

Ensuring refugee
camps in Rwanda have

ACCESS TO SUSTAINABLE ENERGY

Practical
ACTION



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About Practical Action

We are an international development organization putting ingenious ideas to work so people in poverty can change their world.

We help people find solutions to some of the world's toughest problems. Challenges made worse by catastrophic climate change and persistent gender inequality. We work with communities to develop ingenious, lasting and locally owned solutions for agriculture, water and waste management, climate resilience and clean energy. And we share what works with others, so answers that start small can grow big.

We're a global change-making group. The group consists of a UK registered charity with community projects in Africa, Asia and Latin America, an independent development publishing company and a technical consulting service. We combine these specialisms to multiply our impact and help shape a world that works better for everyone.

The Renewable Energy for Refugees project

Working in partnership with UNHCR, the UN Refugee Agency, and supported by the IKEA Foundation, the Renewable Energy for Refugees project will help refugees and their host communities access renewable energy, enabling refugees to move from reliance on aid to economic independence. This project will deliver renewable energy investments through innovative approaches in humanitarian settings, working directly with refugees and host communities in Kigeme, Nyabiheke, and Gihembe refugee camps in Rwanda and with urban refugees in Irbid in Jordan. The project will provide access to affordable and sustainable sources of renewable energy, and improve the health, wellbeing, and security of target populations. It draws on Practical Action's considerable existing experience in renewable energy programmes in developing countries – working directly with communities to deliver the best energy services and products possible for local people.

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PRAISE FOR THIS REPORT

This RE4R report sets out what works for refugees in their search for energy that is renewable, clean and reliable, and details ways to help communities set themselves up for success and growth.

**Annemieke Tsike-Sossah, Refugee Livelihoods Programme
Manager, IKEA Foundation**

This report shows two very important results. First, the energy situation of displaced populations varies and there are positive developments, for example in the usage of solar home systems. However, many more efforts like the RE4R project are needed to achieve SDG 7 for refugees and their hosts in the coming decade. Second, the report shows the importance of a holistic assessment of the energy situation, which is still not the case in many similar projects nowadays. It is for example not enough to look at energy for cooking and ignore electricity for households or essential common infrastructure. In that sense, the total energy access approach and the holistic way of assessing, reporting and changing the energy situation should be a model for future projects in the humanitarian energy sector.

**Thomas Fohgrub, Team Leader of the GPA Coordination Unit,
United Nations Institute for Training and Research (UNITAR)**

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PHOTO CAPTIONS AND CREDITS

Cover. A light connected to a solar home system illuminates a room for the first time. (Credit: Practical Action/David Nkurunziza)

Executive summary. A man in Gihembe uses at a manual sewing machine underneath a solar streetlight that will allow him to continue working into the evening. (Credit: Practical Action/Edoardo Santangelo)

Introduction. A solar panel is left out in the sun to charge a battery whilst people wash clothes in Nyabiheke. (Credit: Practical Action/Edoardo Santangelo)

Methodology. Staff set up a solar home system to demonstrate its capabilities to potential customers in the camp. (Credit: Practical Action/Edoardo Santangelo)

Refugee communities and camp demographics. Gihembe is host to a regular Refugees vs. Organizational Staff football match. (Credit: Practical Action/Edoardo Santangelo)

Electricity and lighting in refugee households. A business owner in Nyabiheke completes a form after agreeing to participate in the survey. (Credit: Practical Action/David Nkurunziza)

Cooking and fuels in refugee households. Women sell fruit and vegetables in the evening under the light of a newly installed solar streetlight. (Credit: Practical Action/Edoardo Santangelo)

Energy for enterprises, businesses, and livelihoods activities. Performing this intricate work after dark would be impossible without the light from an electric lamp fixed to the ceiling. (Credit: Practical Action/Edoardo Santangelo)

Energy for camp operations, community facilities, and institutions. Two refugee technicians carry cables for the installation of solar streetlights. (Credit: Practical Action/David Nkurunziza)

The energy needs and priorities in refugee camps in Rwanda. A solar streetlight in Kigeme charges in bright sunlight during the day to provide illumination around the WASH facilities at night. (Credit: Practical Action/Edoardo Santangelo)

Conclusions and recommendations. A technician installs a solar home system, providing access to sustainable energy for the first time. (Credit: Practical Action/David Nkurunziza)



EXECUTIVE SUMMARY

More than 70 million people around the world are forcibly displaced, and the provision of energy in humanitarian settings for critical services, from cooking meals to powering health centres, is often inefficient, unsafe, or inadequate (UNHCR 2019a, UNITAR 2018). The complexities of providing even the basic levels of energy access necessary for survival are exacerbated in an environment of constantly changing priorities, and the provision of energy resources and technologies are often limited to short-term solutions to immediate problems rather than long-term strategies for technological upgrading. Even in protracted situations, where displaced people have been resident in a host country for many years, delivering fundamental assistance often leaves humanitarian agencies under-resourced and overstretched and, as a result, access to energy beyond the necessary minimum levels has often been out of reach for many refugees.

This is beginning to change. Sustainable Development Goal 7, which aims to provide sustainable, affordable, and reliable access to energy

Sustainable Development Goal 7, which aims to provide sustainable, affordable, and reliable access to energy for all, now includes explicit reference to the needs of refugees and displaced people

for all, now includes explicit reference to the needs of refugees and displaced people (United Nations 2018). A significant contribution to achieving this high-level political recognition has been made thanks to the work of the Global Plan of Action for Sustainable Energy Solutions in Situations of Displacement (GPA), a non-binding framework developed by United Nations agencies, humanitarian and development organizations, the private sector, governments, academia, and other stakeholders (UNITAR 2018). The GPA seeks to strengthen and coordinate existing and emerging initiatives that aim to deliver improved energy access in situations of displacement, as well as supporting other political accords such as the New York Declaration for Refugees and Migrants, the Agenda for Humanity, and the Comprehensive Refugee Response Framework. Five key challenges have been identified that must be addressed if the situation is to be improved (UNITAR 2018):

1. Energy is not a formal priority in humanitarian assistance
2. Displaced people are not included in national or international energy agendas
3. Energy in displacement settings is under-funded
4. Expertise and capacity to implement humanitarian energy solutions is limited
5. Data on humanitarian energy needs and solutions are limited and not widely shared.

A dedicated working group of expert organizations addresses each of these challenges, with GPA Working Group V focusing specifically on the fifth – looking at solutions for data, evidence, monitoring, and reporting. Its recommendations include gathering primary data on energy access in humanitarian settings, understanding how displaced people perceive and prioritize energy sources, and assessing energy usage by a range of user groups including households, businesses, and camp operations.

Implementing strategies to provide wide-ranging energy access improvements requires a comprehensive understanding of current energy uses and needs. Using a total energy access (TEA) approach, which incorporates a range of assessments including surveys and stakeholder consultations to understand energy services across households, enterprises, and community facilities, can help provide a broad and inclusive foundation upon which to design solutions to the most pressing energy access challenges. Coordinating, collecting, and analysing evidence from a variety of sources and stakeholders is a significant and challenging undertaking but is a worthwhile investment when it can help to inform interventions that will yield the greatest likelihood of improving sustainable energy access in the long term.

As part of the Renewable Energy for Refugees (RE4R) project, funded by the IKEA Foundation, Practical Action used the TEA approach to assess levels of energy access in three refugee camps in Rwanda that host displaced people from the Democratic Republic of the Congo. Working in Gihembe, Kigeme, and Nyabiheke camps, Practical Action conducted hundreds of surveys, interviews, and focus group discussions with camp residents, business owners, community leaders, and organizational staff to understand the energy issues in the camps, the technologies and fuels that are being used, the opinions and priorities of camp residents, and the challenges they face on a daily basis. Using this information and in collaboration with government, NGO, and private sector partners, the RE4R project identified the most important energy issues in the camps and with these stakeholders co-designed four renewable energy interventions that each address different needs and priorities.

This comprehensive assessment provides both an illustration of how the aspirations of the Global Plan of Action can be manifested in practice and an invaluable evidence base for understanding energy access in the three camps in Rwanda. Ultimately, it helps to inform the most impactful ways of improving the energy access, wellbeing, and livelihoods of displaced people.

Key findings of the RE4R project's total energy access approach

Practical Action's TEA approach revealed a wide range of energy issues

Practical Action's TEA approach revealed a wide range of energy issues that touch the lives of displaced people in many ways. The availability and use of energy technologies and fuels varies significantly between domestic, business, and institutional settings, and among the individual situations in each of the three camps. Generally, however, it is not sufficient to meet the national targets set by the government of Rwanda. The statistics and information presented in this executive summary are from the primary research and analysis conducted by the RE4R project, and are discussed in detail in the report. Twelve key summary findings demonstrate the scope of the challenges that camp residents face:

- 1. Access to electricity and lighting in refugee households is low and below the targets set by the government of Rwanda.** The majority of refugee households report little or no access to energy for lighting: 58 per cent either have no lighting at night or use only basic sources such as candles and torches. Small minorities primarily rely on either solar lanterns (21 per cent) or solar home systems (16 per cent), and mobile phone torches and burning sticks are commonly used to move around the camps at night. In comparison, 24 per cent of people in Rwanda have access to the national grid network and a further 5 per cent have off-grid electricity access (World Bank 2018a).
- 2. Solar home systems provide an average of four hours of lighting in the evenings, 45 minutes more than solar lanterns and 90 minutes more than non-electrical sources such as candles.** Solar home systems also provide around 10 hours of electricity in total during the day, compared with around 4.5 hours from solar lanterns, and can also facilitate basic services such as phone charging. The proportion of households who own solar home systems was found to vary between camps. Households in Gihembe and Nyabiheke were more likely to have paid for solar products and those households were less likely to suffer issues with them, compared with Kigeme, where receiving solar products as donations was more common.
- 3. More than three-quarters of households rely primarily on basic three-stone fires, mud stoves, and firewood for their cooking needs.** Despite a range of distribution programmes, only 21 per cent of households across the three camps use an improved cookstove as their main source of cooking, compared with 30 per cent of households in the rest of Rwanda (World Bank 2018a) – although 42 per cent reported using an improved cookstove as a secondary backup stove. In Kigeme, three times more households reported using improved cookstoves compared with the other camps, likely in part due to the ongoing Inyenyeri cookstove programme, but refugees shared in interviews that the unaffordability of the fuel in this programme limited their usage.

4. **Firewood was the primary source of cooking fuel in the vast majority of households, although the changes in fuel distribution in the camps since the assessments were carried out may significantly change this.** Before the cessation of firewood distribution mandated by the government of Rwanda, 81 per cent of refugee households primarily relied on firewood and 17 per cent relied on charcoal, with a similar split seen at the national level (World Bank 2018a). For secondary backup stoves, 17 per cent used firewood and 79 per cent used charcoal. The inadequate supply of firewood and shortages of fuels were major concerns for refugee respondents, among other issues such as keeping firewood dry from the rain and the fluctuating price of charcoal between the dry and wet seasons.
5. **A lack of cooking resources, particularly firewood, results in the majority of households using coping mechanisms to get by.** Strategies vary between the camps, but when fuel for cooking is unavailable more than 90 per cent of households rely on some kind of coping strategy. Half of households reported skipping meals while others reduce portion sizes or rely on exchanging food for cooking fuel, all of which could result in food insecurity. Other coping mechanisms included exchanging different kinds of fuels, only feeding certain household members, or sharing resources such as stoves and cooking spaces.
6. **Women spend more than three hours per day on cooking and related activities, four times longer than men.** Of those three hours, female camp residents spend an average of 45 minutes per day collecting and preparing fuel, many experiencing threats and violence when foraging in the local areas around the camps. Cooking is perceived as the sole responsibility of women, and the time burden of cooking falls upon women across all ages.
7. **Three-quarters of businesses in the camps use some form of electricity.** Refugees have a diverse range of livelihoods but most of the businesses are dispersed around the camps in households. Small-scale technologies such as solar home systems allow many small shops and petty traders to offer key services such as phone charging and to use lighting to extend their business hours; this can also provide domestic electricity access as 89 per cent of businesses operate from a household.
8. **Both households and enterprises expressed a need for electricity services that could be provided by solar home systems.** Basic access to lighting, phone charging, and entertainment services such as televisions and radios were the most commonly desired facilities if adequate electricity were made available. Few stated a need for appliances that would require a higher quality of power supply, such as computers.
9. **When asked whether it was more important to address domestic, business, or communal energy needs, households reported that domestic energy needs were of the highest priority.** However, respondents also reported that better lighting was needed in health centres and routes to camp facilities. This could help to improve the perception of safety and reduce incidents of crime or violence, particularly near latrines.
10. **There is a stark contrast in the levels of energy access between camp institutions and facilities that have connections to the camp minigrids and those that do not.** The office buildings, health centres, and other central institutions that are connected to the camp minigrids have the highest levels of energy access in the camps. On the other hand, those located further away, such as schools, latrines, and religious buildings, have only basic or no access to electricity.

A lack of cooking resources, particularly firewood, results in the majority of households using coping mechanisms to get by

Opportunities to access higher levels of power for livelihood activities are limited in the camps

11. **The camp minigrids provide a high level of electricity access to the community facilities connected to them, but rely on carbon-intensive sources of power.** The minigrid networks provide high levels of stable and reliable energy access but are supplied by either or both the national electricity grid and diesel generators, resulting in high levels of greenhouse gas emissions from electricity usage.
12. **Opportunities to access higher levels of power for livelihood activities are severely limited in the current setup of the camps.** The camp minigrids provide power to only a small number of refugee businesses – around one in four enterprises in Gihembe and one in ten in both Kigeme and Nyabiheke. These connections are not metered or paid for and are permitted on an unofficial basis by the camp authorities. They are also available only to businesses close to the administrative centres of the camps, and there is no process by which new entrepreneurs can access the power required to develop their own livelihood opportunities.

How the RE4R project is delivering energy access in refugee camps in Rwanda

Working in partnership with UNHCR, the UN Refugee Agency, and supported by the IKEA Foundation, the Renewable Energy for Refugees project will help refugees and their host communities access renewable energy, enabling refugees to move from reliance on aid to economic independence by delivering four energy interventions in the three camps. These have been informed by the assessments and analysis in this report and further consultation and co-design with government agencies, NGOs, international organizations, the private sector, and the refugee communities themselves. Owing to the scale of the challenges, significant coordination between different actors will be required both to successfully implement these interventions and to use them as further catalysts for new energy access initiatives.

1. **Intervention I will promote the delivery of solar home systems in the camps and increase their usage among households and small businesses.** The systems will provide access to basic lighting, phone charging, and entertainment services and offer a significant increase in the levels of energy access for most of the camp residents reliant on non-electric forms of lighting. Two companies have been selected to provide the systems at a reduced rate to camp residents and members of the host community, with refugees being employed as sales agents. Awareness-raising and technical training activities for camp residents and the host communities will support the delivery of this intervention, which also represents an opportunity for the private sector to learn more about providing products and services in humanitarian settings and the potential to extend their operations into other camps in the future.
2. **Intervention II will increase access to improved cooking solutions and sustainable, renewable fuels.** Owing to the ongoing discussions around the long-term response to the cessation of firewood distribution in the camps – representing a fundamental shift in the way cooking fuel is provided to camp residents – it is yet to be established how this intervention can best contribute to the wider national strategy. Potential activities are being developed and will likely include supporting existing clean-cooking suppliers operating in Rwanda to scale up their

businesses to meet the challenge posed by the situation in the camps, and activities to increase the uptake and affordability of improved stoves and fuels.

3. **Intervention III will provide standalone solar streetlights for public-space lighting with the aims of improving mobility around the camps after dark.** These will help increase the perception of safety in the camp and provide enterprise opportunities by extending the hours in which camp residents can access businesses. The streetlights will be installed at key locations determined by Practical Action and UNHCR staff, the Refugee Executive Committees, and other stakeholders. Camp residents and members of the host communities will both be involved in the initial installation of the streetlights and trained in their long-term operation and maintenance.
4. **Intervention IV will provide solar electricity to camp institutions and businesses to reduce the usage of diesel generators.** This intervention will be based in Nyabiheke, as this camp does not have a connection to the national grid network and relies entirely on diesel generation to provide electricity. The introduction of solar power will reduce both the expenditure and greenhouse gas emissions of the existing minigrid. An initial design stage will measure the present usage of electricity and predict the potential for future energy demands. A number of potential delivery models for infrastructure development and power supply agreements will then be explored to support high-quality electricity provision to both the institutional users and new entrepreneurs in the camp.

The introduction of solar power will reduce the greenhouse gas emissions of the minigrid

Recommendations for assessing energy needs in situations of displacement

Assessing the current levels of energy access, the needs and priorities of refugee communities, and the lived experiences of camp residents was essential in evaluating the key energy issues in the camps. The TEA approach undertaken by Practical Action takes into account many of the aspirations of GPA Working Group V on data, evidence, monitoring, and reporting. Accordingly, based on the processes and findings presented in the report, the RE4R project has made four key recommendations for future projects that aim to implement similar evidence-gathering activities:

1. **Undertaking data collection and analysis before designing and implementing energy interventions facilitates a better understanding of the most important issues.** Data and evidence in humanitarian settings is particularly scarce, and so a dedicated period for gathering information gives stakeholders greater confidence and increases the likelihood of making impactful interventions. The information collected should have a well-defined purpose, a clear pathway for analysis, and be verifiable by other sources where possible.
2. **Data and evidence are multidimensional and this should be incorporated in project design.** Using a range of evidence-gathering methods, such as the quantitative surveys and qualitative interviews used in the TEA approach, provides a multifaceted approach that can capture both camp-level statistics and individuals experiences. Using more than one type of data collection activity provides more compelling evidence and reduces the likelihood of overlooking key energy issues and priorities. It also

provides a supporting narrative to numerical indicators, which can increase both understanding about energy access, and the impact of the interventions designed.

3. **Energy access covers lighting, cooking, and electricity and spans across households, enterprises, and community facilities.** Energy for cooking in households has justifiably received significant attention in the past but access to electricity and lighting technologies are also critical components of energy access. Energy for business activities should also be addressed to offer meaningful livelihood opportunities, and institutional energy should also be included – particularly for community facilities around the camps, and for space lighting.
4. **Refugees should be able to contribute to the decisions that affect them.** Including displaced people in discussions and project design is a key enabler in identifying the potential energy interventions that will be most impactful. This could be indirectly, for example through interviews and discussions with people in the camps, or through direct methods such as refugee participation in meetings during the design and decision-making processes. Engaging with community leaders and representatives can be an effective way of incorporating the views of displaced people and providing validation to ideas and assumptions.

Providing access to affordable, reliable, and sustainable energy is particularly challenging in situations of displacement – but the barriers to adoption are not impossible to overcome. Refugees face specific vulnerabilities and even basic interventions, such as solar products for lighting or improved fuels and technologies for cooking, can significantly increase the levels of energy access among households in the three camps that are the focus of the RE4R project in Rwanda. Improving public lighting, particularly around camp facilities, could help to reduce incidents of crime or violence and using energy to support productive livelihood activities can contribute to the economic inclusion of camp residents in the wider national society. By intervening across these areas the RE4R project will help to ensure the delivery of reliable, affordable, and sustainable energy to displaced people in Gihembe, Kigeme, and Nyabiheke refugee camps.

The RE4R project will help to ensure the delivery of reliable, affordable, and sustainable energy to displaced people



INTRODUCTION

Energy access in situations of displacement

More than 70 million people around the world are forcibly displaced, but in refugee camps the provision of energy to power critical needs such as operational activities and household cooking is often inefficient or inadequate (UNHCR 2019a, UNITAR 2018). Challenges around supplying even basic access to energy for cooking, lighting, and other uses are amplified by the complexities of humanitarian response, so where energy issues are addressed this is generally confined to solving immediate problems rather than identifying long-term solutions. Even in protracted situations, where persons of concern have been displaced for many years, energy has not been a formal priority of the majority of humanitarian agencies and has not, therefore, received the levels of attention or resources necessary to achieve more than the most basic levels of energy access.

Recently there has been an increasing focus on applying the aims of Sustainable Development Goal (SDG) 7, namely the provision of affordable, reliable, sustainable, and modern energy for all by 2030, to humanitarian settings. Although around 1 billion people still live without access to electricity and around 3 billion people lack access to clean cooking (World Bank 2018b), legislative action by national governments has helped to increase the number of people with sustainable sources of power and fuel. But these benefits are rarely extended to displaced populations, despite their often long-term presence in a host country. In 2018, however, the question of energy in situations of displacement was explicitly included, for the first time, in the aims of SDG 7 following its review at the United Nations High Level Political Forum (United Nations 2018). This acknowledgement of the needs of displaced populations will provide additional support to the Office of the High Commissioner for Refugees (UNHCR) and other humanitarian actors in addressing the energy challenges relevant to their core mandates.

A significant contribution to this high-level political recognition derives from the work of the Global Plan of Action for Sustainable Energy Solutions in Situations of Displacement (GPA), a non-binding framework developed by United Nations agencies, humanitarian and development organizations, the private sector, governments, academia, and other stakeholders (UNITAR 2018). The GPA seeks to strengthen and coordinate existing and emerging initiatives that aim to deliver improved energy access in situations of displacement, as well as supporting other political accords such as the New York Declaration for Refugees and Migrants, the Agenda for Humanity, and the Comprehensive Refugee Response Framework (CRRF). The GPA is composed of five working areas, each addressing a different challenge to its overall vision of 'ensuring every

The benefits of energy access are rarely extended to displaced populations

person affected by conflict and natural disaster has access to affordable, reliable, sustainable and modern energy services by 2030' (UNITAR 2018). Its five working areas and their individual visions are:

- I. **Planning and Coordination:** To ensure the efficient implementation of activities within and across sectors.
- II. **Policy, Advocacy, and Host Country Resilience:** To unlock wide-ranging changes to policies and governance.
- III. **Innovative Finance:** To design, test, and scale up new mechanisms for financing energy access.
- IV. **Technical Capacity Building, Expertise, and Training:** To provide humanitarian agencies and practitioners with the knowledge and skills to provide sustainable energy.
- V. **Data, Evidence, Monitoring, and Reporting:** To ensure high quality and useful data is produced, used and shared for planning, monitoring, and evaluation.

The GPA builds upon work of previous initiatives that have aimed to explore, evaluate, and address the energy needs of displaced people around the world. For example, gathering data for decision-making by using relevant needs assessments, feasibility studies, and stakeholder consultations is a core mechanism of the UNHCR Global Strategy for Safe Access to Fuels and Energy (SAFE). Similarly to some of the core aims of the GPA, the SAFE strategy calls on actors across the humanitarian sector to work together in providing refugees with sustainable energy and to enhance their opportunities for self-reliance (UNHCR 2014).

Some of the most prominent and insightful research into these issues has been produced by the Moving Energy Initiative (MEI), a consortium aiming to offer solutions to delivering energy in situations of forced displacement. The goals of the MEI include working with humanitarian agencies and donors to change policies and practices, developing market-based solutions in collaboration with the private sector, cooperating with host governments and non-governmental organizations (NGOs) to improve energy security among both displaced populations and host communities, and, of most relevance to this discussion, improving the evidence base of humanitarian energy issues through original research and the demonstration of new approaches (Corbyn and Vianello 2018).

According to a report produced by Chatham House as part of the MEI, the energy sources currently used by displaced people around the world are economically, environmentally, and socially unsustainable (Lahn and Grafham 2015). Lahn and Grafham calculate that 80 per cent of forcibly displaced people depend on traditional biomass fuels for cooking and have no access to electricity; they further estimate that this results in 20,000 premature deaths from indoor air pollution, the emission of around 13 million tonnes of carbon dioxide equivalent, and a cost to displaced people of USD 2.1 billion. They conclude that the barriers to providing sustainable energy solutions are institutional and operational, rather than technological, and assert that incorporating cleaner and more modern energy into national and international policies could save lives, reduce emissions, and reduce costs by hundreds of millions of dollars per year. Aside from the energy used by displaced people, a subsequent study by the same authors focused on the energy used by humanitarian agencies themselves: an estimated USD 1.2 billion is spent cumulatively on fossil fuel for transport and electricity generation every year by these organizations (Grafham and Lahn 2018).

UNHCR reports that around 40 per cent of displaced people worldwide reside in rural areas, and of those 79 per cent are settled in camps or camp-like situations (UNHCR 2018a). Furthermore, around two-thirds

The barriers to providing sustainable energy solutions are institutional and operational, not technological

of displaced people are in protracted situations where ongoing crises have kept them displaced for more than five years (Betts et al. 2014). The MEI conducted primary research in two such long-term camps – Goudoubo in Burkina Faso and Kakuma in Kenya – in late 2016 and early 2017. Similar to many other camps, Corbyn and Vianello found that levels of access to energy were low, the predominant cooking practices used basic biomass fuels and stoves, and expenditure on energy consumed a substantial share of monthly household budgets (Corbyn and Vianello 2018). They argued that a significant proportion of refugees are willing and able to pay for cleaner, more efficient energy solutions, and that making a diverse range of energy options available to camp residents through market development approaches would therefore be the most successful strategy for increasing the levels of energy access in the camps. The energy interventions enacted from this part of the Moving Energy Initiative incentivized both a greater uptake of liquefied petroleum gas (LPG) for cooking, to displace the use of firewood (Patel and Gross 2019) and the establishment of a commercial distribution outlet for solar home systems (Masinde 2018). Research undertaken for the UNEP DTU Partnership by Rivoal and Haselip identified further opportunities for LPG to mitigate the use of firewood, estimating that a LPG intervention in Nyarugusu Camp in Tanzania would cost USD 397 per capita but bring about USD 700 of benefits over a 10-year period (Rivoal and Haselip 2017).

This report focuses on three refugee camps in Rwanda – Gihembe, Kigeme, and Nyabiheke – each of which hosts refugees fleeing the ongoing situation in the Democratic Republic of the Congo (DRC). A study in 2017 investigated the livelihoods and economic inclusion of refugees in these three camps, and found that residents benefited from the transition from direct food aid to cash assistance, with increases to their welfare and successful economic interactions with the local host communities (Alloush et al. 2017). Another study, featuring analysis of three camps in neighbouring Uganda that also have a majority of residents from DRC, concluded that the inclusion of refugees into host communities also makes a positive impact on the local economy (Betts et al. 2014). But energy issues have previously not been investigated in detail: the study by Alloush et al. did not address access to energy, other than mentioning the sale of firewood and charcoal in the camps, and regular monitoring surveys undertaken by UNHCR focus on evaluating the impacts of specific energy interventions that have already been implemented, rather than the current levels of access to energy in the camps. This results in a deficit of dedicated information on energy that could form the foundations of providing improved levels of energy access to camp residents, businesses, and institutional facilities.

This section provides an introduction to energy access in situations of displacement and to refugee affairs in Rwanda, including an overview of the three camps in question. Section 2 describes the methods that were used to gather primary information from the camps, and Section 3 gives an overview of the camp communities and demographics. Section 4 describes the access to lighting and electricity in the camps and Section 5 presents and evaluates the situation regarding domestic cooking. Sections 6 and 7 assess the access to electricity and cooking energy for enterprises and community facilities, respectively, and Section 8 explains the needs and priorities identified by the refugee communities and the interventions that the RE4R project is implementing in order to address them. Finally, Section 9 provides conclusions and recommendations for future initiatives aiming to conduct similar projects.

Refugee affairs in Rwanda

Rwanda is host to more than 150,000 displaced people (UNHCR 2019b): since the 1990s people from the DRC have fled violence and sought refuge in Rwanda, with around 75,000 currently resident in Rwanda, and more recently almost 70,000 more people have fled conflicts in Burundi to the south. The majority of refugees in Rwanda reside in six camps situated around the country that are primarily coordinated by two agencies: the government of Rwanda’s Ministry in Charge of Emergency Management (MINEMA) and UNHCR. An overview of the key responsibilities of the organizations involved in the camps is given in Table 1.1.

As shown in the table, the Refugee Executive Committee, composed of elected residents of the camp, acts as a community-level administrative body. Committee members are elected by community members and liaise with national and international level partners as the primary representative of refugee concerns. Roles on the camp committees include president or chief, vice president or vice-chief, secretary, and members responsible for specific issues as mentioned in Table 1.1. Further committees also exist for villages (composed of tens or hundreds of households) and *quartiers* (groups of several villages). The Refugee Executive Committees are particularly important for life in the camps, and engage with energy access issues in several ways, including working with other authorities on the distribution of firewood, supporting vulnerable households in accessing distributed energy products, and providing recommendations for energy access in community and public spaces.

In 2017 the government of Rwanda agreed to promote a programme aimed at incorporating refugees into Rwandan society by supporting their inclusion into national schemes for formal employment and educational opportunities, and pledged to graduate camp-based refugees out of assistance programmes by encouraging meaningful livelihoods (UNHCR 2016a). UNHCR’s flagship Comprehensive Refugee Response Framework (CRRF), which provides further support to these goals, is also being applied in Rwanda (UNHCR 2018b) and this has been widely viewed as an important enabling factor in improving the opportunities for displaced people in many areas, including access to sustainable energy.

Rwanda is host to more than 150,000 displaced people, with about 75,000 from the DRC

In 2017 the government of Rwanda agreed to promote a programme aimed at incorporating refugees into Rwandan society

Table 1.1 Overview of organizations operating in the camps and their key responsibilities

Organization	Key responsibilities
UNHCR Rwanda	<ul style="list-style-type: none"> • Registration and protection of refugees • Providing multisectoral assistance (for example shelter, water, health, education) • Finding durable solutions for refugees
MINEMA	<ul style="list-style-type: none"> • Preventing and responding to natural disasters and managing emergency situations • Managing operations in refugee camps and coordinating humanitarian activities • Developing national policies and action plans
Partner organizations	<ul style="list-style-type: none"> • Delivering specific assistance in the camps • Examples include American Refugee Committee (shelter and infrastructure), Africa Humanitarian Action (health), and World Vision (water)
Refugee Executive Committee	<ul style="list-style-type: none"> • Representing the views and interests of camp communities • Coordinating with UNHCR and MINEMA • Engaging on specific camp issues (for example gender, youth, security)

Overview of Gihembe, Kigeme, and Nyabiheke refugee camps

Gihembe, Kigeme, and Nyabiheke camps are situated in rural areas of Rwanda in the Northern, Southern and Eastern Provinces, respectively, at the locations shown in Figure 1.1. The camps operate under the administration of the MINEMA with individual community facilities such as health clinics, water pumping, and educational and training centres being run by their implementing partner organizations.

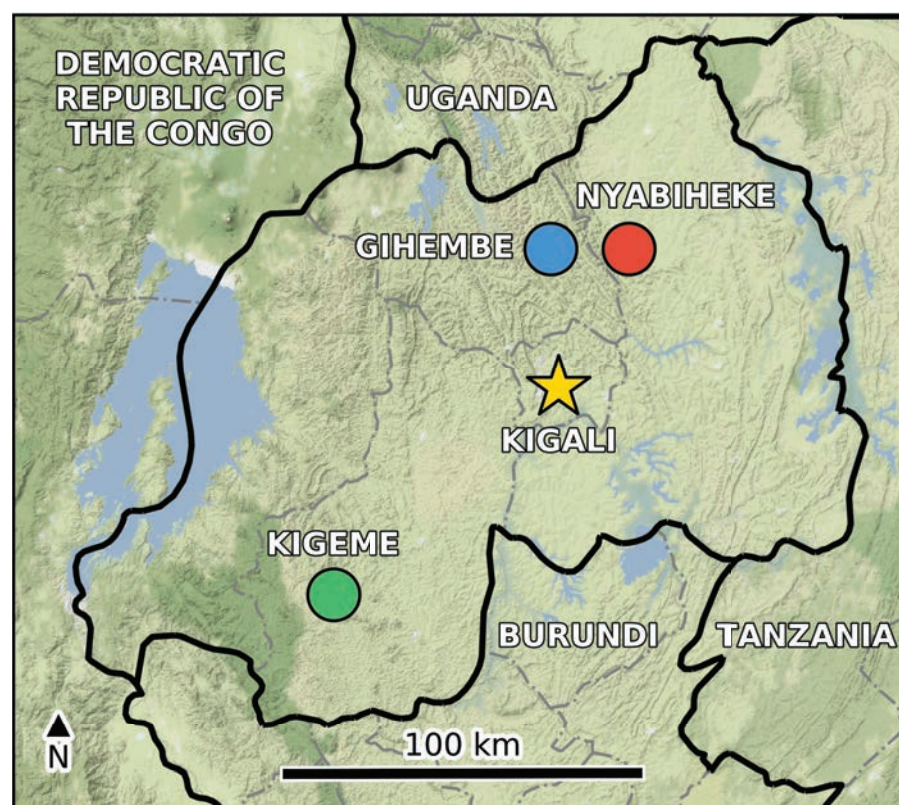


Figure 1.1 Map of Rwanda showing the locations of Gihembe (blue), Kigeme (green), and Nyabiheke (red) refugee camps and the capital Kigali (yellow star)

Table 1.2 Overview of Gihembe, Kigeme, and Nyabiheke camps and their host communities

Camp	Gihembe	Kigeme	Nyabiheke
Established	1997	2012	2005
Population (2019)	13,181	20,626	14,479
Households	3,077	3,830	3,490
Quarters	12	8	8
Distance to Kigali by road (km)	60	150	80
Distance to district capital (km)	5	10	20
Host community			
Province	Northern	Southern	Eastern
District	Gicumbi	Nyamagabe	Gatsibo
District population (2012)	395,606	341,491	433,020
Sector	Kageyo	Gasaka	Gatsibo
Sector population (2012)	30,270	41,522	36,690

Source: UNHCR and National Institute of Statistics Rwanda.

Table 1.2 gives an overview of the three camps and the number of refugees resident in each, primarily from the North Kivu and South Kivu regions of the DRC (UNHCR 2019b). The socioeconomic and ethnic backgrounds of the residents are generally homogeneous, without any significant enclaves. People in the camps have typically been situated in the same camp for many years and, under the current circumstances, are not expected to be able to return to their home countries in the foreseeable future. Although there are resettlement programmes to third countries, these operate only at a limited scale and will reach only a small minority of people. Camp residents typically speak Kinyarwanda, the national language of Rwanda, in addition to Congolese languages and French, and are free to interact with members of the host community but must return to the camps every evening unless granted special permission to travel. Camp residents working in the local area and trading goods with the Rwandese population can provide benefits and employment opportunities for both communities, as identified by Alloush et al. (2017). Under the CRRF and other policies, refugees in these camps and elsewhere in Rwanda are in general afforded a number of progressive legal and economic rights (UNHCR 2016a), and refugee children in these areas attend schools in the host communities.

Camp residents working in the local area can provide benefits to both refugee and host communities



METHODOLOGY FOR GATHERING INFORMATION FROM THE COMMUNITIES

The total energy access (TEA) approach

Gaining a comprehensive understanding of the most important energy issues is a vital step in proposing pragmatic interventions to help overcome them, but there is currently very little data on energy access, in either humanitarian settings in general or in Rwandan camps specifically. Furthermore, in order to provide a well-rounded overview of the most important energy issues to inform decision-making, a range of techniques must be used to investigate energy access, use, and priorities at both the individual level and for the camp as a whole. The Practical Action project therefore used a total energy assessment (TEA) approach, with the objectives of evaluating the current levels of energy access in the three camps and identifying the most pressing energy challenges, which in turn provided an inclusive foundation for designing the most impactful energy interventions.

The TEA approach uses a range of assessments to build an understanding of energy issues

The TEA approach uses a range of constituent assessments to build up a broad understanding of energy issues from a wide range of stakeholders. More information about the TEA approach and the methodology used in the RE4R project is available in the Appendix. Practical Action has used the TEA approach in the past, both in national contexts (Practical Action 2016, 2017) and situations of displacement (Corbyn and Vianello 2018), and the methodology was employed once more in the RE4R project. The project focused on three main areas relevant to the refugee communities:

- **Energy in households and domestic settings**, such as for lighting the home, providing basic electricity services such as phone charging, and a range of cooking-related issues including stove usage, and fuel availability and lack thereof.
- **Energy for businesses and enterprise applications**, including how energy is used to support business operations, such as lighting a shop, and when energy is critical for production.
- **Energy in community spaces, facilities, and for institutional applications**, ranging from high-power electricity usage for camp operations such as health centres and water pumping, to more modest uses, for example lighting in schools.

Collecting data and evidence from households, enterprises, and community facilities

Three quantitative surveys were used to assess the energy needs in the camps, with one survey for each of the categories listed above. The survey focusing on households was the most extensive survey; however, businesses that operated from within households were assessed using the enterprise survey only. The surveys and the methodology used to collect the data were adapted from similar previous projects by Practical Action (Practical Action 2016, 2017) and the MEI (Corbyn and Vianello 2018).

Table 2.1 shows the total sample size of each of the three surveys after data cleansing. This involved removing the responses where the survey was terminated before completion at the request of the respondent, who at the beginning of the survey had been informed of their prerogative to do so for any or no reason. Owing to the binary or categorical nature of the majority of the questions it was not necessary to remove any other complete responses. During data analysis when a respondent declined to answer a question, or the question did not apply to the respondent, only the responses that were recorded were included in the results. Among the household surveys, 9 were discarded in Gihembe (4 per cent of the total in that category), 10 in Kigeme (5 per cent), and 20 in Nyabiheke (9 per cent), resulting in a total attrition of 6 per cent. None of the enterprise and community facilities surveys required removal; this may be because these surveys took less time than the household survey and so fewer respondents chose to leave partway through the process.

Table 2.1 The number of household, enterprises, and community facilities surveys conducted in each camp

Camp	Number of quantitative surveys			
	All	Gihembe	Kigeme	Nyabiheke
Survey type				
Household	623	211	202	210
Enterprise	155	64	54	37
Community facilities	47	10	22	15
Total	825	285	278	262

Refugee enumerators were hired from the camps and trained to conduct the surveys

Box 2.1 Responsible data collection

Collecting information from vulnerable people requires significant attention to be given to ethical, legal, and protection issues and compliance with the humanitarian principle of doing no harm. As well as more common considerations with regards to data management and storage, there is a further responsibility to explain to refugees their rights to choose to consent, or not, to sharing information. During the training sessions run by Practical Action and UNHCR staff, enumerators were informed on how to treat respondents with sensitivity and respect. Survey participants were issued with an information sheet detailing the goals and scope of the survey and the project, and how to report any issues or complaints to the relevant independent authorities. Participants were asked to read the information sheet (or have it read to them) and confirm that they had understood the information, that they knew their participation was voluntary and could be withdrawn at any time for any or no reason, that their information would be recorded anonymously and treated in confidence, and that they agreed to participate in the project. No personal data was collected and no information could be used to identify individuals or households. There were no issues reported by participants, enumerators, or others.

The primary focus of the surveys was to understand the key energy issues, assess the current situation in the camps, and inform potential solutions for how to improve it. Refugee enumerators were hired from the camps and trained to conduct the surveys with a particular focus on responsible data collection, as explained in Box 2.1. The household survey gathered information about household demographics, current access to electricity technologies and lighting services, how energy is used for cooking, and the needs and priorities of the individual respondents. The enterprise and community facilities surveys shared a similar structure that addressed many of the areas covered by the household survey but with a comparatively greater focus on the applications of energy. Limited amounts of economic data were gathered, such as respondents' occupations and expenditure on certain types of technologies and fuels, but others – such as respondents' income and expenditure breakdowns – were not, owing to the sensitivity and potential inaccuracy of this self-reported data. This report contains the most important results from these surveys, but the data could also be used for further analysis of other energy issues (Humanitarian Data Exchange 2019; HEED Project 2019).

Alongside the quantitative research described thus far, qualitative research, meanwhile, provides a valuable lens through which it is possible to understand the energy needs of refugee communities. Focusing on the lived experience of refugee communities, it elucidates how respondents describe their awareness of and vulnerability to energy issues, how and why energy is important to them, and the reality of their circumstances in the process of making decisions (Rosenberg-Jansen et al. 2018).

Two Practical Action researchers collected qualitative data with the support of camp coordinators and the local refugee committees, as well as energy and community engagement staff from UNHCR. Single- and mixed-gender groups were interviewed, as well as individuals. Participants were invited to engage openly and anonymously about their energy experiences in the camps through unstructured interviews, which were allowed to vary and flow depending on the interviewees' experiences and the issues they believed were most important to them.

A snowball method was used to engage interview participants: after initial introductions by UNHCR or other contacts, interviewees were invited to suggest others whom they felt would be interested to become the next participants.

Data analysis, terminology, and categorization

This report presents both statistical analyses of energy issues covering the entire camps, and qualitative information specific to the experiences of individual respondents or groups. Summarizing important issues using camp-level statistics provides an insight into energy access in the camps but, as this eliminates a significant amount of variation between respondents and their individual and unique situations, care has been taken to ensure that the information and analysis is representative of the questions that were asked and the responses and experiences that respondents shared. Throughout the report, energy access is typically categorized in terms of the physical technologies and fuels that respondents have access to rather than the tiers of energy access that they provide, as this provides the best representation of the data that was collected and of the situation in the camps. More on this topic, and the challenges of collecting and analysing data in humanitarian situations, is available in the Appendix.

Despite the nuances of terminology when applied to other situations, in the context of this report terms such as *camp residents*, *refugees*, and *displaced people* are used interchangeably. When paying for energy, camp residents are referred to as *customers* to highlight the fact that refugees are both willing and able to pay for energy services. Monetary values are reported in Rwandan francs (RWF) with their equivalent values given in US dollars at the exchange rate at the time of the assessment – RWF 860 = USD 1 (RWF 697 = EUR 1; RWF 612 = GBP 1) (U.S. Department of the Treasury 2018). As stated earlier, there is relatively little heterogeneity among the situations of camp residents, so any differentiation between groups – for example those with access to different energy technologies – will be made clear in the relevant section.

This report categorizes energy access in terms of physical technologies and fuels rather than tiers



REFUGEE COMMUNITIES AND CAMP DEMOGRAPHICS

Household members and heads of household

Residents in the camps receive support in the form of unconditional cash transfer allowances for supplies such as food and basic items as a household unit, usually composed of members of the same family. The surveys found that a typical household has between five and seven people, of whom two to three are children (see Table 3.1). The overall gender ratio within the camps is split approximately equally, with 48 per cent male and 52 per cent female. The dwellings in which residents live are similar in construction to those in the host community, with mudbrick walls and a corrugated metal roof, and are usually divided into two or three small rooms. Households in Kigeme typically have both a greater number of occupants and a lower number of rooms, and the UNHCR has recognized the need to expand or extend all of the camps to accommodate the increasing number of refugees (UNHCR 2018c).

The duties of the head of household, for example for budgeting, are the sole responsibility of a woman in around half of all households. Around one-third of households are headed by a single male, while a minority share responsibilities between two people, shown in Table 3.2. The gender

Table 3.1 Average numbers of camp residents per household by age and gender, and average number of rooms in dwellings

Camp	Mean values for households in camps			
	All	Gihembe	Kigeme	Nyabiheke
Household members	5.7	5.4	6.5	5.4
Adults	3.5	3.6	3.7	3.3
Male	1.6	1.5	1.7	1.5
Female	2.0	2.0	2.1	1.8
Children	2.2	1.8	2.8	2.1
Male	1.2	1.0	1.5	1.1
Female	1.0	0.8	1.3	1.0
Rooms in dwelling	2.6	2.6	2.1	3.1

Table 3.2 Breakdown of households with single heads or that share responsibilities between two people

Camp	Breakdown of head of household types (% of households)			
	All	Gihembe	Kigeme	Nyabiheke
Single head of household	81	83	89	72
Male	30	33	30	27
Female	51	50	59	45
Shared head of household	19	17	11	28
Mixed	14	14	4	23
Two males	2	1	3	3
Two females	3	2	4	2

of the head of household, and whether the responsibilities are shared or not, could be an influencing factor in decision-making towards household spending, including on energy technologies.

Livelihoods, employment, and energy

Camp residents receive a cash transfer allowance from the World Food Programme (WFP), but many also participate in paid employment as business owners, employees, and day labourers. As of October 2019, refugees received an allowance of RWF 7,600 (USD 8.84) per person per month – although this is subject to change based on factors such as the amount of other in-kind support being distributed – and could receive a wage of up to RWF 24,000 (USD 27.91) per month by working for organizations in the camp. Unlike in many other countries, refugees are allowed to leave the camps and have the right to work in the host communities – but sacrifice their right to camp-based assistance if they are no longer registered as camp inhabitants, for example by moving away to work. Some households also receive remittances from family members and friends living outside the camp and overseas, estimated in a study by Alloush et al. to be the case in 20 per cent of households in Gihembe, 15 per cent in Kigeme, and 8 per cent in Nyabiheke (Alloush et al. 2017).

Table 3.3 shows that across the three camps, 28 per cent of the heads of household were regularly engaged in some form of wage-earning livelihood activities, for example as proprietors of home-based retail shops or small businesses – offering services such as phone charging or

Many camp residents participate in paid employment as business owners, employees, and labourers

Table 3.3 Breakdown of the livelihoods of all heads of households

<i>Camp</i>	<i>Livelihoods of heads of households (% of all heads of households)</i>			
	<i>All</i>	<i>Gihembe</i>	<i>Kigeme</i>	<i>Nyabiheke</i>
Wage-earning occupation	28	21	17	44
Unemployed/looking for work	45	47	49	38
Non-wage-earning occupation	27	32	34	18
Homemaker	13	15	19	6
Volunteer	5	3	7	5
Studying	4	4	5	3
Retired	2	3	2	2
Disabled	2	4	1	2
Other	1	3	0	0

28 per cent of heads of household regularly engaged in wage-earning livelihood activities

haircuts – or as petty traders. A similar proportion, 27 per cent across all camps, either had non-wage-earning occupations such as homemaking, volunteering with NGOs, or being in education, or were not working as they were disabled or retired. The remaining proportion of heads of household were not currently participating in any form of occupation and were either unemployed or seeking work. Nyabiheke was found to have the highest proportion of heads of household in some form of wage-earning occupation – more than double that of either Gihembe or Kigeme – and although the quality and consistency of those jobs is unknown, this could be an enabling factor in accessing energy.



ELECTRICITY AND LIGHTING IN REFUGEE HOUSEHOLDS

Section summary: Lighting and electricity in the home

As this section shows, domestic access to energy for lighting in the three camps is severely limited. An overview of the characteristics and issues of the lighting and electricity sources in the camps is shown in Table 4.1, and the key results presented in this section are summarized below:

- A majority of households (58 per cent) either have no lighting at night or use only basic sources such as candles and torches.
- Small proportions primarily rely on solar lanterns (21 per cent) or solar home systems (16 per cent) for lighting, compared with 24 per cent of people in Rwanda with grid connections and 5 per cent with off-grid access.
- Mobile phone torches and burning sticks are commonly used to move around the camps at night.
- Solar home systems provide four hours of lighting in the evenings – 45 minutes more than solar lanterns and 90 minutes more than non-electrical sources such as candles.
- Solar home systems provide around 10 hours of electricity in total during the day, compared with around 4.5 hours for solar lanterns when used for lighting and other basic services such as phone charging.
- Households who paid for solar products were less likely to suffer issues than those who received solar products as donations.

In this section the issues around domestic lighting and electricity access in Gihembe, Kigeme, and Nyabiheke are explored as follows. An overview of the need for lighting and electricity in domestic settings is presented in the next section. This is followed by a description of the technologies used, and a breakdown of which lighting and electricity sources are used in each of the three camps, including the proportions of households reliant on each lighting source. Then we take a deeper dive into the usage and benefits of solar products, and analyse domestic expenditure on non-renewable sources of lighting. The final section presents some of the issues that

Table 4.1 Overview of the lighting and electricity sources used in the camps and issues reported by respondents

<i>Lighting or electricity source</i>	<i>Characteristics and issues</i>
Solar home systems	<ul style="list-style-type: none"> • Supplies the highest quality and duration of light and electricity for households • Provides lighting, phone charging, and entertainment • Limited access to suppliers and high costs
Solar lanterns	<ul style="list-style-type: none"> • Provides basic access to electric lighting • Available for purchase in the camps or received through donations • Purchased lanterns suffer fewer issues than donated ones
Non-electric and improvised lighting	<ul style="list-style-type: none"> • Mobile phones are commonly used for lighting but can be lost or stolen • Improvised torches made from non-rechargeable batteries can be carried around the camp • Candles are commonplace but are a recurring expense • Burning firewood is a last resort for lighting, and can be dangerous

households face as a result of limited access to energy for lighting and electricity services.

The need for domestic lighting and electricity

Improving the rates of access to basic electricity services has been a major focus of many national and international policies, but at the current rate of progress SDG 7 is not on course to bring sustainable energy to all (World Bank 2018b). Until that goal is met, millions of people around the world will be reliant on inefficient, expensive, and potentially harmful sources of domestic lighting, such as candles and kerosene lamps, to see after nightfall, if anything at all. Households without any sources of lighting are forced to limit their activities to the hours of daylight; this is particularly restricting in equatorial regions, which can receive as little as 12 hours of daylight each day. This constraint can affect the times at which people can socialize, children can study, and businesspeople can earn a living. It is a particular problem in rural areas without widespread access to centralized electricity and public lighting, and also in situations of displacement.

Transitioning to improved lighting, particularly when advancing to electric sources, can support a number of social, educational, and security benefits, while wider electricity services in the home, such as phone charging and entertainment, can help to improve the quality of life for inhabitants (World Bank 2010). Recognizing these benefits, the government of Rwanda has introduced electricity access targets to provide a minimum standard of Tier 1 electricity services to every household in the country (Ministry of Infrastructure 2016). This will provide basic electricity services, including lighting and the facilities to charge small electronic devices like phones and radios. The targets include electrification via either on-grid connections or off-grid technologies, such as solar home systems or minigrids, with the more appropriate method to be determined in each situation by its cost effectiveness. The remit of this policy extends to households in refugee camps, so the provision of lighting and basic electricity services to displaced people, as well as to the host

At the current rate of progress SDG 7 is not on course to bring sustainable energy to all

Transitioning to improved lighting can have social, educational, and security benefits

communities, represents an overlap of humanitarian and wider national development agendas.

Sources of lighting and electricity in the home

Camp residents have no access to the main national electricity grid and access to lighting and electricity is generally limited to basic sources. Households with the greatest levels of electricity access have **solar home systems**: single-household units composed of a small solar panel (with a capacity typically between 10 W and 50 W), a self-contained battery, LED bulbs, electronic control systems, and basic additional appliances dependent on the service plan or model that the household has selected. Two example systems are shown in Figure 4.1. In the past these systems have been available via sales agents who visit the camps, and only households that can save enough money for both the initial deposit and the monthly payments for the two or three years it takes to pay off the purchase, can afford to access them. The surveys found that three companies – BBOXX, Ignite, and Zola – had provided solar home systems to customers in the camps.

The most basic solar home systems, offering three LED bulbs and a connection for charging mobile phones, are available for as little as RWF 4,800 (USD 5.58) per month but remain beyond the means of most households in the camps. More expensive packages, priced at around RWF 5,000 to RWF 7,000 (USD 5.81 to USD 8.14) per month, provide a greater number of bulbs and entertainment services such as radios and small televisions, while the most expensive packages offer large televisions generally marketed towards restaurants, bars, or other businesses. Respondents in all three camps explained that, in general, solar home systems were only accessible to households with a source of consistent income beyond the universal cash allowance, either through employment or from remittances from family members abroad. Maintaining the monthly fees was highlighted as a particular challenge: many households have defaulted on their payments and lost access to the electricity services – which in some cases can be shut



Figure 4.1 Two examples of the solar home systems offered in the camps by Ignite (left) and Zola (right)

down remotely by the supplier – and subsequently had their systems reprocessed.

Solar lanterns consist of a very small solar panel, battery, and bulb integrated in a single encapsulated unit to provide a basic level of lighting and, in some cases, phone charging. Solar lanterns have been previously distributed to specific groups in the camps: in July 2016, for example, 300 Little Sun solar lanterns were distributed to elderly people in Gihembe. Since then these lanterns and others have been offered for sale in the camps and host communities, and are available for as little as RWF 5,000 (USD 5.81). With no recurring monthly payments, solar lanterns are typically affordable to a greater proportion of households but the services they offer are much more limited compared with solar home systems, both in terms of the quality and duration of light, and of the variety of appliances, if any, that can be used.

Improvised lighting sources are also common: **torches** made from bulbs connected to non-rechargeable batteries salvaged from other devices such as radios can provide between a few days and two weeks of lighting and are sold for as little as RWF 700 (USD 0.81). Their portability is viewed as a key feature and allows them to be used for multiple purposes around the home, including being affixed to the ceiling to provide space lighting as shown in Figure 4.2, and to be carried around the camp, in particular to the WASH (water, sanitation, and hygiene) facilities. An elderly woman in Gihembe shared that even the expense of buying batteries can be a challenge for some camp residents: ‘I need these batteries, but sometimes they stop working before I get my cash aid. So I go to the shop nearby and have to buy them on credit, and I pay when the cash aid comes.’ Manufactured rechargeable torches, costing up to RWF 2,500 (USD 2.90), are also available to purchase but are generally used only by those people who can charge them at the NGO offices in the camps, or have their friends or neighbours do so for them. Some camp residents with specific duties, such as security guards, are provided with torches for their work but the low quality of the devices is a common complaint – and with no way of replacing components, repairing broken torches is almost impossible.

With no monthly payments, solar lanterns are affordable to a greater proportion of households

Lighting sources in the camps range from candles and firewood to comprehensive electricity packages



Figure 4.2 Improvised torches made from salvaged non-rechargeable batteries (left) and affixed to a roof beam to provide space lighting (right)

Mobile phones are ubiquitous throughout the three camps as a critical source of both communication and lighting. All households received mobile phones as part of the WFP distribution of cash assistance and, although some later sold their handsets, phones remain an important source of portable light and many people use them as a means of seeing after dark. For those without the opportunity to do so at home, residents charge their phones at shops either inside or outside the camp. One respondent in Gihembe shared that she prefers to charge her phone outside the camp, because if it were stolen she could report it to the police. She would not feel comfortable doing the same if a theft happened within the camp, for fear of getting a fellow camp resident in trouble.

The most basic forms of lighting are also widely used in the camp. **Candles** are available for sale for RWF 50 (USD 0.06) each, and are common owing to their availability and low cost, but respondents reported that the recurrent expenditure and the risk of fire were substantial disadvantages of relying on them as their main source of lighting. Many of the poorest households in the camps forgo these costs by relying instead on using **firewood** as a means of lighting: the small amount of light given off by burning sticks can be used for moving around at night, both inside the home and around the camp. Respondents were well aware of the potential safety and fire hazards of this method and typically used it only as a last resort. For those unable to afford any other lighting source, however, this method was used on a regular basis.

Lighting in the three camps ranges from the most basic sources, such as candles and firewood, to relatively comprehensive electricity packages offering lighting, phone charging, and entertainment services comparable to those available in the host community. Respondents highlighted cost as the main determining factor in the lighting and electricity source that a household primarily relies upon: in general, households that can maintain monthly repayments can afford a solar home system; those with an inconsistent income can potentially afford a solar lantern; others can afford ad hoc expenditure on candles or use their phones for lighting; and the poorest households in the camps are forced to rely on burning firewood or nothing at all. As the following section explains, many more households are reliant on the more basic technologies than have access to reliable forms of energy for lighting.

Breakdown of domestic lighting and electricity sources

The level of access to electricity for lighting in households in all of the camps is very low, as the breakdown of lighting sources in Table 4.2 shows. The majority of households have no source of electric lighting, and only a small proportion, one in five on average, rely on solar lanterns as their primary source – typically receiving only a basic level of lighting. In comparison, 24 per cent of households in Rwanda have a connection to the national grid network and a further 5 per cent have access to off-grid solutions such as solar lanterns, solar home systems, and minigrids (World Bank 2018a).

The prevalence of solar home systems varies between camps and a variety of manufacturers and models were noted. These systems generally provide access to between one and three light bulbs, phone charging, and, for larger models, entertainment services such as radios and televisions. They can offer higher levels of electricity

The level of access to electricity for lighting in all of the camps is very low

Table 4.2 Breakdown of primary and secondary household light sources

Camp	Breakdown of lighting sources (% of households)			
	All	Gihembe	Kigeme	Nyabiheke
Primary source of lighting				
None/non-electric	58	49	66	58
Rechargeable battery	2	4	-	-
Solar lantern	21	17	27	21
Solar home system	16	29	5	14
Minigrid	2	-	-	5
Additional lighting sources in use				
Firewood	11	5	22	6
Candles	41	34	48	43
Mobile phone	48	36	56	52
Torch	18	22	19	14

access, and can achieve compliance with the government of Rwanda's minimum standard – several lights, phone charging, and usage of a radio (Ministry of Infrastructure 2016). Around one in three households in Gihembe have access to a solar home system, but this falls to just 1 in 20 in Kigeme. This could, for example, be caused by varying capacities to maintain the relatively high monthly payments, or by differences in access to suppliers with shops near the camps. A small number of buildings in Nyabiheke, including some households, have opportunistic access to the institutional diesel minigrid that is used to provide power to the health centre and NGO offices, but this access is limited only to those close to the existing distribution network and is unavailable to households in the rest of the camp.

Households with at least one head of household with a paid occupation in Gihembe were twice as likely to have a solar home system as their primary source of light and were half as likely to rely on candles, compared with those without. In Nyabiheke, households with wage earners were five times more likely to have access to a solar home system but there was little difference between households in Kigeme. The use of firewood as the primary source of lighting was four times more common in Kigeme than the other two camps, and this camp also recorded the highest reliance on solar lanterns. This may be the result of previous free distributions of solar lanterns, which would both increase their number in the camp and potentially decrease the incentive for households to spend on other sources of light. With such a high proportion of households relying on rudimentary or improvised sources of lighting, and only a minority having even basic electricity technologies, the overall level of access for lighting and domestic services is very low across all three camps.

The usage and quality of solar products in homes

Solar lanterns and solar home systems are the two most prevalent sources of electricity in the camps, with 21 per cent and 16 per cent of households, respectively, primarily reliant upon them to meet their lighting needs. In this section we will consider three groups of households: those whose primary source of electricity and lighting is a solar home system, those who rely instead on a solar lantern, and those who have access to neither technology. Households with access

Solar lanterns and solar home systems are the most prevalent sources of electricity in the camps

Table 4.3 Average hours of lighting per evening and hours of electricity per day, for all households primarily reliant on each technology

Camp	Average duration of lighting and electricity services (hours)			
	All	Gihembe	Kigeme	Nyabiheke
Hours of lighting per evening				
Candles/torches/phones/none	2.6	2.6	2.6	2.5
Solar lantern	3.3	3.4	3.1	3.5
Solar home system	4.0	4.0	3.6	4.2
Hours of electricity per day				
Solar lantern	4.4	3.9	4.2	5.2
Solar home system	9.9	10.3	7.0	10.4

to the minigrid network in Nyabiheke (5 per cent of residents) are not included, as their situation is not reflective of the rest of the camp or the other camps.

The average number of hours of lighting received by households primarily reliant on solar home systems and solar lanterns, and those using non-renewable or with no electricity sources are shown in Table 4.3. In all of the camps, access to superior electricity technologies resulted in a higher average number of hours of light after nightfall: households with solar lanterns receive around 45 minutes more lighting per evening compared with those reliant on candles, and those with solar home systems receive a further 45 minutes in addition to that. In addition solar home systems, which typically have several bulbs, provide the highest quality of lighting to households compared with less bright solar lanterns and dimmer torches or flickering candles.

Those with solar home systems received an average of almost six hours of electricity in addition to their evening lighting use, while solar lanterns provided around only one additional hour. This suggests that the increased capacity and functionality of solar home systems, for example for phone charging and entertainment, provides significantly longer periods of electricity access. While some solar lanterns also offer phone charging functionalities, their limited electricity generation and storage capacity curtails their ability to provide additional services beyond lighting, and higher levels of energy access overall.

Refugees have several means of obtaining solar products: they could be donated by government or NGO agencies, bought from shops operating inside the camps or outside in the host community, or by other means such as bringing them from a previous location. Table 4.4 gives a breakdown of the origins of solar products by camp.

Households in Kigeme are significantly more likely to have received solar lanterns via donations: over half of respondents with solar lanterns received them as donations, compared with only one in five in Gihembe and a very small number in Nyabiheke. This may explain the higher reliance on solar lanterns in Kigeme described previously. The latter two camps also had far more respondents who stated that they had paid for the lanterns, either from shops inside the camp in Gihembe, or from those in the host community for Nyabiheke.

Solar home systems, meanwhile, were mainly obtained from shops outside the camps: refugee customers are free to purchase systems from shops in the host community, but companies that operate on a rental or leasing model have previously struggled to maintain a permanent presence in the camps. Additional factors, such as the lack of dedicated

Table 4.4 Breakdown of the origins of solar lanterns and solar home systems in the camps

Camp	Breakdown of solar products by origin			
	All	Gihembe	Kigeme	Nyabiheke
Households with solar lantern	115	27	53	35
Origin of solar lantern (%)				
Donation	31	19	57	3
Shop inside camp	37	56	25	40
Shop outside camp	27	26	9	54
Other	5	–	9	3
Households with solar home system	107	60	17	30
Origin of solar home system (%)				
Donation	3	2	12	–
Shop inside camp	33	45	18	17
Shop outside camp	64	53	65	83
Other	1	–	6	–

retailers in the camps and limited amounts of reliable disposable income to spend on more expensive energy services, likely contribute to the limited prevalence of solar home systems across the camps.

Respondents were asked to report any issues they experienced with their solar products, either with the products themselves – such as breakages – or from external factors such as thefts. In both Gihembe and Nyabiheke issues with solar lanterns were rare overall: of the two most common sources of lanterns, respondents who bought them in shops inside the camp in Gihembe reported no issues, and only 5 per cent those who bought them in shops outside Nyabiheke camp experienced problems. For those who bought lanterns from shops outside the camp in Gihembe, however, 57 per cent reported that the lamps had broken and 40 per cent of those with donated lanterns also suffered issues. In Kigeme, meanwhile, donated solar lanterns are much more common and also had a similar prevalence of problems. More than half of solar lanterns obtained via donations were broken, stolen, or had some other issue, as was the case for more than 40 per cent of the overall lanterns bought from shops. A lack of post-delivery product support for donated solar lanterns may contribute to the number of issues, as recipients may not be able to go through supplier warranty processes to resolve any problems.

Issues with solar home systems in all camps were less common, but a minority of respondents with access to them – ranging from 8 per cent in Gihembe to 18 per cent in Kigeme – reported them as being broken. This could be caused by normal wear over the lifetime of a system but could also be a result of respondents not being aware of supplier warranties on the products or an inability to access repair facilities, either from the original retailer or a third party in the camp. Attempting to make unauthorized repairs or modifications to the systems also often results in their becoming inoperable or being shut down remotely, which may add to the number being reported as faulty or broken. Some camp residents have made livelihoods from repairing broken systems, as shown in Box 4.1.

Solar lanterns and solar home systems are the two most common sources of electricity for households in the three camps. The step up the energy ladder from relying on candles and torches to solar lanterns, and again to solar home systems, provides not only longer periods of illumination at night but also benefits such as a superior quality of light and access to key functions like phone charging. The ways in which these solar products are accessed, either via shops in the camps or host

More than half of solar lanterns obtained via donations were broken, stolen, or had some other issue

Box 4.1 Fixing broken electronics

The ability to repair broken electronics is a valuable skill, and some camp residents are able use their technical proficiency to earn an income. A technician in Kigeme explained how he provides an important service when solar home system companies are unable or unwilling to come to the camp: ‘Customers call me to their homes then I call the [solar home system] company for support for them; they tell me they’ll come but they never show up. Most issues are with the batteries if they’re not charging properly. So I repair the systems otherwise people will be without light.’

In Gihembe, a technician repairs phones for between RWF 500 and RWF 1,000 (USD 0.58 and USD 1.16) depending on the materials that need to be brought in from Gicumbi, the district town. ‘Most of my clients are women as they have the most phone accidents. Sometimes their phones fall in water while washing clothes or dishes, or into pots while cooking, and children like to take their mothers’ phones to play games and can damage them accidentally.’ Despite this being his livelihood, he aims to keep his services as affordable as possible: ‘When I serve a fellow refugee I try to minimise the amount of money I charge. I know they don’t have a lot of money, and for me they are my brothers and sisters.’

communities or through a more traditional donation model, varies between the three locations and suggests that camp residents have differing experiences with and perceptions of these technologies. Residents of Kigeme were more likely to have received solar lanterns from donations and were more likely to have had issues from those products, whereas households in Nyabiheke were most likely to have bought lanterns from shops outside the camps and suffered the fewest problems. Furthermore solar home systems were typically obtained from suppliers in the host community and had fewer issues overall than lanterns. This suggests that refugee households are not only willing and able to pay for electricity technologies, but also that they generally receive a superior product or care for it better when it was bought from a retailer rather than received as a donation.

Household expenditure on non-renewable energy for lighting

Some households are able to maintain regular payments for solar home systems, or have enough money to buy them outright, but the majority in all three camps are instead reliant on the most basic technologies for lighting – candles, burning sticks, solar lanterns – or nothing at all. This section presents the expenditure by households on non-renewable lighting sources, such as candles and non-rechargeable batteries for torches, and looks at how these could potentially be replaced by spending on improved lighting sources as part of a technological transition to cleaner energy sources. Only households with no access to electricity or access to solar lanterns are considered here: it is assumed that those households with superior technologies, such as solar home systems, have their basic lighting needs met.

Evaluating self-reported expenditure is challenging for several reasons: respondents may vary the amount they spend on energy each month; other expenses may arise that limits the amount spent on energy; respondents may be unable or unwilling to give an accurate estimate for the amount they spend; or any number of unforeseeable factors could affect the accuracy or reliability of their response. Anchoring expenditure around certain values, for example multiples of RWF 100 (USD 0.12) or, in the analysis below, RWF 1,500 or RWF 3,000 (USD 1.74 or USD 3.49), may give undue precedence to those values when in reality they are given as convenient numbers for estimation purposes only. For this reason the values and analysis presented here should be treated with appropriate

Refugee households are willing and able to pay for electricity technologies

caution and should be considered only an indication of spending on energy in the three camps rather than a precise definition of the current situation.

Figure 4.3 shows the breakdown of reported spending with respondents grouped into expenditure bands in RWF 500 (USD 0.58) increments. The bands are inclusive of the upper figure but not the lower; for example the RWF 500–1,000 per month group represents expenditure from RWF 501 to RWF 1,000 inclusive. Around 60 per cent of households report a regular monthly expenditure on candles and non-rechargeable batteries, with the remainder reportedly spending nothing or relying on improvised sources of lighting, for example burning sticks or using lights from mobile phones.

Around one household in three reports spending RWF 1,500 (USD 1.74) or more per month on non-renewable sources, with a smaller second peak representing households spending up to RWF 3,000 (USD 3.49). These values correspond to a daily expenditure of up to RWF 50 and RWF 100 (USD 0.06 and USD 0.12), respectively, equivalent to the use of one or two candles per day, although the usage of non-rechargeable batteries would need to be taken into account as well. As stated above, these two figures where the chart peaks (RWF 1,500 and RWF 3,000) may represent anchor points around which respondents estimated their expenditure, as there are significant decreases in the proportion of respondents reporting spending marginally higher than these values (see Figure 4.3).

The data in Figure 4.3 is also shown in a cumulative form in the inset, which considers only those households who reported any expenditure.

The relative prevalence of respondents in the categories from zero to RWF 1,500 (USD 1.74) expenditure per month could represent either a variation in the typical spending between households, or it may be a result of month-to-month variation in the amount of money available to spend on energy for lighting, after other expenditures have been

Around 60% of households report regular monthly expenditure on candles and non-rechargeable batteries

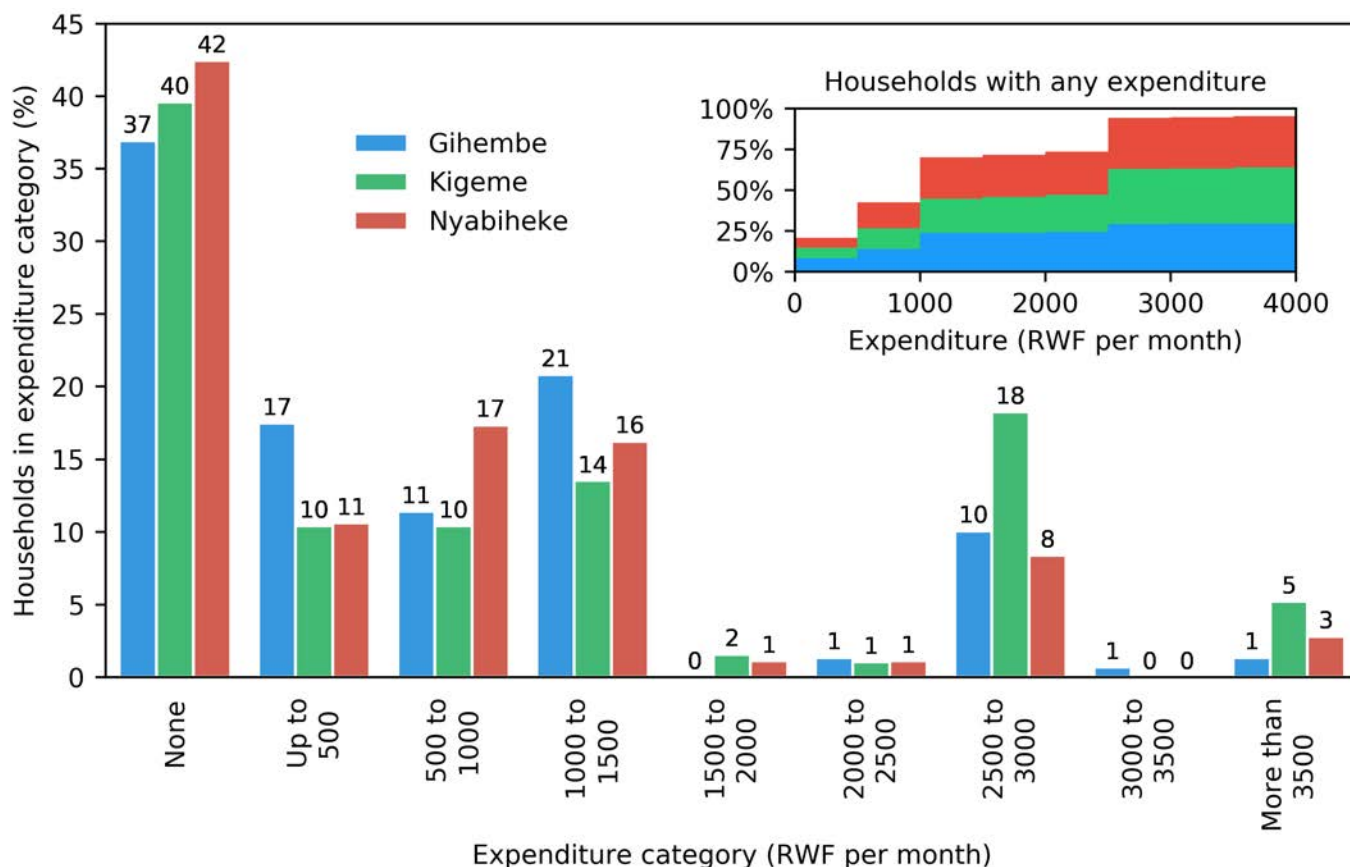


Figure 4.3 Reported expenditure on both candles and batteries by households without a solar home system and (inset) as a cumulative distribution excluding those with zero expenditure

More households report spending at least something on candles than on non-rechargeable batteries

accounted for. Figure 4.3 and Table 4.5 show that households in Kigeme report spending greater amounts on non-renewable lighting sources; given that the proportion of households reliant on solar lanterns is relatively consistent across the camps, this may suggest that the solar lanterns used in Kigeme are insufficient and that respondents augment their use with other lighting sources.

Table 4.5 breaks down the expenditure on non-renewable energy for lighting, and Box 4.2 gives more information about additional expenditure on phone charging. The mean and median values suggest the typical monthly spend for households, while the top 10 per cent value represents the amount that puts a household in the highest 10 per cent of spenders in each category. A greater proportion of households report spending at least something on candles than on non-rechargeable batteries, and when they do they also spend more on candles than on batteries, potentially owing to variations in their use: candles may be used more frequently and for longer for lighting homes, whereas batteries used in torches may be used for shorter periods, such as when walking around the camp, and therefore require replacement less frequently. The households that spend the most on these sources of lighting far outspend the median household – which spends little

Table 4.5 Breakdown of current expenditure on candles and non-rechargeable batteries for households without access to a solar home system (RWF 860 = USD 1.00)

Camp	Spending by all households without solar home systems (RWF per month)			
	All	Gihembe	Kigeme	Nyabiheke
Candles				
Mean	867	819	1041	721
Median	0	275	0	400
Top 10%	3000	3000	3000	3000
Non-rechargeable batteries				
Mean	119	111	111	133
Median	0	0	0	0
Top 10%	480	500	600	576
Combined (candles and batteries)				
Mean	986	930	1153	854
Median	480	350	500	450
Top 10%	3000	3000	3000	3000

Box 4.2 Paying for phone charging

Phone charging is a key electricity service that households require, but the majority lack access to this in their home. Households without solar home systems, rechargeable batteries, or other means to charge their phones rely on enterprises to do so: small shops often offer this service, as do dedicated solar-powered phone-charging kiosks that operate in the camps. Some camp residents are able to use the institutional minigrid to charge their phones if they, or a friend or family member, are involved with one of the organizations that have a connection. The standard cost of charging a phone is RWF 50 to RWF 100 (USD 0.06 to USD 0.12) and is generally required every two days, but some refugee groups, such as the Maison Mère association in Nyabiheke, offer unrestricted charging for RWF 500 (USD 0.58) per phone per month.

or nothing in the individual categories – and therefore the mean value is likely to be unrepresentative in indicating the typical spending of households across the camps. An analogue to Table 4.5 with the values in US dollars is available in the Appendix.

In comparison, Corbyn and Vianello found that the average household expenditure on energy for lighting in Goudoubo Camp in Burkina Faso was USD 0.71 (RWF 611) per month, although for households without solar lanterns this increased to USD 2.51 (RWF 2,159) per month (Corbyn and Vianello 2018). The same study also found that residents of Kakuma Camp in Kenya spent an average of USD 3.72 (RWF 3,100), although a small number of households with connections to a comparatively expensive minigrid increase this average. Although these figures are not directly comparable to the data presented here, it suggests that residents in the three Rwandan camps spend less on energy for lighting than their counterparts in Goudoubo and Kakuma, particularly compared with the far higher amounts being spent by those without solar lanterns in the Goudoubo.

This data may highlight a consistent problem with supplying energy for lighting in the camp: the majority of households spend very little on lighting at present, albeit for very basic technologies, and only a small minority spend amounts comparable to the costs of superior options such as solar lanterns and solar home systems. Most households spend at least something on this basic need but it is not the case that current spending on non-renewable technologies could be directly applied to renewable alternatives without products being made more affordable or increasing the monthly spending of typical refugee households. Using this information alone it is also not possible to deduce how much expenditure on lighting would increase by if superior lighting products were made available, and if expenditure on lighting were to go up, then that increase might need to come from current spending on other important household necessities.

Issues with household lighting and electricity

A lack of access to energy for lighting can introduce significant health and safety risks, particularly to the poorest people in the camps. Households reliant on burning sticks often try to keep the wood smouldering throughout the night in order to see inside their homes and light a cookstove the next morning – and to save on the cost of matches. Respondents shared that many people have been injured in fires and the use of candles increases that risk, with children being particularly vulnerable: ‘Fires occur when children move candles around the room, they might accidentally burn a curtain or a mosquito net and the fire spreads up to the roof and through the whole house’. Burning sticks are also used outside of the home, for example on the way to WASH facilities, but do not offer much illumination and extinguish easily in the rain. Across the three camps respondents expressed that using burning sticks for lighting was a last resort.

Even basic electric lighting technologies can have a significant positive impact when replacing a traditional source. One woman in Nyabiheke explained some of the benefits she experienced when she received a solar lantern and how it eliminated her reliance on candles:

I have a solar lantern and it has made such a big difference to our lives. We never pay for light anymore, the sun charges the light for us. Using candles was costly and always required you to have money in your pocket. Every evening we used one candle, which meant buying a new candle for RWF 50 (USD 0.06) every day, and sometimes one candle

A lack of access to energy for lighting can introduce significant health and safety risks

There have been numerous cases of serious injuries sustained by people moving around at night

was not sufficient. Every day we were worried about this. But now we have light until we go to sleep! And I do not have to sell a portion of my food to buy candles, so the food in our household has increased as well! We can even charge our phone on the lantern, but we don't do that often as it reduces the light to only 30 minutes. Instead, we pay RWF 50 (USD 0.06) to charge the phone near the camp.

In some cases camp residents have no choice but to go without any form of lighting. Focus group participants shared that moving around and locating things inside the home was a persistent problem, and elderly people and those with disabilities are especially vulnerable to trips and falls on the uneven floors. Outside the home a lack of lighting has more significant impacts: the rocky terrain and dirt tracks that constitute the access routes around the camps are precarious, and there have been numerous cases of serious injuries sustained by people moving around at night. Accessing WASH facilities was highlighted as a particular issue, with respondents reporting that many people relieve themselves at the entrance to the latrines through a fear of the pitch darkness inside the buildings. Hazards are also present throughout the camp: 'At night thieves move around', one female respondent in Kigeme shared, 'Young men rob people's phones and handbags in the streets or at the toilets under the cover of darkness.'

Low levels of access to lighting and electricity also have a limiting effect. Interviewees shared that their children were unable to study at night, either at home or at school, owing to a complete lack of access to lighting or because the only lighting source was needed for another purpose. Students in the camp are enrolled in the Rwandan national education system, and compete academically with students in the host community who have the opportunity to revise in the evenings; this was raised as a significant issue. In the home more generally, two respondents in Nyabiheke expressed how nightfall constrains their activities: 'I want to sleep at 21:00 or later, but I sleep at 19:00 now because it is completely dark', a young man explained, while a young woman said 'We do not have the time for household conversations, and the children cannot study, because this place is dominated by darkness.'

Camp residents are limited in their access to electricity for entertainment. Those with radios generally use them to listen to specific programmes, usually news, documentaries, or dramas, and then switch them off to make the non-rechargeable batteries last longer, although some are solar powered. Televisions are usually available only to those with solar home systems, and a group of older men in Nyabiheke reported that the only people who can afford them are residents who receive remittances from family members abroad. They also described how public cinema halls, run by entrepreneurs in the camp, are popular but can lead to petty crime and theft as children and youths steal soap or food from households to pay the entrance fee. A group of women in the same camp explained, 'We wish those movie halls would be closed! Some of teenagers, and even some younger boys, lie to their parents that they are going to school but actually go to watch movies. They steal soaps or anything else from their home to sell it and get a ticket; they pay RWF 50 (USD 0.06) per movie!' They suggested that having televisions at home would help to reduce this bad behaviour and that this is a gendered issue: girls do not steal to buy cinema tickets as most of the time they are at home doing housework.



COOKING AND FUELS IN REFUGEE HOUSEHOLDS

Section summary: Cooking technologies and fuels in domestic settings

Households generally rely on the most basic forms of cooking technologies and, at the time the survey was conducted, access to cooking fuels was a significant issue. The vast majority of households used basic stoves and firewood as their primary sources of cooking, in similar proportions to the general population of Rwanda (World Bank 2018a), and improved cookstove programmes have had limited effectiveness. Camp residents reported issues around the supply of firewood and, when fuel was unavailable, relied on a range of coping mechanisms to get by. Women in

Table 5.1 Overview of the stoves and fuels used in the camps and the issues reported by respondents

<i>Stove or fuel</i>	<i>Characteristics and issues</i>
Three-stone fires and mud stoves	<ul style="list-style-type: none"> • Very common and can be easily made in the camps • Low fuel efficiency and produce large amounts of air pollution
Improved cookstoves	<ul style="list-style-type: none"> • Many different types and some can be made in the camps • Limited uptake despite many distribution programmes • Inyenyeri stoves in Kigeme can offer the highest levels of cooking energy access
Firewood	<ul style="list-style-type: none"> • Cessation of firewood distribution from January 2019 means future plans are uncertain • Inconsistencies with distribution and wet firewood are both important issues • Foraging for fuel in the local environment can expose people to risks
Charcoal	<ul style="list-style-type: none"> • Used for both cooking and heating homes • Fluctuating prices between seasons cause affordability issues
Briquettes and pellets	<ul style="list-style-type: none"> • Use of these fuels limited to Kigeme only • Affordability cited as a major issue inhibiting their usage

the camps were found to spend several hours per day on cooking activities – far longer than men. An overview of the stoves and fuel types used in the camps is given in Table 5.1, and the key results presented in this section are summarized below:

- More than three-quarters of households rely primarily on basic stoves and firewood for their cooking needs.
- Only 21 per cent of households use an improved cookstove as their main source of cooking, despite a range of previous distribution programmes, although 42 per cent use one as a secondary backup stove.
- Before the cessation of firewood distribution, 81 per cent of refugee households primarily relied on firewood and 17 per cent relied on charcoal; for secondary stoves, 17 per cent used firewood and 79 per cent used charcoal.
- The supply of firewood and shortages of fuels were major concerns, along with the challenge of keeping firewood dry and the fluctuating price of charcoal between seasons.
- More than 90 per cent of households used coping mechanisms to get by when fuel for cooking was unavailable.
- More than half of households reported skipping meals and others rely on exchanging food for cooking fuel, reducing portion sizes, exchanging different kinds of fuels, or sharing cooking resources.
- Women spend more than three hours per day on cooking and related activities – four times longer than men – as cooking is perceived as the responsibility solely of women.

This section investigates access to energy for cooking in Gihembe, Kigeme, and Nyabiheke. An overview of cooking issues is presented next. With a discussion on the government policy to cease the distribution of firewood in the camps – which was implemented after these assessments were carried out – and its potential effects on the results of this report. Subsequent sections describe the many different types of stoves used in the camps and a breakdown of their usage in households, followed by a description of the fuels that were used. The time burden associated with cooking activities is discussed later in this section along with a description of the challenges that respondents reported being caused by the shortage of fuels. Finally the section concludes with a presentation of some of the coping strategies that camp residents rely upon to overcome these challenges.

Women in the camps spend several hours per day on cooking activities – far longer than men

Burning firewood and charcoal exposes people to dangerous levels of smoke and toxic gases

The necessity of energy for cooking

Around 3 billion people lack access to clean cooking (The World Bank 2018b), and the use of modern stoves that emit lower levels of harmful particulate matter is comparatively rare in situations of displacement. Corbyn and Vianello found that more than 90 per cent of households in both Goudoubo Camp, Burkina Faso and Kakuma Camp, Kenya rely on either three-stone fires or basic improved stoves that do not provide significant reductions in indoor air pollution (Corbyn and Vianello 2018), while Rivoal and Haselip found that 79 per cent of households in Nyarugusu Camp, Tanzania rely on mud stoves and 20 per cent use three-stone fires to cook (Rivoal and Haselip 2017).

Burning fuels such as firewood and charcoal can expose the people who cook to dangerous levels of smoke and other toxic gases, to which around 2.6 million deaths worldwide are attributed each year (GBD 2016 Mortality Collaborators 2017), and this disproportionately affects women and girls as the primary responsibility for cooking falls on their shoulders. Reliance on traditional three-stone fires and mud stoves exacerbates these problems by decreasing combustion efficiency and increasing cooking times, which increase the exposure to harmful emissions by both intensifying the amount and lengthening the time that people are in contact with them. Cooking practices, such as preparing meals indoors or in enclosed spaces to shelter from the rain or wind, compound this issue. Although cooking fuels are distributed centrally in camps, and available in local markets, supplementing this resource by searching for fuel in the areas around refugee camps can lead to conflict with the host communities.

The government of Rwanda is supporting a nationwide transition from firewood to cleaner fuels such as briquettes, pellets, LPG, and biogas (Ministry of Infrastructure 2018); one component of this strategy is that the government and large institutions, such as UNHCR, are no longer permitted to supply firewood to displaced communities in the camps. In January 2019 the delivery of fuel in Gihembe, Kigeme, and Nyabiheke, as well as two other camps in the country, changed: households who chose to sign up to alternative cooking solutions supplied by two preselected suppliers already operating in the camps, Inyenyeri and Bamboo Riverside, were to receive cash assistance to buy cooking fuel, while families who did not sign up would continue to receive in-kind firewood support. In the following months sales data indicated that the spending on these cleaner fuel alternatives was not congruent with the cash support being received and so the decision was taken to temporarily suspend cash assistance for energy until refugees fully adapt to the usage of clean cooking technologies. Residents were to be provided instead with in-kind distribution. The long-term strategy for energy for cooking, and its effectiveness in meeting the needs of camp inhabitants, is yet to be determined. The findings presented in this report are based on data collected before the changes described here, and as a result may not reflect the situation in the camps following them; however, while the proportion of households using different types of stoves and fuels will likely have changed, for example, a number of the wider issues around energy for cooking are likely to remain in the camps and in other situations of displacement.

As a basic requirement for survival, the supply of food, and the fuel to cook it with, is one of the greatest priorities in situations of displacement. Humanitarian agencies are in an unenviable position: when operating in an environment where resources are stretched, meeting the cooking needs of thousands of households in camps reliably is a significant challenge in and of itself – but added to the additional considerations of complying with changing government regulations and introducing technologies

to households unfamiliar with them, it can end up a herculean task. Access to clean cooking is a much wider issue beyond humanitarian settings, although many of the issues are made more acute in situations of displacement. It should therefore be beholden on a wide range of actors, including the private sector, NGOs, and humanitarian agencies, to support each other in developing sustainable delivery models for the uptake and continued usage of cleaner cooking technologies.

Types of cookstoves used in homes

Having the ability and resources to prepare meals is a fundamental requirement for survival. Common foods and dietary staples in developing regions need to be cooked before consumption, and compromised access to energy for cooking can lead to food insecurity. In some cases a lack of fuel to cook with can be tantamount to a lack of food itself, so households are reliant on a number of coping mechanisms to get by in such situations.

Some dishes require high heats for short periods of time but others, such as beans, which are commonly prepared in the camp, involve long periods of heating at lower temperatures. As a result, 50 per cent of households reported using more than one stove to cook at meals, either for convenience, personal preference, or to prepare two dishes at the same time. The types of cookstoves being used in the camps vary from the most basic traditional stoves made by camp residents to modern designs available commercially and imported from overseas.

The most common stoves used in the camps are the most basic. The simplest, the three-stone fire shown in Figure 5.1, is made from three stones or mud bricks upon which a pot can be balanced above a fire. Mud stoves are also commonplace, formed by building up a horseshoe-shaped construction of mud or clay for a stove to sit upon. These basic stoves are inefficient, have no safety protections, and give off significant amounts of smoke that can contribute to a variety of health issues, from eye irritation to increased susceptibility to respiratory infections. Those who lack the means or skills to buy or build a different kind of stove, or whose other cookstoves have been damaged or sold, generally use these stoves out of necessity.

The ability and resources to prepare meals is a fundamental requirement for survival



Figure 5.1 Basic three-stone fire stoves made from balancing a pot on stones (left) and mud bricks (right) in Nyabiheke

Three-stone fires and mud stoves remain the predominant cooking technology in the camps

To alleviate some of the issues caused by traditional cooking methods, a variety of programmes have been introduced in the camps to distribute and increase the uptake of improved cookstoves. The designs of improved cookstoves generally aim to burn fuel more efficiently, reduce the amount of smoke being produced, and minimize the risks associated with cooking, but their goals and effectiveness at meeting them vary between the types of stoves and their practical usage.

UNHCR provided improved cookstoves to households in Kigeme and MINEMA distributed stoves to Gihembe and Nyabiheke, but these programmes have had varying levels of success and so far none has been able to displace three-stone fires and mud stoves as the predominant cooking technologies in the camps, and only a minority of improved stoves remain in regular use. Some households have also purchased improved stoves that are available in the host communities around the camps. Owing to their relatively limited prevalence, all varieties of improved cookstoves are categorized together later in this report to distinguish them from the more common traditional three-stone fires and mud stoves; this section, however, gives more details on the different kinds of improved stoves that are currently used in the camps.

Simple charcoal cookstoves, made from a variety of materials including clay and metal (shown in Figure 5.2), are produced outside the camps and can be purchased in the host communities for RWF 1,500 to RWF 2,500 (USD 1.74 to USD 2.90). In contrast to the basic traditional stoves, these cookstoves are portable enough to carry around the home even when lit and are used for heating to keep homes warm during the wet season, as described in Box 5.1. The improved cookstoves distributed in Gihembe and Nyabiheke by MINEMA can use both charcoal and firewood as fuel but, as they are much larger than the other stoves, these are rarely used. Respondents explained that the stoves are too heavy for women or children to move, limiting their convenience, and their larger size means that flames from the fuel do not reach the pot. In Nyabiheke one woman stated, ‘The stove releases so much smoke, it’s unhealthy. I don’t use this stove.’

In Kigeme a different type of improved stove, called Save80, was distributed. Instead of charcoal this stove uses firewood chips and small wooden branches for fuel, and was delivered with its own saucepan



Figure 5.2 A basic charcoal cooking stove in Kigeme

Box 5.1 Charcoal cookstoves for heating

When it rains it often gets cold in the camps located on the hilltops. An elderly woman in Kigeme explained that the charcoal she uses for cooking is also used for heating her home: ‘When it rains I use the charcoal to heat the room, as well as to cook. I put the stove in the sitting room where my husband sits. If he is resting on the bed, I bring the stove to the bedroom.’ She adds that she would not want to use a firewood stove, which would need to be fixed in one location: ‘Why would I use firewood if I cannot use it for heating when we are cold?’ Although its portability allows household members to carry the cookstove to warm different areas of the house, doing so increases the risk of burns and fires.

and lid. Very few Save80 stoves were still being used in Kigeme at the time of this survey; respondents explained that the cooking time was too long, resulting in most stoves being sold on or simply discarded. In Gihembe and Nyabiheke, meanwhile, camp residents were trained to make an improved stove called the *Rondereza* (‘save fuel’ in Kinyarwanda). Since 2009, those who were initially trained by ARC, along with other camp residents whom they subsequently taught, have used iron bars, clay, and stone bricks to construct pit stoves (see Box 5.2). These are sold to other residents at a cost of RWF 2,000 (USD 2.33) for firewood stoves and RWF 2,800 (USD 3.26) for charcoal stoves. This business is solely carried out by women. As one stove maker explained: ‘The stove makers are women and their clients are women because only women are concerned with cooking activities.’ Examples of the Save80 and *Rondereza* stoves are shown in Figure 5.3.

Inyenyeri, a cookstove and fuel company operating throughout Rwanda, distributes pellet stoves in Kigeme. These improved stoves (shown in Figure 5.4) are manufactured in China by Mimi Moto, and are delivered through a system of free leases. Households receive the stoves without charge but are encouraged to purchase at least 10 kg of biomass pellets at a cost of RWF 2,000 (USD 2.33) per month. The stoves use an integrated fan to increase fuel efficiency, powered by an internal battery charged by a separate solar panel, and households receive training on its use. Unlike the other improved cookstoves in the camps, the Mimi Moto stove has been verified as Tier 4 for emissions, indoor emissions, and efficiency (Global Alliance for Clean Cookstoves 2015). At the time of the assessment, 390 households in Kigeme were participating in the scheme, but respondents had mixed opinions of them. Although respondents stated that they mostly liked the stoves, they explained that the pellets are expensive and insufficient in meeting their cooking needs for the entire month. This is especially pertinent among smaller

The Mimi Moto stove has been verified as Tier 4 for emissions, indoor emissions, and efficiency

Box 5.2 Moving from stove distribution to skills training

Discrepancies between camp residents’ needs and preferences for cookstoves and those previously distributed by the camp authorities has resulted in many improved stoves going unused. Realizing this, the American Refugee Committee (ARC) transitioned from the free distribution of stoves to instead providing camp residents with the skills to build stoves. Training programmes taught residents how to make *Rondereza* stoves and adapt them to best suit household needs, providing residents with more suitable stoves and stove makers with a livelihood opportunity.



Figure 5.3 Save80 cookstoves distributed by UNHCR in Kigeme Camp (left, centre) and a Rondereza stove (right)



Figure 5.4 The Mimi Moto pellet stove distributed by Inyenyeri in Kigeme, showing (left) the solar panel used to power the fan and (right) the burning chamber of the stove

households, as the money distributed to the refugees to purchase pellets, in lieu of firewood, is dependent on the number of household members. This makes meeting the required monthly spend more challenging. Despite this, the supply of Inyenyeri stoves does not yet meet the demand from households wanting to participate in the scheme, with one man in Kigeme saying that he had been on the client waiting list for more than one year.



Figure 5.5 An LPG stove with two burners and its gas canister in Gihembe

Liquefied petroleum gas (LPG) is widely available in Rwanda, but its high cost is the main inhibitor of its use in the camps. Only one LPG stove was observed, in Gihembe, in a household that received remittances from abroad (Figure 5.5). ‘There are many advantages of using LPG; the woman who owned the stove explained, ‘It is simple, automatic and clean, and it doesn’t release smoke that creates a black layer on saucepans. It cooks food faster, it can be used at any time, it can be used during the rain, it can be used in the dining room or in the bedroom, and it does not change the taste of my food.’ She said that many people in the camps want to cook with LPG but the cost is prohibitive, with a 12 kg canister of gas costing RWF 12,000 (USD 13.95) in the nearby town of Gicumbi. ‘For me buying the gas is fine now, it is even affordable. But before you can buy the gas you need to buy the stove and a canister. You also have to pay transport [of the canister by bicycle or motorbike from the town] for refilling the canister, which is RWF 1,000 [USD 1.16]. Only after all this do you have the gas to cook, it’s just too much for the people here.’

LPG is widely available in Rwanda, but its high cost inhibits its use in the camps

Breakdown of cookstoves used in households

This section presents a breakdown of the usage of the types of cookstoves outlined above. As discussed earlier, the previous programmes to distribute improved cookstoves varied between the camps and so, despite the differences between the various models and their performances, it is more reflective to categorize these types of stove as one ‘improved cookstove’ group rather than segregate individual models (World Bank 2018b). While most of the improved cookstoves in the camps were unrated, it is likely that they would be classified as Tier 1 or Tier 2, with the exception of the stoves used by Inyenyeri in Kigeme, which have been certified as Tier 4 (Global Alliance for Clean Cookstoves 2015).

Using more than one type of cookstove, known as stove stacking, or fuel stacking when using more than one type of fuel, is common in the camps and can be a result of many factors ranging from personal preference and the types of food being cooked to the cost or availability of fuel. The term ‘stove stacking’ is often used when a household relies on stoves that provide different tiers of energy access, rather than the

More than two-thirds of households own improved cookstoves but do not use them as frequently

higher-tier stove simply replacing the lower-tier stove. This report therefore differentiates between primary cookstoves, considered to be the stoves most commonly used by a household or the stove that is used most often on a typical day, and secondary cookstoves, which are those used either less frequently, for less time, or as a backup option when the primary cookstove cannot be used.

Three-stone fires and mud stoves are the most commonly used stoves in the three camps, representing 35 per cent and 42 per cent of primary cookstoves, respectively. There were some variations in the relative prevalence of the two basic stove types between the camps; for example households in Gihembe were more than twice as likely to use mud stoves than three-stone fires, while there was a negligible difference in Nyabiheke. The clearest difference in stove usage, however, is the relatively high use of improved cookstoves in Kigeme compared with the other two camps. This camp has historically received the greatest number of improved cookstove distributions, including the ongoing programme by Inyenyeri, which likely contributes to their increased and continued usage. A breakdown of the types of stoves being used in each camp is shown in Table 5.2. The table also gives a breakdown of secondary stoves in use in the camps, showing that in Gihembe and Nyabiheke over half of households do not use a secondary stove, but over two-thirds of households in Kigeme use some form of secondary option.

When considering the combinations of both primary and secondary stoves in individual households, 36 per cent of all households across the camps have access to a single basic stove only with no secondary stove. In both Gihembe and Nyabiheke 37 per cent of households have a basic primary stove and use an improved cookstove as a backup, but in Kigeme this rises to 44 per cent. This means that across the three camps more than two-thirds of households rely on basic stoves either primarily or entirely and, despite owning them, do not use their improved cookstoves as frequently as traditional designs.

On the other hand, households with improved primary cookstoves in Gihembe and Nyabiheke are generally reliant on that stove only. Only around one in eight of those households use any kind of backup stove, but in Kigeme around half of households with improved primary stoves also use a secondary stove. Furthermore, among households in Kigeme that use a second stove to augment their improved stove, half use another improved cookstove as the backup. Despite this, across the three camps a similar proportion of households overall use one improved stove only, which may suggest a comparable number of households in each camp are both willing

Table 5.2 Breakdown of the primary and secondary cookstoves used by households

Camp	Breakdown of cookstove usage (% of households)			
	All	Gihembe	Kigeme	Nyabiheke
Primary stove				
Three-stone fire	35	24	38	43
Mud stove	42	60	24	44
Improved cookstove	21	13	37	13
None	1	1	1	0
Secondary stove				
Three-stone fire	3	0	7	1
Mud stove	3	3	5	2
Improved cookstove	42	35	53	37
None	50	57	34	59

and able to rely on a single improved stove alone. This may also suggest that the improved cookstove distribution programmes in Kigeme have had a relatively wide reach but have not had the desired impact in displacing the usage of other stoves, including basic types. This may be a result of the affordability of fuels, which is discussed in later sections.

Types of fuels for domestic cooking

Domestic energy for cooking in the camps is reliant on consistent access to fuels, with firewood being the predominant fuel source used by residents. At the time the assessments were conducted, refugee households in Gihembe, Kigeme, and Nyabiheke camps received firewood for cooking, and were allocated rations equivalent to one cubic metre of stacked wood shared between 22 people per month. The UNHCR provided the budget for buying the firewood and MINEMA recruited a local supplier who delivered the firewood at least one month before the time of distribution. The Adventist Development and Relief Agency (ADRA) was responsible for firewood distribution and camp residents received the firewood once per month. Since the time of the assessments, the government position on supplying firewood has changed (see Box 5.3) so the information in this report is a representation of the situation at the time the assessments were undertaken, rather than that at the time of publishing.

Keeping firewood dry for a long time, especially during the rainy season, was a significant challenge. As a solution ADRA, MINEMA, and the camp executive committee members resolved to distribute firewood to households every two months instead. This has been challenging for some households, as the time between their supply of firewood running out and the new allocation being distributed was increased substantially: rather than a household receiving an allocation for one month that would last two weeks, for example, a household would now receive an allocation for two months that would last one month, leaving a waiting time of one month until the next allocation.

Despite these issues most households, especially those with greater numbers of members, prefer cooking with firewood because it cooks food faster, is convenient for feeding children who need to go to school, and also because it produces a strong fire that is necessary for preparing certain dishes such as cornbread, a staple meal. The use of this fuel also

Firewood was the predominant fuel source used by residents at the time of the assessments

Box 5.3 The cessation of firewood distribution in refugee camps in Rwanda

The distribution of firewood in the camps was largely stable, if sometimes inconsistent, until 2018 when the government of Rwanda announced their new priorities for the energy sector. Among other initiatives, the vision for the period 2018–20 states that biomass usage must be halved, public facilities and institutions should move to LPG and cleaner fuels, and government agencies and institutional bodies such as UNHCR must end the distribution of firewood in refugee camps. This change will have a significant impact on the current distribution system in the three camps considered in this report and, at the time of writing, the UNHCR and other partners are working to resolve this issue and find alternative solutions. The information and analysis provided in this report are reflective of the situation before the cessation of firewood was announced but, as the resolution to this issue is still under development, the situation in the camps may change significantly in the future.

Charcoal is also commonly used and widely available in the camps

has cultural links to cooking practices in DRC, where firewood is widely available to collect in the local environment.

Charcoal is also commonly used and widely available in the camps. Charcoal is most often used as a substitute fuel when the household allocation of firewood has been expended, if there is a delay in the supply of firewood, or during the raining season, but some households use it preferentially ahead of firewood. Charcoal is produced in the camps or in the host community and costs RWF 2,000 to RWF 5,000 (USD 2.33 to USD 5.81) per bundle. Like firewood, its usage is being discouraged in favour of other fuels, but it is still widely available in the camps.

Some households, in particular those with an improved cookstove distributed by Inyenyeri, use pellets. These are made in Rubavu District, Western Province from biomass, sawdust, reeds, and tree branches and transported to the camps. In lieu of their firewood allocation, participating households receive cash aid of RWF 500 (USD 0.58) per household member per month to pay for the pellets. Once subscribed to the Inyenyeri programme, each household is encouraged to purchase a minimum of 10 kg of pellets per month, with additional pellets sold by Inyenyeri for RWF 175 (USD 0.20) per kg. Respondents who participate in the programme stated that 10 kg of pellets typically lasts between four and 12 days, so buying additional pellets, or searching for alternative cooking fuels, is always required.

Briquettes have been sold in Kigeme by Bamboo Riverside, a Rwandan company based in Kigali, since March 2018. Respondents said that the briquettes, made from sawdust, are used as substitutes for both as firewood and charcoal: when first ignited the briquettes produce a flame like firewood but later smoulder like charcoal (see Figure 5.6). Bamboo Riverside has one shop in Kigeme, where briquettes are sold for RWF 150 (USD 0.17) per kg, and the company employs two camp residents, each receiving a daily stipend of RWF 600 (USD 0.70) to help raise awareness of the product. Most respondents who were interviewed had heard of the briquettes; however only a small number said that they would use them: aside from firewood as the traditional source of fuel, camp residents indicated a preference for either charcoal or pellets if they had the money available, rather than briquettes. At the time of the assessment Bamboo Riverside had been operating in the camp for only a few months, and so the awareness and perception of the product have subsequently improved.



Figure 5.6 Briquettes from Bamboo Riverside in Kigeme that produce a flame like firewood at first (left) and then smoulder like charcoal (right)

Breakdown of domestic fuel usage

Households were asked about the type of fuel they used for their primary stove and, if applicable, their secondary stove, which are referred to here as the primary and secondary fuels, respectively. Although most stoves are generally more suited to a specific type of fuel, this definition does not consider the potential use of two different fuels on the same stove but does allow some insight into the differences in usage between types of fuels comparable to the earlier analysis of stove usage. The most common primary fuel in all camps was found to be firewood, but Kigeme also had a significant minority of households using charcoal. Charcoal was the most common secondary fuel in households that used a backup stove, with more than half of respondents reporting using it. Table 5.3 gives a summary of the primary and secondary fuels used in the camps.

This analysis can be broadened by taking into account the type of stoves used with the fuels in this data set. Almost every household in Gihembe and Nyabiheke that used a three-stone fire or mud stove as their primary stove reported using firewood as their primary fuel, but in Kigeme around one-third of those using mud stoves primarily used charcoal. Across all three camps 64 per cent of households with improved cookstoves as their primary stove used charcoal and 26 per cent used firewood, with only a minority in Kigeme using briquettes or pellets. The high usage of charcoal in Kigeme may suggest a correlation between the prevalence of improved cookstoves and the greater usage of charcoal, but firewood remains the most common fuel in all of the camps.

Camp residents were asked about their reasons for relying on a secondary stove and fuel: the most common reason was that their primary fuel was unavailable, as was often the case with firewood. Households using briquettes or pellets primarily, particularly those in Kigeme, also reported that these fuels were too expensive to be used exclusively. Most primary stoves are more suited to a specific type of fuel; however secondary stoves were generally used with a greater diversity of fuels as a result of necessity, fuel availability, or personal choice once the preferred primary fuel was exhausted.

Considering the combinations of primary and secondary stoves, in Gihembe and Nyabiheke 47 per cent and 54 per cent of households, respectively, were reliant on firewood only, either across one stove or two, while 39 per cent and 37 per cent used firewood as their primary

Table 5.3 Breakdown of the primary and secondary fuels

Camp	Breakdown of fuel usage (% of households)			
	All	Gihembe	Kigeme	Nyabiheke
Primary fuel				
Number of households using primary fuel	614	209	199	206
Fuel breakdown (% of households)				
Firewood	81	87	64	92
Charcoal	17	13	30	8
Briquettes/pellets	2	0	7	0
Secondary fuel				
Number of households using secondary fuel	310	90	134	86
Fuel breakdown (% of households)				
Firewood	17	8	28	9
Charcoal	79	91	63	91
Briquettes/pellets	4	0	9	0

Activities associated with preparing meals constitute a significant time burden

fuel and charcoal as the secondary fuel. In Kigeme, just 20 per cent of households were reliant on firewood only and 38 per cent on firewood with a charcoal backup. Charcoal usage appeared to be more prevalent in Kigeme in general, as a much higher proportion of households compared with the other camps – 28 per cent – used charcoal as their primary fuel and two-thirds of those did not rely on any other fuel, suggesting greater availability and affordability. The number of households using briquettes or pellets only, either as the primary or secondary fuel, was found to be negligibly small: only 1 per cent of households in Kigeme fit this category, and no households were found to do so elsewhere.

The combinations of fuels that households rely upon are likely dependent on a number of factors. Across all camps there is a significant reliance upon firewood, reflecting the distribution programme in place at the time of the survey and the relative availability of the resource in the host community. Many households also rely on charcoal to supplement their firewood usage. With the majority of households also reliant on basic mud stoves and three-stone fires, this suggests that fuel efficiency is low – exacerbating the drain on scarce resources – and exposure to air pollutants is likely to be high, potentially contributing to long-term health issues. At the time the survey was conducted the proportion of households using briquettes and pellets was very small. Recent developments in the camps have likely increased usage of these fuel types, but the transition to improved fuels and stoves is far from complete.

The gendered time burden of cooking

Activities associated with preparing meals, ranging from collecting fuel to cooking, constitute a significant time burden. To gain an insight into the amount of time taken up by cooking activities, the survey asked respondents about how long each of their stoves was in use, and the time contribution each household member made towards preparing meals. However, accurately estimating the amount of time spent on different activities can be challenging. The time spent can vary significantly over the course of a week or month, depending, for example, on the types of fuels being used, or on unexpected factors such as a household member being sick. The results in this section are therefore presented as an indication of the situation in the camps, but should be considered in the context of the inherent uncertainty of this area of research.

First considering cookstove usage, respondents typically reported their primary stoves being in use for around three or four hours per day, even when using improved stoves. Respondents who used both a three-stone fire and mud stove reported more than five hours of cumulative stove usage per day, while those with mud stoves only reported an average of more than six hours. Respondents in Nyabiheke – particularly those reliant on firewood – were found to be using their stoves for significantly longer, reporting that their stoves were used for more than seven hours per day – more than double the figure for Gihembe or Kigeme. Interviews in Nyabiheke revealed that households receiving damp firewood was a common complaint in the camp and increased the cooking time significantly. Aside from firewood usage in Nyabiheke, there was little difference in the duration of stove usage between households primarily reliant on firewood and charcoal, each reported at around three or four hours, but those using briquettes or pellets in Kigeme used their stoves for only around two hours per day.

The time spent by household members performing cooking activities varies significantly with gender, as shown in Figure 5.7. Across three

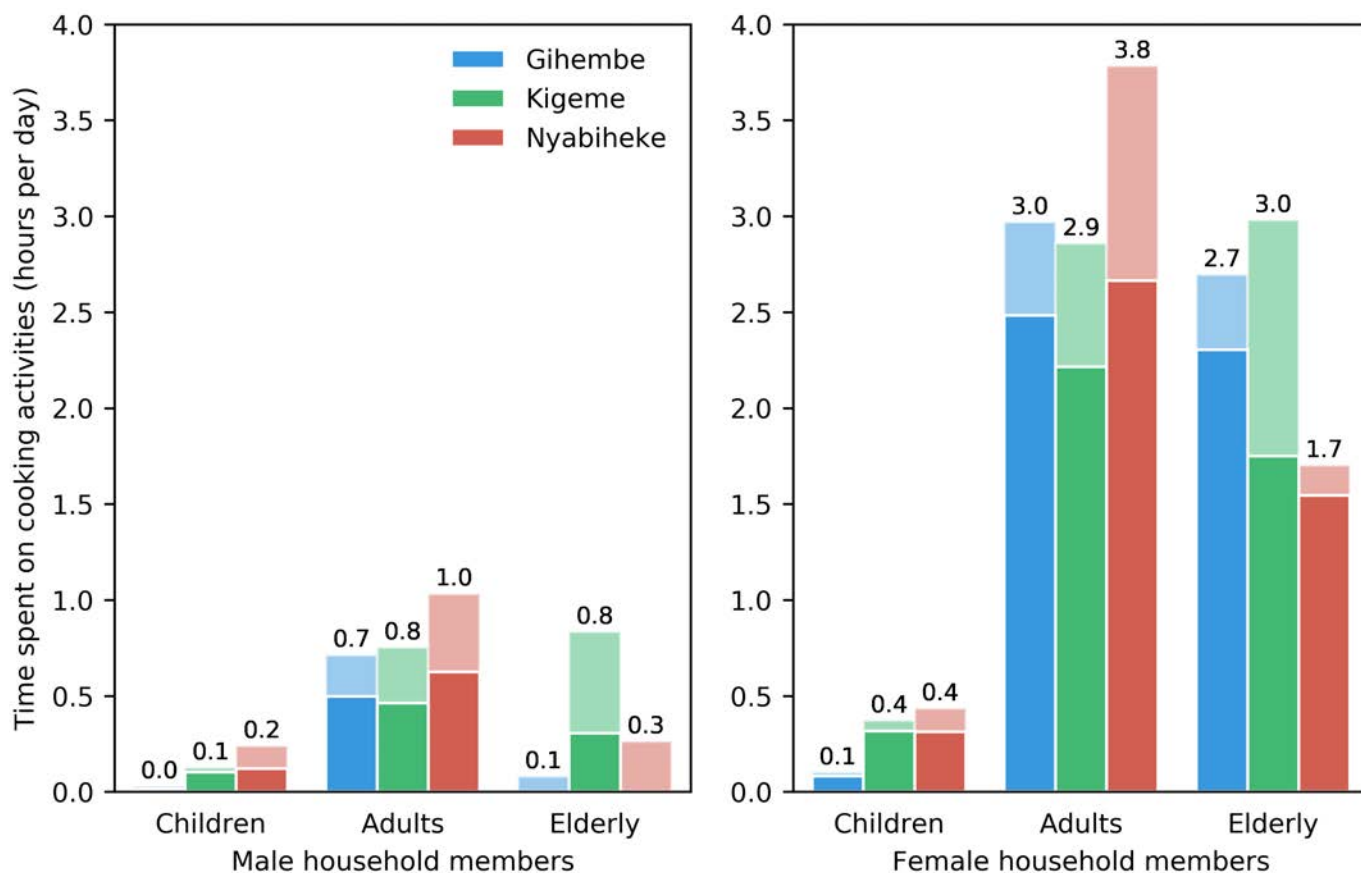


Figure 5.7 The number of hours per day spent on cooking (solid bars) and additional cooking-related activities (translucent bars) by male (left) and female (right) household members

categories – adults, children under the age of 15, and the elderly over the age of 65 – female members of the household spent more time cooking, as well as performing preparatory activities such as collecting, purchasing, and preparing fuel. Across all camps, female adults spent an average of 3.2 hours per day on cooking activities compared to just 0.8 hours per day for male adults. This difference is also present for elderly people, where females and males spent an average of 2.6 and 0.3 hours per day, respectively, although owing to the relatively small sample size for this age group there is a significant amount of variation in the values reported. Children were found to contribute little or no time towards cooking activities but, among those who did, girls spent marginally more time doing so. While the actual cooking of food is the most time-intensive activity, the other activities contribute significantly: of the 3.2 hours per day spent by female adults, around 20 per cent, or roughly 45 minutes, is spent on other activities such as fuel collection. Similar proportions were found among the other age groups and for males. This is a particular issue in Nyabiheke, where fuel collection times were reported to be twice as long as in the other camps, potentially caused by the greater need for firewood of sufficient quality.

The burden of cooking is a gendered issue. Although other family members contribute to cooking activities, women shoulder the majority of the time commitments and responsibilities and significant portions of every day are devoted to both cooking meals and other preparatory activities. Although cooking can be a social activity among family members or with friends, the necessity of spending long periods of time tending stoves and performing other cooking chores compromises the opportunity for people, especially women, to engage in other productive or leisure activities.

Women spend more time than men on cooking and obtaining fuel

Challenges caused by the shortage of fuels

Ensuring that enough fuel is available to prepare meals is a significant and common issue for households in each of the camps. At the time the survey was conducted an allowance of firewood was distributed to residents dependent on the number of people in the household. This was widely considered to be inadequate in meeting the cooking needs of households, with the monthly ration typically lasting around only two weeks. The quantity of distributed firewood has been decreasing for several years, as a refugee representative in Gihembe explained: ‘From 1997 to 2001 each household was supplied with one cubic metre of firewood per month, regardless of the household size. In 2015, the same quantity had to be shared by 16 people. And since 2017, 22 people share one cubic metre. As a result the firewood received by each household runs out after one or two weeks of use.’ Under these circumstances the poorest families and those composed of fewer than around six people are more likely to face cooking energy shortages: they receive a reduced allowance of firewood or cash for buying pellets, but the amount of fuel used for cooking does not vary much with the quantity of food being prepared.

Camp residents face fuel shortages because of the reduced firewood allowance and also from delays in the distribution operations that can amount to up to two months. These delays vary owing to seasonal variations in the climate and, as a result, affect the supply and consumption of firewood and charcoal. In Rwanda the climate is characterized by a dry season from June to mid-September and two wet seasons from March to May and from mid-September to January; during the wet seasons there is limited access to efficient dry firewood and affordable charcoal. Erosion during this period due to the rain can damage both the roads around the camps and the places where firewood is sourced, disrupting the delivery of fuel. Furthermore, when the firewood is delivered to the camp it is stored in the open and exposed to the rain until the distribution period (see Figure 5.8), resulting in camp residents receiving

Camp residents face fuel shortages because of reduced firewood allowance and delays in distribution



Figure 5.8 Bundles of firewood lying ready to be picked up at the firewood centre in Kigeme

inefficient, damp fuel. Households have no option but to accept the wet firewood, unless they are willing to pay for other sources.

Supplying charcoal is an activity generally performed in the dry season and, during the wet season, suppliers are instead occupied by farming activities. During the wet season, charcoal suppliers find it nearly impossible to create charcoal from wet branches, bushes, and trees, and charcoal sellers in the camp stated that they travel more than 5 km from the camp to find suppliers in the host community. This logistical challenge results in shortages, which in turn lead to higher prices across the entire value chain. Another factor that causes increases in the price of charcoal during the wet season is the increased demand: one reason for this is that most of the households in the three camps do not have a covered cooking area, and cooking with firewood is more challenging during the rain than with charcoal. Many refugees sell their wet firewood to buy charcoal that further inflates the price of the latter. Rather than increase the price of a bundle of charcoal, some sellers keep the price the same but instead the quantity contained in a bundle is significantly reduced, as described in Box 5.4.

Most respondents explained that their energy consumption increases during the wet season. In particular, more firewood is used, as wet fuel burns less efficiently, and more fuel is required to prevent the fire from extinguishing. Camp residents shared how this impacts their cooking schedules: to eat lunch around noon requires cooking to begin at around 10:30 in the dry season but 9:00 in the wet season, while beginning cooking the evening meal at 17:00 results in eating at around 19:30 to 20:00 or 20:30 to 21:00 in the dry and wet seasons, respectively.

Another impact of the wet season is that the colder weather demands the use of fuel for heating. Generally camp residents prefer to keep themselves warm by sitting around the stove while cooking, with one explaining

Energy consumption increases during the wet season because wet firewood burns less efficiently

Box 5.4 The varying costs of cooking fuel

The costs of firewood and charcoal, or the quantities provided for the same price, fluctuate throughout the year in response to the availability of supply. In Gihembe a married woman explained,

We are in the wet season now so everything has become expensive. A firewood bundle costing RWF 2,500 (USD 2.91) is now so small that it can be used only three times when we cook beans, and finding it in the camp marketplace is not as easy as outside the camp because firewood sellers delay drying the wood because of the rain. Charcoal has become very expensive due to the increased demand because many of the refugees are cooking inside their homes, since the roofs of most of their kitchens leak. A charcoal sack [larger than a bundle] now costs RWF 9,000 (USD 10.47), but normally during dry seasons it costs RWF 7,000 (USD 8.14).

In Kigeme a group of men spoke about the high cost of fuel: 'In most cases households do not buy a whole sack of charcoal because it is expensive: it costs around RWF 7,000 (\$8.14), so instead they buy a firewood bundle for RWF 2,000 or RWF 3,000 (USD 2.33 or USD 3.49). But we do not know much about the fuel and charcoal prices because women are responsible for the food and cooking in the household.' In Nyabiheke, a group of six women explained, 'During wet seasons, firewood and charcoal are very expensive; the price of a charcoal sack is around RWF 9,000 to RWF 10,000 (USD 10.47 to USD 11.63). The price for firewood and charcoal bought as bundles does not vary but instead the bundles become smaller. And during dry seasons, the price stays the same and the bundles become bigger, while the price of a charcoal sack is RWF 7,000 (USD 8.14).'

The varying costs of fuel also had an impact on the analysis of the household surveys. Respondents were asked to report the quantity of each fuel type they received as donations, collected from the local environment, or bought, and how much money was spent on fuel. The goal of this was to estimate the price of fuels and the expenditure of households but a combination of factors, including the fluctuating seasonal prices and the inability of households to estimate the weight of fuels, made this analysis unviable and instead it is more reflective to turn to the qualitative interviews for this information. Administering a kitchen performance test, as used by the UNHCR Energy Monitoring Framework, would provide a more accurate estimate of household fuel use (UNHCR 2019c).

‘I always feel cold and if possible I keep myself warm, but I can only do this when I cook or when there is some remaining charcoal after cooking.’ This can be especially challenging for people with reduced mobility.

Some households do not have access to charcoal during the wet seasons and have to wait until the rain stops to start cooking. One woman told us: ‘When it rains the whole day, I do not cook and we have to sleep without eating.’ The only other option that remains is cooking underneath a makeshift shelter using the wet distributed firewood, but this is inefficient and uncomfortable as it burns poorly and produces a lot of smoke. One woman informs us: ‘It is exhausting when I cook with wet firewood! I feel stressed when using it because it extinguishes so easily. It is also tiring because I have to blow into the stove constantly, which hurts my eyes and causes headaches. My eyes always turn red.’

Strategies for coping when fuel is unavailable

The lack of fuel for cooking is a persistent and significant issue. Camp residents do what they can to improve the usefulness of the fuel they are allocated. In Gihembe a young woman explained the technique they use to store and dry wet firewood. Households chop the firewood into small pieces and then lay them on a small bed, called an *urusenge*, just above their cookstove (see Figure 5.9) so that the heat from the stove fire dries the wood. Households who have a separate kitchen can use this process and, if the kitchen is enclosed and security can be ensured, the firewood is kept there throughout the night. If not, a household member takes the firewood into their house and stores it underneath the bed. Similarly, an older woman in Kigeme camp had placed firewood on the roof of her kitchen so that the wood would dry faster without being exposed to the mud.

When camp residents have no other option for obtaining cooking fuel they rely on foraging for firewood in the local environment. Foraging is not permitted and refugees risk violence from landowners or members of

With no other option to obtain cooking fuel, some residents forage for firewood in the local environment



Figure 5.9 Firewood laid on an *urusenge* in Gihembe (left) and firewood dried on the roof of a shelter in Kigeme (right)

Box 5.5 The risks of foraging for firewood in the areas around the camps

A group of women in Nyabiheke shared their experiences with collecting firewood in the local environment. 'Foraging is always done by women. We can't send our children into the forests because they are tempted to climb tall trees and are prone to accidents; some children have even died from that. If we forage, it is not because we want to but because we do not have any other option. We are especially afraid to send girls [to the forest] because they can be caught and arrested, and because girls are more vulnerable than boys. As parents we think that they might meet the people who rear cattle, or other bad boys, that might beat them or rape them.'

In the same camp a woman spoke about her husband who died from an accident when he was climbing a tree to cut firewood. 'I go foraging outside myself, I don't send my children because sometimes when they get caught in the forest they are arrested for stealing firewood. As a mother I sacrifice myself for them because I do not want to lose them like I lost my husband. My husband died in 2011, only four days after I gave birth to my seventh child. He had gone to fetch firewood so that he could cook something for me to eat because at that time we were not eating due to the lack of firewood. He went into a forest, climbed a tree, fell from it and died immediately.'

In Gihembe four young women were asked about foraging as they returned to the camp from collecting wood from eucalyptus trees; they carried firewood bundles on their heads while their babies were on their backs. They explained that they went as a group of four as a way of protecting themselves against any harm that they may encounter in forests because sometimes refugees who get caught collecting firewood are beaten and their axes are confiscated. One woman explained their strategy of safety in numbers, 'No one can attack one of us when we are all together because he will think that we can defend ourselves.' When asked why they were a group of women only, they said that foraging is a chore for women as they are responsible for all activities around cooking: 'This is our Congolese culture, no man should cook!'

the host community who also rely on fuel collection from the same area. In Congolese culture foraging and fuel collection are undertaken almost exclusively by women; the small number of male refugees who forage for fuel have been met with stronger resistance from the host community, who reportedly suspect them of cutting down trees to sell rather than collecting fallen branches to meet their basic cooking needs. More details about the risks of foraging for fuel are given in Box 5.5.

In the focus group discussions, respondents described incidents of sexual and gender-based violence (SGBV) during foraging. Two females – a 15-year-old girl and an older married woman – were both victims of SGBV: 'Foraging is so risky but we have to do it because we lack other options for finding the cooking fuels to survive. Women and girls get beaten under the pretext of stealing firewood and their axes are confiscated, they get injured running to escape the forests guards, and a few of them have been raped.' They shared that it is very likely that many cases of SGBV go unreported as the survivors prefer to keep silent to avoid social exclusion, dishonour, and shame. One woman explained, 'I cannot say that it happened to me because, if you say it, you become known by everyone. When you pass people they start murmuring "This girl got raped", and it stains your reputation. You lose confidence and your voice around others, and because of this you cannot find a husband to marry you.'

Aside from foraging, households employ other strategies to cope when cooking fuel is not available. Some may have relatively little impact on personal wellbeing, such as using stoves already heated by other households, sharing resources, using different techniques to dry firewood, and preparing faster-cooking food. Several other common coping mechanisms, however, such as foraging, exchange of food for fuel, reducing portion sizes, feeding only some family members, or skipping meals, could lead to more serious welfare implications.

Around 9 out of 10 households in the camps report that they employ some kind of coping strategy when fuel is unavailable, with a breakdown shown in Figure 5.10. The most commonly reported strategy in both Gihembe and Nyabiheke was to skip meals, used by 73 per cent and

Many cases of SGBV go unreported as survivors want to avoid social exclusion, dishonour, and shame

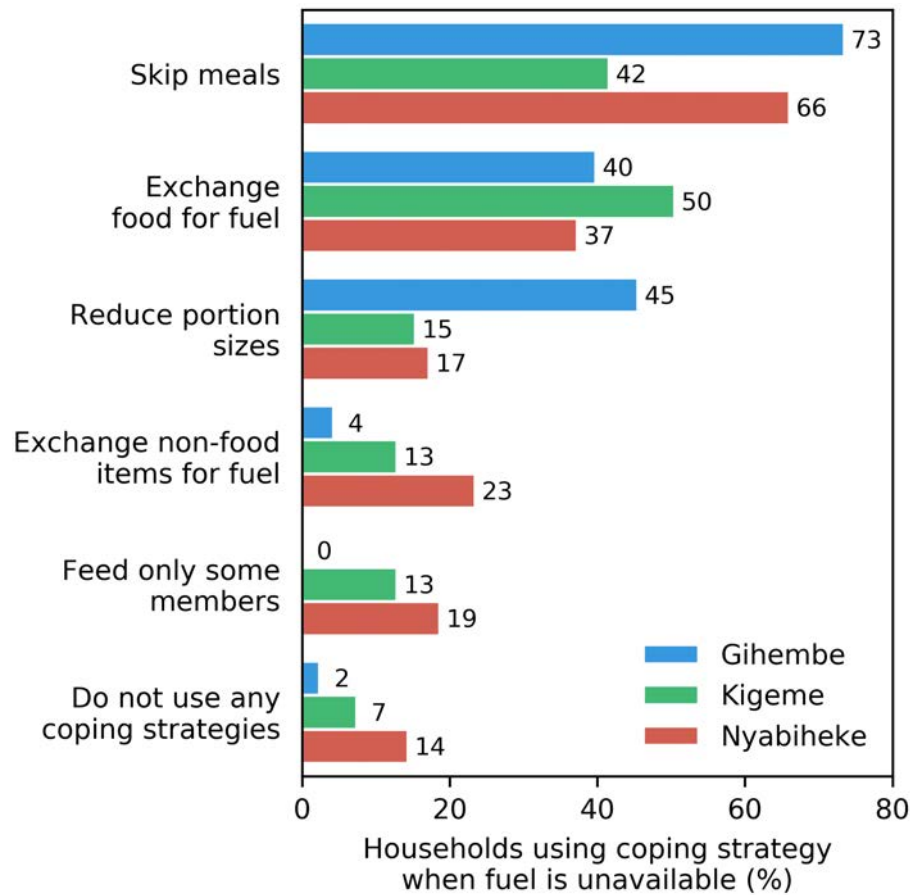


Figure 5.10 The proportions of households that use coping strategies when fuel for cooking is unavailable. Households could report using more than one strategy

66 per cent of households, respectively, when fuel was unavailable, while 42 per cent of those in Kigeme relied upon this method; for the latter camp the most commonly reported strategy was to exchange food for fuel, with half of households doing so compared with around 40 per cent in the other camps. Reducing portion sizes was three times more common in Gihembe, with 45 per cent of households reporting this, than in the other camps but no households reported feeding only some members. In Kigeme and Nyabiheke, however, 13 per cent and 19 per cent of respondents respectively stated that they have used this coping mechanism. Around 1 respondent in 10 reported that they did not use any strategy, despite the options presented here being seemingly exhaustive, but it may be that they chose not to disclose their strategy or were unaware of a strategy used by another household member.

Most of the camp residents explained how they use their cash assistance, designated for the purchase of food, to buy fuel for cooking. One resident stated, ‘When we have a shortage of firewood we spend less money on food and more money on firewood and charcoal. We prefer to eat less but be able to eat cooked food.’ When the firewood distribution is late or charcoal is less available on the market, the prices for cooking fuels inflate but the cash assistance stays the same, which can strain household finances beyond what they can manage. Trading food for fuel, as an alternative to purchasing with cash, exposes families to food insecurity. The decision to exchange food for fuel is most often taken by the female head of household or wife of a male single head of household, with all interviewees saying that, as women are responsible for food preparation, they are the ones who realize the shortage of cooking energy in the family. In some cases the woman would discuss the shortage

of fuel with her husband and older children so that they could take a decision together.

The scarcity of cooking supplies in the camps leads many households to share resources, but the prevalence of this varies between the camps. In Gihembe only around 1 household in 10 shares any kind of resource with other households but this increases to around one in four in Nyabiheke and around half of households in Kigeme. When asked about sharing fuel, food, the cooking area, or stoves, those households in Gihembe that shared any resources reported that they tend to rely on different kinds of sharing in a typical month. Households in Kigeme, meanwhile, were more likely to share their stoves and cooking area but those in Nyabiheke were more likely to share food and fuel.

This could represent a difference in resource stresses: the poorer quality of firewood in Nyabiheke could result in households exchanging wet fuel for dry fuel for more immediate use, for example. In Kigeme the more common occurrence of shared cooking areas and stoves, at 26 per cent and 20 per cent of households, respectively, may be caused by the relative prevalence of improved stoves: these stoves are generally less well suited to slow-cooking foods such as beans, and so sharing stoves could allow fast- and slow-cooking foods to be cooked more efficiently. Kigeme is the camp with the greatest proportion of households using improved stoves, some of which come with minimum usage requirements as part of participation in the schemes, so households may have developed strategies to optimize the usefulness of their mutual resources. Finally, in Gihembe, the relatively small proportion of households reporting that they share resources may indicate that the needs of that segment are widely unmet, while the majority are relatively satisfied; on the other hand, it may reflect a minority of camp residents choosing to share resources to maximize their benefits.

Some camp residents exchange one form of fuel for another. This is common in households that do not have separate kitchens and prefer to use charcoal for cooking inside their homes. These households trade firewood for charcoal, but the firewood is bought from them at very low prices. A household of five people could sell two weeks' allocation of firewood for around RWF 600 (USD 0.70), for example, but the cost of the charcoal that would be used in its place would cost around RWF 2,000 (USD 2.33). An alternative to trading food or fuel is to take out loans or to go in debt with fuel sellers, but this leads to a vicious cycle: 'When we run out of food [after trading food for fuel] we go to the bank agent, who is sometimes also the businessman that sells food, and we ask him or her for a loan to buy food', one respondent explained. 'Then we sell some of the food we bought to buy charcoal to cook it. We then have little food, little fuel and are in debt.' These issues are exacerbated in the wet season, as described in Box 5.6.

While the strategies differ between households and camps, each coping mechanism poses a potential threat to the safety of refugee households. Camp residents are provided with sufficient allowances for long-term subsistence, but any reduction in these modest resources could compromise their nutrition; skipping meals, exchanging food for cooking fuel, and reducing portion sizes all therefore represent instances where household members go without food and, in doing so, potentially compromise their health and wellbeing. The analysis here only considers coping strategies for the unavailability of fuel, but other causative factors, for example unexpected expenditures or changes in household circumstance, could also create scenarios where coping strategies are required. Similar coping mechanisms were reported by Alloush et al. with regards to food security: 60 per cent of households in Gihembe were found to be food secure but only 39 per cent of those

Scarcity of cooking supplies in the camps leads many households to share resources

Skipping meals, exchanging food for fuel, and reducing portion size can compromise health and wellbeing

Box 5.6 Exchanging of food for fuel during the wet season

In Gihembe refugee camp a group of six young women aged between 19 and 23 shared: ‘Many of the kitchens leak when it rains because they have bad roofs, mostly made of damaged or older plastic sheeting bags. Because of that, many of the households have to buy charcoal with the money from their cash assistance so as to cook inside their houses.’ As firewood is used up faster during the wet season, most of the refugees sell their food provision to buy charcoal. The women gave examples of this:

To measure the quantity of corn flour, we use a big bowl that normally measures 1.5 kg but they pay us as if it is 1 kg. For something that costs RWF 1,000 (USD 1.16) per kilogram, they pay us RWF 850 (USD 0.99) per 1.5 kg. And because of this our food finishes faster. And then we return to the business owner or bank agent to get other food on credit that will then have to be paid back with a higher interest rate: for a rice sack of 25 kg bought on credit we pay RWF 23,000 (USD 26.70), while it actually costs RWF 21,000 (USD 24.40). If paid cash, a kilogram of cassava flour costs RWF 500 (USD 0.58) but on credit we pay RWF 600 (USD 0.70). Also during this period refugees delay eating; for example lunch is eaten at 14:00 while it is normally taken at 12:00. And because wet firewood causes headaches, most of the refugee households cook and eat once per day to save on firewood.

in Nyabiheke and 14 per cent in Kigeme, even though at the time of that study Kigeme was still receiving direct food aid (Alloush et al. 2017). The same study also found that the most common coping strategies were eating less preferred meals, skipping meals, and reducing portion sizes. Resolving fuel resource scarcity would not eliminate the occurrence of these kinds of coping mechanisms, but would likely help to reduce the frequency with which they are used.



ENERGY FOR ENTERPRISES, BUSINESSES, AND LIVELIHOODS ACTIVITIES

Section summary: Energy for productive uses and livelihoods

Enterprises in the camps have greater access to energy than households – most likely owing to their higher spending power and the revenue creation effect electricity can have on their businesses – but the opportunities for productive livelihoods remain limited. Below is a summary of this section:

- The survey included 155 enterprises across the three camps.
- There is a diverse range of livelihoods, but 89 per cent of the businesses are located in homes around the camps.
- Seventy-five per cent of businesses use some form of electricity – a higher proportion than households use.
- Small-scale technologies such as solar home systems allow many small shops and petty traders to offer key services, such as phone charging, and to use lighting to extend their business hours.
- There are a small number of opportunities related to energy for cooking, such as selling charcoal and making stoves.
- The co-location of enterprises and households can provide electricity access in both domestic and business settings.

This section describes how energy is used among businesses and for entrepreneurial activities in the camps. The first section provides an introduction to how energy is used as a key facilitator of economic growth and productive livelihoods. This is followed by a description of the business activities that exist in the camps and a presentation of the lighting and electricity sources used by enterprises. We then show some of the ways that cooking fuel is used for livelihoods activities and discuss the electrical appliances that are used by businesses to generate an income.

Energy as an enabler for livelihoods activities

In a speech highlighting the importance of the Sustainable Energy for All agenda, the then Secretary-General of the United Nations, Ban Ki-moon, declared, 'Energy is the golden thread that connects economic growth, social equity, and environmental sustainability' (United Nations Meetings Coverage and Press Releases 2012); this statement is as pertinent in situations of displacement as it is in the wider global community.

Among other factors, such as the legal right to work and access to training and financial support, access to energy for income-generating activities can help refugee communities build resilient economies and increase self-reliance (UNITAR 2018). This is in line with the aims of both the global CRRF and national host governments, including the government of Rwanda. MINEMA and UNHCR have committed to a Joint Strategy for the Economic Inclusion of Refugees in Rwanda, which aims to transform refugee camps into vibrant economic and social centres, creating jobs for both displaced people and members of the host community and ensuring that they are able to 'fulfil their productive potential as self-reliant members of Rwandan society who contribute to economic development of their host districts' (UNHCR 2016a).

Energy can provide a spectrum of support to refugee enterprises. At the most basic level, access to even the simplest lighting technologies can extend the opening hours of shops and community lighting in public spaces can facilitate marketplaces operating after sunset, as customers feel safer in the illuminated environment. Simple electricity services, such as phone charging or powering televisions, can be used to create businesses, especially when customers lack the means to access them in their homes. Appliances that typically have higher electricity requirements, such as sewing machines, power tools, computers, and refrigerators, offer greater potential for productive uses and income generation but generally require a reliable source of power beyond the means of simple solar products such as solar home systems. Energy for cooking, too, offers a number of business opportunities: food service outlets such as restaurants, bars, and cafés rely on energy for heating food and boiling water, and typically at scales greater than found in refugee households. Building cookstoves for camp residents and selling fuels in the camp marketplaces can offer an income stream to women in particular, who are viewed as the most knowledgeable regarding household cooking needs. Finally the provision of energy to enterprises can be a business itself, either by national companies operating in the camps or refugee entrepreneurs providing connections to other residents, such as the minigrid operators in Kakuma Camp in Kenya (Rosenberg-Jansen et al. 2018).

Access to energy can allow entrepreneurs to build their businesses, expand their operations, and create more employment opportunities. When supported by financial and skills training these opportunities can help create a new source of income for refugees, decreasing their reliance on support from the camp authorities and increasing their capacity for self-dependence. As with energy access in households, however, businesses in humanitarian settings have generally not received enough support to extend energy provision beyond a small number of users, and so greater focus and resources will be necessary to bring equitable and widespread energy access to livelihood activities.

Access to energy for income-generating activities helps build resilient economies and self-reliance

Greater focus and resources are necessary for equitable and widespread energy access for livelihood activities

The range of enterprises and businesses in the camps

A diverse range of enterprises exist in each of the camps, allowing residents to access a range of services, from day-to-day necessities like small shops and phone charging points to enterprises such as tailors and hairdressers. The majority of businesses operate from within the homes of the respondents. This may be the result of several factors, including the lack of available space in the camps for dedicated shops or buildings for enterprise use, and the convenience of running a business from within one's own home. Furthermore, small home businesses can take advantage of using a single power source for both commercial and domestic purposes. Some businesses, however, such as mobile kiosks for phone charging, operate outside buildings as standalone units. Most businesses in the camps are small, have just one or two staff members, and occupy two rooms of the dwelling or building. A breakdown of the locations of businesses is shown in Table 6.1.

Unlike the number of households, the total number of enterprises in the camp is not recorded by the camp authorities; those in dedicated buildings, especially near the administrative centres of the camps, are straightforward to identify, but with a far greater number operating from private dwellings it is impossible to know how many more small businesses are located in each camp. The survey enumerators endeavoured to find as many businesses as possible within the allocated surveying period and, although it is impossible to know how many more exist, the sampled population of businesses is likely to reasonably reflect the situation in the camps.

Table 6.1 also shows the types of enterprises in each camp. Almost half of businesses are engaged in petty trade of basic goods and phone charging, and one in five are more established restaurants or bars serving food and drinks. A small number of tailors and sewing businesses are present in Gihembe and Kigeme while farming activities are more common in Nyabiheke; a mixture of other enterprises such as food sellers and hairdressers also operate in the camps.

Businesses were invited to report their approximate monthly revenue, but owing to the small number of respondents for businesses of each type

Almost half of businesses are engaged in petty trade of basic goods and phone charging

Table 6.1 Breakdown of enterprise locations and types in the camps

Camp	Breakdown of enterprises surveyed			
	All	Gihembe	Kigeme	Nyabiheke
Number of enterprises surveyed	155	64	54	37
Enterprise location (%)				
Respondent home	89	86	87	97
Dedicated building	5	9	4	3
Not in a building	6	5	9	0
Enterprise type (%)				
Retail/phone charging	46	48	48	41
Restaurant/bar	20	27	17	14
Food shop	11	6	20	5
Tailor	9	11	11	3
Farming	5	2	2	16
Hairdresser	4	5	2	5
Other	5	2	0	16

Box 6.1 Entrepreneurial activities supported by NGOs

A small number of enterprises and refugee associations receive support from either the camp authorities or other NGOs to help them sustain or grow their businesses. An example of this is the Inkomoko entrepreneur development programme, funded by UNHCR, Mastercard, and other partners, which helps refugees in Rwanda start and grow businesses in different sectors, such as agriculture, food services, wholesale, retail, and fashion. In 2017, Inkomoko supported refugee businesses in creating 2,492 jobs and the organization continues to provide training to refugee entrepreneurs in camps, with the goal of helping refugees become more self-reliant, improving their businesses and living conditions, and creating more jobs.

A women's cooperative in Gihembe operates a large community meeting room that is used for training and leisure activities, for example watching football matches on a television, for which they charge a fee. In Nyabiheke, meanwhile, UNICEF supported a carpentry workshop by providing training and tools to make furniture – for example chairs that are sold for RWF 5,000 (USD 5.81). The workshop has a connection to the institutional minigrid and the operator employs one staff member and three apprentices.

A lack of electricity access can make it difficult to sustain a business. A repairman in Gihembe was trained by a local NGO and started a business with three other men, using electricity from the camp minigrid to use a soldering iron, but now works alone: 'We bought the tools to repair broken appliances but all three of my partners have quit. There is not much money in repair and the materials we used are all damaged, there's no way of getting good quality materials here. I don't pay for electricity since I don't earn enough. I mostly repair torches, radios, and phones; I run this business because I like it, but if I were given other opportunities, I wouldn't hesitate to leave this business and take them.'

in each camp, and the fact that official bookkeeping practices are not common, these figures are uncertain for many enterprise types. For small retailers and phone charging businesses, however, there are sufficient samples to gain an indicative insight: in Gihembe respondents reported average monthly revenues of RWF 20,500 (USD 23.83), in Kigeme this was RWF 17,500 (USD 20.34), and in Nyabiheke RWF 24,500 (USD 28.48). Five respondents in Kigeme, who reported monthly revenues of greater than RWF 100,000 (USD 116.28), were discounted as either outliers or potential recording errors.

Aside from a small number of activities supported by the camp authorities and NGOs, (see Box 6.1), these enterprises are generally small operations and are limited in scale for a number of reasons, including limited access to both electricity and financing. At the time the survey was taken most businesses had not accessed any kind of financial support such as grants, loans, or microfinancing schemes. The most common form of financial service in use was found to be loans from other camp residents, either from a private source or from cooperative groups: around one-third of enterprises in Nyabiheke had accessed this resource, compared with 1 in 10 in Kigeme and a negligible proportion in Gihembe.

Lighting and electricity for businesses and enterprises

Access to electricity among enterprises is both more common and reaches higher levels than households; a breakdown of the sources used by businesses in the camps is shown in Table 6.2. A sizeable minority of enterprises, around one in four, across all of the camps do not use any electricity source for lighting or business operations. This could be as a result of electricity technologies being too expensive or because affordable solutions are unviable or irrelevant, for example lighting for agricultural purposes. The proportion of businesses with solar home systems is three times higher than for households, but this varies between the camps: in Kigeme they are more than four times more prevalent, but were reported

Around three in four enterprises use electricity for lighting or business operations

Table 6.2 Breakdown of enterprises primarily reliant on each electricity and lighting source

<i>Camp</i>	<i>Breakdown of lighting sources (% of enterprises)</i>			
	<i>All</i>	<i>Gihembe</i>	<i>Kigeme</i>	<i>Nyabiheke</i>
<i>Primary source of electricity or lighting</i>				
None/non-electric	25	25	20	32
Rechargeable battery	5	3	8	5
Solar lantern	28	14	39	32
Solar home system	27	34	23	22
Minigrid	15	23	9	8

at similar levels in Gihembe where access among households is more common. The relative ownership of more basic electricity technologies, such as rechargeable batteries and solar lanterns, was also greater among businesses. Some enterprises had connections to the minigrid supplying power to institutional users, including in Gihembe and Kigeme where no domestic connections were reported; this system offers significantly higher levels of electricity access for productive purposes in comparison with more basic commercially available options.

Business respondents were asked about the applications they use energy for, with the most common response being lighting: almost every enterprise stated a requirement for it and, of those, three-quarters already had access to it. This suggests that lighting services are relatively accessible to businesses, with only one in six reporting high prices as the reason for not using lighting already, although this includes the use of basic products such as solar lanterns. The next most common application was electricity for phone charging and entertainment: 23 per cent of businesses across the camps have access to this already, but a further 49 per cent stated that they require it. Considering each camp individually, a total of 85 per cent of businesses in Kigeme and 78 per cent in Nyabiheke stated a need for these services but only 56 per cent in Gihembe, perhaps reflecting the increased domestic ownership of solar home systems that reduces the need for customers to access these elsewhere.

The most common reason given by those who required, but did not have access to, phone charging and entertainment services, was that they are too expensive: this could be the result of higher prices charged by many suppliers for entertainment services, or potentially that business owners think supplying these services is unlikely to generate a return on their investment.

Very few respondents stated that either lighting, phone charging, or entertainment services were unavailable or inadequate. Around two-thirds of respondents in Kigeme and Nyabiheke, and one-third in Gihembe, stated a need for heating applications such as for cooking; this service was also generally considered to be too expensive, but in addition several respondents stated it was unavailable in the camp, most likely reflecting the scarcity of fuel. However, this could be a misinterpretation on the part of the respondents when considering energy access in their homes in general rather than their business activities only. Finally, on the subject of energy for cooling, such as for keeping food fresh, similar responses – that it was required but too expensive – were given with the exception of Gihembe, where only a small number of enterprises stated a need for it.

Greater levels of electricity access among enterprises compared with households are to be expected: firstly, businesses will typically have greater access to disposable finances compared with the majority of camp

Box 6.2 Unreliable electricity access limiting businesses

The enterprises in Gihembe that have minigrad connections receive higher levels of power than those with other sources of electricity, but experience different problems. ARC does not charge many of the users of electricity for their consumption, but does control the hours when it is available. A shoemaker in the camp described how it affects his working hours: 'I'm happy using ARC's electricity since I don't have to pay and I can earn more income, but the only problem I face is that electricity is not always available. It's usually cut off early at 16:00, and sometimes from 12:30 to 14:00 too, so I work from 9:00 and have to stop at 16:00.'

A barber in the same camp works with three others in a salon housed in a room provided by ARC, which also supplies them with free electricity. They also experienced problems with electricity supply affecting their work: 'The only problem we face is a sudden power cut, and since there is sometimes a long delay, our clients prefer to go outside the camp to a salon with grid electricity. If a power cut happens in the middle of a haircut then we give them a hat to wear while they wait for the electricity to come back on, or they have to come back the next day.'

households without a wage-earning occupation. Secondly, using electricity services to promote a business or extend its opening hours, for example lighting in shops, or for entrepreneurial activities such as production, can incentivize investment in an energy technology. Those with a connection to the camp minigrads can access a higher quality of electricity and provide additional services, but complain of limitations in the duration of the supply (see Box 6.2).

When considering that the majority of enterprises operate from within household dwellings, these business activities can also provide further benefits to camp residents: a solar home system used for a household shop, for example, can also provide electricity access to the family that lives there. The relative prevalence of this technology among both households and enterprises in the camps likely contributes to the current perception that energy for lighting, phone charging, and entertainment applications in businesses is widely accessible, albeit expensive for some; this contrasts with the perception that energy for heating and cooling applications are generally prohibitively expensive or unavailable.

While it is possible to conclude that households operating businesses have a greater level of electricity access in general, it is not possible to establish the causative link in this relationship. If households with wage-earning heads of households are compared with enterprises: in Gihembe more households had access to a solar home system, but in Kigeme more enterprises did, and in Nyabiheke access levels were approximately equal. Domestic ownership of a solar home system may be an enabling factor for establishing a home business and providing a source of income, but many other factors not explored by this survey are also likely to play a role.

Energy for cooking as a business opportunity

There are also livelihood opportunities related to energy for cooking, with the most common being selling fuel. As described earlier, in all three camps a number of people sell charcoal to overcome shortages of firewood, with a two-week supply for five household members costing around RWF 2,000 (USD 2.33). There are also entrepreneurs who focus on cooking technologies, making cookstoves for households. A businesswoman in Gihembe, for example, learned how to make improved cookstoves after visiting Kiziba, a refugee camp in Western Province, in 2005: 'When I first started making stoves the first one failed, but I kept practising and the second stove I made was in use for one and a half years! From that stove on other women in the camp asked me to make their stoves, my clients

Using electricity services for entrepreneurial activities can incentivize investment in an energy technology



Figure 6.1 A close-up of the oven in Kigeme showing where bread is cooked (left) and the entrance to the firebox that fuel (firewood) is fed into (right)

Entrepreneurs capitalize on the scarcity of cooking resources by offering food products in the camps

like them because they release the least amount of smoke.’ She charges RWF 1,000 (USD 1.16) for each stove that she makes, saying that her clients prefer her stoves – which use less firewood – than their more basic counterparts.

As previous sections discussed, cooking in households in the camps is severely constrained by the lack of available stoves, fuels, and space. This presents an opportunity, however, for entrepreneurs to capitalize on this scarcity by offering food products in the camp that would otherwise only be available in the host community. A young man in Kigeme worked in a bakery in the host community after completing secondary school in 2016, and realized that the food service businesses in the camp sometimes suffered shortages of products, as host-community bakeries would supply the local demand first. He built an oven made from materials brought in from outside the camp, shown in Figure 6.1, and now has a successful bakery business providing customers in Kigeme with breads, doughnuts, biscuits, and cakes.

Electricity can also be beneficial for restaurant businesses, with one proprietor in Nyabiheke explaining how she was the first to use electricity for her business. A connection to the camp minigrad allowed her to use a kettle to boil water but also facilitated a range of secondary services that helped her business, such as lighting, bringing in customers and encouraging them to stay for longer. As her restaurant is connected to her home, she also related how her children spend more time with her in the restaurant rather than moving around the neighbourhood at night.

Access to energy for cooking among enterprises, as with households, is limited. Enterprises experience many of the same problems as domestic users of energy for cooking and, in particular, a lack of fuel that stifles opportunities to build a sustainable business. Some entrepreneurs have been able to establish successful trades, but energy for cooking currently lags significantly behind the opportunities that are offered by even modest electricity services.

Box 6.3 Gendered access to electricity for entertainment

Interviewees shared that it is almost exclusively young men who pay for entertainment services such as watching movies or football matches. There are no large cinemas inside the camps, so small informal cinema halls and TV-watching businesses can provide this service for a fee. In Gihembe a 20-year-old woman explained her negative view of them: ‘I never watch television, only boys go watch movies and football matches in cinema halls. Because of this most of the youth adopt bad manners such as getting drunk and coming home late at night, after 23:00. There are some girls who used to go out with them, but many of them got an unwanted pregnancy.’

In 2017, the youth centre in Nyabiheke was donated a subscription to the television service Canal+. The first six months were free of charge, after which the subscription was handed over to the youth committee, who charged RWF 50 (USD 0.06) to watch a football match or a movie. ‘The TV now primarily shows sports, as that is what our youth wants to watch’, a representative of the youth committee explained, ‘This is something for young men to do, it keeps them from getting into trouble. Women do not come here so much as they are busy at home after school and in the evening. So we tune into what the men want to see.’ These testimonies reveal that, although energy for entertainment is available in public spaces in the camps, it is the domain of men only, while women gather in households instead. A woman in Nyabiheke shared: ‘It is not that I do not want to watch movies, but it is more for men. I do not have the money and the time to go and sit and watch movies, I have younger siblings and there is a lot that has to be done for them.’

Appliances for income generation

Appliances used by enterprises are typically basic and have low power requirements. After electric lighting, the most common appliance across all of the camps was found to be the phone charger, used by around half of all enterprises in all camps. This reflects the importance of this service both to camp residents, the majority of whom are in need of a place to charge their phones through lack of electricity access in their homes, and enterprises to whom it is a reliable source of income. This may be affected, however, by an increase in domestic solar home system ownership, which would reduce the need for camp residents to charge their phones outside their households. The proportion of enterprises using phone chargers exceeds the percentage that classified themselves as phone-charging businesses: this suggests that charging is a beneficial auxiliary service that can be provided either for their customers or staff alongside the main business activities – as it has a relatively low power demand is unlikely to impact their other operations.

Radios, which also have low power requirements, were present in around one-third of enterprises but the data gathered by the surveys does not show whether radios are used to attract customers or simply as a benefit of having access to electricity. Televisions are the next most prevalent appliance but were used by only around 1 in 20 businesses across all of the camps; these offer a greater potential for income generation, through charging customers to watch programmes or films, but their relatively high costs likely contributes to their scarcity. As described in Box 6.3, these entertainment activities are generally limited to men only. Other appliances were reported in negligibly small proportions.

The appliances that enterprises use are limited by the energy technologies they have access to. Basic solar home systems, rechargeable batteries, and some solar lanterns can supply low-power services such as lighting, phone charging, and radios, while appliances such as televisions often require more expensive solar home systems, which are less common in the camps. The availability of technologies enables enterprises to perform a number of productive activities, but the highest level of energy access, necessary for businesses such as skilled trades, is limited only to those with connections to the camp minigrids. The restriction of these connections to only a handful of enterprises constrains the overall opportunities for diverse kinds of income generation. Among other enabling factors, the solution relies on the availability of higher levels of energy access.

Appliances used by enterprises are typically basic and have low power requirements

High level energy access, necessary for skilled trades, is limited to those with minigrid connections



ENERGY FOR CAMP OPERATIONS, COMMUNITY FACILITIES, AND INSTITUTIONS

Section summary: Energy access for community facilities and institutions

Energy is essential for providing critical camp services such as healthcare and water, and energy access among institutions is the highest in the camps, but community facilities not connected to the camp minigrids have very low energy access. Those with high levels of energy access source their power from the national grid network and diesel generators,

the latter of which are expensive and produce high levels of greenhouse gas emissions. The key results of this section are:

- There is a stark contrast in levels of energy access between camp institutions and community facilities that have connections to the camp minigrids, and those that do not.
- The camp minigrid networks provide high levels of energy access but are supplied by either or both of the national electricity grid and diesel generators, resulting in high levels of greenhouse gases.
- A lack of public lighting in communal areas, particularly around WASH facilities, is a concern for refugee communities.

This section describes how energy is used among institutions and community facilities in Gihembe, Kigeme, and Nyabiheke. The next paragraph provides an introduction to institutional energy use in humanitarian settings followed by a presentation of the types of community facilities present in the three camps. We then describe the levels of energy access among these facilities and present the appliances that are used to provide core services to the camp communities.

Powering essential services in situations of displacement

Energy is essential in providing core humanitarian services to displaced communities, such as healthcare and the supply of water for drinking and sanitation. Other key services run by the camp authorities use electricity to make their operations more effective or efficient, such as administrative and communications equipment in office buildings or at food and fuel distribution centres. Operating health centres and water pumps would be impossible without a connection to a high-power source of electricity that, in many situations of displacement, is sourced by a diesel generator; this can incur significant costs and is a source of greenhouse gas emissions.

A 2018 report by Chatham House, *The Costs of Fuelling Humanitarian Aid*, investigated the spending of international agencies on operational and logistical energy use in humanitarian settings (Grafham and Lahn 2018). A large contribution to this spending is the use of diesel generators for onsite electricity generation to power institutional offices, water pumps, health and educational facilities, and temperature-controlled storage of food and equipment in warehouses. The report estimated that in 2017 about USD 1.2 billion was spent by these agencies on diesel, petrol, and other associated costs such as maintenance of generators. These agencies are heavily dependent on fossil fuels and often have few incentives to conserve fuel or to change their current practices, despite the fact that the use of renewable energy solutions would reduce their expenditure and energy-related greenhouse gas emissions.

Grafham and Lahn estimate that through the use of currently available best practice and recent technology, the humanitarian sector could save 60 per cent on electricity generation costs and 10 per cent on transport costs, as well as 37 per cent from changes in behaviour and the use of more efficient technologies. These potential savings amount to over USD 517 million a year for the sector, roughly equivalent to 5 per cent of UNHCR's 2017 funding gap. The report recommends a '3M' strategy to help humanitarian agencies reduce their spending on fossil fuel use in refugee settings: measuring – collecting energy use and emissions data; monitoring – reporting on data and identifying where quick improvements with short payback periods can be made; and motivating – introducing targets on emissions reduction as key performance indicators

Energy is essential in providing core humanitarian services to displaced communities

Access to electricity for lighting and equipment can provide higher quality education to schoolchildren

and encouraging entrepreneurial activities by country teams, such as partnerships with firms providing renewable energy services and cooperation with other agencies.

Other institutions in situations of displacement require energy access to improve the service they provide. Access to electricity for lighting and equipment such as computers can provide a higher quality of education to schoolchildren and, although refugees in Rwanda have the right to attend schools in the host community, primary education for young children is provided in the camps themselves. Institutions such as community centres providing valuable spaces for meetings, training, and socialization can extend their opening hours with greater access to space lighting, and religious services in churches and mosques can be facilitated with audio equipment. Limited access to energy in these spaces limits the potential for refugees to engage in social, educational, and recreational activities.

Types of community facilities providing services to refugees

UNHCR, MINEMA, and the partner NGOs working in the camps rely on electricity to implement their services for camp residents. Office buildings, health clinics, and distribution centres for food and fuel are normally located together in a central location, but many institutional buildings are dispersed around the camp; schools, community centres, and religious buildings are distributed far from the administrative centre and, as a result, are too dispersed to be connected to the minigrid. The location of water pumps is different in each camp, but refugee communities access drinking and sanitation at one of many local distribution points and WASH facilities around the camps. Most community facilities serve the needs of refugees only, but a small number also serve members of the host community and staff from UNHCR and other NGOs.

The sample size of the quantitative surveys is much smaller than that for households and enterprises, and is naturally limited by the small number of relevant institutions in the camps. Furthermore, while two community facilities may both provide important services to refugees, there is a significant difference between the energy requirements of a camp health centre and a school, for example. The next section aims to present the energy issues of a range of institutions but, as will be discussed, the variations between community facilities often outweigh the similarities.

Institutional lighting and electricity

Institutional access to lighting and electricity in all of the camps is most decisively split between those facilities with a connection to the local camp minigrid and those without. In Gihembe and Kigeme, electricity is sourced from both a connection to the national grid network and a diesel generator; in Gihembe grid power is used during the night only and is the sole source of power for water pumping. ARC, who manages the health centre, uses a diesel generator to provide power during the day to ensure continuity of supply; the generator is operated for eight hours per day and staff reported using 20 litres of fuel per day at an estimated cost of RWF 618,000 (USD 720) per month for 600 litres of fuel. In Kigeme, meanwhile, grid electricity is the primary source of power and almost all of the surveyed community

facilities using electricity currently rely on it. Previously, however, diesel power was used for water pumping; transitioning to using grid electricity reportedly lowered costs from RWF 600,000 (USD 700) per month to RWF 500,000 (USD 580) and eliminated the use of 600 litres of diesel.

The institutional minigrid in Nyabiheke is supplied by two diesel generators, of which only one is used at a time, and power is available for 24 hours per day when the system is operational. Unlike the other camps, Nyabiheke does not have a connection to the national grid network. Staff reported diesel fuel consumption of 120 litres per day, or 3,600 litres per month, with a cumulative monthly cost estimated at RWF 3,900,000 (USD 4,500). Despite two generators being available, maintenance issues affect both their overall reliability and the consistency of service, resulting in periods of downtime where no electricity is available in the camp. The MINEMA office, at the edge of the camp and far from the other institutions, has a connection to the national grid but this does not extend to any other users.

Those with these connections are afforded very high levels of electricity services, but those without have little or no access. Some schools, religious buildings, and community centres in all of the camps rely on solar lanterns or solar home systems for simple electricity services, or receive no power at all. A school representative in Nyabiheke explained that the lack of electricity in their school was a barrier to participating in national education programmes – such as ‘one laptop per child’ initiatives – and a head teacher in Gihembe said that the absence of power caused students to drop out. Although the school had power in the past, when the NGO providing a connection left the camp and took the generator with them, the school was left without electricity and unable to light classrooms and charge laptops. In Kigeme, on the other hand, the primary and secondary schools have a reliable connection to the electrical grid that is paid for by the government. Appliances such as computers and photocopiers help with teaching, and lighting classrooms at night allows teachers and students to work in the evening, improving their opportunities to revise for competitive national exams.

Finally, there is no public space lighting in communal areas such as marketplaces and WASH facilities, nor on access routes around the camps. As described in earlier sections and Box 7.1, a lack of lighting can lead to a number of issues and reduce the perception of safety around key facilities and the wider camp after nightfall, as well as potentially limiting the usage of marketplaces and gathering spaces for social activities in the evening.

Many schools, religious buildings, and community centres rely on solar lanterns or solar home systems

Box 7.1 The need for better lighting at WASH facilities

A group of six women shared their experience of using public WASH facilities in Nyabiheke: ‘We usually use phone torches or burning sticks to avoid stepping on faeces or into the toilet hole, but sometimes people use nothing as households only have one torch which must be left at home. Children are scared of going in the toilets at night and so go outside or at the entrance. It would be better if the toilets were lit.’ There was a similar sentiment among a group of adult men in the same camp, who said that they used to share mobile phones for lighting when going to use the WASH facilities but had to stop after several phones were stolen.

Theft is not the only crime that occurs at the WASH facilities. Women in Kigeme explained how young women are afraid of going to use the toilets at night: the threat of sexual and gender-based violence is perceived as a significant issue, as potential assailants can easily hide in the unlit facilities. They also highlighted the risk of falling into the latrines, an issue that is exacerbated for those less able to move such as disabled or elderly people.

Institutional buildings with minigrid connections have access to a greater range of appliances

Appliance ownership among community facilities

Institutional buildings with a connection to the camp minigrids have greater access to a more diverse range of appliances than either households or businesses. The availability of standard electrical outlets in the offices and health centres allows staff to use appliances such as computers, printers, projectors, and other typical office equipment. Some high-power appliances, such as kettles, are also used. The consistent supply of electricity also facilitates the use of refrigerators – critical to the safe storage of vaccines and other medication – and schools with minigrid connections in Kigeme are able to use computers and photocopiers to aid their teaching.

Community facilities without a connection, however, have low levels of energy access and appliance usage. Particularly in Nyabiheke where a greater proportion of the schools, religious buildings, and community centres do not have a connection, the use of solar home systems provides basic lighting and phone charging services but does not allow the more energy-intensive appliances used elsewhere, such as computers. Other facilities, however, have no access to electricity. A pastor in Nyabiheke explained that his church used rechargeable lead-acid batteries for a music sound system for their choirs, but stated that the cost was high, at between RWF 1,200 and RWF 2,000 per week (USD 1.40 and USD 2.33); he also said that the businessmen charging the batteries outside the camp often did not recharge them fully in order to maximize the number of customers.

Box 7.2 Energy access for host community facilities

Many of the community facilities present in the camps have counterparts in the host community and some of these, such as schools, serve both refugees and the local Rwandese population. In Gihembe the host community facilities close to the camp have been served by a reliable connection to the national grid for many years and receive power throughout the day. The situation is similar for both Kigeme and Nyabiheke, where almost all host institutions have access to the grid, but some reported issues with supply reliability and used a diesel generator as a backup when required. Some representatives of host community facilities expressed a desire for new electrical appliances, such as computers, to improve their services, and others mentioned the potential for solar electricity to lower their running costs. While host community institutions currently have superior access to electricity compared with those in the camp, it is important to be mindful that any activities perceived as raising levels of camp facilities above those in the host community may be viewed unfavourably and cause tensions with local residents.

Institutional-scale cooking is limited to schools in the camps. Large cookstoves are used to provide meals to schoolchildren and were provided and are maintained by funds from the WFP. Feeding programmes for primary school children in the camp are implemented by ADRA, while students in secondary schools fall under the programmes administered by the government of Rwanda. This is an example of how access to energy, and the benefits it can provide, is not necessarily geographically isolated: refugees are able to access many of the services provided in the nearby host communities, including education and healthcare, and so it is important to also consider institutional energy use outside the camps when assessing overall levels of energy services to which refugees have access (see Box 7.2).



THE ENERGY NEEDS AND PRIORITIES IN REFUGEE CAMPS IN RWANDA

Section summary: Energy needs and priorities in Gihembe, Kigeme, and Nyabiheke

Incorporating displaced people into the design process of potential energy interventions can help to ensure that the solutions address the most important energy needs. By analysing the priorities reported by survey respondents, and through a co-design process with stakeholders, the RE4R project will implement the four energy interventions:

- Camp residents ranked energy for households as the most important energy need to be met, but also ranked the needs of community facilities highly.
- Camp residents ranked working at home and studying as the most important reasons for needing electric lighting in the home.

- Respondents reported that improved public lighting was needed on the roads around the camps
- Enterprise respondents reported a need for basic electricity services such as lighting and entertainment.
- Community facilities and institutions with connections to the camp minigrids report that their needs for electrical appliances are well met.

This section presents the energy needs and priorities reported by survey participants and the interventions that aim to address them. The next part describes how these needs and priorities were included in the intervention design process and is followed by a report on the findings among household and enterprise respondents, respectively. Considering community needs, we present the opinions of camp residents as to where improved public lighting is needed, and report the situation for community facilities and institutions.

Incorporating the needs of refugee communities in intervention design

Data collection, surveys, and interviews can be used to gather information about the status of energy access in refugee camps, but the opinions and priorities of displaced people themselves are often overlooked when designing potential solutions. In acknowledgement of this, respondents were asked to share their opinions about energy needs and to rank those that they considered to be areas of highest priority. These results were analysed by allocating the most ranking points to the highest priority area for each respondent, then averaging these points over all of the respondents to establish an overall rank for that area for each camp, with rank 1 representing the highest priority. This method is inherently dependent on the individual priorities of each household and respondent, whose situations may vary considerably, but gives a reflective categorization of the relative needs and priorities across the camps. These can then be taken forward into identifying the solutions with the greatest potential for impact.

The stated priorities of the refugee communities, and the other information included in this report, were presented to the attendees of an intervention design workshop held in May 2018 in Kigali. Participants included government and humanitarian agencies, NGOs, private sector businesses, and other key stakeholders. A number of potential renewable energy solutions were discussed, with the goal of increasing access to sustainable energy through market-based approaches. Following the workshop, and after further development and consultation, four interventions were selected:

- **Intervention I: Renewable electricity services for households and small enterprises**
- **Intervention II: Renewable biomass and advanced cooking technologies for households**
- **Intervention III: Solar powered community street lighting**
- **Intervention IV: Solar power for institutions, community facilities, and enterprises**

The RE4R project will implement each intervention under its own independent schedule and, although each has a specific focus area, together they will contribute to increased access to sustainable energy for the people, businesses, communities, and institutions in Gihembe, Kigeme, and Nyabiheke refugee camps.

The opinions and priorities of displaced people are often overlooked when designing solutions

Table 8.1 Rankings of priority energy needs in the camps, reported by households. Rank 1 represents the highest priority

Camp	Ranking given by households			
	All	Gihembe	Kigeme	Nyabiheke
Most important energy needs to be addressed				
Households	1	1	1	1
Health facilities	2	2	2	3
Schools	3	3	3	4
Street lighting	4	4	4	2
Businesses	5	5	6	5
Camp administration	6	6	5	6

Households rank their own energy needs as the most important

Households need access to basic energy technologies and services

The priorities ranked by households in each camp are shown in Table 8.1, ranked here by the overall levels of priority across all camps. Households rank their own energy needs as the most important; this is unsurprising given the overall low levels of present access to even basic electricity technologies and severe issues limiting the availability of firewood and other cooking fuels. The next highest priorities are energy for health facilities and schools. These are areas that camp residents interact with on a regular basis, and therefore they may seem more important to respondents than, for example, camp administration, which performs critical but less visible functions. It may also be that the office buildings in the camps are perceived as already having sufficient access to energy – a reasonable conclusion given their vastly superior situation compared with households – and therefore not ranking as a priority need. Energy for businesses is also ranked relatively low by households, perhaps again for their comparatively higher levels of energy access or a perception that they have a greater capacity to pay for energy technologies, therefore requiring less assistance. Street lighting – another area with a daily impact on residents’ lives – was considered to be a moderate priority, except in Nyabiheke where greater need was reported. At the time of the survey there was no public lighting in operation in the camps.

Household respondents were also asked to rank the reasons why electric lighting is important to them, whether they currently have access to it or not (see Table 8.2). Working at home was the reason ranked highest, followed by studying and doing chores – and these reasons are often cited by the organizations implementing projects as benefits of gaining access to electric lighting for the first time. Two reasons relating to personal safety – at home and moving around the camp at night – are the next most important. Issues around protection can have significant impacts on the lives of those affected, but it may be that electric lighting is not particularly seen as a mitigating factor for these issues; or, at least, that its effect is less impactful to people’s lives than the reasons they ranked more highly. Electric lighting for recreation received a low ranking, possibly because recreation activities do not require electricity at all, or because lighting is not particularly relevant to entertainment. The latter depends more on other electricity services, such as televisions.

Finally, respondents were asked to consider and rank the most important uses of energy if adequate supplies were made available; that is, if energy access were affordable to them at a reasonable, realistic but

Table 8.2 Rankings of the reasons why electric lighting is important to households at present, and important uses of energy if it were adequately available

Camp	Ranking given by households			
	All	Gihembe	Kigeme	Nyabiheke
Reasons why electric lighting is important				
Working at home	1	2	2	1
Studying and school work	2	1	1	3
Doing household chores	3	4	5	2
Safety and security at home	4	3	4	4
Moving around the camp at night	5	5	3	5
Recreation	6	6	6	6
Most important uses if energy were available				
Mobile phones	1	2	1	1
Electric lighting	2	1	2	3
Radio or television	3	3	3	2
Preparing food/hot water	4	4	4	4
Making things or doing work	5	5	5	5

yet-to-be-determined price. As shown in the lower part of Table 8.2, the two most basic services, phone charging and lighting, were ranked highest. Electricity for entertainment – i.e. using appliances such as radios or televisions – was next most important. Preparing food and hot water, which includes issues around stoves and fuel, was ranked only fourth and energy for productive uses was ranked fifth. Given the results discussed earlier these final findings may be surprising; it may be that although cooking fuel is a significant and immediate issue to almost all households in the camps, alternative fuels are available and strategies to deal with the problem – while detrimental – are familiar. Lighting, phone charging, and entertainment, however, are not available through any other means, and these are therefore seen as more important uses for energy if it were to be made available. Meanwhile, the fact that working at home was ranked highest in important uses of electric lighting but lowest for important uses of energy in general may be because lighting is an independent category within the latter – and indeed is ranked highly. This ranking therefore incorporates the fact that *lighting* is required for work and productive purposes, but any other energy requirements in that category may be comparatively insignificant.

Intervention I will promote the delivery of solar home systems in the camps and increase their usage among households. The systems will provide access to basic lighting, phone charging, and entertainment services and offer a significant increase in the levels of energy access for most of the camp residents in line with their stated priorities. Two companies operating in Rwanda have been selected, through a competitive tendering process, to receive investment to supply solar home systems at a reduced rate to camp residents. The use of two companies, each determining their own pricing strategies, will provide users with a choice and accommodate differences in willingness and ability to pay between households and enterprise customers. Awareness-raising and technical training activities for camp residents and the host communities will support the delivery of this intervention. Finally, it also represents an opportunity for the companies involved to learn more about operating in humanitarian settings, so they can potentially extend their operations into other camps in the future.

Solar home systems will provide access to basic lighting, phone charging, and entertainment services

Intervention II will focus on increasing access to improved cooking solutions and sustainable, renewable fuels. Although energy for cooking was ranked as a lower priority than lighting and electricity, the range and severity of the issues discussed in earlier sections highlight the need for viable long-term solutions for domestic cooking. Although the situation in the camps has changed in the time since the assessments were conducted, many of the same issues have not yet been resolved. Owing to the ongoing discussions around the long-term response to the cessation of firewood distribution in the camps, the implementation of this intervention has been postponed to establish how it can best fit into the wider national strategy. Potential activities to support the delivery of sustainable cooking solutions are being developed and will likely include supporting current clean cooking suppliers operating in Rwanda to scale up their businesses to meet the challenge posed by the situation in the camps, and activities to increase the uptake and affordability of improved stoves and fuels.

Enterprises want energy to increase their income-generating potential

The diversity of enterprises in the camps and the range of current energy access levels means that businesses reported a variety of appliances that would improve their operations. The most commonly desired appliance was the television, with at least half the enterprises in each camp wanting to use one if they did not already, and the proportion of enterprises expressing a desire for this appliance far outweighed those that owned one already. A similar but less significant situation was found for radios. Despite being comparatively common already, phone chargers were also found to be a highly desired appliance, with around one in three businesses in the camps expressing a need for them. Two appliances that require a high-quality supply of electricity – computers and kettles – also emerged as priorities, with around one in three enterprises stating a desire for them. In general, enterprises in Kigeme expressed a slightly lower desire for new appliances, which could be a result of a number of factors not adequately available from the surveying process.

The appliances desired by businesses are typically just more of those that are already available. Like households, enterprises expressed, in general, a greater desire for access to basic electricity services – such as phone charging and entertainment – than advanced electronics such as computers. This could be informed in part by respondents observing the business potential for the basic appliances already being used by other enterprises in the camp, but also by their making a realistic assessment of their current energy access and financial situation – concluding that they are unable to support higher-powered appliances in the foreseeable future. Some existing businesses with access to minigrad connections expressed that their greatest issue was not a need for new appliances but a more reliable supply of electricity. With the majority of enterprises stating an enduring need for basic electricity services and appliances, this highlights the fact that relatively simple technological solutions, such as solar home systems, could provide a significant impact.

Intervention I will also promote the uptake and usage of solar home systems among small businesses. Solar home systems can offer electricity to small enterprises such as shops, particularly those operating from domestic locations, and in doing so provide access to energy services for the phone charging and entertainment needs that were stated as high priorities among business operators.

Enterprises expressed a greater desire for access to basic electricity services than for advanced electronics

Public lighting would contribute to improved mobility around the camp at night

Respondents were then asked about specific communal areas where better lighting is required (see Table 8.3). Health facilities were ranked very high, but roads around the camp were also priority areas: access routes around WASH facilities, which are dispersed around the camps, were ranked higher in Gihembe and Nyabiheke but major camp access roads were prioritized in Kigeme. This may be due to the structure and layouts of the camps, the number of WASH facilities, or many other factors, but in all camps this highlights that moving around the camps at night is an issue for camp residents and better lighting is needed to address this.

Lighting in schools was seen as the next most important priority, perhaps due to their being little or no lighting currently available in them, and the assumption that improved lighting would allow children to study for longer and more effectively. Lighting for community spaces was reported to be a moderate priority, while shops were ranked relatively low, perhaps once again because electricity access among enterprises is relatively high compared with households, or the belief that shops and businesses should provide lighting for themselves. Respondents in Nyabiheke ranked lighting in religious buildings relatively high compared with the other camps, possibly because there is a greater number of them in that camp.

Improved lighting for access roads and around key camp facilities can help to improve the perception of safety for refugee communities. The experiences of intimidation and theft shared by respondents in earlier sections, for example, could be reduced if lighting around WASH facilities were to be provided by dedicated space lighting, rather than being reliant on residents providing their own lighting via mobile phones or basic torches, or using nothing at all. Street lighting could also help facilitate livelihood activities by encouraging greater numbers of customers to visit the camp marketplaces in the evenings.

Intervention III will deliver standalone solar streetlights for public space lighting around the camps. These aim to improve mobility around the camp after dark, increase the perception of safety, and provide better enterprise opportunities by extending the hours in which camp residents can access businesses. More than 180 streetlights will be installed across the three camps in key locations determined by Practical Action and UNHCR field staff, camp managers, and the Refugee Executive Committees. Camp residents and members of the host communities will be both involved in the initial installation of the streetlights and trained in their operation and maintenance to increase the longevity of this intervention.

Improved lighting for access roads and around camp facilities can improve the perception of safety

Table 8.3 Rankings of communal areas in the camps where better lighting is needed, reported by households. Rank 1 represents the highest priority

Camp	Ranking given by households			
	All	Gihembe	Kigeme	Nyabiheke
Communal areas where better lighting is needed				
Health facilities	1	1	1	3
Routes to WASH facilities	2	5	2	1
Camp roads	3	2	3	2
Schools	4	3	4	4
Community spaces	5	4	5	6
Shops	6	6	6	7
Religious buildings	7	7	7	5

Community facilities and institutions would benefit from wider access to cleaner energy

Many community facilities in the camps benefit from both the connection to the camp minigrids and organizational funding from international agencies to supply them with the appliances necessary to operate, and consequently have comparable levels of energy access to their counterparts in the host communities. In most cases a greater proportion of institutional buildings already had access to a given appliance compared with those who stated an unmet need for it, but this varied between camps. In Gihembe and Kigeme the needs for appliances were relatively well met, but community facilities in Nyabiheke reported a relatively higher need for equipment such as computers, projectors, and printers, possibly because a higher proportion of unconnected facilities, such as schools, were included in the survey. Respondents in Kigeme and Nyabiheke also expressed a greater need for kettles and refrigerators compared with those in Gihembe.

Compared with both households and enterprises, many institutions in the camps have all the appliances they need, but this is not universal. Unconnected community facilities, such as schools, would benefit from services and appliances such as lighting and computers, which they currently cannot access due to their low tier of electricity access. Efforts to supply reliable power to these community facilities should also be cognizant of the need for the appliances to use that power, in order to provide a meaningful improvement in the services they can offer to camp residents.

Intervention IV will provide solar electricity to camp institutions to mitigate the usage of diesel generators. This intervention will be based in Nyabiheke, as this camp does not have a connection to the national grid network and the introduction of solar power could reduce both the expenditure and the greenhouse gas emissions of the existing diesel-powered minigrid. Community facilities that previously were not part of the existing minigrid, such as schools and community centres, will benefit from new connections to the new system, to provide a more equitable level of energy access across the camp. Furthermore, new opportunities for livelihood activities for camp residents will be explored and accommodated in the design of the minigrid, to supply refugee businesses with reliable, affordable, and sustainable electricity.

During an initial design stage of Intervention IV, electronic metering will be used to measure the present usage of electricity and predict the potential for future energy demands. This will inform the technical design of the system, while a number of potential delivery models for the procurement of equipment and the sale of electricity will be explored to support a sustainable strategy for high-quality power provision to the institutional and enterprise users in the camp.

New opportunities for livelihood activities will be explored and accommodated in the minigrid design



CONCLUSIONS AND RECOMMENDATIONS

Summary of energy access in Gihembe, Kigeme, and Nyabiheke

The data collection undertaken by Practical Action using the TEA approach revealed a wide range of energy issues in the camp. Some of the most pressing – both based on the findings of the assessments and in the views of the refugee communities themselves – affect households. The vast majority of households have little or no access to electricity for lighting, with 58 per cent reliant on basic sources such as candles and torches. The prevalence of solar products is relatively low; only 21 per cent of households primarily rely on solar lanterns and 16 per cent use solar home systems. Most households make regular payments for candles and non-rechargeable batteries or rely on burning sticks for lighting.

Those who have solar products, however, reported tangible benefits: on average, solar home systems provided four hours of lighting in the evenings – 45 minutes more than solar lanterns and 90 minutes more than non-electric sources. Households also ranked electricity access in domestic settings as among their highest priority needs to meet,

particularly for working at home and for basic services such as phone charging and entertainment. Electricity access in domestic settings, and also for small enterprises, will be addressed by the delivery of solar home systems as part of Intervention I.

At the time of the assessments, access to modern cooking solutions was very low. More than three-quarters of households relied mainly on three-stone fires and mud stoves fuelled by firewood for their cooking needs, and only 21 per cent primarily used improved cookstoves. Far more households, 42 per cent, used improved stoves as a secondary option instead. The Inyenyeri programme in Kigeme likely contributed to the fact that three times more households used improved stoves there compared with the other camps; however, participants in that scheme were concerned that the affordability of the fuel limited their usage of the stoves.

Before the cessation of firewood distribution, 81 per cent of households in the camps were reliant on firewood for fuel, with an additional 17 per cent using charcoal. For secondary stoves, however, these proportions were almost reversed: 17 per cent used firewood and 79 per cent used charcoal. Interviews revealed that the supply of firewood was inadequate to meet the cooking needs of households, and there were additional problems, such as the need to dry firewood before it could be used. Charcoal was sometimes seen as preferable as it could be used to heat homes during the wet season; however its fluctuating prices limited its usage. Respondents reported that this lack of cooking resources, in particular firewood, resulted in their relying on coping strategies to get by. More than half of households skipped meals when fuel was unavailable, while others reduced portion sizes, exchanged food for fuel, or shared resources with other households.

Cooking is viewed as a gendered activity in the camps, with the majority of the responsibility falling to women. On average, women spent three hours per day on cooking and related activities, including 45 minutes per day collecting and preparing fuel – four times longer than men. Interviews with camp residents revealed that they felt exposed to threats and violence when foraging in the local areas around the camps. The delivery of cleaner fuels for cooking is now being implemented in the camps in response to new policies; however, significant coordination between humanitarian agencies, NGOs, and the private sector will be needed to ensure a successful transition to these fuels and to reduce the incidence of the extant issues. The activities in Intervention II will help to support this.

Energy access among businesses is typically higher than that of households: three-quarters of enterprises have access to some form of electricity, and solar home systems allow small shops and petty traders to extend their opening hours with lighting or to offer phone charging services. Many businesses operate from within households, so can share the benefits of electrification with their family members. Businesses identified a need for greater access to many of the services that can be offered by solar home systems, such as phone charging and the opportunity to charge customers to watch television. As such, Intervention I will also focus on increasing the uptake of solar home systems among small enterprises.

Households ranked their own energy needs as the highest priority, but also highlighted that the lack of lighting in communal spaces was an issue, particularly around camp roads and key facilities. Respondents shared experiences of intimidation and theft at WASH facilities when using mobile phones, if anything, to light their way at night, and considered that improved street lighting could increase the perception of safety. To this end, Intervention III will introduce standalone solar streetlights at key locations around the camp to help alleviate some of these issues.

Intervention I will focus on increasing the uptake of solar home systems among small enterprises

The camp institutions and community facilities that have a connection to the camp minigrids, such as UNHCR and NGO offices, health centres, and water pumping stations, have the highest levels of energy access in the camps. Power for the minigrid system comes from either the national grid or diesel generators, the latter of which is both costly and emits high levels of greenhouse gases. Meanwhile, those facilities further from the administrative centres, including schools and religious buildings, have only basic access to electricity, if any at all.

The minigrid networks also supply a small number of refugee enterprises, but these connections are managed informally, suffer from outages affecting business operations, and are not available to new entrepreneurs. Intervention IV, which will be delivered in Nyabiheke, aims to address the two main issues with the existing minigrid: 1) solar power will be used to mitigate the problems with the use of diesel generators (cost and climate impact), and 2) the amended system will provide reliable and sustainable power for entrepreneurs to develop new livelihood opportunities in line with the goals of both UNHCR and MINEMA.

Refugees deserve the same opportunities to use energy to improve their lives as others in Rwanda and across the world. Living in camps, particularly for many years without the expectation of returning home, unquestionably limits these opportunities. In response to this challenge, the government of Rwanda, UNHCR, and other NGOs are taking steps to improve the situation that refugees have been forced into. Solutions that are already in use in the camp could, if scaled up, bring about significant change to the lives of thousands of camp residents, and in some cases new technologies will need to be introduced. Through its four renewable energy interventions the RE4R project aims to facilitate greater access to sustainable energy and provide long-term solutions to refugee communities in Gihembe, Kigeme, and Nyabiheke.

Recommendations and learning from the RE4R project assessments

The RE4R project aims to facilitate greater access to sustainable energy for refugee communities

As the volume of experience around energy needs in humanitarian settings grows it will become increasingly important to share the experience of past projects to take forward into future ones. Generating a pool of resources, evidence, and initiatives around energy in situations of displacement, and sharing and developing best practices, is a guiding objective of the GPA, and humanitarian actors learning from one another is one of the visions of its Data and Evidence Working Group (UNITAR 2018). Importantly, operating in a resource-constrained environment requires not only that the processes and analyses in selecting the most suitable energy interventions can be implemented successfully, but also that the assessments can deliver sufficient confidence in the decisions being made, based on the evidence they provide.

The TEA approach used by Practical Action involved a broad range of evidence-gathering techniques and was supported by the involvement of experts across the humanitarian and energy sectors, both in Rwanda and more widely. As a result there are a number of recommendations for future assessments that have come from this work, both for projects with similar aims and for those with more specific foci on particular humanitarian energy issues.

Undertaking a dedicated period of data collection and analysis can provide a greater understanding of the most important energy issues. Including a designated phase for assessing the current situation and scoping out potential interventions within the project cycle,

before moving on to the design of how a specific intervention could be delivered, can promote critical reflection of both the issues that are being addressed and the most effective ways of overcoming them. Data and evidence around energy in humanitarian settings is relatively scarce, so contributing robust analysis – even when focused on a specific situation – can benefit both that project and the sector as a whole.

Data should not, however, be collected for its own sake. In particular, any primary data collection should have a well-defined purpose, a clear pathway for how it will be analysed, and an understanding of how the results will be used. Considering both the sensitivities around collecting data from vulnerable people and the need to avoid research fatigue among participants, it is important to know how the body of evidence that is being collected will be used, in order to minimize the time burden on respondents and the staff conducting assessments. This can be a challenge when using a TEA approach where many different kinds of information are being gathered and, at the start of the data collection phase, a wide range of potential interventions are being considered. In the RE4R project, this was managed by bringing together the results of the assessments in an intervention co-design workshop, where the findings of the assessments were presented to stakeholders from a variety of institutional backgrounds. A shortcoming of this, however, was that it was not possible to fully present the breadth and depth of the data that was collected. Coordinating the activities of the separate data collection streams and including regular feedback sessions between them can help ensure that the evidence being gathered is clear, concise, and relevant to the overall process.

Data and evidence are multidimensional and this should be incorporated into project design. Different projects will have different motivations, means, and goals, and knowing the types of information that will be most influential – in both understanding the situation initially and making decisions ultimately – is critical. In some cases broad camp-level statistics would be most appropriate to assess the current levels of energy access typical in households, for example, but in others more specific discussions with key stakeholders would reveal more targeted and relevant information, such as when selecting the best locations to install a limited number of public streetlights around a camp.

The TEA approach incorporates many different types of assessments, to capture a range of information from camp-level overviews to individual personal experiences. Using more than one type of information in assessments and decision-making can provide a more compelling foundation for supporting interventions: presenting numerical information about energy issues in combination with the real-life impact that they have on people's lives can increase the power of both.

Energy access incorporates cooking, lighting, and electricity and includes households, enterprises, and community facilities. As an activity essential to survival, energy for cooking has justifiably been the focus of many initiatives in the past, but refugees also have a stated need for basic electricity services such as lighting and phone charging. Using data to understand how displaced communities currently use energy for business opportunities, and the potential to use new sources of sustainable power for increased productivity, will also be critical in supporting livelihood-related activities and the economic integration of refugees. Quantifying the energy usage of humanitarian agencies for operations and institutions, particularly the use of diesel generators, is also a necessary step in the design of cleaner alternative sources of power. Finally, approaching energy access in an integrated manner – for example identifying areas of overlap between the needs of or provision of energy to different segments of the community – could give an insight into potential economic or planning efficiencies in energy projects. The objectives and practicalities of the RE4R project led to

Results of the RE4R project assessments were brought together in an intervention co-design workshop

Decreasing costs and new business models mean electricity access can be delivered using market-based approaches

Viewpoints, experiences, and aspirations of displaced people should be included in discussions about energy interventions

four interventions that are relatively siloed in their scope, but future projects could benefit from greater integration in terms of how energy is provided to the community as a whole.

Opportunities to meet the diversity of energy needs in situations of displacement are growing. The increasing prevalence of electricity access technologies in the wider global development sector, especially of solar lighting products, has made meeting basic electricity needs more viable in humanitarian settings. Furthermore, their decreasing costs and the new innovative business models being explored by the private sector are making it more likely that these products can be delivered using market-based approaches. The provision of energy and appliances for business activities, both for electricity and cooking, has also become more affordable and widespread in many of the countries hosting refugees and should be similarly promoted within camps, in combination with skills training and capacity building. The implementation of larger-scale energy projects for camp operations, such as solar-powered or hybrid minigrids, has also become more feasible as the costs of renewable technologies decrease and flexible financing opportunities continue to be developed.

Refugees should be able to contribute to the decisions that affect them. The viewpoints, experiences, and aspirations of displaced people should be included in discussions about potential energy interventions, both to inform the decision-making process and to help ensure the suitability and longevity of the projects that will be delivered. This could be done indirectly, for example through interviews with people in the camps, or more directly through the involvement of refugees or their representatives in meetings and discussions.

Incorporating the voices of displaced people can be challenging, particularly in projects with tight timelines and which are focused on specific objectives or deliverables. Community leaders and elected committee members in the camps can offer a potential solution to this, both by representing the viewpoints of their communities and by reporting back to the wider camp. They can also offer a valuable means of validating the viability of potential interventions, for example capturing any practical considerations that had not been accounted for during the design process.

Increasing the amount and utilization of data and evidence in the humanitarian energy sector is a necessary step in improving the access to sustainable energy in situations of displacement. It is important that existing projects share their knowledge and experiences – of their findings, but also the effectiveness of their processes – so that new initiatives can build upon them. The level of support for energy for refugees among humanitarian agencies, governments, NGOs, and the private sector is growing; as it does so the coordination, usage, and dissemination of new evidence will become ever more important in delivering sustainable, affordable, and reliable energy to displaced communities around the world.

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APPENDIX

Data collection and analysis

The TEA approach aims to provide a comprehensive understanding of the energy issues across the camp communities. One dimension of the TEA approach comprises quantitative and technological assessments, such as surveys and feasibility studies, which provide numerical and statistical information for high-level analysis, case-specific engineering, or intervention design appraisals. Another dimension is made up of interviews and stakeholder consultations, for example one-to-one discussions or focus groups with many participants, to gain the opinions and ideas of experts, specialists in the field, and displaced people themselves. Finally, these are supported by reviews of existing literature and assessments of the energy markets in the camps and in the wider country.

For the quantitative surveys, refugee enumerators, supervised by field staff from Practical Action and UNHCR, were recruited from the camps and paid a daily stipend to conduct the surveys. At a two-day workshop in Kigali the enumerators received training on the aims and objectives of the work, how to use electronic tablets to conduct the surveys and record information, how to minimize their potential influence on responses, and appropriate conduct when gathering information, as well as other sessions to minimize any issues during the data collection phase. Particular consideration was given to the sensitivities of working with, and collecting data from, vulnerable people. The surveys were professionally translated from English to Kinyarwanda and provided on paper as an aide memoire for the enumerators. The surveys were conducted in Kinyarwanda, but the responses were recorded electronically on tablet in English to facilitate the later analysis of the data.

For the qualitative interviews and focus groups the researchers collected data from many locations around the camps and engaged with participants with a variety of roles in the community and throughout the energy value chain, but with a focus on the end consumers of energy. As with the quantitative data collection, households represented the majority of the participants of the qualitative research, but participation from business owners, community leaders, NGO staff, and others provided a broad cross-sectional view of the energy issues in the three camps. Participants were asked about how and why they use energy, what their perspectives and priorities are, the relationships as they see them between fuel and food, and their preferences towards different kinds of energy technologies. To complement the information shared by interviewees, and with their consent, photographs were also taken of some of the energy objects and technologies within the camp spaces.

Challenges of data collection and analysis in humanitarian settings

The data and analysis presented in this report, and the methods that were used to collect it, cover a wide range of topics but are inherently limited. The quantitative approach aims to present aggregated information about each camp as well as the three camps together, to provide a broad but representative overview of the situation at the time the survey was conducted. As far as possible, questions were designed to elicit closed responses. While these are important in calculating camp-wide statistics, for example, they do not allow respondents to elaborate open-endedly about their energy use and cannot capture the nuances of their responses. Energy is a topic that can touch upon many aspects of a person's life, and it would be implausible to design a survey such as this that would adequately explore every issue using this methodological approach.

Aside from the methodological limitations of the quantitative data collection, other sources of errors may have been encountered. Enumerators and respondents may have misunderstood, mistranslated, misinterpreted, or misreported answers to questions – particularly if the format of a response did not suitably correspond to the input required for that question on the tablet, which could affect the ways in which answers were recorded. Respondents may not have been able to give accurate answers to questions, particularly about estimations of expenditure and times, or may have chosen to over- or under-report figures in order to influence any decision-making resulting from the survey. Responses to some areas of the survey are sensitive to the time of year, such as energy used in the wet or dry season, and other temporal factors such as the length of time since the last distribution of firewood. The surveys were conducted simultaneously across the three camps, with the household, enterprise, and community facilities surveys being undertaken sequentially, during March and April 2018.

The qualitative research methods used to interview respondents are inherently limited to the experiences of each respondent. Although there are many common themes and issues surrounding energy use in the camps, the researchers received a wide variety of opinions from different actors on seemingly similar topics. This report aims to incorporate a diverse sample of respondent viewpoints and opinions but, as there can be no single correct answer to the types of questions that were posed, it is inevitable that those reported here might not be reflective of the diversity of opinion in the camps on the whole.

It is possible to categorize energy technologies in terms of tiers of energy access to reflect the quality of services that they provide, from Tier 0 (no or extremely limited access to modern electricity services) to Tier 5 (access to reliable, safe, legal, and high-power electricity sources) (World Bank 2015). Tier 2, corresponding to access to basic electricity services like lighting and phone charging for four hours per day, is the level at which the government of Rwanda considers a household as electrified (Ministry of Infrastructure 2018). These tiers are defined by a number of performance criteria, each of which has its own scale of what constitutes a given tier of energy access.

The nature of the surveys and interviews makes it possible to use parts of this methodology to categorize the tiers of access of the households, enterprises, and community facilities included in this report; however, its direct application to the data that was collected has a greater potential to obfuscate rather than illuminate. This is because the criteria used to establish a tier may assign several different tiers to the same household: for example a solar home system could have its capacity classified

as Tier 2, but the hours of service received as Tier 1, and its electricity consumption as Tier 0. Similarly some of the criteria used to define the tiers, such as convenience and legality, are not included in the surveys and so cannot be used to assign a tier.

In this report, therefore, the technologies that are used are presented and discussed, rather than the tiers of access that they are likely to provide, to better reflect the situation in the camps as recorded by the surveys. In particular, the enumerators were more familiar with the different types of technologies (such as solar lanterns or solar home systems) so could more reliably report on this straightforward categorization rather than potentially more subjective or technical metrics (such as service quality, convenience, and component power capacities). If desired, categorizing access in the camps broadly along technological lines will give a reasonable summary of the energy access tiers: for electricity access, solar home systems can be considered as Tier 2, solar lanterns as Tier 1, and all other sources as Tier 0 (World Bank 2015); for access to cooking energy, stoves distributed by Inyenyeri have been rated as Tier 4 (Global Alliance for Clean Cookstoves 2015), other improved stoves can be considered as Tier 1 or 2, and three-stone fires and mud stoves as Tier 0.

Household expenditure on non-renewable lighting in US dollars

Table A.1 gives a breakdown of the expenditure reported by households on candles, non-rechargeable batteries, and the two sources combined, in US dollars. For the values in Rwandan francs, see Table 4.5 in the main report.

Table A.1 Breakdown of current expenditure on candles and non-rechargeable batteries for households without access to a solar home system in US dollars (RWF 860 = USD 1.00)

Camp	Spending by all households without solar home systems (USD per month)			
	All	Gihembe	Kigeme	Nyabiheke
Candles				
Mean	1.01	0.85	1.21	0.84
Median	0.00	0.32	0.00	0.47
Top 10%	3.49	3.49	3.49	3.49
Non-rechargeable batteries				
Mean	0.14	0.13	0.13	0.15
Median	0.00	0.00	0.00	0.00
Top 10%	1.33	0.58	0.70	0.67
Combined (candles and batteries)				
Mean	1.15	1.08	1.34	0.99
Median	0.56	0.41	0.58	0.52
Top 10%	3.49	3.49	3.49	3.49

Ensuring refugee camps in Rwanda have access to sustainable energy

More than 130 million people around the world are in need of humanitarian assistance and the provision of energy for critical services is often inefficient, unsafe, or inadequate. The complexities of providing energy access can be exacerbated in humanitarian situations and the provision of energy is often limited to short-term solutions rather than long-term strategies. Even when displaced people have been resident in a host country for many years, delivering fundamental assistance often leaves humanitarian agencies under-resourced and overstretched and, as a result, access to energy beyond the necessary minimum levels has often been out of reach for many refugees.

Working in partnership with UNHCR, the UN Refugee Agency, and supported by the IKEA Foundation, the Renewable Energy for Refugees (RE4R) project will help refugees and their host communities access renewable energy, enabling refugees to move from reliance on aid to economic independence. Practical Action conducted hundreds of surveys and interviews with residents, business owners, community leaders, and organizational staff in three refugee camps in Rwanda. Using this information to understand the key energy issues, the RE4R project is implementing interventions to ensure that displaced communities in Gihembe, Kigeme and Nyabiheke camps have access to sustainable energy.

This RE4R report sets out what works for refugees in their search for energy that is renewable, clean and reliable, and details ways to help communities set themselves up for success and growth.

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