user subsidies
Lack of qualified local technicians and spare parts	Training of a pool of technicians and establishment of repair centres Supply chain development support for spare parts and tools
High fuel costs and safety concerns due to poor connections of unregulated private electricity providers	Grant funding and technical support to access higher quality generators and improve wiring, introduction of metering devices Promote development of solar-diesel mini-grids meeting minimum standards, provide operator training, use phased grants to ensure the quality of electricity provision

Clean cooking for households

More than 90% of Kenyan families use firewood, charcoal, and kerosene as their primary or secondary cooking fuels and mostly rely on traditional cookstoves, such as three-stone-fire stoves and low-tier charcoal and firewood stoves [70]. This is also the case in refugee camps: most households in the Kakuma-Kalobeyei area rely on firewood to cook, and 92% of refugee households use it as their primary fuel.

Households use an average of three bundles of firewood a week which typically costs KES 100 ($0.75) per bundle. Hosts usually collect their own firewood and sell it to refugees (see Figure 4). Firewood sales represent an important source of income for many hosts: there are both large- and small-scale firewood traders whose livelihoods would be affected by the adoption of alternative fuels. In the past, most refugees relied on firewood provided by UNHCR which was replaced by cash transfers in 2021 and ended in February 2023; now households have to buy or (illegally) forage for firewood. Reports of assault and gender-based violence during firewood collection by refugees is a major concern [26]. Firewood is usually collected by adult women (84% of whom collect firewood), who are sometimes assisted by female (13%) or male (8%) children, but only 12% of men do this.

The production of charcoal mostly occurs in the host community as refugees are prohibited from doing this to avoid conflicts. Most users buy charcoal themselves and it is usually sold in *debes* (containers cut out of a 20-litre plastic jerry can) or sacks. Prices vary depending on the size of the container [26], area, and season [65]. Average monthly expenditure per household is typically KES 1,150 ($8.30) and 45 kg sacks typically cost between KES 650-750 ($4.75-5.50) [26]. In Kakuma town, charcoal use is more widespread than firewood with 79% of households using it, compared to the average of 59% across the Kakuma sub-camps and Kalobeyei [26]. ››

FIGURE 4

A Turkana trader selling charcoal to households.

©Nyayow Deng Chuol/GPA/UNITAR

FIGURE 5

Production of charcoal stoves by Sunken Limited.

©Nyayow Deng Chuol/GPA/UNITAR

Clean cooking for households

LPG for cooking is not common and only 15% of households in Kakuma town use it. Half of households which cook with LPG use 6 kg cylinders which cost KES 1,400-1,500 ($10-11). The main barrier to the uptake of LPG is the high initial purchase cost of the cylinder, as cited by 58% of surveyed respondents [26]. This was echoed by READS interviewees who said they were not able to afford the initial investment and would prefer to spend that money on purchasing a charcoal stove, charcoal or firewood, and food. Electric cooking is also not widespread, although the expansion of the Renewvia mini-grid offers new opportunities to promote e-cooking, including pilot projects run by SNV to promote EPCs for households and in social institutions.

Three-stone-fire stoves, Kenyan Ceramic Jiko stoves (KCJ), all-metal stoves, and the locally manufactured Maendeleo stove – distributed for free by UNHCR to new arrivals – are the dominant cookstoves in Kakuma [72]. Some progress has been made to increase access to affordable cooking solutions that are produced and sold by local cookstove manufacturers.

SNV has supported the establishment of a stove production unit to manufacture higher-quality, affordable, artisan charcoal cookstoves and trained 65 refugee and host community members in the production of five different types of stoves. Sunken Limited, a private company, won the tender to commercialise this stove production unit and now manages the production unit independently [65]. ››

FIGURE 6

Medium (left) and large (right) charcoal stoves costing KES 400 and KES 1,000 respectively.

©Nyayow Deng Chuol/GPA/UNITAR

Clean cooking for households

Other manufacturers, like Usafi Green Energy, have also developed their production sites through support from SNV and other development partners including the IFC KKCF. These companies provide energy-saving KCJ charcoal cookstoves at prices ranging from KES 300 ($2.30) for the smallest stove and KSH 1,500 ($11) for the largest (see Figure 5 and Figure 6). Suppliers accept cash and mobile money as forms of payment but do not sell on credit due to issues with repayments. These artisan stoves have been fairly successful, with demand outstripping the current production capacity, and so manufacturers are currently exploring ways to expand their operations. Industrially manufactured stoves are also in use in the camp but have limited reach and are only sold in Kakuma town [65]. The high upfront cost and lack of flexible payment options pose additional barriers to increasing uptake of these stoves.

One of the challenges faced by charcoal stove users who were interviewed by READS is that stoves sometimes last only a few months before they break. Users believe that current stoves manufacturers use cheaper raw materials and add less cement, which makes the stoves less durable. In contrast they reported that the multipurpose Maendeleo cooking stoves lasted for up to four years and can use both charcoal and firewood; previously these were distributed to all households for free, rather than only new arrivals (see Figure 7). Some residents of the camp have built home-made multipurpose clay stoves (Figure 8) as an alternative to the factory-manufactured stoves: these are typically made from clay mixed with sand which is collected from around the camp. The clay of these homemade stoves tends to crack when it rains, however, and so they must remolded continuously to maintain their shape.

READS interviewees expressed that they were comfortable with their current cooking systems but, when asked about it, some respondents shared that they would be willing to explore new options including electric and gas cookers. Despite the high reliance on traditional forms of cooking there could be opportunities for camp residents to transition to much cleaner alternatives if sufficient support were available. ●

FIGURE 7

A multipurpose cookstove that was provided by UNHCR

©Nyayow Deng Chuol/GPA/UNITAR

FIGURE 8

Homemade multipurpose cookstoves.

©Nyayow Deng Chuol/GPA/UNITAR

I have used charcoal and firewood stoves even before I came to this camp. If there are technologies that would allow for faster and safe cooking, then I would be willing to learn how to use them.

– South Sudanese refugee in Kakuma Camp

PEPCI-K by SNV and CLASP

From November 2021 to December 2022, the Piloting Electric Pressure Cookers in Kalobeyei (PEPCI-K) project was implemented by SNV and CLASP with funding from the EnDev Innovation Window [71]. EPCs were selected as a cooking technology to be tested based on findings from earlier studies which showed expected compatibility with staple foods and the ability to prepare them unsupervised during daytime, when demand for electricity is lower. Other factors included convenience of cooking, fast and efficient cooking times, and availability in the Kenyan market. EPCs had not yet been tested with mini-grid customers in displacement settings and so the pilot sought to assess their potential for cooking, as well as to understand the requirements and barriers to develop a market.

The project activities included product sensitisation, testing and selection, commercial distribution of EPCs (including end-user training and marketing), and testing various payment models for EPC purchase. Solar Integrated Appliances Limited (Solaria), a solar and stove distributor for d.light and Burn, was selected after a competitive process and managed the commercial distribution and testing of payment models activities. An initial pre-pilot testing was conducted with 20 units from different suppliers which were provided to 15 households and five businesses, along with end-user training. Sales through Solaria began in May 2022 and, by October 2022, all 80 units had been sold (45% of sales to women and 55% of sales to men). Four payment models were tested which required customers to pay either within one week of purchase or through instalment payments within four weeks, 12 weeks, or 20 weeks, with the latter two models being the preferred options.

The project collected data on end-users' cooking experiences and their electricity consumption through baseline, bi-weekly, and endline surveys, as well as through electricity metering. The pilot initially was intended to be implemented only in Kalobeyei in areas which were served by the Renewvia mini-grid but, due to high demand from customers in Kakuma Town who had access to the KPLC mini-grid, the project reach was eventually expanded to Kakuma Town and Kakuma sub-camps.

Key findings from the pilot indicated that there is high demand and willingness to pay for EPCs, although high default rates for customers on longer payment plans were observed. This could be explained by several factors including low purchasing power, competing financial commitments, a common indebtedness culture, insufficient customer vetting, and ineffective processes and systems for payment recollection.

Data on EPC usage patterns show that using an EPC can reduce overall cooking time and free up time during cooking. Most EPC users reduced their use of charcoal and firewood, leading to savings of approximately KES 700 ($5) per month. The type of meals cooked with an EPC, compared to other cooking methods, did not change which suggested compatibility with preferred foods. Marketing activities played a key role in supporting uptake with time and cost savings, convenience of cooking, and reduced smoke being the most important factors, and lack of access to finance and high upfront costs being the most significant barriers. Most customers liked their EPC because of faster cooking times and as it is a clean fuel source; aspects that were disliked were the pot size that was considered too small and the lack of a spare pot. As for electricity use, most EPC users contributed an average of 4 kWh per month when using the high-usage type of EPC, indicating a potential to promote energy efficiency through end-user training.

Barriers to clean cooking

AVAILABILITY BARRIERS

The supply of improved cookstoves is one of the largest barriers to improved access to clean cooking. The supply chain for stoves produced elsewhere in Kenya, or further afield, is relatively limited: there is moderate private sector penetration by cookstove companies in Kakuma, supported by the ongoing work of humanitarian and development organisations, but is particularly limited in the Dadaab camps, exacerbated by their remote locations. Transporting stoves that are manufactured elsewhere is costly and susceptible to breakage, whilst repair and maintenance services are not usually available to customers.

While there are local cookstove manufacturers operating in Kakuma, the stoves meet only low-tier standards and generally have low fuel efficiencies. The consumer demand currently exceeds the supply as the stove production faces the challenge of an unstable water supply and limited availability of the necessary raw materials, for example soil for stove casings and liners for the interior, and metal sheeting must be brought in from Nairobi or Mombasa. This leads to an increase in the price of the finished products and, when compared to low- or no-cost alternatives such as three-stone fires, improved cookstoves are a less popular choice. Legislative and regulatory requirements, for example for company registrations, also represent a barrier to smaller, local stove companies growing and reaching scale.

Supply chains for LPG and e-cooking are also not well established, limiting options of non-biomass fuels, whilst the production of fuel from sustainable biomass or waste products is limited by a lack of available feedstocks. Efforts have been made by SNV's EnDev MBEA project to support the introduction of alternative fuels such as bioethanol, pellets, and briquettes through the co-financing of activities. Bio-ethanol cooking systems experienced high demand but initial interest was dampened due to supply issues with transporting liquid fuels [65]. In addition, entrepreneur training was provided to fuel traders to support them with transitioning to different livelihoods [65].

Even when cash assistance was provided for firewood, it only amounted to KES 42 ($0.30) per month and covered only a fraction of a household's needs; this means that it was necessary to forage for or purchase firewood to supplement their rations [72]. This contributed to widespread deforestation as well as leading to conflicts with host community members.

OPPORTUNITIES

The government can play a significant role in promoting the shift away from biomass solutions by setting financial incentives and supporting supply chains for LPG and electric cooking. Considering that biomass solutions are likely to remain the most prevalent technology, supply chains should also be strengthened for the raw materials used in the local production of charcoal stoves. More generally this is supported by improving infrastructure: the new road between Lodwar and Kakuma, for example, has given the local economy a huge boost by facilitating private sector engagement. Efforts should also be devoted to promoting improved charcoal production to increasing its efficiency by setting standards and providing trainings.

Financial institutions and organisations could work with existing local cookstove manufacturers to invest in their supply chains, expand their production sites, and hire and train more employees. Companies selling industrially manufactured cookstoves, especially those which are more efficient and use less fuel, could be incentivised to begin operations in Kakuma through RBF schemes and end-user subsidies. Existing pilot projects which test new solutions, like EPCs, should be assessed and scaled up if the results are favourable.

In addition, opportunities could be explored to decentralise operations. For example by setting up a local logistics system, such as through a shared storage space, logistics and delivery costs for individual companies could be reduced. Es- ››

Barriers to clean cooking

tablishing repair and maintenance services for cookstoves in general, or training a pool of technicians, could speed up repair processes and improve the accessibility of technical support.

AFFORDABILITY BARRIERS

Recurring fuel costs are a significant household expense. Charcoal, which is commonly used by refugee households and must be bought, is an expensive commodity: this is in part because of the high production and transport costs associated with accessing charcoal stocks. Increasing destruction of forest reserves also contributes to the rising price of charcoal, as well as for firewood. Many households resort to collecting firewood to save money, in spite of it being a time-consuming, burdensome and sometimes dangerous task, causing conflicts with host community members and exposing women and girls in particular to gender-based violence. The IFC study found that there was considerable interest in LPG: 46% of surveyed households had considered acquiring it and 61% would be interested if they had the opportunity, but these respondents also indicated that they were not currently able to afford the initial lumpsum payment [26].

As for stoves, many households who purchased a fuel-saving biomass stove have opted for smaller, cheaper models, even though they would prefer larger, multipurpose stoves. Amongst other reasons, most households cannot afford industrially manufactured stoves [65]. The SNV study found that higher disposable income of host community households was a key driver for the uptake of improved lighting and cooking solutions, but that there were also different ways of supporting lower-income households.

OPPORTUNITIES

The promotion of more efficient, cleaner cooking solutions should be accompanied by measures to lower upfront costs. These could include end-user subsidies, access to credit, or conducive repayment terms. Longer or more flexible repayment periods, which could allow for smaller repayment amounts at a time, can make it easier for low-income customers to access energy products. The viability of leasing models would also be worth exploring. Saving groups can support other members by making a purchase and acting as guarantors in case of defaults [65].

Pay-as-you-go mechanisms for solar products are generally well accepted, and there is familiarity with M-PESA's mobile money platform, so this could potentially be applied to cookstoves. As for off-grid solar products, issues around the use of refugee IDs for M-PESA accounts would need to be assessed to understand the long-term viability of using mobile payments for clean cooking.

On a supply side, small companies which sell clean energy products such as cookstoves often lack sufficient capital to buy enough stock upfront, meaning that they cannot always sell products in a timely manner and are dependent on larger suppliers to give them favourable payment terms [65]. This could be addressed through the option to access credit from MFIs to purchase a larger amount of stock. Humanitarian and development organisations also have a role to play in providing financial support in supporting private companies with setting up operations in displacement settings, such as through RBF schemes, as well as facilitating introductions to humanitarian contexts.

ACCEPTABILITY BARRIERS

Cooking habits are deeply entrenched in cultures and clean cooking solutions do not always match these customs and preferences. Some more efficient cooking solutions are not capable of cooking traditional food in the same way as traditional cooking methods. People are unlikely to adopt new technologies if the food does not taste or feel right. They are not always aware of the advantages of alternative cooking solutions and, whilst there have been successful marketing and public awareness campaigns to promote more efficient and cleaner solutions, these are often conducted for too short a period of time and in a fragmented way [65]. Advertisements and promotions for clean cooking ››

Barriers to clean cooking

solutions are sometimes also hampered by the diversity of languages spoken in the camps and settlements. In addition, cooking solutions need to be assessed at field level – in addition to laboratory tests – to make sure they perform well in the specific context and meet end-users needs.

OPPORTUNITIES

While households expressed openness to trying new solutions, these would need to be easily accessible, affordable, and match their preferences. Interest in LPG and electric cooking exists and may increase in the future but biomass cooking systems are likely to remain prevalent for a long time, also considering that stove and fuel stacking is the norm. As such, it will be important to promote efficient, fuel-saving technologies. Humanitarian and development organisations can play a role in supporting the sustainable management of forest resources and promoting agroforestry measures. As sales of firewood and charcoal are a huge source of income for host community members, they would need to receive support to gradually shift their livelihoods, for example through entrepreneurship trainings or as technicians for other energy technologies.

The promotion of clean cooking solutions such as LPG and e-cooking should continue to be supported, with the expectation that uptake may be incremental and initially only as a secondary stove. Awareness raising campaigns such as live cooking demonstrations play an important role in these solutions, and refugee community leaders and other influential figures have an important role to play in these campaigns to support successful market building [65]. These champions of clean cooking could play a crucial role in demonstrating benefits of products and supporting uptake. For this to be a success, the messaging of these campaigns needs to be well coordinated and should be conducted over longer periods of time. An example of an awareness raising campaign which incorporates these considerations is SNV's Behavioural Change Communication Campaign. Ongoing since May 2021, it targets both specific community groups and broader markets in close collaboration with the private sector. Local leaders are engaged to mobilise their communities and convey the messages in local languages. As access to mobile phones increases, the effectiveness of digital communication channels like social media or bulk SMS should be furthered explored.

BARRIER	OPPORTUNITY
High upfront costs of multipurpose stoves, LPG and EPCs	End-user subsidies, saving groups, pay-as-you-cook systems, flexible repayment mechanisms
Limited supply of raw materials for local cookstove production	Strengthening supply chains for raw materials, assessment of viability of cookstoves which use other fuels
Limited private sector engagement	RBFs, easier access to credit, and other incentives to start and expand operations
High cost of firewood and charcoal	Support to supply chains of sustainably sourced firewood and charcoal
Preference for three-stone-fire stoves, unfamiliarity with clean cooking solutions	Awareness raising and product sensitisation campaigns in local languages using community leaders and other influential figures, clear evidence that other cooking solutions save time and fuel

Energy access for livelihoods and productive uses

Kakuma's informal economy is thriving with more than 2,500 businesses [66] including 14 wholesalers [73]. Common businesses include retail outlets like small general stores, kiosks, grocery stores, butcheries, fruit vendors, cosmetic stores, mobile phone shops, clothing and shoes shops, and hardware shops. There are also many service sector businesses like eateries and hotels, barbershops, salons, and tailoring businesses [11]. These businesses have a wide range of electricity needs including for cooling beverages, storing perishable goods, water pumping, agro-processing, phone charging and ICT services.

All of these businesses could use access to reliable energy to enhance their operations, and improved energy access could create new opportunities for income-generating activities [11]. They would also all benefit from reliable lighting sources to allow them to extend their opening hours. Present access to productive uses of energy (PUE) varies between different areas, and between the communities: a study by GIZ in 2019 which focused on Turkana County, for example, found that the refugee community engages more in productive uses of energy for the sale of goods and for powering their appliances, as well as for educational purposes, compared to the host community (Table 7) [11].

Increased energy access offers many opportunities to grow other sectors. For example, improved internet connectivity and higher mobile phone penetration in most parts of Kakuma have opened up opportunities for potential private sector investment [75] and there is a high demand for information and communication technologies [11]. Cyber shops and computer centres in the camp require Wi-Fi services to enhance the use of their computers and printing services; this has created business opportunities for community-led enterprises like Kakuma Ventures to provide these services (described in the following section). Community-led organisations such as Fradi and the Raphael Recycling Plant recycle different forms of waste, activities which could be boosted by improved energy access. Given the increasing use of small solar systems, an e-waste management system should be established to adequately dispose of these products. Entertainment options could be also expanded through electricity services, including entertainment halls screening videos and football games. Solar-powered refrigeration or cold storage units, meanwhile, could help generate revenues by offering chilled drinks or extending the shelf-life of perishable food.

Access to electricity for productive uses is increasing: a midline assessment by GIZ found that electricity access for businesses had in- ››

TABLE 7

PUE usage by host and refugee communities in Turkana County [74].

VALUE CHAIN	PUE USAGE	HOST COMMUNITIES	REFUGEES
TRADE	SELLING OF PRODUCTS AND SERVICES	4.2%	19%
	ENERGY FOR LIGHTING	33%	42%
HOSPITALITY AND SERVICES	ENERGY FOR APPLIANCES (TV AND RADIO)	20%	33%
AGRICULTURE	USE OF MINI-GRID ELECTRICITY FOR WATER PUMPING	11.4%	14.3%
	USE OF SOLAR ENERGY OF WATER PUMPING	23.5%	52.4%

Energy access for livelihoods and productive uses

creased from 9% in 2021 to 47% in 2022. Electrification rates for businesses were found to be higher than for households, with 60% of businesses in Kalobeyei settlement and 50% in Kalobeyei town being electrified, with business owners between the ages of 25-34 having the highest rates of access [69].

A survey conducted by SNV in 2020, meanwhile, found that 54% of businesses in Kakuma and Kalobeyei used electricity, and that 73% wanted to obtain or increase their electricity access. Most businesses used diesel-based electricity for more power-intensive appliances (such as for refrigerators and audio systems) and solar for smaller appliances (such as for lighting and phone charging) [66]. A breakdown of power sources used by businesses with electricity access is shown in Figure 9 and the electricity services used are shown in Figure 10. ››

FIGURE 9

Power sources used by businesses with electricity access [66].

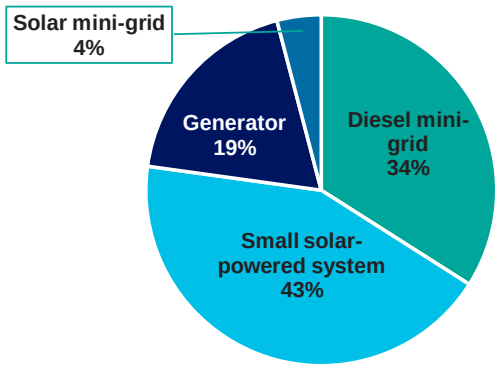
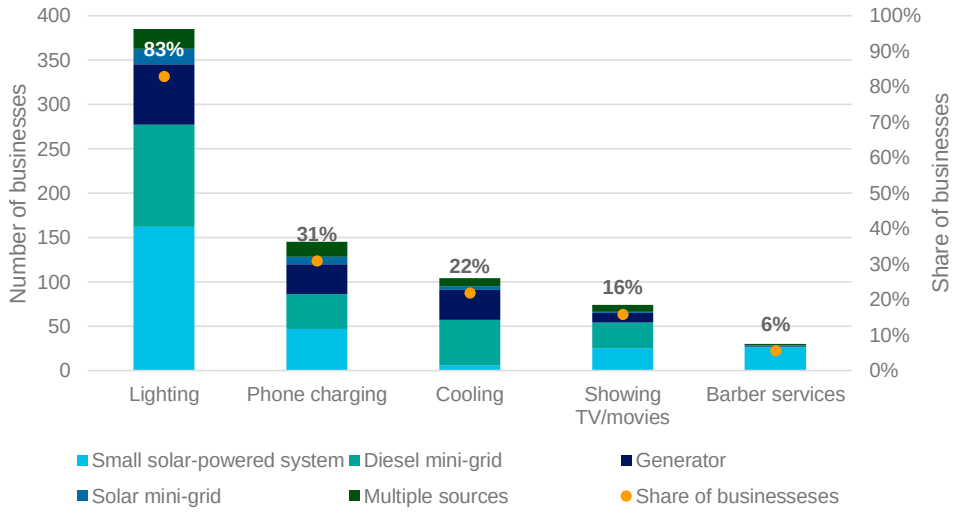


FIGURE 10

Numbers of businesses with electricity access which use electricity for given services [21].



Energy access for livelihoods and productive uses

A recent assessment by SNV for the ESDS programme created an inventory of the available appliances in Kakuma and Kalobeyei (see Figure 11). It found that there was a wide array of both on-grid and off-grid appliances for sale, albeit mostly in Kakuma sub-camps 1 and 3 and in Kakuma town, with only four vendors in Kalobeyei. Off-grid appliances which can be powered by standalone systems are available as plug and pay kits (ranging from light bulbs and USB charging stations to televisions, fridges, fans, and radios) or through component-based systems that are tailored to consumers' needs, for example to power a refrigerator (see Figure 12), freezer, EPC, water pump, or maize mill [21]. Suppliers noted that the main challenges they faced was competition from other vendors, defaulting customers, high costs for transporting stock from Nairobi to Kakuma, stock delivery delays, lack of local repair capacity or spare parts, and warranty issues. ››

FIGURE 11

Summary of appliances available in Kakuma and Kalobeyei and their PUE application [21].

Appliance type	PUE application	On-grid	Off-grid (with solar)
Light bulbs	Longer opening times		
Mobile phone charging station	Charge for a fee		
Fridge/freezer	Sell cold beverages/fresh produce		
Audio system	*Complementary service/entertainment (in eatery, barber, cybercafé, bar)*		
Radio	*Complementary service (in eatery, barber, cybercafé)*		
TV	Show movies/football matches for a fee + *complementary service*		
Fans	*Complementary service (in eatery, barber, cybercafé)*		
Computer/laptop	Use IT services for a fee		
Printer	Print for a fee		
Photocopier	Copy services for a fee		
Hair clipper	Hair dressing services		
Hair dryer	Hair dressing services		
Sewing machine	Tailor services		
Blender	Food preparation (eateries/catering)		
Electric pressure cooker	Food preparation (eateries/catering)		
Water dispenser	Sell water/Eateries/Catering		
Public address system	Rent for use/marketing tool		
Water pump	Irrigation for farming		
Electric kettle	Food preparation (eateries/catering)	Yes	

Key

- Available
- Expected Supply
- None/Unknown

Being connected to solar power makes my business easier because electricity is available throughout the day. If I were connected to the standalone generator, I would only be able to work for limited hours and earn less income.

– Phone charging vendor in Kakuma

Energy access for livelihoods and productive uses

For cooking businesses, the reliance on charcoal and firewood stoves is nearly universal, as found by SNV's EnDev MBEA project and shown in Figure 13: 96% of businesses involved with cooking used basic charcoal or firewood stoves or three-stone fires [66]. A majority (58%) of businesses expressed an interest in switching to other stove types such as improved charcoal stoves, LPG, or bioethanol stoves for health and stove capacity reasons [66]. However, they faced limiting factors such as unavailability and high costs of the alternative stoves.

In interviews conducted by the READS programme, business owners expressed the need to access financial services to expand their sources of livelihoods and to access efficient energy sources. Surveys have found that refugees wanting to own a business are also constrained by the high rental charges (16%), movement restrictions (13%), lack of space available for rent (12%), lack of support from camp administration (11%), and the time it takes to get a travel pass (10%) [73].

To address some of these challenges, the International Finance Corporation set up the KKCF with the aim of overcoming the information gap and improving the regulatory environment for refugees and host communities in Turkana County [25]. To address the need for financial services for businesses, this initiative aims to improve access to funding and offer advisory services to facilitate a long-term sustainable business environment for the camp. ››

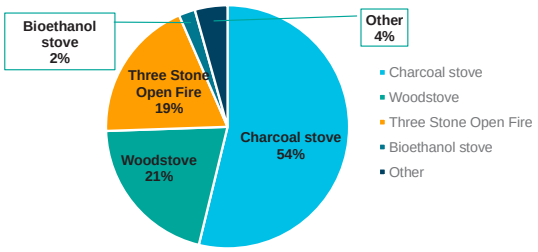
FIGURE 12

A battery-powered solar system used to power a refrigerator in a shop in Kakuma 1.

©Nyayow Deng Chuol/GPA/UNITAR

FIGURE 13

Distribution of cookstove types used by businesses [66].



This system powers my refrigerator and provides electricity in the evenings. I am currently content with it, but if I am to expand my shop and have more appliances, I will need connection to a mini-grid.

– Shopkeeper in Kakuma 1

Energy, gender and livelihoods

There is a gender gap in business ownership and job opportunities in Kakuma. In the camp, 23% of male respondents have a business or are self-employed, while only 7% of women respondents are self-employed [11]. Furthermore, female entrepreneurs in Kakuma camp are less likely to register their business (22%) than men (49%). Women tend to work in activities that require lower starting capital and skills and also yield lower income, including care work, retail, hospitality and services such as baking or tailoring [11]. Lower education levels for women translate into lower rates of employment, business ownership, and access to finance. Insights from the READS interviews also confirmed that women were less likely to be involved in formal jobs and business ownership compared to men, who were mostly entrepreneurs. This disparity highlights the need for interventions that focus on empowerment and capacity-building to ensure that all genders gain equal opportunities. Examples of capacity building addressing this disparity in Kakuma include educational and vocational programmes for women dedicated to developing and fostering entrepreneurship skills and approaches, and training in computing and IT skills, such as coding. Some energy companies that are active locally are pushing to hire equal numbers of female and male technicians and site managers. In order to do so, efforts must be made to train more women, as the negative bias towards women in typically male-dominated professions has resulted in unequal training opportunities. Women already working in these domains can play an important role in encouraging other women to pursue training and employment opportunities, thereby combatting these biases.

The majority of businesses in Kakuma and Kalobeyei are owned by men. This gender gap highlights the need for targeted interventions that increase opportunities for female entrepreneurs.

Barriers to energy access for livelihoods and productive uses

AVAILABILITY BARRIERS

Many businesses do not have sufficient access to electricity. A SHS may not have the necessary capacity for power-intensive appliances, and the electricity provided by the network of informal diesel generators only provides a limited amount of power for certain hours a day. Private solar mini-grid operators currently only reach businesses in certain areas and struggle to meet the high demand. While there are plans to further expand the connections to these systems, these are subject to acquiring sufficient funding to overcome high initial costs and navigating the long and complex regulatory processes for new sites, which also inhibits new entrants to the market. Underlying these issues, land acquisition remains a challenge both for the location of the mini-grid site (which could potentially be outside of the main population centres) and the distribution network to bring the power to the communities (which would inherently need to permeate them). Identifying and training staff to operate and maintain the systems can also pose a challenge. In addition, even for businesses with reliable access to energy, acquiring electric appliances for productive uses is often challenging as they are not always available in local markets and come with high upfront costs.

OPPORTUNITIES

The planned expansion of the existing mini-grids through the OkRene energy partnership offers an important opportunity to significantly increase access to electricity for businesses. In addition, streamlining mini-grid approval processes would facilitate both new entrants to the market – or formalise existing ones – and increase the speed at which systems can be installed in displacement settings. SNV's recent assessment on the availability and demand for PUE appliances shows that there is a relatively wide array of on- and off-grid appliances available and recommended showcasing them and supporting direct linkages for entrepreneurs with vendors. It also recommended training vendors on how to provide support to customers on appliance maintenance and on how to provide high quality after-sales services [21].

AFFORDABILITY BARRIERS

Most of the challenges for accessing energy for productive uses relate to high costs, with interest in switching electricity source discouraged by high upfront expenses. Larger, higher-capacity SHS are too expensive for some businesses to afford, for example, and customers of informal electricity providers pay higher prices to cover increases in diesel costs. As these systems do not use electricity meters, customers are obliged to pay fixed rates regardless of their consumption. Some clients of solar(-hybrid) mini-grids also struggle with the high tariffs that are charged by some operators. Mini-grids which have gone through the official regulatory processes have tariffs determined by financial modelling and set by the regulators; as of now, there are significant differences between the tariffs of the different systems. Even customers who have access to the Renewvia mini-grid with cheaper tariffs perceive electricity to be more costly than it actually is, and believe that they will need to pay more than in reality, and so are hesitant to use electric appliances [21].

Power-intensive electric appliances like refrigerators can also be costly, both to purchase initially and operate due to high tariffs. Credit options are often limited, particularly for refugees with limited access to formal financial services due to a lack of collateral or credit history [21].

OPPORTUNITIES

Feasibility studies could support the development of systems that are closely designed around their potential customers. These could focus on the time and amount of electricity consumption, and adapt the generation and distribution equipment requirements around these needs, resulting in better-designed systems. Following this, increased grant funding for mini-grid development projects will be necessary to overcome initial capital constraints and allow for affordable connection fees and tariffs. This could also be used to investigate the potential for improved tariff systems: implementing time-of-use tariffs which are lower during the day, for example, could promote productive activities and electricity for livelihoods. Tariffs across different mini-grid sites should ››

Barriers to energy access for livelihoods and productive uses

be harmonised to not disadvantage customers in certain areas.

On the demand side, while costs are usually cited as the main barrier for switching to a renewable power source or a cleaner cooking system, businesses are currently already spending a lot of money on diesel-based electricity and on biomass fuels which indicates an ability to pay for improved solutions. Businesses should receive more information on the opportunities of appliances through cost-value demonstrations and different types of payment models, and the use of electricity meters in demonstration activities could increase the understanding of actual versus perceived costs [21]. A business case should be developed for solar-powered appliances to assess their return on investment and demonstrate their cost savings [66].

Tailored microfinance loans can support the acquisition of appliances, which should also be accompanied by entrepreneurship and financial literacy training. Informal savings groups should also be supported and receive training on the benefits and opportunities of PUE so that they can promote the uptake of appliances by their members by providing appropriate lending services [21].

ACCEPTABILITY BARRIERS

Many businesses that currently do not use electricity are interested in obtaining it for lighting purposes and to power appliances, but they are not always well informed about available solutions [66]. Business operators may also lack familiarity and a good understanding of how to use electric appliances in an energy-efficient way. Cooking businesses may also not have experience with more energy efficient cooking solutions, preferring to cook with more familiar biomass stoves and fuels.

OPPORTUNITIES

Mini-grid operators, off-grid solar companies and clean cooking companies could expand their market through increased advertising of their products. This should account for the needs of different types of businesses, proprietors, and their customers. Hiring successful entrepreneurs as brand ambassadors could help to improve the acceptability and awareness of newer technologies, as well as promote their benefits. Entrepreneurship training can support the increased use of appliances and the offering of new business activities [21]. NGOs and governments also have a role to play in supporting product sensitisation campaigns to promote electricity connections and energy-efficient appliances, as well as improved cooking solutions.

BARRIER	OPPORTUNITY
Low awareness of availability of solar-powered appliances and energy efficient cooking systems	Showcase existing solutions and link entrepreneurs to vendors
Limited familiarity with appliances and lack of repair services and spare parts	Product sensitisation campaigns and trainings on PUE appliances Train vendors in after-sales services
Limited availability of mini-grid connections	Partnership of existing mini-grids and harmonisation of operations Streamlining mini-grid approval and development processes
High costs of upfront costs solar systems, solar-powered appliances, and clean cooking systems	Flexible repayment mechanisms, instalment payments, tailored micro-loans Cost-value demonstrations using electricity meters Collaborate with and train informal savings groups

Energy access for community facilities

There are around 60 social institutions in Kakuma town, Kakuma refugee camp and Kalobeyei Integrated Settlement. These include schools (with between 250 to 5,500 pupils each), hospitals and clinics (40 to 180 patients), special service centres (6 to 200 users), and reception centres for new arrivals (2,000 people) [76]. Each of these facilities has different energy needs depending on the type of the institution and the services it provides and, whilst access to sustainable cooking is still very limited, community facilities generally have better access to electricity than households or businesses [77].

Community facilities which have access to electricity are powered either by individual diesel generators, standalone solar systems, or are connected to a mini-grid. Some of these are self-funded, other systems have been provided by donor projects. Humanitarian organisations provide funding to some institutions, such as schools and clinics, for fuel to operate their generators [78]. Some social institutions are also connected to the Renewvia mini-grid.

Lutheran World Federation, which operates in Kakuma camp and Kalobeyei settlement, provided internal and street lighting to 24 schools in Kakuma and five sites in Kalobeyei through the use of decentralised stand-alone solar systems [26]. Additionally, six schools and clinics in Kakuma camp were supported under Project Jua, funded by the OVO Foundation and implemented by Energy 4 Impact, with the installation of 800 Wp solar systems [79]. In 2018, the Moving Energy Initiative funded the installation of solar systems at two clinics in Kakuma Camp, run by the International Rescue Committee. Clinic 5 (3 kWp) and Clinic 6 (36 kWp), and involved the refugee and host communities in the installation and maintenance of the solar systems [26]. In July 2018, UNHCR solarised the main hospital in the Kalobeyei settlement with a 55 kWp solar hybrid system that was designed and installed by the private sector [25].

A midline assessment by GIZ found that schools that had electricity access experienced an increase in enrolment compared to non-electrified schools and were able to offer evening classes. Electricity enabled the use of digital platforms like YouTube and established learning centres, and also allowed teachers to access online training. Access to the mini-grid has also allowed for new institutional cooking technologies, like EPCs, to be piloted in three schools. Similarly, health centres benefitted from electricity access by being able to introduce specialised healthcare by using laboratory, pharmacy, and refrigeration equipment and by implementing digital record-keeping [69].

Improving public lighting can increase the feeling of safety of local residents. In 2016, the IKEA Foundation launched a project to install 350 solar street lights around public facilities in Kalobeyei settlement and 900 solar streetlights in the Kakuma camp, including around the airstrip [25]. To reduce potential vandalism UNHCR worked with residents to promote community ownership, an approach which included training 60 refugees to maintain the solar equipment. The Turkana County Government, meanwhile, has a goal to install solar streetlights in 20 towns, as well as solar systems in 450 public institutions [26]. Students reported feeling safer walking to school early in the morning or home in the evening, whilst businesses reported being able to operate for longer hours. There were also reports of decreased incidences of theft and scorpion bites as further benefits of public lighting [69]. ››

Energy access for community facilities

Community facilities like cyber cafes, ICT centres, and learning hubs require power for their equipment. Swisscontact and SAVIC launched a solar-powered ICT centre that provides skills training, commercial services such as photocopying and phone charging, and opportunities for local schools. Additionally Okapi Green Energy, a refugee-owned energy enterprise, has registered the solar-powered Nuru Access ICT Centre to provide ICT services in Kakuma [11]. Nuru offers internet access, virtual meeting tools, printing, and photocopying, among others, and has become a hub of connectivity [80].

Most schools rely primarily on firewood and charcoal for cooking and use multipurpose institutional stoves, as shown in Figure 14. Firewood donations from UNHCR to social institutions amounted to 63 metric tonnes per month on average in 2022. To address this, the SNV EnDev MBEA II Project is promoting market-based access to clean cooking and solar power in social institutions. In partnership with MECS, SNV has conducted an assessment of the feasibility on cooking with EPCs in four institutions which either have their own solar system or are connected to the Renewvia mini-grid. This includes the Angelina Jolie School in Kakuma (see Figure 15), and some of the users of these EPCs were interviewed as part of the READS research. Some respondents were very positive about the EPCs, particularly because they cooked food faster, and expressed their interest in switching to this technology. Others said they preferred familiar cooking methods, voicing concerns about the safety of cooking with electricity and expressed that they were worried about electric shocks. They said they would require more training to use the EPCs as it was an unfamiliar technology for them.

Further insights from the fieldwork were that hospitals in Kakuma use both solar power and generators as a backup because electricity demands are high and critical, such as for medical equipment and storing patient records. A nurse explained that solar is used during certain hours, usually from 9.00 to 22.00, whilst generators are used late at night and during emergencies. For institutions without generators, however, operations are more limited, for example in boarding schools which use solar to provide lighting for studying at night. ››

FIGURE 14

Institutional cookstoves used at the Angelina Jolie School.

©Nyayow Deng Chuol/GPA/UNITAR

FIGURE 15

An EPC piloted at the Angelina Jolie School.

©Nyayow Deng Chuol/GPA/UNITAR

Barriers to energy for community facilities

AVAILABILITY BARRIERS

Many schools, clinics and other community facilities have access to relatively reliable power from diesel generators, a connection to a mini-grid, or standalone solar systems. Those with the latter only, however, face challenges with power being available during the daytime or for short periods in the evenings which limits activities such as studying after dark. READS workshop participants also shared that these availability challenges can be compounded by maintenance issues. These could be exacerbated by an actual lack of skilled labour to fix issues, or the presumption of a lack by installers based outside of the camps who do not have local staff. Access to non-biomass cooking solutions at institutional scales is rare and limited to pilot projects, owing to a lack of available technologies and suppliers.

OPPORTUNITIES

Recent expansions of the Renewvia mini-grid throughout Kakuma offers new opportunities to increase connections for social institutions under private-sector-led modalities. This is likely to increase both the availability and the long-term sustainability of electricity provision for facilities within the reach of the mini-grid. It also provides opportunities to scale up electric cooking projects to greater numbers of institutions.

For those located far from reliable electricity connections, more resources will be necessary to provide access to electricity and this may instead require more traditional grant-funded implementation models. For these solutions in particular, technical training of local staff and providing recognised qualifications would help to ensure their long-term effectiveness.

AFFORDABILITY BARRIERS

Standalone electricity systems have high upfront costs, and even connecting to the grid or a mini-grid system could come with an unaffordable connection fee. Whilst some social institutions might receive an income from users, for example school fees, or funding from the government or humanitarian agencies, their budgets are usually very limited and do not include spare funds for energy. Some facilities receive ongoing payments for fuel but READS workshop participants shared that typical, donor-funded projects have limited initial budgets and often do not provide sufficient funds for long-term operations and maintenance (O&M), affecting the functionality of energy systems during and later in their lifetimes.

OPPORTUNITIES

Budgeting for O&M costs from the outset of a project is essential to ensure the longevity of the system. Diversifying funding streams could also play a key role in contributing to the sustainability of the project. For example, community facilities could explore income-generating activities as a side business to generate revenue to cover O&M costs, including selling cold drinks, offering phone charging services, or serving meals.

ACCEPTABILITY BARRIERS

In Kakuma, workshop participants highlighted issues relating to acceptability and community perceptions for public lighting in particular. These included community members not being consulted on the locations of streetlights, the thinking that they belong to the donor rather than the community, and cultural beliefs and resistance to change about the installation of lights at all. Each of ››

Barriers to energy for community facilities

these diminishes community buy-in to energy projects for social institutions and makes long-term success much harder.

OPPORTUNITIES

Community ownership will be critical in any model under which members are expected to contribute towards the upkeep of a system which provides a public good. To support this, local leaders can offer an opportunity to introduce and endorse the benefits of energy in public facilities to their respective communities. Additionally, there is the opportunity for greater consideration of who uses services from social institutions – with men reported to typically access them more, and people with disabilities less – to be included in community engagement plans to increase acceptability and ensure equitable access for all groups. ●

FIGURE 16

An institutional EPC being piloted at a school.

©EnDev and SNV

BARRIER	OPPORTUNITY
Lack of skilled and qualified labour for the maintenance of electricity systems	Provide training and capacity building which leads to certified qualifications
Reliance on grants for upfront costs and limited funding for O&M	Connect to private mini-grids where available and diversify funding streams, such as through revenue generating activities as a side business
High costs of public lighting and reliance on grant funding, with low community engagement and buy-in for public lighting projects	Connect public lighting to existing electricity infrastructure Involve local leaders and engage community groups during project planning phases Form community-based maintenance cooperatives
Lack of institutional cooking technologies that do not use firewood	Assess viability of institutional stoves that use other fuels than biomass such as EPCs, and support private sector to supply these technologies Invest in R&D for development of alternative institutional cooking technologies

Energy access in Dadaab

Far less work has been done to improve energy access in the Dadaab camps compared to in Kakuma and Kalobeyei. Participants of the READS workshop shared that, while the Kakuma camp has many private actors and community-led initiatives working on energy access, these are much rarer in Dadaab. One of the main issues is the relative inaccessibility of Dadaab: the Lodwar-Nadapal-Juba highway passes through Kakuma and Kalobeyei, but the Dadaab camps are much more remote. This increases the difficulties of transporting people, raw materials, and goods, and weakens the linkages to suppliers and organisations working elsewhere in Kenya.

As a result of this reduced attention and number of actors, the volume of research and available literature is also much smaller. Reports that have been published, however, agree that energy access in Dadaab is low amongst both the refugee and host communities. A field study in 2016 found that 61% of refugee households, and 85% in host community, used dry-cell battery torches for lighting [81]. More affluent households, around 10%, have connections to diesel generators: some have their own, whilst others connect to their neighbours' for a monthly fee, offering a business opportunity for those who can afford to buy and operate them. Just 7% of households were found to use solar lanterns. A similar breakdown was found by a UNHCR study from 2014, which also found that an average household spent KES 230 ($2.30 at the time) on dry cell batteries per month, and KES 885 ($8.90) across all electricity services, including phone charging [82].

Domestic access to clean cooking energy in Dadaab was even lower. The 2016 study found that 98% of sampled residents use firewood as their primary cooking fuel. Three quarters of households received donated cookstoves from NGOs working in the camps, whilst 11% of the households also had an additional secondary stove [81]. Amongst these secondary stoves, 48% use charcoal. In 2014, social institutions reported experiencing a scarcity of wood fuel owing to competition with households and the increasing distance from which fuel was sourced [82].

Some initiatives have been implemented to try to improve energy access. As far back as 2011 the Household Energy Project, implemented by GIZ, highlighted the inadequate access to cooking energy in Dadaab [83]. To help reduce firewood consumption compared to three-stone fires GIZ promoted several alternative stoves, in partnership with WFP and UNHCR, including:

- The Save80 stove, so-called as it aims to reduce firewood consumption by 80%, which is made from stainless steel and is designed to provide high fuel efficiency cooking for several years,
- The Wonderbox, designed to retain the heat of food or water within it and made from durable materials, and
- The Envirofit stove, which aims to reduce biomass fuel use by up to 60% and cooking time by up to 50%.

From 2010 UNHCR implemented a series of projects to increase sustainable energy access mainly through distribution models [84]. At the time of writing of their progress report in 2014, their projects had installed 913 streetlights in the camps and host community, distributed more than 33,000 solar lanterns and 41,000 stoves, or were expected to by the end of that year.

Despite these initiatives, increasing energy access in the Dadaab camps has faced many challenges and much more work is needed. Most previous projects have been implemented under free distribution models, owing to the current lack of private sector involvement, but this does not need to be the case forever. UNHCR and the International Labor Organization conducted a market analysis for refugee livelihoods in Dadaab and, similar to the READS workshop participants, recommended strengthening linkages with actors outside of Dadaab to increase the private sector presence in the camp [85]. Whilst this will require a significant investment to reach the levels seen in Kakuma and Kalobeyei, and elsewhere in Kenya, this will likely be necessary to improve sustainable access to energy products and services in Dadaab.

Energy access for operational and organisational purposes

Most humanitarian organisations operating in Kakuma camp rely on diesel to power their offices. The UNHCR and WFP compounds each rely on diesel generators, but UNHCR is in the process of solarising its compound through a lease agreement with an independent power provider. Meanwhile Compound 1 and Compound 3, where most of the offices are located, are connected to the main KPLC grid – itself powered by a diesel power station – and have generators for backup during outages. Other humanitarian agencies operating in the towns of Kakuma and Kalobeyei, such as Kenya Red Cross, LOKADO, World Vision and KKCF, also have both connections to the KPLC grid and backup generators.

Whilst diesel generation is prevalent for organisations' offices, renewable energy is becoming more commonly used for social institutions in Kakuma. UNHCR has rolled out a solarisation programme in Kakuma and Kalobeyei for hospitals, field posts, protection centres, schools, and reception centres. Of the 22 boreholes in the Kakuma and Kalobeyei, 18 have been transitioned to solar power; the remainder are at risk of washing away and so still rely on diesel. The Renewvia mini-grid, which mainly serves households and businesses, also provides power to 21 religious buildings, nine NGO offices, and three schools.

Humanitarian agencies in Dadaab, meanwhile, rely on diesel generators for electricity but several solar solutions have been piloted [84]. Solar panels were used to provide electricity for radio communications and internet connectivity as a backup to generators in the UNHCR offices, and a solar-powered compound perimeter fence lighting system was being operated by the International Rescue Committee in Hagadera hospital. Solar powered water chlorination systems and pumps have been adopted in the UNHCR compounds, and the hot and windy weather in Dadaab offers high potential for other and more widespread uses of solar energy.

Barriers to operational electricity use

In Kakuma, humanitarian operations typically have reliable access to electricity and this is increasingly being sourced from solar, rather than diesel, and under private-sector models as opposed to grant funding. As this transition continues, the long-term maintenance of solar systems will become more important to ensure continued usage and avoid reverting to using diesel generators as a backup.

In Dadaab, meanwhile, increasing the usage of solar energy might require greater reliance on traditional donor-funded models until more private options become available. The limited in-house capacity of humanitarian and development organisations to design, install, and maintain renewable energy systems could present a barrier as it would result in an increased reliance on external parties, either NGOs or the private sector, to undertake these. In remote locations such as Dadaab this could result in additional challenges relating to the accessibility of the camps and expense of transporting equipment and personnel to them.

OPPORTUNITIES

Kakuma offers a relatively strong enabling environment for further transitioning diesel usage to solar power: many operations have already swapped over, including under private-sector-led models. In the future O&M will become increasingly important which presents an opportunity for the training and certification of refugees, host ››

Energy access for operational and organisational purposes

community members, and even humanitarian staff to ensure the longevity and uptime of the systems.

The transition to solar appears more nascent in Dadaab, offering greater opportunities to offset diesel in favour of renewable energy. Introducing private sector companies which specialise in standalone systems or mini-grids to Dadaab could show them the market potential, and replicating existing modalities from Kakuma could help this transition. This could potentially be accelerated by involving NGOs with specific experience in electricity system design to provide assessments, demand estimations, and introductions to the private sector and demonstrate the viability of the business case.

Kakuma offers a relatively strong enabling environment for further transitioning diesel usage to solar power. O&M services provide an opportunity for training and certification of refugees and host community members.

BARRIER

Existing solar systems will require increasing maintenance over time

Limited in-house capacity of organisations for designing, installing and operating systems

Remoteness of Dadaab camps and perception of the private sector that they are too risky

OPPORTUNITY

Provide training and capacity building which leads to certified qualifications

Involve NGOs to support in energy assessments and business case development

Facilitate private sector introductions to Dadaab to demonstrate market potential and replicate contracting models used in Kakuma

Energy access in urban settings

Most refugees in Kenya reside in Kakuma and Dadaab camps, but over 90,000 also live in urban areas. Nairobi in particular has a relatively large refugee population, with different areas having higher numbers of refugees from different countries including Eastleigh (predominantly those from Somalia, Ethiopia, and Eritrea), Kawangware (South Sudan and DRC), and Umoja/Kayole (Republic of the Congo, DRC, Burundi and Rwanda) [86]. As urban refugees live amongst host populations and are spread across larger areas, this can limit the amount of direct support they receive from humanitarian organisations, especially when they lack documentation.

Access to the national grid is relatively high in urban areas but many refugees also live alongside Kenyans in low-income areas and informal settlements where grid connections are more sporadic. Kenyans and urban refugees living in the same areas experience similar barriers, such high costs of electricity, as most residents have low incomes [87]. This is exacerbated by power companies expecting upfront fees before connections which inhibits households from gaining a connection. Efforts are underway to improve this: the Kenya Slum Electrification Project, implemented by KPLC and the World Bank, has used community-centric approaches to market the advantages of cheap, legal power in slum areas [88].

The provision of electricity in Nairobi is mainly through the national grid but the issues of power outages and unreliable electricity were shared by participants of the READS research who live in the city. Residents of wealthier areas of Nairobi mentioned that power outages were less frequent compared to the more rural and low-income areas.

Pre-paid meters are becoming increasingly popular and are used by 83% of households formally connected to the national grid [89]. Households interviewed as part of the READS research expressed interest in switching to the prepaid tokens system as it allows them to monitor their usage and adjust their consumption accordingly: customers purchase electricity tokens for their meters and screens allow customers to view their credit balance, as well as prompts to make payments. Before the installation, users are trained on how to operate the interface. Customers with this system felt that it was easy to use and affordable, but shared concerns that it may not ››

> The power outages in Nairobi are mostly caused by network maintenances which are usually communicated in advance by KPLC. When I go back to my rural home, there is usually inconsistent electricity supply with multiple power outages.
>
> – Nairobi resident

Energy access in urban settings

be accessible to households which cannot afford the upfront costs of purchasing a pre-paid meter. Users also shared that the alternative post-paid method is more costly, as the meter charges for reconnection fees as well as late payment penalties and lacks flexibility regarding the payment amount.

Similarly to the three quarters of Kenyan households [90], urban refugee households interviewed by the READS team rely on traditional cooking methods like using firewood and charcoal to cook. Most use charcoal stoves (*jikos*) for their daily cooking needs whilst some households that receive monthly remittances from relatives abroad use both LPG and charcoal stoves. Interviewees shared that the main barrier to access cleaner cooking methods was the costs associated with purchasing them, as most households bought stoves through an upfront cash payment.

Overall, refugees living in urban areas have similar levels of access to sustainable energy as their Kenyan neighbours. Grid connectivity is better in more affluent areas of cities compared to informal settlements and slums and, in general, households rely on charcoal for cooking rather than cleaner sources such as LPG or electricity. Access to formal humanitarian support is more limited for urban refugees and increased sustainable energy access may be more likely to come from national government policymaking rather than traditional humanitarian sources.

> Prepaying for electricity tokens is easy and affordable because I can pay any amount that I have and access power. Sometimes I pay KES 200 ($1.40), which lasts for up to a week or two depending on my use. When I lack money to pre-pay for electricity, I stay without power until the next time I get money. This system is better because if I was to use the post-pay method, I would be charged more for late payment.
>
> – Nairobi resident and pre-paid system customer

05

Present energy solutions in displacement settings

Overview of stakeholders in Kenya

Sustainable energy in displacement settings in Kenya is delivered through a complex network of stakeholders, each with their own mandates, projects, and objectives. Some organisations operate across the country or internationally, whilst others focus on issues in specific displacement settings.

The stakeholders working in Kenya can be classified into broad categories:

- **Government agencies** with mandates and responsibilities defined by the Government of Kenya.
- **Humanitarian and development organisations** which typically address specific issues including UN agencies operating across the world, international NGOs with projects in Kenya, and local NGOs working across the country or in certain areas.
- **Community-led organisations** which are directed and managed by members of the displaced or host communities, as well as appointed community representatives.
- **Private sector** companies which offer energy products or services on a commercial basis.
- **Finance institutions** which offer access to banking and other financial services to community members.
- **Other organisations** with a focus on issues that are related to energy in displacement settings.

This section provides a short summary of the most relevant organisations working in displacement settings in Kenya, their work, and relevant partnerships. It also provides deep dives into some of the projects and organisations aiming to improve access to sustainable energy in Kenya. The refugee response, and the organisations working within it, spans the entire country but most of the existing literature and projects focus on work in Kakuma and Kalobeyei in Turkana County. Similarly, the READS workshop was hosted in this area and so, aside from those operating nationally, this section focuses mostly on stakeholders operating in Kakuma and Kalobeyei but those working elsewhere are included where possible. The directory of stakeholders included in this section intends to be extensive but not exhaustive.

A diverse range of stakeholders deliver sustainable energy in displacement contexts in Kenya.

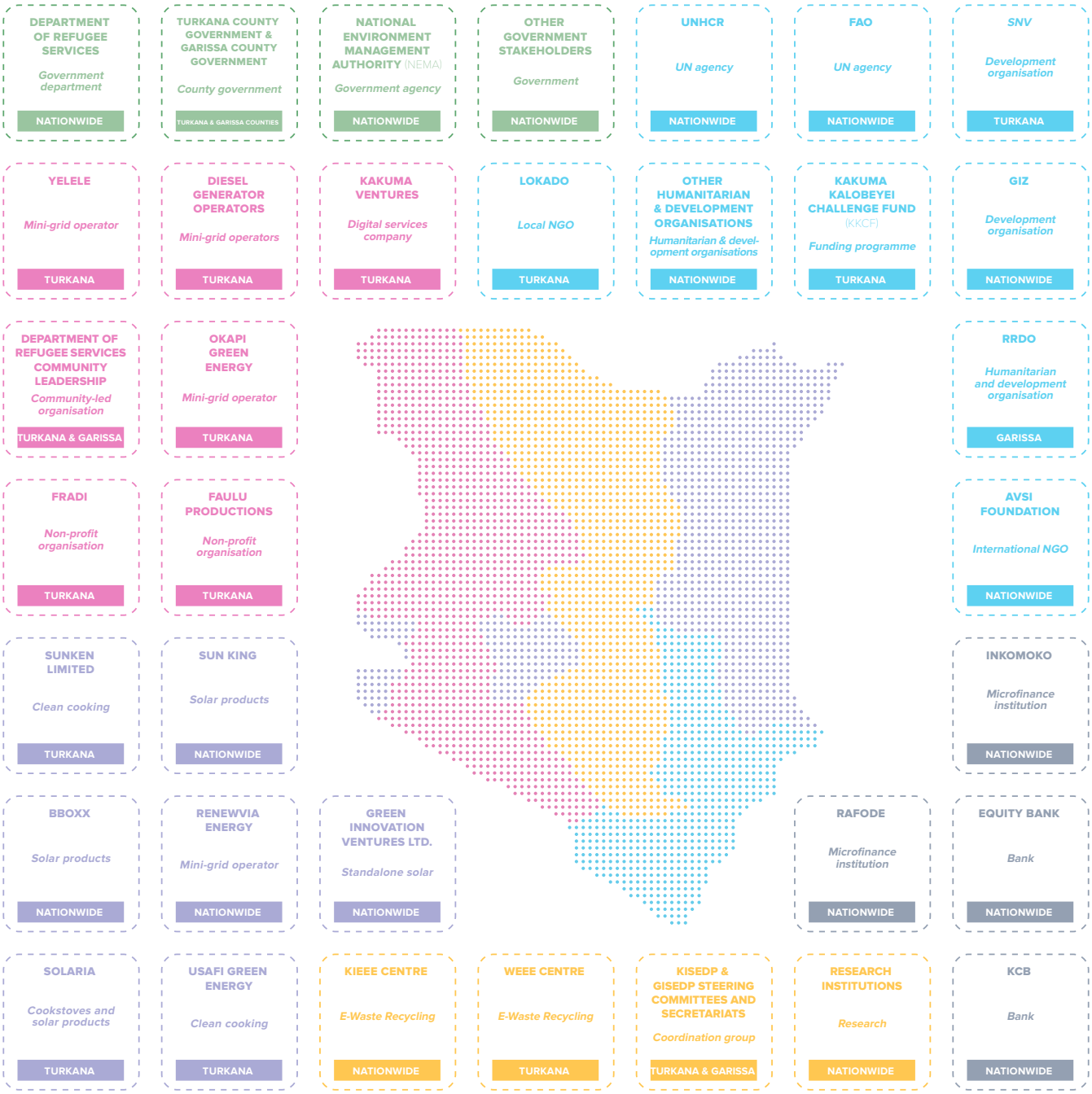
Overview of stakeholders in Kenya

The refugee response in Kenya is managed by the GoK's Department of Refugee Services (DRS), which oversees services such as registration and management, and UNHCR, which manages the refugee camps and villages and runs projects focused on livelihoods, agriculture, and education. These organisations are supported by implementing partners such as Norwegian Refugee Council, which is responsible for water, sanitation and hygiene, and the International Rescue Committee, which is responsible for healthcare [26]. National, county, and sub-county government organisations oversee their specific mandates in displacement settings, such as environmental protection, whilst humanitarian and development organisations run interventions across a range of focus areas, including energy.

Refugee and community groups advocate for the energy needs of community members, and several refugee-led companies and organisations work in the domain of energy provision. Local cookstove manufacturers operate and sell their products in the camp, as well as both local and international companies providing off-grid solar products, SHS, and connections to solar or diesel mini-grids. Many of these work in partnership with NGOs which provide training and market development assistance, such as under SNV's EnDev MBEA project, and the recent expansion of Renewvia's solar mini-grid supported by KKCF has provided the opportunity for thousands of new customers to access electricity. ●

©GIZ

Overview of stakeholders in Kenya



Stakeholder directory

GOVERNMENT

DEPARTMENT OF REFUGEE SERVICES

Government department

NATIONWIDE

The Government of Kenya's **Department of Refugee Services (DRS)** is responsible for the coordination of humanitarian assistance programmes for refugees and host communities, managing camps, promoting durable solutions, and other key services in displacement settings. Although **DRS** does not implement energy-specific programmes, it is involved in the coordination and management of many projects that take place in Kakuma, Kalobeyei and Dadaab.

TURKANA COUNTY GOVERNMENT & GARISSA COUNTY GOVERNMENT

County government

TURKANA & GARISSA COUNTIES

The **County Governments** of both Turkana and Garissa are responsible for the devolved administration of 14 critical functions including planning and development, environmental conservation, agriculture, and community participation. County governments are also mandated to further decentralise to the **Sub-County** level for more a direct provision of services, making both levels of government relevant to implementation in displacement settings.

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

Government agency

NATIONWIDE

NEMA has offices throughout Kenya to fulfil its mandate for environmental protection, management, and utilisation. It promotes environmental considerations into national policies and monitors activities to assess and prevent environmental degradation - relevant for clean cooking projects with fuelwood components. Projects are required to submit environmental impact assessments to NEMA; in Kakuma these have included those for water and sanitation treatment facilities.

OTHER GOVERNMENT STAKEHOLDERS

Government

NATIONWIDE

Other government stakeholders include **Kenya Power** (**KPLC**, electricity generation planning, and owner and operator of most electricity transmission and distribution infrastructure), the **Energy and Petroleum Regulatory Authority** (**EPRA**, the regulatory body for electricity and energy), **KETRACO** (government-owned company for high-voltage electricity transmission) and the **Renewable Electrification and Renewable Energy Corporation** (**REREC**).

Stakeholder directory

HUMANITARIAN & DEVELOPMENT

UNHCR

UN agency

UNHCR provides protection and assistance for displaced people throughout Kenya, including the delivery of critical services such as for water, sanitation, health, shelter, and nutrition. **UNHCR** aims to promote peaceful coexistence between refugees and host communities in Kakuma, Dadaab, and in urban settings. It works with government agencies such as **DRS**, as well as implementing and operational partners of all kinds, and plays a central coordinating role for the **KISEDP** and **GISEDP** (see below). **UNHCR** has projects working on the immediate supply of cooking energy for refugee communities, as well as solarisation projects for institutions and community facilities, and plays a supporting role in many other projects.

NATIONWIDE

FAO

UN agency

The **Food and Agriculture Organization of the United Nations (FAO)** works with the **Government of Kenya** to improve food security nationwide. In Kalobeyei, **FAO** has used solar energy to power water points for horticultural farms, and has also distributed stoves to 5,000 households in the settlement. The organisation has a project on briquette production in collaboration with **Usafi Green Energy**, **LOKADO** and **UNHCR**.

NATIONWIDE

SNV

Development organisation

Working in Kenya since 1967, **SNV** aims to transform the agri-food, energy, and water systems to enable sustainable and more equitable lives for all. In Kakuma and Kalobeyei, the EnDev Market Based Energy Access Programme promotes private-sector delivery of cooking and solar solutions for households, entrepreneurs, and social institutions through providing technical assistance and activity-based financial facilitation to the private sector to enter the market, develop distribution channels and raise awareness for their products and services among the host and refugee communities. Under the Energy Solutions in Displacement Settings (ESDS) project, implemented by **GIZ**, **SNV** provided raised awareness and provided training on productive uses of electricity to increase electricity consumption from the **Renewvia** mini-grids in Kalobeyei. The PEPCI-K project, implemented in 2022 with **CLASP** and in close collaboration with **Renewvia** and **Solaria**, piloted the use of EPCs in Kakuma and Kalobeyei. **SNV** co-manages RBF and debt facilities for solar and clean cooking companies in the **World Bank**-financed KOSAP project.

TURKANA

Stakeholder directory

HUMANITARIAN & DEVELOPMENT

GIZ

Development organisation

NATIONWIDE

The German development agency **GIZ** aims to shape a future worth living around the world and to provide tailor-made, cost-efficient and effective services for sustainable development. Under the ESDS Project, and in partnership with the **Ministry of Energy and Petroleum**, **Turkana County Government** and **UNHCR**, it promotes the provision of sustainable energy services through market-based approaches, for example through technical assistance towards private sector development and the expansion of solar mini-grids in Kalobeyei. As part of its COVID-19 response, the project connected schools and health centres to the mini-grid, as well as a WFP horticultural farm. ESDS also supported UNHCR to solarise its infrastructure and has collaborated with **SNV** to promote market-based access to energy for livelihoods and clean cooking. On a policy level, the ESDS project has partnered with the **Turkana County Government** to develop the Turkana County Energy Sector Policy and Plan.

RRDO

Humanitarian and development organisation

GARISSA

Founded in 2008, the **Relief, Reconstruction and Development Organization (RRDO)** works to respond effectively to local humanitarian challenges and contribute to development. Operating across several sectors, its environment, natural resources management, and energy access programme aims to both protect the environment and provide sustainable energy to displacement affected communities. Working with **UNHCR**, one project in 2022 saw **RRDO** train 10 participants on the construction of Haines1 solar cookers, whilst another involved the distribution of around 23,000 improved cookstoves and solar lanterns to people living in camps in Garissa. Other projects have included the procurement and distribution of various fuels and stoves (firewood, ethanol, LPG) to refugee and host communities, briquette production, the installation of solar streetlights, and establishing tree nurseries and green belts.

LOKADO

Local NGO

TURKANA

The NGO **Lotus Kenya Action for Development Organisation (LOKADO)** works on environmental protection and access to energy in Kakuma, Kalobeyei, and Turkana County. **LOKADO** is contracted by **UNHCR** to manage the supply chain for firewood in Kakuma, tendering the supply to the host community. The NGO also worked with local communities to establish green belts to protect the local environment around Kakuma, manages tree nurseries, and provides seedlings to households for planting. Other projects have focused on clean cooking using hybrid or multipurpose improved cookstoves, and briquette making.

Stakeholder directory

HUMANITARIAN & DEVELOPMENT

AVSI FOUNDATION

International NGO

NATIONWIDE

Founded in 1972, the **AVSI Foundation** is an international NGO which supports a range of humanitarian and development objectives worldwide. Amongst its work in Sub-Saharan Africa, **AVSI** supports improving access to clean energy through projects in Kenya, Uganda, DRC, Rwanda, and other countries. These include the promotion of renewable energy technologies like off-grid mini-grids and solar home systems for rural communities, as well as biodigesters for farmers and households. **AVSI** also facilitates the development of the renewable energy value chains through market studies, access to finance, and access to electric appliances. It also uses a market-based approach for clean cooking involving awareness raising, behavioural change campaigns conception and implementation, market studies and assessment, and advocacy. **AVSI** also promotes PUE and energy efficient lighting and appliances. The **AVSI Foundation** works with households, schools and communities, with a particular focus on rural areas.

KAKUMA KALOBEYEI CHALLENGE FUND (KKCF)

Funding programme

TURKANA

The **KKCF** is an International Finance Corporation programme, implemented by the Africa Enterprise Challenge Fund. Its objective is to attract private and social enterprise companies to invest in Kakuma and Kalobeyei with the wider goal of expanding socio-economic opportunities to refugee and host communities in Turkana County. The programme is sector-agnostic but energy companies have featured prominently in their investments – these include **Green Innovation Ventures** (rooftop solar), **Rafode** (solar products and improved stoves), **Renewvia** (solar mini-grids), **Sunken** (improved stoves), and **Usafi Green Energy** (improved stoves and briquettes).

OTHER HUMANITARIAN AND DEVELOPMENT ORGANISATIONS

Humanitarian and development organisations

NATIONWIDE

Other humanitarian and development organisations working on issues aligned with energy and the environment include **StepUp.One** (digital skills and marketing training and opportunities; Kakuma and Dadaab), **Farm Africa** (supporting agricultural productivity; nationwide), as well as numerous **faith-based organisations**.

Stakeholder directory

COMMUNITY-LED ENTERPRISES & ORGANISATIONS

DEPARTMENT OF REFUGEE SERVICES COMMUNITY LEADERSHIP

Community-led organisation

TURKANA & GARISSA

The **Department of Refugee Services Community Leadership** provides a link between **DRS** and displacement-affected communities. Offering support for coordination and referrals, including for energy projects, the **DRS Community Leadership** helps by providing a bridge to help with oversight, community engagement, and peacebuilding.

OKAPI GREEN ENERGY

Mini-grid operator

TURKANA

The refugee-owned company **Okapi Green Energy** was established in 2018 to bring electricity to residents of Kakuma Refugee Camp. Its 20 kWp solar mini-grid system, commissioned in 2022 and funded by the US African Development Foundation, connected 200 households and businesses in Kakuma 3. The company focuses on providing power to support productive livelihoods and improve quality of life in the camp, and employs 10 staff. In 2023, **Okapi** and **Renewvia** partnered on a joint venture, **OkRene Energy**, to provide mini-grid connections to 15,000 people living in Kakuma III.

YELELE

Mini-grid operator

TURKANA

A 7 kWp solar mini-grid is operated in Kalobeyei Village 3 by **Yelele Limited**, a host-community-owned and refugee-managed company. The mini-grid supplies power to around 20 households and 30 businesses. Recently **Yelele** has partnered with **Renewvia** to scale up operations in the area.

DIESEL GENERATOR OPERATORS

Mini-grid operators

TURKANA

Informal **diesel generator operators** provide power to households and businesses – in 2019 around 30 were estimated to be supplying residents in Kakuma Camp [25]. Typically power is provided for certain hours of the day and customers pay a monthly fee depending on the appliances they use. Some operators, such as **IKRA Hotel** (Kakuma 1) and **Baraka Stima** (Kakuma 3), supply several hundred customers.

Stakeholder directory

COMMUNITY-LED ENTERPRISES & ORGANISATIONS

KAKUMA VENTURES

Community-led organisation

Kakuma Ventures provides internet connectivity services in Kakuma camp and Kalobeyei settlement through a network of entrepreneurs. Entrepreneurs receive a solar home system and Wi-Fi equipment on credit from **Kakuma Ventures** to offer subscription-based internet access in their local area. Payments from their customers are used to finance the equipment, as well as provide income for the operator. The organisation has launched a digital listing platform which allows local businesses to advertise and sell their products online, and has provided technical skills training to more than 60 young people. In 2022, **Kakuma Ventures** won the Ashden Award 2022 in the Energising Refugee Livelihoods category.

TURKANA

FRADI

Community-led organisation

Established in 2019, **Fraternity for Development Integrated (FRADI)** is a refugee-led waste management and plastic recycling organisation working across Kakuma and Kalobeyei. **FRADI** generates income from processing plastics and selling recycled items, generating an income for its network of around 500 members, mostly refugee women. At present the organisation sells semi-processed material to recyclers elsewhere in Kenya, owing to a lack of machinery and electricity for on-site processing which could increase the value of this product. As of 2022, **FRADI** had also planted more than 9,000 trees to combat soil erosion [91].

TURKANA

FAULU PRODUCTIONS

Community-led organisation

Faulu Productions is a non-profit refugee-founded organisation operating in Kakuma. In collaboration with **LOKADO**, it has planted 20,000 trees in Turkana West Subcounty to combat deforestation and has other projects focusing on education, livelihoods, and community empowerment for vulnerable youths, women and girls, and community groups.

TURKANA

Stakeholder directory

PRIVATE SECTOR

SUNKEN LIMITED

Clean cooking

TURKANA

Sunken produces energy-saving cookstoves for low-income households in both the refugee and host communities. Sunken has a stove production facility in Kakuma, which was initially set up by **SNV** as part of the EnDev MBEA I project, providing job opportunities and skills development for displaced and host communities on stove production, partnering with various organisations including **UNHCR** and **SNV**. Operating in Kakuma since 2018, **Sunken** also has agriculture and irrigation projects elsewhere in Kenya.

USAFI GREEN ENERGY

Clean cooking

TURKANA

Clean cooking company **Usafi Green Energy** provides improved cookstoves, both for domestic and institutional applications, and briquettes for sale in Kakuma, Kalobeyei, and Turkana West Constituency. With production beginning in 2020, **Usafi** has sold over 17,000 cookstoves and partnered with **SNV**, **UNHCR**, **FAO**, **NRC** and the **Turkana County Government**. The company received funding from **KKCF** to scale up its cookstove and briquette production facilities to meet the high demand in the area. In 2022, **Usafi Green Energy** employed 17 people from the refugee and host communities, produced around 300 stoves per week, and manages a network of 70 local vendors.

RENEWVIA ENERGY

Mini-grid operator

NATIONWIDE

US-based **Renewvia Energy** is one of the largest builders and operators of standalone mini-grids in Africa. In 2019 the company commissioned a solar mini-grid in Kalobeyei Town, currently providing power to more than 120 customers. It also commissioned another mini-grid, serving Village 1 in Kalobeyei Settlement, which served around 500 households – in 2022, the capacity was increased tenfold and now serves nearly 2500 customers. In 2023, **Renewvia** and **Okapi Green Energy** partnered on a joint venture, **OkRene Energy**, to provide mini-grid connections to 15,000 people living in Kakuma III. The company has also partnered with **Yelele** to provide power in Kalobeyei Integrated Settlement. The company also has seven other mini-grids in Turkana and others elsewhere in Kenya.

SOLARIA

Cookstoves and solar products

TURKANA

The Kenyan company **Solaria** sell solar lighting products and clean cookstoves across eight counties in northern Kenya, including Turkana. Serving refugee and host community customers in Kakuma and Kalobeyei, the company partnered with **SNV** on the MBEA Project and on the PEPCI-K pilot project.

Stakeholder directory

PRIVATE SECTOR

BBOXX

Solar home systems

NATIONWIDE

In February 2018, supported by the Moving Energy Initiative, **Bboxx** established a local outlet in Kakuma town to offer sales, distribution, and technical support to customers in the area. The company supplies solar home systems to refugee and host community customers across Kakuma, Kalobeyei and Turkana County. **Bboxx** offers solar home systems for lighting and phone charging (KES 1500-3000 down payment and KES 40-65 per day) and additional appliances such as televisions (KES 5500-7500 and KES 115-130 per day) or refrigerators. Headquartered in the UK, **Bboxx** provides solar home systems around Africa and the world.

SUN KING

Solar products

NATIONWIDE

Sun King offer a variety of solar products from small solar lanterns (upfront costs of KES 1000-6000) to solar home systems and inverters. **Sun King** has a shop in Kakuma town and, in 2020, had a network of around 40 last-mile entrepreneurs selling its products in the camp. The company offers products for sale or on monthly payment plans, and has offices across Africa and India.

GREEN INNOVATION VENTURES LTD.

Standalone solar

NATIONWIDE

Incorporated in 2018, **Green Innovation Ventures** has installed rooftop solar systems, water pumps, irrigation systems for around 10,000 customers across Kenya. It began operations in Kakuma in 2020 supported by the EnDev MBEA II project with **SNV**, providing solar home systems to businesses and schools. After needing to step back from the area owing to large capital outlays, **KKCF** supported its re-expansion to new clients in Kakuma, Kalobeyei and the surrounding host communities. The company aims to deliver clean energy for productive uses to at least 200 businesses by 2025.

Stakeholder directory

FINANCE INSTITUTIONS

EQUITY BANK

Bank

Kakuma town has a branch of **Equity Bank** which provides banking access to refugees as part of an agreement with **UNHCR**. It provides services to both refugee and host community customers including its "EcoMoto" loan programme [24], launched in Kenya in 2014, to provide financing for improved cookstoves and solar products through selected suppliers. As of 2018, Equity Bank had 20,000 customers resident in Kakuma Camp and 40,000 customers in the host community.

NATIONWIDE

KCB

Bank

Kenya Commercial Bank (KCB) provides bank accounts for residents of Kakuma camp which are used for receiving cash-based interventions, in lieu of direct assistance, in partnership with **UNHCR**. Residents can withdraw cash from **KCB** agents in the camp with the first transaction free of charge.

NATIONWIDE

INKOMOKO

Microfinance institution

Inkomoko provides business advisory support and access to finance for entrepreneurs across Africa. Operating in Kenya since 2019, the organisation supports over 4,000 refugees and host community members in Kakuma, Kalobeyei and Turkana, and a further 2,000 in Dadaab and Garissa. **Inkomoko** is supported by partners including **KKCF**, **DRS**, and **UNHCR Kenya**.

NATIONWIDE

RAFODE

Microfinance institution

Rafode offers microfinance products across Kenya, including in a recent expansion to Turkana supported by **KKCF**. One of its products, a Green Energy Loan, helps clients access renewable energy products in partnership with selected suppliers, including **Sun King.**

NATIONWIDE

Stakeholder directory

OTHER ORGANISATIONS

KIEEE CENTRE

E-Waste Recycling

The **KIEEE Centre** provides disposal and recycling services for solar panels, dry cell batteries and other electronic equipment in Turkana County. In Nairobi, the organisation works with the **WEEE Centre** and battery producer **Aceleron Kenya** to provide second-life batteries for off-grid communities.

NATIONWIDE

WEEE CENTRE

E-Waste Recycling

The **Waste Electrical and Electronic Equipment (WEEE) Centre** collects, dismantles and recycles e-waste in Kakuma and Kalobeyei. Since 2012 it has processed an estimated 10,000 tonnes of e-waste across its eight collection centres around Kenya. Motivated to work in Kakuma by the growing amount of solar and ICT products being used, and the opportunity to provide decent incomes for residents, the **WEEE Centre** received funding from **KKCF** to train agents on e-waste collection, management and repairs, as well as run public awareness campaigns.

TURKANA

KISEDP AND GISEDP STEERING COMMITTEES AND SECRETARIATS

Coordination group

The **Kalobeyei Integrated Socio-Economic Development Programme** (**KISEDP**) was established in 2015, and its equivalent in **Garissa** (**GISEDP**) launched in 2021, with the aim to create an enabling environment for inclusive service delivery, strengthened local capacities, improved legal frameworks, and increased investment and job creation. Implementation is led by the **County Government** and **UNHCR**, with the **KISEDP** and **GISEDP** providing a settlement approach to promote self-reliance for refugees and host communities in line with the former's County Integrated Development Plans. Each programme has a **Steering Committee** (members include **DRS**, **WFP**, **FAO**, and NGO representatives) to provide oversight and guidance on policy matters, and a **Secretariat** (composed of **UNHCR** CRRF officers) to facilitate stakeholder communication.

TURKANA & GARISSA

RESEARCH INSTITUTIONS

Research

Several research institutions have undertaken energy- and environment-related studies or projects in displacement settings in Kenya. These include **Strathmore Energy Research Centre** (**SERC**, sustainable energy), **Kenya Forestry Research Institute** (**KEFRI**, forestry and natural resources), the **Center for International Forestry Research** (**CIFOR**, forestry and environmental management), and **Kenya Industrial Research and Development Institute** (**KIRDI**, engineering for industrial development).

NATIONWIDE

Project deep-dives

Renewvia's solar mini-grids in Kalobeyei

Two solar mini-grids – one in Kalobeyei Integrated Settlement, one in Kalobeyei town – supply power to both displaced and host communities. Established in 2019 by US-based developer Renewvia Energy, these were the first licensed and regulated systems to provide affordable, reliable, and renewable electricity to people living in Kalobeyei.

Initial scoping and development began before Renewvia entered the region. GIZ first identified the opportunity and undertook extensive feasibility studies in the area to understand the potential for solar mini-grids. It followed this through to gain the approval of the government for two systems: one each to serve the displaced and host communities, providing fair access. Following a competitive tender process, Renewvia was awarded the project to develop the sites.

Both systems provide basic electricity services for households such as lighting, phone charging and televisions, as well as electricity for businesses. The mini-grid in Kalobeyei town, with 20 kWp of solar and 60 kWh of battery storage, serves around 120 customers in the local community including households, shops, schools, and religious buildings [92]. A larger system in Kalobeyei Integrated Settlement originally used 60 kWp of solar and 120 kWh of battery storage to serve around 500 customers, exceeding its original target. Both systems also have diesel generators to provide backup power.

Establishing mini-grids in displacement settings involves a large and high-risk upfront capital expense. To overcome this Renewvia sought grant funding from donors: this was provided by UKAID and implemented through GIZ by offering RBF under its EnDev project to subsidise the tariffs to the same levels as the national utility[21] [93]. For both systems, households are charged KES 20/kWh and businesses pay KES 25/kWh, with initial connection fees of KES 500[22]. This is lower than other mini-grid developers, and lower than what Renewvia would typically charge (around KES 1,000-2,000 or $7-14), to encourage large number of customer sign-ups early on. The expected payback period for the mini-grid was around five years.

Setting up complex projects in remote environments always comes with issues. Despite GIZ obtaining the initial government approval for the systems, further regulatory processes, particularly permitting, delayed implementation and Renewvia came under pressure to comply with the grant funding window. The tariff approval process by EPRA, which sets the limits of what Renewvia could charge its customers, was also challenging to navigate, with the approved tariff of other mini-grid operators in the same displacement settings being considerably higher than Renewvia's, which led to complaints by customers who were charged more.

Compared to the regulatory processes, the engineering aspects – shipping equipment to the sites, assembling electronics, installing hundreds of kilometres of cabling – were relatively straightforward and efficient. Considering Renewvia's other sites, such as in remote areas or on islands, the relatively regular nature of the street layouts made implementing the distribution network easier. There were some technical challenges, however: battery failures and high escalation of ››

21 An 82% subsidy was required to reduce the market price of the mini-grid electricity ($0.89/kWh) to that of the national grid ($0.16/kWh).
22 Around $0.15/kWh for households and $0.18/kWh for businesses, exclusive of VAT, and around $3.66 for the connection fee.

Project deep-dives

demand, with around 50% more subscribers than initially expected, meant that the diesel generators were used regularly rather than as back-up. The need to scale up became evident very quickly.

The system grew almost ten times larger in 2022: Renewvia was awarded funding from the KKCF[23] to expand the capacity of the mini-grid to 541 kWp and increase the number of connections [67]. The system now provides electricity to around 2300 households, 350 businesses, 21 churches, nine NGOs, three schools, and a handful of other users. Despite representing only around 13% of connections, business users account for around two-thirds of electricity consumption. This growth has also offered new opportunities: a campaign implemented by SNV is sensitising households, businesses and social institutions on income generation and productive uses of electricity using power from the Renewvia system [94].

Compared to the initial setup in 2019, the system expansion was much more straightforward as Renewvia was already familiar with the context and, crucially, had established good relationships with local leadership entities who could support with moving things forward such as the local government, GIZ and UNHCR. In addition, authorisations could be amended rather than beginning from scratch, there was no need for additional land acquisition, and environmental impact assessments could build on previous submissions.

Working with the communities was critical throughout. From working with community leaders during the initial approval processes, to hiring equal numbers of refugee and host community members during construction, to the ››

23 The funding was composed of around 75% grant funding and 25% equity.

> Compared to a lot of the other very remote areas where we work, a huge benefit of the refugee context is that you have highly skilled people coming from all different walks of life. So it's actually been much easier for us to find the technical skills necessary for our sites.
>
> – Julie Greene, Managing Director, Renewvia Solar Africa

Project deep-dives

site agents responsible for the operation of the systems and customer management, community members have been closely involved with the Renewvia systems. Achieving gender balance among employees was also a key consideration for the company: efforts are made to recruit women as site agents by offering convenient daytime working hours, and many women were hired for manual jobs in the construction phase. Renewvia tries to hire site agents from diverse backgrounds to deal with the wide range of languages spoken by customers. With people from all walks of life resident in the camp, finding highly skilled local labour was easier than for some of Renewvia's other sites, but challenges around customer identification and access to mobile money for payment made some elements of customer service more difficult.

Now, Renewvia is exploring ways to bring solar to Kakuma camp. Renewvia has partnered with the local refugee-led company Okapi Green Energy to form OkRene Energy, a joint venture to provide electricity in the camp [95]. OkRene has been granted an exclusive 20-year national power provision license to supply Kakuma III which will allow Okapi's present operations – providing power to around 200 people – to scale up under the joint venture. Renewvia has also partnered with Yelele, another refugee-led mini-grid company operating in Kalobeyei Integrated Settlement, to scale up their operations together. These collaborations offer the opportunity to leverage each partner's strengths – such as project development, knowledge of the local context, technical and financial expertise – to provide greater access to electricity in Kakuma. In June 2023, it was announced that Renewvia was awarded RBF of up to $4.2 million to increase the capacity of their system, to 2.4 MWp and 6 MWh of battery storage, and extend their network to serve up to 19,000 customers around Kakuma [96]. ››

> One problem we face is setting up payments for power on our platform: often refugees don't hold national IDs and so most don't have M-PESA accounts. Some have accounts registered with other people's names, which is not secure.
>
> – Kennedy Odhiambo, Regulatory & Customer Manager, Renewvia

Project deep-dives

Now we understand the intricacies of operations in displacement settings, we're enthusiastic about the partnerships we've developed. We can leverage on the ground experience with technical and financial expertise in a combination that works well for everyone.

– Trey Jarrard, CEO Renewvia Energy

©GIZ

Project deep-dives

Market Based Energy Access (MBEA) Project

SNV's EnDev Market Based Energy Access (MBEA) Project aims to promote the uptake of clean cooking and solar solutions in Kakuma camp, Kalobeyei settlement, and the surrounding host communities using market-based approaches. In its first phase (2017-2019) the MBEA project promoted the supply and distribution of these clean technologies through activities including [65]:

- Recruiting private sector companies to create supply chains and set up operations in the area, including providing financing support to help their investments,
- Running market activation events at which companies could demonstrate their products, developing marketing materials and campaigns, and linking companies to local traders and "last mile entrepreneurs" (LMEs),
- Conducting awareness-raising campaigns, particularly focusing on the disadvantages of traditional sources of energy (such as firewood) and the benefits of investing in safer, sustainable alternatives, and
- Establishing a stove production unit to increase the supply of higher-quality, affordable, locally-produced stoves.

©GIZ

Beneficiary companies of MBEA I sold 2,556 solar lanterns, 4,322 SHS, 2,005 industrially-produced stoves and 277 locally-manufactured stoves[24]. The project introduced bioethanol, briquettes, and pellets to the camp, and 120 LMEs were trained to sell clean energy products. Management of the stove production unit was taken over by Sunken Limited in 2019. The project's core recommendations included ensuring all stakeholders are committed to market-based models, complementing marketing activities with awareness raising and sensitisation, addressing access to finance and payment barriers, and decentralising maintenance to the local level to improve customer service.

Building on this work, MBEA II (2019-2023) aims to facilitate access to household lighting for poor communities, increase the adoption of standalone solar and cookstoves for productive and institutional users, and facilitating access to credit for both suppliers and end-users [97, 98]. ››

24 Sales for solar lanterns and SHS fell short of the project target, attributed to slow uptake and initial lack of product availability. Industrially-produced stoves exceeded the target, but locally-manufactured stoves again fell short owning to a late start-up of the production unit.

The Behavioural Change Campaign [of MBEA II] makes great positive impact on our market network in Kakuma. Through the campaign our market base of clean cookstoves has already significantly increased based on the recent sales numbers.

– Brian Oyenge, CEO of Usafi Green Energy

Project deep-dives

Kakuma Ventures

The refugee-led business Kakuma Ventures was founded to improve access to digital services in Kakuma camp and Kalobeyei through public Wi-Fi networks. Under its business model, Kakuma Ventures first maps areas with high concentrations of potential users before identifying a local entrepreneur with whom to collaborate [99]. Kakuma Ventures installs a public Wi-Fi network (composed of an internet router and other necessary accessories, powered by a solar system) under a partnership agreement with the entrepreneur who is responsible for overseeing and maintaining the system. Customers access the internet through a subscription model, with Kakuma Ventures receiving a 20% commission to finance the equipment. The entrepreneur, meanwhile, receives most of the revenue and also has access to the excess electricity generated by the system for their own use. After the system financing has been paid off, the length of which depends on the revenue generated from the system, the entrepreneur gains ownership of the system. As of 2022, more than 1,400 people had gained access to the internet through Kakuma Ventures' systems [100].

Kakuma Ventures has also launched a digital listing platform for businesses in the camp to advertise and sell their products online – enabled by their improved access to the internet. It also offers skills training courses for young people from the refugee and host communities on digital literacy, e-commerce, and technical skills for maintaining electrical and digital systems, reaching 60 people by mid-2022 [101].

In 2022, Kakuma Ventures won the Ashden Award in the Energising Refugee Livelihoods category [101]. The organisation wants to scale to reach the huge need, targeting 10,000 households and 1,000 businesses in Kakuma and Kalobeyei and aiming to expand operations to other displacement settings and rural areas in Kenya [102]. ●

> Kakuma Ventures is the pillar of the digital ecosystem of the camp, supporting our graduates to take the next step.
>
> – Honore Ebengo, non-profit organisation ADIYD2

06

Potential high-impact projects

©GIZ

Effective long-term solutions cannot be implemented in isolation. Close coordination among stakeholders and fostering learning between different organisations is essential to use resources as efficiently as possible and to scale up existing work. Designing potential energy interventions together – bringing together the experience and expertise of many different stakeholders – can help to identify the most impactful areas of programming as well as the potential barriers and enablers that will affect its implementation.

In support of this, the READS workshops featured a session in which groups of diverse participants came together to learn about each other's work and co-design potential high-impact projects, building on the experience made with existing interventions. Each group focused on a different energy issue with the goal of outlining a viable project opportunity that would directly address some of the greatest challenges currently faced in displacement contexts in Kenya.

By involving a range of stakeholders in the collaborative co-design process, and crucially refugee and host community representatives who are integral to any project design, the project concepts aim to address the barriers and gaps that the participants identified as the most pressing. They draw on approaches that have already been piloted that show potential to be either replicated in different settlements or scaled up.

Following these initial designs, and incorporating ideas from previous work in displacement settings in Kenya and elsewhere, these ideas have been further developed into the project concepts presented in this section. These summaries provide an outline of the potential project including:

- The proposed location and scale,
- The project activities and potential implementation partners,
- Enablers and barriers which could affect its realisation, and
- How these projects link to previous work through replication and scaling.

The estimated costs of the projects are included as a guide and will vary significantly depending on their scale and complexity. The project concepts are designed to be a starting point to further develop interventions, scope out potential partnerships, attract investment, and ultimately increase access to sustainable energy.

Important considerations for project design

There are huge differences between Kakuma and Dadaab refugee camps, between Kakuma camp and host town, between Kakuma camp and Kalobeyei settlement, and within the refugee and host communities themselves in terms of income, levels of education, literacy, and other factors. Variations in the amount of existing infrastructure, levels of economic activity, distances to towns, culture, and local needs and priorities will determine what kinds of interventions would have the greatest effect in increasing access to sustainable energy in each location. In all interventions, efforts must be made to address both the needs of host communities as well as refugees to not disadvantage one group and to promote social cohesion and peaceful coexistence.

A one-size-fits-all approach will not be able to account for these nuances. Before beginning any of these projects, further research and detailed assessments at the local level will be necessary to better understand the specific and unique situations on the ground. Such assessments should also be independent, objective, and afforded appropriate time and resources to best develop long-term implementation plans. These should be done with stakeholders which best understand their energy needs and are therefore best positioned to shape the proposed interventions. ››

Many of the project concepts aim to use market-systems to better integrate the private sector in the provision of sustainable energy in displacement contexts. For this to work in the long term, national or international companies should set up operations with supply chains to outlets in refugee camps and host communities – and be adequately supported in doing so, where required – to establish a permanent presence which endures after external funding ends. Local companies in the camps, meanwhile, should be supported to conform with national and international product standards to ensure quality for customers. All companies and organisations which implement sustainable energy technologies should facilitate ongoing and independent evaluations to assess their benefits to the user in the field, not just under laboratory or ideal conditions, to monitor their continued usage and long-term benefits. ●

The READS workshops featured a co-design session for stakeholders to develop viable, high-impact projects to increase access to sustainable energy for their specific area.

©GIZ

Community involvement

Refugee and host communities should be involved from the outset when designing sustainable energy interventions as they understand best their own energy needs and priorities. Community members are particularly well-placed project partners owing to their networks and knowledge of the context, and so should have crucial roles in the design and implementation of interventions. Some potential opportunities to involve the community include:

- Working with community groups and a range of leading figures to gather input on design of intervention plans, and to advocate for sustainable solutions with other stakeholders and within their communities,
- Consulting with different community segments during the design phase of interventions and for delivery model development, such as through focus group discussions, co-design workshops and community mapping interventions, whilst coordinating with other organisations to minimise overlap and survey fatigue,
- Hire community members as sales agents, community mobilisers and product ambassadors,
- Equitably target both refugee and host community members for employment and sales targets,
- Providing training and capacity building for community members, such as on the installation or maintenance of energy technologies and customer services,
- Involving or creating cooperatives to oversee and manage community-wide or public projects and their locations, such as streetlights, and
- Direct collaboration with humanitarian and development actors, the private sector, and other organisations for project planning, management, auditing and other key activities.

Gender mainstreaming

Sustainable energy interventions could have different implications for women and men. This can be exacerbated when decision makers, typically men, are not the same gender as the primary users of energy technologies, for example typically women with regards to domestic responsibilities. Considering these differences and the effects they may have during both the design and implementation of energy projects can allow them to better meet the needs of all community members and promote gender equality. Gender mainstreaming will vary depending on individual contexts and communities but could be integrated into projects by:

- Using single-gender focus groups during initial scoping phases to identify gender-specific concerns, for example around the locations of public lighting,
- Targeting equal opportunities for training and employment for both women and men,
- Increasing opportunities for training and employment for women in roles that are traditionally seen as “men’s work”,
- Identifying employment opportunities for women which are compatible with family, childcare or household responsibilities, for example near to their homes,
- Schedule engagement events at convenient times of the day and/or provide stipends to avoid conflicting with childcare responsibilities and allowing mothers to participate,
- Using awareness-raising campaigns for energy solutions that target men and women to promote interest in new technologies,
- Offer cooking classes in schools to both boys and girls to raise awareness of clean cooking solutions and encourage both boys and girls to learn how to cook, and
- Highlight the needs of different household members during product sensitisation campaigns and encourage joint decision-making.

Inclusivity strategies

Achieving sustainable energy for all requires understanding and meeting the needs of every member of the community. In displacement contexts some people may have specific vulnerabilities or require different considerations to access sustainable energy, for example if they have a disability. Including these people in project design, and offering strategies for their inclusion during implementation, can mean that energy interventions meet their needs more effectively. Some inclusivity considerations could include:

- ☑ Holding focus groups with people with specific vulnerabilities to ensure an intervention will be accessible to them and meet their needs,
- ☑ Include people with disabilities in trainings and employment opportunities whilst accommodating any specific needs,
- ☑ Engaging with microfinance companies to develop services which make upfront costs more accessible to low-income customers, such as for connections to mini-grids,
- ☑ Use voucher systems for vulnerable customers to access technologies within a wider market-based approach, such as for solar products or improved cooking solutions, and
- ☑ Promote technologies, products and designs which accommodate users with specific vulnerabilities or disabilities.

©EnDev and SNV

Project concepts

IMPROVED CHARCOAL STOVE PRODUCTION

1/2

LOCATION

Kakuma, Kalobeyei, and Dadaab

BACKGROUND

Access to clean cooking solutions is very low in displacement settings. There is a strong preference for and reliance on biomass cooking solutions. Local production of charcoal stoves by refugee-led companies has shown promise in Kakuma but, so far, demand far outweighs supply. The potential for scaling up the production of charcoal stoves manufactured by using locally available materials should be assessed and further promoted, and initiatives that have worked in Kakuma could potentially be replicated in Dadaab.

ACTIVITIES

Undertake a feasibility study and supply chain analysis to assess the viability of the local production of cookstoves (Y1)

Scale up local improved cookstove production (Y1-2)

Work with community members to identify preferred stove types and involve them in design or adaptation of solution (Y1)

Provide business training and grant support for local manufacturers (Y1-2)

Pilot the collection and use of the invasive species *Prosopis juliflora* as firewood (Y1-2)

Assess and support the production of improved charcoal production (Y1-3)

Create jobs for the communities in manufacturing and for sales agents throughout the camps (Y1-3)

Roll out information-raising and public awareness campaigns in local languages (Y1-Y3)

Invest in increasing the capacity of existing refugee-led companies where possible (Y1-3)

Replicate project through implementation of pilot in Dadaab after feasibility study with option to scale up (Y2-3)

ENABLERS

Several local cookstove producers already operate in Kakuma, with demand currently outstripping supply

Economies of scale could reduce unit cost of stoves

Great need for more efficient biomass cooking solutions

High potential for impact for women and girls

Build on previous examples of awareness raising and marketing

Customer preference for multi-purpose stoves

BARRIERS

Strong preferences or traditional reliance on basic charcoal stoves, wood stoves and three-stone fires

Limited supply chain for raw materials for stoves

Customer perceptions that manufactured stoves could break after a few months and are not worth the investment

Limited private sector involvement in Dadaab and so would require extra support and market research

Project concepts

PROJECT REACH, TIMELINE & BUDGET

100,000 households across all contexts

Year 1: Supply chain analysis and feasibility study ($100,000)

Year 2: Begin or scale up production of stoves ($200,000)

Year 3: Continuation of activities and evaluation ($200,000)

Medium to large

$500,000 to scale up existing production and support new manufacturers in Kakuma, $500,000 to establish in Dadaab

FURTHER INFORMATION

Representatives of cookstove companies at the workshop highlighted the potential scalability of clean cooking solutions in the camps. Existing models for cookstove production have been demonstrated in Kakuma, creating skilled jobs in the process, but are too small to meet the needs of the camp and surrounding host communities. In Dadaab this private sector-led model is yet to be tried. Based on the existing work in Kakuma, scaling up the project could produce around 3,000 stoves per month – the same could be possible if replicated (from scratch) in Dadaab.

REPLICATION & EXPANSION

Scales up local production capacity

Replicates some existing work by UNHCR, LOKADO, and SNV

Replicates work from Kakuma in Dadaab

STAKEHOLDERS AND ROLES

Cookstove manufacturers to lead upscaling of production and production sites, as well as training and job creation activities

Humanitarian and development organisations to provide RBF and support market development and awareness raising

Government agencies to provide permits, access to land and regulation

SCALABILITY

Moderate: Could be scaled up to different degrees in Kakuma, and could be initiated at a smaller scale in Dadaab.

IMPROVED CHARCOAL STOVE PRODUCTION 2/2

Project concepts

SCALING ELECTRIC PRESSURE COOKERS

1/2

LOCATION

Kakuma and Kalobeyei

BACKGROUND

Most households in Kakuma and Kalobeyei rely on firewood and charcoal for cooking, as do most businesses that serve food (such as restaurants and eateries). The expansion of the solar mini-grids has brought electricity access to many more customers and this power could be used to supply electric cooking technologies, such as electric pressure cookers (EPCs). Previous projects (such as PEPCI-K) have supported pilots for electric cooking for households and businesses in Kakuma. Initial findings from the pilots have shown promising results. Access to EPCs could be significantly scaled up alongside the expected increase in mini-grid connections through the OkRene Energy partnership.

ACTIVITIES

Assess household cooking needs and preferences, particularly focusing on interest in electric cooking (Y1)

Roll out EPCs to households and businesses (Y1-2)

Support purchase of EPCs through instalment payments, flexible repayment schedules or pay-as-you-cook models (Y1-2)

Run information and training sessions for potential customers to learn how to use EPCs and let them experience the advantages for themselves (Y1-2)

Work with companies and government partners to design suitable tariff structures to accommodate electric cooking (Y1)

Use grant funding to subsidise customers to access EPCs in the pilot phase, before introducing access to finance for equipment in scale up phase (Y1-2)

Research the impacts and long-term uptake of electric cooking as a replacement to (or when used alongside) traditional methods (Y2-3)

ENABLERS

Relatively high access to connections to solar mini-grids with planned expansions

Government support for electric cooking

Aligns with national objectives to reduce biomass usage

High potential for significant decreases in indoor air pollution

BARRIERS

Limited existing knowledge and familiarity with electric cooking

User preferences for traditional cooking methods

Limited existing supply chains for EPCs

Reliant on connections to mini-grid

Project concepts

PROJECT REACH, TIMELINE & BUDGET

Large

$1 million

6,000 households, businesses and social institutions

Year 1: Cooking needs assessment, development business case, contracting EPC companies, set up operations ($500,000)

Year 2: Roll-out of technologies, hire sales and repair agents, product sensitisation ($250,000)

Year 3: Continued implementation and monitoring ($250,000)

FURTHER INFORMATION

Electric cooking solutions for households and businesses are relatively novel in displacement settings. Some projects have trialled their usage both in Kakuma and elsewhere, such as one implemented by Mercy Corps and Pesitho in refugee settlements in Uganda, but not at scale. In general EPCs require a connection to a reliable electricity source – such as the grid or a mini-grid – or a dedicated standalone solar system.

REPLICATION & EXPANSION

Relevant previous projects for EPCs in displacement settings and national contexts (PEPCI-K and MECS)

Aligns with projects supporting EPCs for institutional settings in Kakuma

STAKEHOLDERS AND ROLES

Community groups to encourage the uptake of electric cooking solutions

Humanitarian and development organisations to run training and sensitisation sessions on EPCs

Private sector companies to supply power and develop suitable tariff schemes

Microfinance institutions to provide financing and instalment payments for EPCs for households and businesses in scale-up phase

SCALABILITY

Moderate: Potential to be scaled in areas where mini-grid power is available, but limited opportunities elsewhere.

SCALING ELECTRIC PRESSURE COOKERS 2/2

Project concepts

HOUSEHOLD LIGHTING SOLUTIONS IN DADAAB

1/2

LOCATION

Dadaab camps and host community towns

BACKGROUND

Household electricity access in Dadaab is very low. Despite a potentially large market size, the private sector generally perceives Dadaab as riskier and more difficult to operate in, and so fewer products are available to potential customers. NGOs could work with private sector companies through RBF schemes to purchase off-grid solar products in bulk and establish warehousing facilities and delivery mechanisms to the Dadaab camps. Local shop owners could be contracted as sales agents and trained to perform basic repairs. They could initially be provided with a start-up stock and then have the possibility of purchasing further stock at a discounted rate. To stimulate demand for the products and address affordability barriers, voucher systems could be used in which customers could select a product of their choice.

ACTIVITIES

Assess the needs for household electricity solutions as well as ability and willingness to pay (Y1)

Arrange site visits for company representatives to camps and local towns to help them understand the contexts (Y1)

Coordinate introductions with local community leaders, government officials, and organisations working in the camps to facilitate future administration and other processes (Y1)

Procure a variety of high-quality solar products in bulk, establish warehousing facilities and delivery mechanisms through RBF schemes (Y1)

Recruit and train shop owners in sales and repairs of solar products (Y1)

Provide start-up capital and products to be sold by contracted shops (Y1)

Use a voucher system and instalment payments to subsidise the initial uptake of solar products (Y2-3)

ENABLERS

Large potential market based on low access to household electricity at present

High solar resource and potential for high-quality solar products

Many opportunities for training and capacity building

BARRIERS

Low ability to pay of customers

Operating in more remote areas without existing supply chains is riskier and more costly

Project concepts

PROJECT REACH, TIMELINE & BUDGET

10,000 households

Year 1: Needs assessment, bulk procurement and warehousing of off-grid solar products, contracting and training of shop owners ($300,000)

Year 2: Use voucher system and instalment payments to subsidise initial uptake ($100,000)

Year 3: Continue operations ($100,000)

Medium

$500,000

FURTHER INFORMATION

Dadaab has experienced little market development due to limited infrastructure, a volatile security situation, and speculation about camp closure. While a pure market-based approach might not be possible, there is the potential to improve access to high quality energy products and services by working together with the private sector. A blended approach could be used that, while grant funded, replicates some elements of market-based approaches including selling energy products from established brands and services in shops that are run as businesses, training staff in repair and maintenance services, and supporting end-users with upfront costs while still enabling them to choose between products.

REPLICATION & EXPANSION

Market activation activities for off-grid solar products have occurred in Kakuma (e.g. for Bboxx under MEI Project) and work in other countries (e.g. RE4R Project in Rwanda, GIZ ESDS in Uganda)

STAKEHOLDERS AND ROLES

Companies to provide off-grid solar products and provide training in repairs and maintenance services

Humanitarian and development organisations to support companies with storage, transport, training, and awareness raising activities through RBF schemes

Development organisations to facilitate working in the Dadaab region and provide support on administrative processes

Local leaders to engage with communities and support sensitisation and market building activities

SCALABILITY

High: Very scalable dependent on the number of companies to be supported, the scope of the initial project, and the goals of a larger long-term rollout.

HOUSEHOLD LIGHTING SOLUTIONS IN DADAAB 2/2

Project concepts

SOLAR MINI-GRID EXPANSION IN KAKUMA AND KALOBEYEI

1/2

LOCATION

Kakuma and Kalobeyei

BACKGROUND

The solar mini-grids in Kakuma Sub-camp 3 and Kalobeyei Settlement have been effective in bringing power to both host and refugee communities but reach only a small portion of the population. Scaling up the systems, as is planned by the mini-grid companies already working in the area, could bring power to a far greater number of people, as well as providing electricity to businesses and social institutions in the area. This would require around five times the current capacity of the systems.

ACTIVITIES

Undertake feasibility studies to scope, size and design the project, including capacity for new or scaled up applications such as electric cooking and increased productive use appliances (Y1)

Conduct market research into affordability and tariff structures to support both households and businesses (Y1)

Train and hire community members to operate the system (Y1-2)

Expand the capacity of the existing mini-grids by around 2.5 MWp (Y2-3)

Revamp the existing distribution network to accommodate more customers (Y2-3)

Provide microfinance for businesses to purchase PUE equipment (Y2-3)

ENABLERS

Present solar mini-grids have demonstrated the community interest and willingness to pay for electricity

Several companies have experience of working in Kakuma and Kalobeyei and so know the local context, conditions and constraints

Very high solar resource in the area

Expansion of existing mini-grids is easier than establishment of new plants

Economies of scale could allow savings on equipment and project costs

Existing collaborations between several potential partners

High demand for electricity for households and businesses

After the development of this project concept based on conversations with Renewvia and workshop participants, it was announced that Renewvia would receive RBF funding to expand its mini-grid.

BARRIERS

High up-front capital requirements for the system expansion

Could overlap or compete for customers with existing informal diesel-based mini-grids

Permitting and regulatory requirements could slow down implementation, particularly for new sites

Multi-stage implementation process (from initial design to operation) with long lead time to commissioning

Relies on coordination between multiple partners

Land acquisition for large solar installation potentially necessary depending on size of expansion

Project concepts

PROJECT REACH, TIMELINE & BUDGET

Around 15,000 connections (households, businesses, and social institutions) in the refugee and host communities

Year 1: Feasibility study and regulatory approval process ($1 million)

Year 2: Expansion of existing sites and operations ($3 million)

Year 3: Continued operations and evaluation ($1 million)

Very large

$5 million

FURTHER INFORMATION

Workshop participants from mini-grid companies estimated that households connected to the existing mini-grids consumed around 0.17 kWh per day, whilst businesses consumed around 2.1 kWh per day. Scaling this up to around 15,000 connections, with a mix of both types of consumers plus social institutions and comparing to the existing mini-grids, results in a requirement of around 2.5 MWp of additional solar generation capacity. Participants also estimated that the cost of a connection would be around $300-350 depending on the local area, logistical considerations, and layout of the distribution network.

REPLICATION & EXPANSION

Replicates and scales-up existing projects in terms of technologies used and general implementation

STAKEHOLDERS AND ROLES

Mini-grid developers and operators to design, build and operate the system

Development organisations to provide market research, awareness raising, feasibility studies, and technical capacity

Government agencies to provide permissions, regulatory oversight and authorisation

Donors and financial institutions to provide capital financing for mini-grid developers and microfinance for businesses

SCALABILITY

High: Expansion of existing mini-grid allows for economies of scale by leveraging established operations.

SOLAR MINI-GRID EXPANSION IN KAKUMA AND KALOBEYEI 2/2

Project concepts

FEASIBILITY STUDY FOR SOLARISING PRIVATE DIESEL-BASED ELECTRICITY PROVISION

1/2

LOCATION

Kakuma Camp

BACKGROUND

Many diesel generator operators provide electricity to customers in Kakuma. The high price of diesel is making this business more expensive and costs are passed on to customers who pay high, unmetered tariffs. In addition, unsafe wiring presents electrical and safety hazards. These private electricity providers have expressed interest in transitioning to running a solar-diesel mini-grid. Conducting a feasibility study would be an important first step to assess the viability of such a transition.

ACTIVITIES

Undertake a feasibility study to assess the viability of transitioning from a diesel-based power supply to operating a solar-diesel mini-grid (Y1)

Consult with diesel generator operators, customers, and other key stakeholders (Y1)

Scope, size and design a potential solarisation project (Y1)

Conduct market research into affordability and tariff structures to support both households and businesses (Y1)

ENABLERS

Current customer base demonstrates willingness to pay for electricity

Network of diesel genset operators have experience of working in Kakuma and know the local context, conditions, and constraints

High cost of diesel fuel

High solar resource in the area

Technical experience available from solar mini-grid operators

High demand for electricity for households and businesses

BARRIERS

High up-front capital requirements for solar equipment

Need for training in solar-diesel mini-grid operations

Permitting and regulatory requirements could slow down implementation, particularly for formalisation of existing operations which are led by refugees

Relies on coordination between multiple partners

Land acquisition for solar installation could be required

Project concepts

PROJECT REACH, TIMELINE & BUDGET

Year 1: Feasibility study and regulatory approval ($300,000)

Small

$300,000

FURTHER INFORMATION

During the workshop, diesel generator operators explained that their businesses are under pressure because of high diesel prices. As a result they are interested in transitioning to a solar (or hybrid) system, but only if they were to receive adequate support in making the transition. They would require both technical assistance and financial support to convert their diesel-based solutions to solar.

REPLICATION & EXPANSION

Transitions existing electricity provision to more cost-effective, sustainable, and safer alternatives

Develops existing electricity businesses, including their customer bases, networks, and experience

Builds on existing knowledge from other solar mini-grid operators

STAKEHOLDERS AND ROLES

Development, humanitarian, or private sector organisations to conduct feasibility study

Diesel generator operators to provide key data and information for feasibility study

Donors and financial institutions to fund the feasibility study

SCALABILITY

Moderate: Lessons learned from exploring how to formalise the diesel generator businesses could be very relevant in other contexts with similar types of informal electricity provision.

FEASIBILITY STUDY FOR SOLARISING PRIVATE DIESEL-BASED ELECTRICITY PROVISION

2/2

Project concepts

BLOCK MINI-GRIDS FOR COMMUNITY GROUPS

1/2

LOCATION

Kakuma (1, 2, 4) and Dadaab (Ifo, Dagahaley, Hagaden)

BACKGROUND

Many households in Kakuma and Dadaab rely on off-grid solutions. Major mini-grid projects have brought the benefits of domestic lighting to many households in Kalobeyei and Kakuma but are not yet available to all, whilst solar home systems can be expensive compared to larger systems which can benefit from economies of scale. Standalone modular solar systems, such as the 500 Wp units offered by Power-Blox, offer an innovative in-between solution. These solar-powered units can be combined to construct larger modular nano-grids or mini-grids which can power businesses and households. Groups of households and businesses could come together to jointly save up for and invest in these systems.

ACTIVITIES

Conduct feasibility study to assess the viability of the potential block scale mini-grids and determine the business case (Y1)

Scope potential blocks where such systems would have an advantage (far from existing mini-grids, low penetration of solar home systems) (Y1)

Work with community leaders to form groups to manage the block scale mini-grids (Y1)

Pilot "block scale" standalone solar mini-grids which can provide electricity services to 10-20 households in one area (Y2)

Implement initial pilot systems under a grant model to assess the opportunity (Y2-3)

Partner with microfinance institutions to support customers with acquiring the credit to pay for technology (Y2-3)

Train local technicians to install and maintain the systems, and handle customer service (Y2-3)

ENABLERS

High interest in household electricity services and demonstrated willingness to pay

Modular structure and portability of systems allows them to be scaled up and relocated easily if needed

Very high solar resource

BARRIERS

Relatively small solution and would require many systems to achieve scale

Technology is not yet well known

Permitting and regulatory requirements could slow down implementation

Could conflict with existing mini-grid expansions or increase in solar product ownership

Reliance on good cooperation of groups

Project concepts

PROJECT REACH, TIMELINE & BUDGET

One system per block (15 households), piloted in 20 blocks
Pilot project duration of 3 years

Year 1: Feasibility study ($100,000)

Year 2: Implementation ($300,000)

Year 3: Implementation and evaluation ($200,000)

Medium

$600,000 for a pilot of 20 blocks

FURTHER INFORMATION

Block-sized solar systems could fill a gap in the market between large-scale mini-grids and off-grid solar products by providing more affordable power to those living in presently unserved areas of the camps. Even in areas where diesel mini-grids are available, these provide power only at certain times of the day and so solar could supply households in the remaining periods. The modular technology of Power-Blox offers the advantage of being able to be scaled easily by purchasing additional units and combining them with the existing system, as well as being easily transportable if needed. Workshop participants estimated that each project would require around 5 kWh per day to serve around 20 households and, based on their experience, could cost around $20,000.

REPLICATION & EXPANSION

Replicates pilot project by International Lifeline Fund and Power-Blox in Kiryandongo and Rwamwanja refugee settlement in Uganda

High potential for replication in other areas, if successful

STAKEHOLDERS AND ROLES

Private sector to design, install and maintain the solar systems

Financial institutions to provide access to credit to purchase systems

Community leaders to coordinate formation of blocks and encourage uptake

Government and regulatory bodies to provide processing of permits and applications

SCALABILITY

Moderate: Once a successful design has been established, the same template could be scaled and replicated throughout other unserved areas of the camps.

BLOCK MINI-GRIDS FOR COMMUNITY GROUPS 2/2

Project concepts

PUBLIC LIGHTING THROUGH COMMUNITY COMPOUNDS

1/2

LOCATION

Kakuma and Dadaab

BACKGROUND

Street lighting in Kakuma and Dadaab Refugee Camps is incredibly limited. Previous projects designed to increase public lighting have suffered many challenges, from a lack of both maintenance and engagement with the community. Improved street lighting could help camp residents to move around at night and increase the perception of safety. Connecting public lighting to existing electricity infrastructure where possible, for example mini-grids or standalone systems user for operational purposes, could be more cost-effective and last longer than standalone streetlights.

ACTIVITIES

Conduct community mapping exercises with women and men separately to identify the highest-priority locations for public lighting (Y1)

Conduct feasibility study to connect public lighting to existing electricity infrastructure such as mini-grids and standalone systems (Y1)

Install public lighting in priority areas (Y1-2)

Train community members to maintain the streetlights and form O&M cooperatives (Y1-2)

Generate revenue from using streetlights for advertising to fund maintenance and repairs (Y1-2)

Monitor and maintain streetlights (Y2-3)

ENABLERS

Previous street lighting projects have proven to be popular

Streetlights could be integrated into existing electricity systems (mini-grids or standalone systems)

BARRIERS

Some previous street lighting projects have not achieved longevity

Reliant on large initial grant funding

Limited existing local capacity for maintenance

Project concepts

PROJECT REACH, TIMELINE & BUDGET

200 streetlights in high-impact areas per camp complex

Year 1: Community mapping and procurement ($450,000)

Year 2: Installation of public lighting and technician training ($150,000)

Year 3: Monitoring and maintenance ($100,000)

Medium

$700,000 per camp

FURTHER INFORMATION

Ensuring the longevity of public lighting solutions has always been perceived as challenging: for grant-funded projects there is often little funding for maintenance and low buy-in from the community and so systems quickly fall into disrepair. Engaging with the community to identify the best locations for streetlights and connecting to existing electricity systems, rather than using standalone units, could help to improve local support for the lights and keep them operational for longer.

REPLICATION & EXPANSION

Can build on the learnings from previous, smaller-scale projects in Kakuma

Transferable learning from Renewable Energy for Refugees (RE4R) Project in Rwanda

STAKEHOLDERS AND ROLES

Community members to prioritise areas for lighting, O&M cooperatives to be established to support the maintenance of lights

Private sector companies to install streetlights and connect to community-scale electricity systems

Humanitarian and development organisations to provide capacity building on technical maintenance skills

SCALABILITY

Moderate: Scalable across camps (or areas within them) and directly replicable in other displacement settings.

PUBLIC LIGHTING THROUGH COMMUNITY COMPOUNDS

2/2

07

Conclusions

Key issues for energy access

Displacement settings in Kenya offer great potential to scale up access to sustainable energy. National policies to improve the economic and social integration of displaced people, as well as those aimed at increasing energy access in rural and remote areas, provide strong foundations to roll out sustainable energy interventions. Many market-based interventions, especially in Kakuma and Kalobeyei, demonstrate how the private sector can meet the energy need of displaced and host communities. Much more work is required in Garissa, however, which is hindered by less infrastructure and by perceptions that the security situation in Dadaab is far more unstable. This has historically limited private sector engagement and results in overall levels of energy access being far lower.

Like most households in Kenya, refugees and host community members rely predominantly on firewood and charcoal for cooking. In Kakuma, several local companies sell improved cookstoves but users report that they have low durability and the scale of their operations is much lower than the community demand, limited by the availability of raw materials. Scaling up these operations in Kakuma, and catalysing them in Dadaab, would increase access to clean cooking.

Refugee and host communities in Kakuma and Kalobeyei have access to several sources of electricity, although electricity access remains low overall. Solar lanterns and SHS are readily available and connections to larger-scale mini-grid systems, both those supplied by diesel and the solar mini-grids of Renewvia, Okapi and Yelele, offer higher levels of electricity access, albeit often with high upfront costs and high tariffs. In Dadaab, levels of electricity access are much lower and the private market for electricity solutions is almost non-existent. Introducing more solar companies to operate in these displacement settings and supporting the growing mini-grid expansions in Turkana could further increase electricity access.

Access to productive uses of energy in Kalobeyei has been boosted by the expansion of the solar mini-grids. Standalone solar systems and connections to diesel-based systems provide other sources of electricity for businesses, powering appliances such as phone chargers, televisions, laptops and refrigerators. Still, many enterprises would benefit from improved energy access and investments are required to expand both access to energy and the use of energy-efficient appliances, particularly in parts of Kakuma refugee camp and Dadaab.

Many community facilities, such as hospitals and schools, have access to electricity in Kakuma from either diesel generators or solar power. Most institutions rely on traditional fuels for large-scale cooking but small pilot projects have shown promise for electric cooking in schools. The longevity of grant-funded projects, particularly around community engagement and training for operating and maintaining equipment, should be a priority focus for future implementation.

Humanitarian organisations typically have high levels of electricity access. Compounds in Kakuma and Kalobeyei are connected to the national grid or rely on diesel generators, similar to organisations based there, and almost all boreholes have been transitioned to solar power. The solar mini-grids and their expansions also offers opportunities for smaller organisations in the camp to access reliable electricity. ●

Successful market-based projects in Kakuma and Kalobeyei have helped to increase energy access; these should be scaled up to match the needs of the communities there. More work is needed in Dadaab where access to energy is lower.

The road to sustainable energy in displacement settings

©GIZ

Improving access to sustainable energy will require a concerted effort from all stakeholders working in displacement contexts, with refugee and host community members having a central role in the design and implementation of any intervention.

The READS workshops brought together a diverse range of stakeholders to co-design potential high-impact projects. Whilst these are presented as individual opportunities – and would each merit investment and implementation on their own – rolling out coordinated interventions addressing several energy themes together could have a truly catalytic effect on increasing sustainable energy access as a whole.

Acknowledging this, and the work of other initiatives, the roadmap below presents a vision of how access to sustainable energy in displacement settings could develop in the short, medium, and long term. Greater coordination will be central to achieving progress, which could be greatly supported under the frameworks offered by the Kalobeyei and Garissa Integrated Socio-Economic Development Programmes (KISEDP and GISEDP). ››

All stakeholders will need to play a role, with refugee and host communities in the centre, to improve access to sustainable energy.

SHORT TERM (2023-2024)
MEDIUM TERM (2025-2027)
LONG TERM (2028-2030+)

MINI-GRID EXPANSION

- **SHORT TERM:** Operationalisation of partnership between Renewvia, Okapi and Yelele and expansion of connections in Kalobeyei settlement and Kakuma Zone 3
- **MEDIUM TERM:** Increase of capacity of mini-grid systems and expansion of distribution network through OkRene partnership to reach 15,000+ connections, including Kakuma Zones 1, 2, and 4
- **MEDIUM TERM:** New mini-grid sites to be developed covering other Zones in Kakuma
- **LONG TERM:** Further increase in capacity and reach of mini-grids to cover all of Kakuma camp and Kalobeyei settlement

PRIVATE ELECTRICITY PROVISION

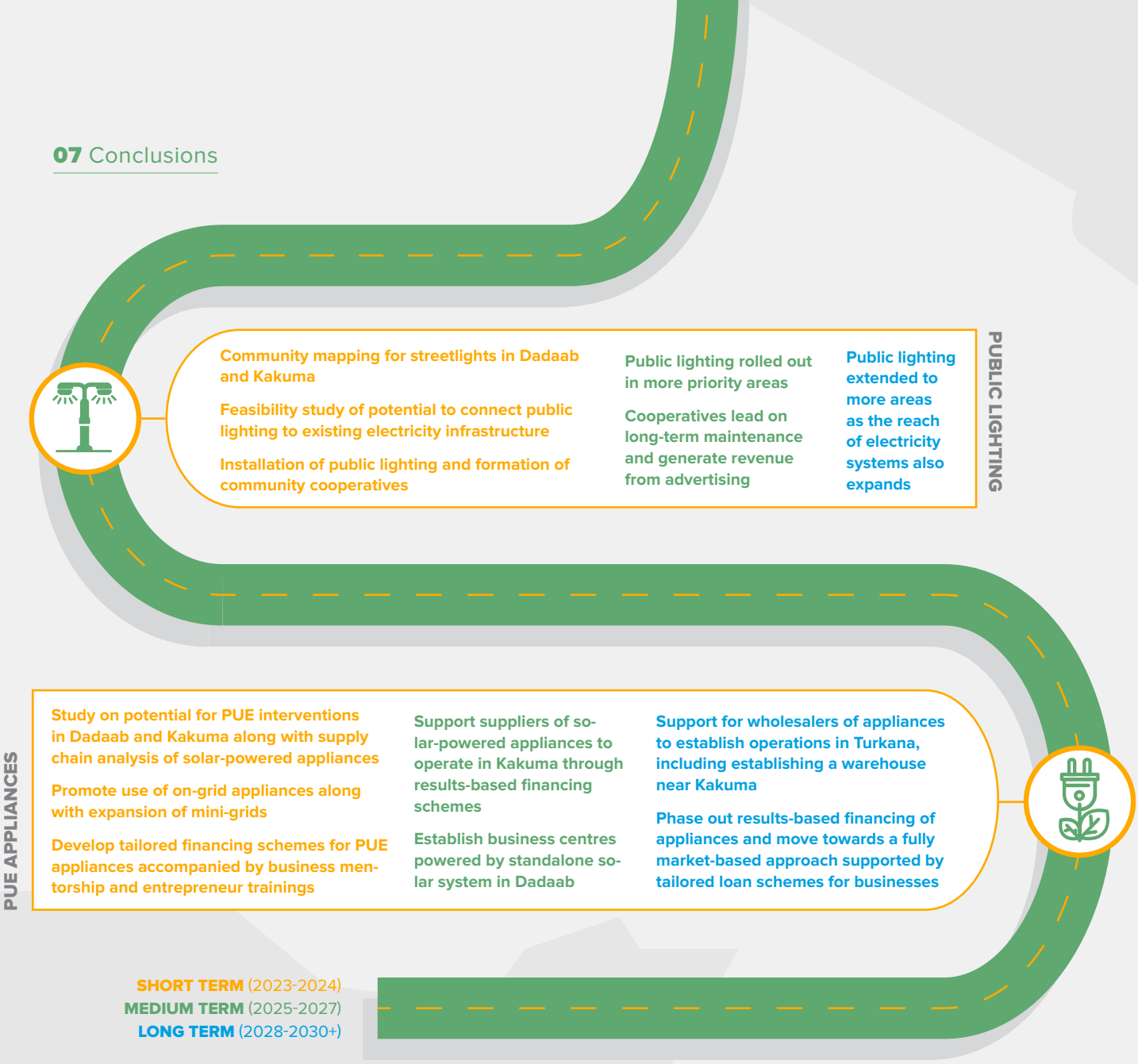
- **SHORT TERM:** Conduct feasibility study for diesel-based power supply to switch to solar
- **SHORT TERM:** Support diesel generator operators to formalise operations and provide grants to improve wiring
- **MEDIUM TERM:** Based on results of feasibility study, support diesel generator operators with grant funding for solar or hybrid mini-grids and/or more efficient generators
- **LONG TERM:** Development and operationalisation of solar or hybrid mini-grids, in coordination or collaboration with OkRene Energy
- **LONG TERM:** Integration of diesel-based power provision into existing mini-grids

LOCAL CHARCOAL STOVE PRODUCTION

- **SHORT TERM:** Supply chain analysis and feasibility study for local production of charcoal stoves in Kakuma and Dadaab
- **SHORT TERM:** Support the establishment or scale up of stove production units
- **SHORT TERM:** Training of stove manufacturers
- **SHORT TERM:** Conduct assessment on feasibility of improved charcoal production
- **MEDIUM TERM:** Investment in machinery to manufacture stoves at larger scale
- **MEDIUM TERM:** Support supply chain development for raw materials
- **LONG TERM:** Establishment of semi-industrial production site meeting higher levels of demand

E-COOKING

- **SHORT TERM:** Scale-up of electric pressure cooker pilots in Kakuma in line with mini-grid expansion
- **MEDIUM TERM:** Incentives (e.g. RBFs) for different e-cooking companies to start working in Kalobeyei-Kakuma
- **LONG TERM:** Scale up of e-cooking as a more prominent or primary source of cooking



The challenge is huge: achieving access to affordable, sustainable, reliable, and modern energy for refugees and host communities by 2030 will require more projects, activities, partners, community involvement, coordination, and investment than ever before. Fortunately, existing market-based solutions for household lighting, clean cooking, and large-scale electrification projects for businesses and community facilities provide a blueprint for scaling up and replicating sustainable energy solutions in displacement settings throughout Kenya. ●

The projects and stakeholders already working in Kenya offer an excellent foundation to scale up sustainable energy access.

References

[1] Global Platform for Action on Sustainable Energy Solutions in Displacement Settings, 'State of the Humanitarian Energy Sector: Challenges, Progress and Issues in 2022'. UNITAR, 2022. Available: https://www.humanitarianenergy.org/assets/resources/SOHES.pdf

[2] OECD, 'DAC List of ODA Recipients'. OECD, 2022. Accessed: Nov. 02, 2022. Available: https://webfs.oecd.org/oda/DataCollection/DAC%20List/DAC-List-of-ODA-Recipients-for-reporting-2022-23-flows.pdf

[3] Fund for Peace, 'Fragile States Index Annual Report 2022', Fund for Peace, Washington DC, 2022. Accessed: Nov. 02, 2022. Available: https://fragilestatesindex.org/wp-content/uploads/2022/07/22-FSI-Report-Final.pdf

[4] UNHCR, 'Operational Data Portal: Kenya', Mar. 31, 2023. https://data.unhcr.org/en/country/ken (accessed May 18, 2023).

[5] World Bank, 'World Bank Open Data'. World Bank, 2022. Accessed: Sep. 23, 2022. Available: https://data.worldbank.org/

[6] UNHCR, 'Kakuma Refugee Camp and Kalobeyei Integrated Settlement', *UNHCR Kenya*. https://www.unhcr.org/ke/kakuma-refugee-camp (accessed Dec. 09, 2022).

[7] UNHCR, 'Dadaab Refugee Complex', *UNHCR Kenya*. https://www.unhcr.org/ke/dadaab-refugee-complex (accessed Dec. 09, 2022).

[8] UNHCR, 'Kenya Infographics and Statistics Package'. UNHCR, Oct. 31, 2022.

[9] UNHCR Kenya, 'Key figures in Kenya', *UNHCR Kenya*, Apr. 2022. https://www.unhcr.org/ke/figures-at-a-glance (accessed May 11, 2023).

[10] A. Betts, N. Omata, and O. Sterck, 'The Kalobeyei Settlement: A Self-reliance Model for Refugees?', *Journal of Refugee Studies*, vol. 33, no. 1, pp. 189–223, Mar. 2020, doi: 10.1093/jrs/fez063.

[11] M. N. Wanjiku, S. Alemu, P. Breul, and J. Sanchez, 'Access to energy for livelihoods in displacement settings'. GIZ in cooperation with Practical Action Consulting, 2022.

[12] J. Graham and S. Miller, 'From displacement to development: How Kenya can create shared growth by facilitating economic inclusion for refugees', Center for Global Development, Refugees International, Nov. 2021.

[13] A. Betts, Omata, Naohiko, and Sterck, Olivier, 'Refugee Economies in Kenya', Feb. 2018.

[14] H. Etyang, 'Turkana opens Huduma-Biashara Centre in Kakuma', *The Star*, May 04, 2023. https://www.the-star.co.ke/counties/rift-valley/2023-05-04-turkana-opens-huduma-biashara-centre-in-kakuma/ (accessed Jun. 23, 2023).

[15] I. Leghtas and D. Kitenge, 'What Does Kenya's New Refugee Act Mean for Economic Inclusion?', *Refugees International*, May 04, 2022. https://www.refugeesinternational.org/reports/2022/4/29/what-does-kenyas-new-refugee-act-mean-for-economic-inclusion (accessed Jan. 06, 2023).

[16] I. Leghtas and D. Kitenge, 'How Implementing the New Regulations for the 2021 Refugee Act Can Improve the Lives of Refugees in Kenya', *Refugees International*, Mar. 24, 2023. https://www.refugeesinternational.org/reports/2023/3/24/how-implementing-the-new-regulations-for-the-2021-refugee-act-can-improve-the-lives-of-refugees-in-kenya (accessed May 11, 2023).

References

[17] Practical Action Consulting, 'Socio-Economic Impact Assessment of Energy Solutions for Displacement Settings Project Implementation in Kenya: Midline Study Report', May 2023.

[18] A. B. Halakhe and S. Deardorff Miller, 'Can Kenya emerge as a role model on refugees?', *Aljazeera*. https://www.aljazeera.com/opinions/2022/11/30/kenya-has-a-chance-to-lead-on-refugees (accessed May 11, 2023).

[19] UNHCR and World Bank Group, 'Understanding the Socioeconomic Conditions of Refugees in Kenya: Volume B - Kakuma Camp: Results from the 2019 Kakuma Socioeconomic Survey', 2021.

[20] L. Wellen, M. Pasini, and G. Mazza, 'Access to Finance for Energy in Displacement Settings'. 2022.

[21] SNV, 'Situational Analysis: Consultancy Service to Promote Productive Use of Energy in Kalobeyei Settlement and Kalobeyei Host Town, Turkana West Sub-County', SNV, Aug. 2022.

[22] UNHCR, 'Country Reports: Displaced and Disconnected'. Apr. 15, 2019.

[23] A. Betts, A. Delius, C. Rodgers, O. Sterck, and M. Stierna, 'Doing Business in Kakuma: Refugees, Entrepreneurship, and the Food Market', Refugee Studies Centre, ODID, University of Oxford, Oxford, UK, Sep. 2019.

[24] USAID and Winrock International, 'Equity Bank's EcoMoto Loan Program', Sep. 2019. https://winrock.org/wp-content/uploads/2017/09/EquityBankProfile.pdf (accessed Jun. 30, 2023).

[25] L. Patel, F. Razzaq, and K. Sosis, 'Assessing the potential for off-grid power interventions in Turkana County with a focus on the communities in Kakuma and Kalobeyei'. Smart Communities Coalition, Mar. 2019.

[26] International Finance Corporation, 'Energy Sector Baseline Study in the Kakuma-Kalobeyei Refugee-Hosting Area in Kenya'. Mar. 2022.

[27] Kenya Vision 2030, 'About Vision 2030', *Kenya Vision 2030*. https://vision2030.go.ke/about-vision-2030/ (accessed Dec. 13, 2022).

[28] C. Kambanda and R. L. Mshana, 'Country priority plan and diagnostic of the electricity sector: Kenya', African Development Bank, 2021. Accessed: Dec. 19, 2022. Available: https://www.afdb.org/sites/default/files/2021/11/22/kenya.pdf

[29] Ministry of Energy and Sustainable Energy for All, 'Kenya Action Agenda'. Sustainable Energy for All, 2016. Accessed: Dec. 22, 2022. Available: https://www.seforall.org/sites/default/files/Kenya_AA_EN_Released.pdf

[30] Energy Sector Management Assistance Program (ESMAP), 'Regulatory Indicators for Sustainable Energy (RISE) Sustaining the Momentum', World Bank, Washington DC, 2020. Accessed: Sep. 22, 2022. Available: https://rise.esmap.org/data/files/reports/2020-full-report/RiseReport-010421.pdf

[31] Government of Kenya, 'Energy Act 2019'. Government of Kenya, Mar. 14, 2019.

[32] Ministry of Energy, 'National Energy Policy'. Ministry of Energy, Oct. 2018. Accessed: Dec. 19, 2022. Available: https://kplc.co.ke/img/full/BL4PdOqKtxFT_National%20Energy%20Policy%20October%20%202018.pdf

References

[33] Ministry of Energy, 'Kenya National Electrification Strategy: Key Highlights'. Ministry of Energy, 2018. Accessed: Dec. 19, 2022. Available: https://pubdocs.worldbank.org/en/413001554284496731/Kenya-National-Electrification-Strategy-KNES-Key-Highlights-2018.pdf

[34] Ministry of Energy, 'Bioenergy Strategy 2020-2027'. Ministry of Energy, 2020. Accessed: Dec. 19, 2022. Available: https://repository.kippra.or.ke/bitstream/handle/123456789/3017/Bioenergy-strategy%202020-2027.pdf?sequence=1&isAllowed=y

[35] Ministry of Energy, 'Kenya National Energy Efficiency and Conservation Strategy'. Ministry of Energy, 2020. Accessed: Dec. 19, 2022. Available: https://repository.kippra.or.ke/bitstream/handle/123456789/3074/ENERGY%20STRATEGY.pdf?sequence=1&isAllowed=y

[36] GOGLA, 'Kenya Country Brief'. 2021. Accessed: Dec. 20, 2022. Available: https://www.gogla.org/sites/default/files/resource_docs/kenya_country_brief_0.pdf

[37] Loughborough University, 'Invitation to Tender Document: Appointment of a consultant for Kenyan National Clean Cooking Strategy (KNCCS)', May 2022. https://mecs.org.uk/wp-content/uploads/2022/05/KNCCS-ToR-Final-Comments-Amended-May-2022.pdf (accessed Jun. 19, 2023).

[38] World Health Organization, 'Defining clean fuels and technologies', 2023. https://www.who.int/tools/clean-household-energy-solutions-toolkit/module-7-defining-clean (accessed Jun. 19, 2023).

[39] A. Nilsson *et al.*, 'The Kenyan cooking sector: Opportunities for climate action and sustainable development', New Climate Institute, Jul. 2021. Accessed: Dec. 22, 2022. Available: https://ambitiontoaction.net/wp-content/uploads/2021/07/A2A_Kenya_CleanCookingStudy_July2021.pdf

[40] IRENA, 'Energy Profile: Kenya'. IRENA, Aug. 24, 2022. Accessed: Dec. 12, 2022. Available: https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical_Profiles/Africa/Kenya_Africa_RE_SP.pdf

[41] Ministry of Energy, 'Ministry of Energy: Background', *Ministry of Energy*, 2018. https://energy.go.ke/?page_id=439 (accessed Dec. 19, 2022).

[42] EPRA, 'EPRA: About Us', *Energy and Petroleum Regulatory Authority*, 2019. https://www.epra.go.ke/about/ (accessed Dec. 19, 2022).

[43] Ministry of Energy, 'Energy (Appliances' Energy Performance and Labelling) Regulations'. Ministry of Energy, 2016.

[44] EPRA, 'Standards and labelling', *Energy and Petroleum Regulatory Authority*, 2019. https://www.epra.go.ke/services/energy-efficiency-project/standards-and-labelling/ (accessed Dec. 22, 2022).

[45] Ministry of Energy, 'Draft Energy (Energy Management) Regulations'. Ministry of Energy, Jun. 04, 2020.

[46] Kenya Renewable Energy Association, 'Organisation overview', *Kenya Renewable Energy Association*, 2022. https://kerea.org/company-overview/ (accessed Dec. 21, 2022).

[47] Clean Cooking Association of Kenya, 'Who We Are', *Clean Cooking Association of Kenya (CCAK)*, 2022. https://ccak.or.ke/index.php/about-us/who-we-are (accessed Dec. 22, 2022).

[48] Kenya Power, 'Last Mile Connectivity', *Kenya Power*, 2022. https://www.kplc.co.ke/content/item/1120/last-mile-connectivity (accessed Dec. 20, 2022).

References

[49] K. Mathu, 'Integrated national energy planning: A new path for Kenya', *ESI-Africa.com*, Jul. 18, 2022. Accessed: Dec. 21, 2022. Available: https://www.esi-africa.com/industry-sectors/energy-efficiency/integrated-national-energy-planning-a-new-path-for-kenya/

[50] Energy Regulatory Commission, 'Schedule of tariffs'. 2018. Accessed: Dec. 21, 2022. Available: https://kplc.co.ke/img/full/R6kP4e4oBapV_Schedule%20of%20Tariff%20-%202018.pdf

[51] Kenya Power, 'Kenya electricity prices', Jan. 07, 2022. https://kplc.co.ke/img/full/tarr.jpg (accessed Dec. 21, 2022).

[52] EPRA, 'Standard Tariff Application Model for Minigrids', *Energy and Petroleum Regulatory Authority*, 2017. https://www.epra.go.ke/services/standard-tariff-application-model-for-minigrids/ (accessed Dec. 21, 2022).

[53] Ministry of Energy, 'KOSAP Project Components', 2022. https://www.kosap-fm.or.ke/kosap-project-components/ (accessed Dec. 20, 2022).

[54] Ministry of Energy, 'KOSAP Solar Debt Facility Information Pack'. Ministry of Energy, Jun. 2019.

[55] EPRA, 'Energy (Mini-Grid) Regulations'. EPRA, 2021. Accessed: Dec. 21, 2022. Available: https://www.epra.go.ke/wp-content/uploads/2021/06/REVIEWED-ENERGY-MINI-GRIDS-REGULATIONS-2021.pdf

[56] I. Indriunaite, 'Interrogating Kenya's draft minigrid regulations', *ESI Africa*, Aug. 12, 2021. Accessed: Dec. 21, 2022. Available: https://www.esi-africa.com/industry-sectors/future-energy/interrogating-kenyas-draft-minigrid-regulations/

[57] MECS, 'Kenya National Clean Cooking Strategy (KNCCS)', *Modern Energy Cooking Services*, 2023. https://mecs.org.uk/kenya-national-clean-cooking-strategy-knccs/ (accessed Jun. 15, 2023).

[58] C. Muindi, 'Kenya launches strategy for clean cooking', *Kenya News Agency*, Jul. 20, 2022. Accessed: Dec. 22, 2022. Available: https://www.kenyanews.go.ke/kenya-launches-strategy-for-clean-cooking/

[59] I. Mwathi, 'National Biomass Briquettes Program', *National Biomass Briquette Program*, 2022. https://hivos.org/program/national-biomass-briquettes-program/ (accessed Jun. 15, 2023).

[60] M. Shupler *et al.*, 'COP26 and SDG 7 goals under threat: 16% VAT on LPG reverses progress made in clean cooking adoption in Kenya'. Feb. 03, 2022. Accessed: Dec. 22, 2022. Available: https://www.ucl.ac.uk/bartlett/construction/sites/bartlett_construction/files/policy_report_dec_2021_v3.pdf

[61] Clean Cooking Association of Kenya, 'Quick guide booklet'. Clean Cooking Association of Kenya, Sep. 09, 2020. Accessed: Dec. 22, 2022. Available: https://ccak.or.ke/index.php/component/jdownloads/send/2-ccak-downloads/11-quick-guide-booklet

[62] J. Atela *et al.*, 'Techno-policy spaces for e-cooking in Kenya', Nov. 2021.

[63] Efficiency for Access Coalition and 60 Decibels, 'Uses & impacts of electric pressure cookers: Insights from Kenya'. 2021. Accessed: Dec. 23, 2022. Available: https://storage.googleapis.com/e4a-website-assets/Uses-and-Impacts-of-EPCs_2021.pdf

[64] J. Leary, 'Kenya: eCooking Market Assessment'. MECS, Feb. 2022. Accessed: Dec. 23, 2022. Available: https://mecs.org.uk/wp-content/uploads/2022/02/MECS-EnDev-Kenya-eCooking-Market-Assessment.pdf

References

[65] K. Groen, 'Promoting Market Based Energy Access for Cooking and Lighting in Kakuma Refugee Camp: Experiences and lessons learned', GIZ and SNV, Jul. 2020.

[66] K. Groen, S. Hounsell, M. Havinga, and J. M. Njongu, 'Access to Energy for (Micro) Businesses in Kakuma Refugee Camp and Kalobeyei Integrated Settlement', Nov. 2020. Available: https://snv.org/assets/explore/download/mbea_ii_business_survey_report_final.pdf

[67] Renewvia, 'Minigrid Sites | Renewvia Energy Africa', *Renewvia*, 2023. https://www.renewvia.com/minigrid-sites (accessed Apr. 14, 2023).

[68] Authority of the Republic of Kenya, 'The Kenya Gazette: Vol. CXXIII - No. 89', Nov. 30, 2021.

[69] Practical Action, 'Dissemination Webinar: Energy Solutions for Displacement Settings Project - Kenya Socio-Economic Impact Assessment - Midline Study', Jun. 15, 2023.

[70] C. A. Ochieng, Y. Zhang, J. K. Nyabwa, D. I. Otieno, and C. Spillane, 'Household perspectives on cookstove and fuel stacking: A qualitative study in urban and rural Kenya', *Energy for Sustainable Development*, vol. 59, pp. 151–159, Dec. 2020, doi: 10.1016/j.esd.2020.10.002.

[71] K. Groen *et al.*, 'Piloting Electric Pressure Cookers in Kalobeyei Integrated Settlement: Project Experiences and Key Lessons Learned', May 2023.

[72] EnDev and SNV, 'Behavioural Change Campaign: Promoting Improved Cooking Solutions in Kakuma Refugee Camp: Key Research and Implementation Findings'. Accessed: May 17, 2023. Available: https://snv.org/assets/explore/download/BCC%20report%20%28final.2%29.pdf

[73] International Finance Corporation, 'Kakuma as a Marketplace', World Bank, Apr. 2018. doi: 10.1596/34645.

[74] M. W. Ngunjiri, S. Alemu, P. Breul, and J. Sanchez, 'Access to Energy for Livelihoods in Displacement Settings: With a focus on Ethiopia, Kenya and Northern Uganda', GIZ and Practical Action Consulting, 2022. Available: https://energypedia.info/images/5/58/Access_to_energy_for_livelihoods_in_displacement_settings.pdf

[75] 'Study finds refugee businesses play vital role in local economy', *UNHCR*. https://www.unhcr.org/news/stories/study-finds-refugee-businesses-play-vital-role-local-economy (accessed May 16, 2023).

[76] 'Institutional-cooking-CCA-Webinar_-SNV.pdf'. Accessed: May 11, 2023. Available: https://mecs.org.uk/wp-content/uploads/2021/10/Institutional-cooking-CCA-Webinar_-SNV.pdf

[77] 'Press release: Energy 4 Impact leading innovative clean energy and livelihood initiatives for Kakuma refugees - Sun Connect News', Feb. 06, 2018. https://sun-connect.org/press-release-energy-4-impact-leading-innovative-clean-energy-and-livelihood-initiatives-for-kakuma-refugees/ (accessed May 17, 2023).

[78] 'Empowering Refugees Through Energy - Kenya | ReliefWeb', Dec. 20, 2018. https://reliefweb.int/report/kenya/empowering-refugees-through-energy (accessed May 17, 2023).

[79] 'OVO Foundation funds £1.75m electrification project in Kenya | Energy 4 Impact'. https://energy4impact.org/news/ovo-foundation-funds-%C2%A3175m-electrification-project-kenya (accessed May 18, 2023).

References

[80] 'Kakuma Refugee Camp ICT Centre: Connecting communities, protecting the environment and accelerating self-sufficiency'. https://www.crownagents.com/blog-post/how-the-kakuma-refugee-camp-ict-centre-connects-communities-protects-the-environment-and-accelerates-self-sufficiency/ (accessed May 18, 2023).

[81] S. Okello, 'The Energy Situation in Dadaab Refugee Camps, Kenya'. Chatham House, May 2016.

[82] UNHCR, 'SAFE Access to Fuel and Energy (2015-2018)'. UNHCR, 2014. Accessed: May 23, 2023. Available: https://kkcfke.org/wp-content/uploads/2020/08/Energy_Kenya-SAFE-Strategy-2015-18.pdf

[83] G. C. Gitau, 'The GIZ Dadaab Household Energy Project'. GIZ, 2011.

[84] UNHCR, 'Dadaab Refugee Camps, Kenya: Solar Energy and Energy Efficiency'. UNHCR, Sep. 2014.

[85] ILO and UNHCR, 'Doing Business in Dadaab'. Jan. 2019. Accessed: May 15, 2023. Available: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_696141.pdf

[86] K. Muindi and B. Mberu, 'Urban refugees in Nairobi: tackling barriers to accessing housing, services and infrastructure'. IIED, Dec. 2019.

[87] 'The Status and Challenges of Universal Electricity Connectivity in Urban Informal Settlements, a Case of Silanga in Kibera Informal Settlement, Nairobi-kenya'.

[88] ESMAP, 'Bringing global best practices to transform Kenya's slum electrification program'. Sep. 2015. Accessed: May 17, 2023. Available: https://documents1.worldbank.org/curated/en/478251467995396760/pdf/106032-BRI-PUBLIC-IMPACT-9-ESMAP-ImpactStory-Kenya-Electrification.pdf

[89] NORCAP, 'Urban transitions: Clean energy in urban recovery'. Aug. 2021. Accessed: May 12, 2023. Available: https://www.nrc.no/globalassets/pdf/reports/urban-transitions/urban-transition-clean-energy-in-urban-areas_norcap-urban-a-2021.pdf

[90] F. Lambe, 'Bringing clean, safe, affordable cooking energy to Kenyan households: an agenda for action'. Stockholm Environment Institute, 2016. Accessed: May 14, 2023. Available: https://media-manager.sei.org/documents/Publications/SEI-NCE-DB-2016-Kenya-Clean-Cooking.pdf

[91] T. Asrat, 'Cleaning Kakuma's dirt, recycling waste and environment', *KANERE*, Dec. 31, 2022. https://kanere.org/cleaning-kakumas-dirt-recycling-waste-and-environment/ (accessed Jul. 03, 2023).

[92] J. Mutonga and C. Seeger, 'Household electricity access in displacement settings: Mini-grids in Kenya'. GIZ, Jun. 21, 2021. Accessed: Apr. 14, 2023. Available: https://www.humanitarianenergy.org/assets/resources/GIZ_Household_Electricity_in_Displacement_Settings_Kenya_Mini-grids.pdf

[93] P. Kwamboka Omagwa, 'Clean Power Generation: The Case of Renewvia Energy', *The Global Compact on Refugees | UNHCR*. https://globalcompactrefugees.org/good-practices/clean-power-generation-case-renewvia-energy (accessed Apr. 14, 2023).

[94] SNV, 'Promoting electricity for income generation in displacement settings | SNV', Oct. 2022. https://snv.org/update/promoting-electricity-income-generation-displacement-settings (accessed Apr. 14, 2023).

References

[95] Renewvia, 'Renewvia Launches Joint Venture with Okapi Green Energy Ltd. to Deliver Clean and Affordable Energy', *Renewvia*, Feb. 06, 2023. https://www.renewvia.com/post/renewvia-launches-joint-venture-with-okapi-green-energy-ltd-to-deliver-clean-and-affordable-energy (accessed Apr. 14, 2023).

[96] Y. Kemp, 'Grants for Kenya companies to set up mini-grid connections', *ESI-Africa.com*, Jun. 01, 2023. https://www.esi-africa.com/renewable-energy/solar/grants-for-kenya-companies-to-set-up-mini-grid-connections/ (accessed Jun. 19, 2023).

[97] 'Market based Energy Access (MBEA) II'. https://snv.org/project/market-based-energy-access-mbea-ii (accessed Mar. 30, 2023).

[98] SNV, 'Behavioural change campaign to promote improved cooking launched at Kakuma refugee camp', Jun. 2021. https://snv.org/update/behavioural-change-campaign-promote-improved-cooking-launched-kakuma-refugee-camp (accessed Mar. 30, 2023).

[99] Kakuma Ventures, 'Platform', 2023. https://kakumaventures.com/?page_id=119638 (accessed Jun. 30, 2023).

[100] Kakuma Ventures, 'Kakuma Ventures revealed as Finalist in the 2022 Ashden Awards at the international London Climate Action Week conference', Jul. 02, 2022. https://kakumaventures.com/?p=121076 (accessed Jun. 30, 2023).

[101] Ashden, 'Kakuma Ventures - 2022 Ashden Award Winner', 2022. https://ashden.org/awards/winners/kakuma-ventures/ (accessed Jun. 30, 2023).

[102] Kakuma Ventures, 'Kakuma Ventures – Bridge to Digital Services & Opportunities', 2023. https://kakumaventures.com/ (accessed Jun. 30, 2023).

The GPA is steered by

unitar · UNHCR The UN Refugee Agency · IOM UN MIGRATION · World Food Programme · Food and Agriculture Organization of the United Nations · Sustainable Energy for All · CLEAN COOKING ALLIANCE

UN environment programme · Practical ACTION · MERCY CORPS · CHATHAM HOUSE · UNDP · SNV · MECS Modern Energy Cooking Services · giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

The GPA is supported by

Norwegian Ministry of Foreign Affairs · Federal Foreign Office · IKEA Foundation · NORCAP PART OF NORWEGIAN REFUGEE COUNCIL · UKaid from the British people · Transforming Energy Access

READS
KENYA

unitar
United Nations Institute for Training and Research

GPA
GLOBAL PLATFORM FOR ACTION