

Can Market Mechanisms Facilitate Energy Access for People Living in Extreme Poverty?

Part 1: Understanding the Relationship Between Energy Access and Extreme Poverty

Appendix 7.2e

Energy Access among People Living in Extreme Poverty in Rwanda with a Focus on Displaced People

1. Introduction

This review is one of a series of six,¹ looking at energy access for people living in extreme poverty in specific country contexts.² It has been carried out as part of a wider study entitled ‘Can Market Mechanisms Facilitate Energy Access for People Living in Extreme Poverty?’ under the Transforming Energy Access programme. Rwanda was chosen for review because of its relatively high rates of extreme poverty and low rates of energy access, which mean that it is among the 20 countries with largest numbers of people living in extreme poverty without access to energy, despite a relatively small total population.

Each of the reviews also looks at issues around energy access for a specific demographic group who experience differential levels of extreme poverty or lack of energy access; have distinctive energy needs; and/or face distinct barriers to achieving energy access. This review looks specifically at extreme poverty and energy access among displaced people. This group was chosen as the focus in Rwanda because of the body of research on energy access among displaced people living in the country and availability of relevant information.

Some of the key findings and recommendations from the research include:

- **People living in extreme poverty in Rwanda have significantly lower levels of energy access than the rest of the population.** We estimate that some 4.0 million people living in extreme poverty had no effective access to electricity and ~6.4 million, had no access to clean energy for cooking.
- **Displaced people in camps on average have higher levels of both electricity and clean cooking energy access than people living in extreme poverty more generally across Rwanda, and in some camps higher than the national access rate.** This is largely due to higher penetration of off-grid solutions and UNHCR provision of LPG.
- **Cost is by far the main reported barrier to energy access among those living in extreme poverty (including displaced people) in Rwanda,** so it seems likely that market mechanisms which improve affordability could enable many to access energy.
- **The option to pay in instalments increases willingness to pay for energy access among people living in extreme poverty in Rwanda,** but it continues to lag that among the rest of the population. Even with instalments and subsidies, some **45% of people living in extreme poverty remain unwilling to pay for electricity access, indicating that higher levels of subsidy and/ or action to overcome other barriers will be needed** if many are not to be left behind.
- **Limited access to finance and lack of subsidies or loan facilities aimed at energy access have been identified as a key barrier for refugees,** providing further evidence of the need for appropriate market mechanisms.

Information on the methodology used; definitions of terms and acronyms; and the sources referenced can be found in the report ‘Part 1: Understanding the Relationship Between Energy Access and Extreme Poverty’.

2. Country context

Rwanda is a landlocked country in the Great Rift Valley, where the African Great Lakes and East Africa converge (AfDB, 2021). Rwanda's population was estimated at 12.96 million in 2021 and is mostly young and predominantly rural.



Figure 1: Map of Rwanda (Source: CIA, 2023)

Rwanda is the most densely populated mainland African country. The population comprises one cultural and linguistic group, the Banyarwanda. However, within this group there are three subgroups: Hutu, Tutsi and Twa (ibid).

Rwanda has maintained political stability since the 1994 genocide against the Tutsi and some moderate Hutu and Twa groups (World Bank, 2023a). The country is a Presidential Republic with a parliamentary system. Elections in September 2018 saw the Rwandan Patriotic Front maintain an absolute majority. President Paul Kagame was re-elected for a seven-year term in August 2018, after an amendment to the constitution (ibid).

Rwanda recorded impressive GDP growth and per capita growth averaging 7.3% and 5.7%, respectively, in the period 2015-2019. However, the economy was forced into a recession by the Covid-19 pandemic in 2020. Additional challenges include the War in Ukraine, climate-related shocks and inflation. Despite these challenges, real GDP grew by 8.2% in 2022 (ibid).

3. Extreme poverty

Rwanda's extreme poverty rate was 52% (6.1 million people) in 2016/17 (the last year survey data was recorded), having fallen significantly from 66% in 2005/06 (World Bank, 2023b). The poverty gap also fell from 29.3% in 2005/06 to 18.3% in 2016/17. Poverty reduction was correlated with strong economic growth over the same period (ibid).

Extreme poverty is estimated to have increased from 48.1% in 2019 to 51.1% in 2020, as a result of the Covid-19 pandemic, and then declined slowly, reaching 47.4% in 2022. Population growth is likely to have outstripped further poverty reduction between 2022 and 2024, with the rate remaining at the 2022 level (ibid). In 2023, we estimate that the extreme poverty rate was 48%.³ This represents some 6.7 million people, a rise in absolute terms from the number of people living in extreme poverty in 2016/17.

4. Poverty among displaced people

As of July 2023, 133,628 displaced people were living in Rwanda (UNHCR, 2023a), higher than Burundi but much lower than other neighbouring countries including the Democratic Republic of Congo; Uganda and Tanzania (UNHCR, 2023d). Overall, Rwanda had the 17th (of 43 countries) largest displaced population in Sub-Saharan Africa at the end of 2022 (ibid).

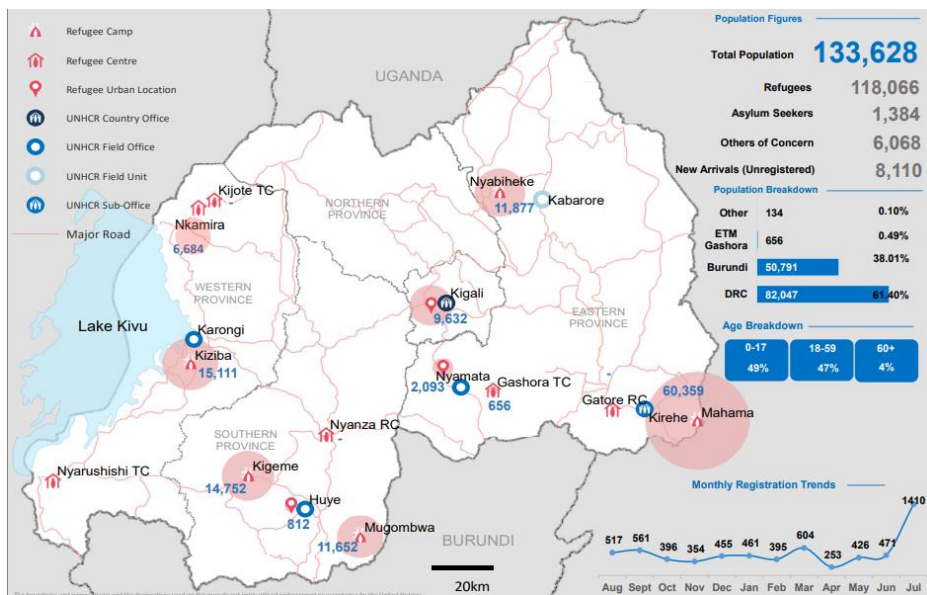


Figure 2: Geographic distribution and demographic makeup of displaced people in Rwanda as of July 2023 (Source: UNHCR, 2023)

Figure 2 shows the population of sub-groups of displaced people, their country of origin and geographic distribution across Rwanda. Overall, 85% of displaced people live in 5 formal refugee camps - Mahama; Kiziba; Kigeme; Nyabiheke; and Mugombwa. A smaller number live in other sites, including urban locations and smaller refugee centres.

It is not possible to estimate how many displaced people in Rwanda are living in extreme poverty because income data is not systematically recorded. One challenge is accounting for all income sources. Data is available on the number and type of income opportunities engaged in by displaced people but not income levels. In addition, camp-based refugees receive a mix of cash and non-cash assistance for food, energy and basic commodities but it is not possible to account for specific levels of assistance in all cases.⁴

Instead of assessing monetary poverty, the World Food Programme (WFP) and UNHCR have assessed levels of vulnerability using non-income criteria (UNHCR, 2023b). In February 2023, of the 113,650 camp-based refugees recorded at the time, 87% were classified as highly vulnerable and 6% as moderately vulnerable, with the remaining 7% classed as least vulnerable (ibid). Highly vulnerable households are more likely to have a female or uneducated head of household, more than 5 members and a high dependency ratio of around 1.8 (UNHCR and WFP, 2021).⁵ Moderately vulnerable households also tend to be female headed or headed by an uneducated person but to have a lower dependency ratio (1:4) and smaller size. In contrast, least vulnerable households tend to be male headed with a lower proportion of uneducated heads, around 4 members and fewer children, in line with generally observed patterns of poverty (ibid).

UNHCR (2022) reports that poverty and vulnerability among Rwanda’s displaced population have worsened in recent years due to high fuel, food and commodity price inflation triggered by disruptions to global supply chains as a result of the War in Ukraine. As a result, the share of refugees suffering from poor food consumption has doubled over the last two years (from 3% to 6%) and households facing borderline food consumption have nearly doubled from 17% to 32% (ibid).

Limited access to employment and other income opportunities is a key driver of poverty in refugee camps. In 2020, 54% of households living in camps had no productive activities generating income (UNHCR and WFP, 2021). Surveys conducted in 2022 for Practical

Action's (2023) Renewable Energy for Refugees (RE4R) programme also indicated that unemployment is more severe within camps than within host communities. Across all five camps, 44% of heads of households surveyed had no source of income (other than cash assistance from camp authorities), mainly due to unemployment.⁶ In contrast, only 14% of heads of households surveyed in host communities had no source of income (ibid). Unlike many other countries, refugees in Rwanda have the right to work in and outside of camps (Practical Action, 2020). However, gaining employment can be hindered by discrimination, lack of training or documentation and additional costs such as travel (ibid).

With limited access to employment opportunities, refugees living in camps are highly reliant on humanitarian assistance for income, with some additional income from NGO work and small commerce within camps (Mercy Corps, 2022). This creates conditions of dependency and vulnerability to sudden changes in the level of cash and in-kind assistance provided. For instance, funding shortfalls have forced the WFP to reduce levels of cash assistance for food items, making it harder for refugees to meet daily needs (UNHCR, 2023b).

5. Energy access

Background

Estimates of Rwanda's total on-grid electricity generation capacity range from 210 MW (USAID, 2023) to 332.6 MW (Rwanda Energy Group, 2018). Rwanda's grid network is limited and mainly concentrated near Kigali. Total installed electricity generation capacity includes hydro (103 MW), solar (9 MW), and biomass (1 MW) with the remaining 97 MW coming from diesel, methane, peat and other sources (USAID, 2023). Rwanda's major rivers have enabled significant hydroelectric power generation with opportunities for additional hydro capacity (Rwanda Development Board, 2023). There is also potential for more solar generation as the country has between 4.3 and 5.2 kWh/m²/day of solar irradiation and daily average sunshine time of around 8 hours (RURA, 2023)

Rwanda's off-grid electricity market is one of the largest in East Africa and has grown in recent years with increased sales of off-grid lighting products including multi-light systems and solar home systems (GOGLA, 2021). This has been driven largely by increased PAYGo sales as well as improved legal and regulatory frameworks. However, the market continues to face challenges. The COVID-19 pandemic and lockdown measures reduced the ability of low-income households to service payments on energy products. Additional challenges include complex requirements for importing technologies; access to finance (local companies have limited access to bank loans); limited market research for specific technologies; high foreign exchange fluctuations; and VAT and import duties on critical solar accessories such as batteries and cables, raising the cost of solar products (ibid).

Key policies and programmes

The Rwandan Government aims to achieve universal electricity access by 2024 (52% on-grid, 48% off-grid) (GOGLA, 2021). By the same year, it also aims to ensure that 16% of all households employ modern energy cooking technologies (Practical Action, 2023).

Key energy policies include:

The seven-year National Strategy for Transformation (NST1) (2017-2024) aims to halve the number of households depending on firewood for cooking from 79.9% (2016/17) to 42% by 2024, by promoting alternative fuels such as cooking gas and biogas.

National Energy Strategy, Energy Sector Strategic Plan (2008-2020) aims to increase generation capacity to achieve universal energy access by 2024, with at least 52% from renewable sources, and to promote improved and clean cooking solutions.

National Electrification Plan (2021-2024) aims to electrify 182 villages (1.2%) through microgrid development and 1,320 (8.9%) using Solar Home Systems.

Rural Electrification Strategy (2016) targets those out of reach of the grid in the near term through programmes to provide basic solar systems; risk mitigation facilities for the private sector; development of mini grids; and electricity access in public buildings (ibid).

Sector support programmes include:

- **Renewable Energy Fund** supports local off-grid solar companies and on-lending through local commercial banks and savings and credit cooperatives (SACCOs) (GOGLA, 2021). It is the main support mechanism for off-grid energy and aims to enable 1.8 million Rwandans to access off-grid solar by September 2023.
- **The Power Africa Off-grid Project (PAOP)** provides technical assistance and targeted grant funding to support private sector development of off-grid SHS and mini-grid sectors in Rwanda and other African countries (supported by USAID).
- **The African Development Bank Scaling Up Electricity Access Program (2018-2024)** is a three-year RBF programme to increase off-grid and grid access.
- **The KawiSafi Ventures Technical Assistance Facility (2020-2025)** provides firm and sector level support for activities such as consumer protection, gender inclusion and knowledge creation to the off-grid sectors in Rwanda and Kenya (ibid).
- **Clean Cooking Results-Based Financing:** a subsidy scheme to reduce the price of improved biomass and clean energy cooking stoves at varying amounts for low-income households (BRD, 2023). CC-RBF is expected to enable 500,000 households (of which 25% will be female-headed) to gain access to clean cooking technologies (ibid).

Energy access levels

As of 2021, 49% of people in Rwanda had access to electricity while 5% used modern energy for cooking (IEA et al, 2023). This represents significant progress from 2015 when only 23% of the population had access to electricity and 1% had access to clean cooking (ESMAP, 2023). Access to electricity and modern energy cooking remain geographically uneven. There is near universal access to electricity in urban areas (98% of residents) but only 38% of residents have access in rural areas (IEA et al, 2023). Similarly, 24% of urban residents, but only 1% of rural residents, have access to clean cooking (ibid).

When people were asked, as part of the World Bank's (2023c) Multi-Tier Framework energy access diagnostic survey carried out in 2016, what access they had to energy, only 11% of people living in extreme poverty had a grid connection, compared to 38% of the rest of the population (see Fig 3).⁷ Off-grid electricity access among people living in extreme poverty, at 5%, was similar to levels among the rest of the population (7%). Most, 83%, of people living in extreme poverty, compared with 55% of the rest of the population, had no access to electricity at all. In total, we estimate that 86% of people living in extreme poverty had no effective modern electricity access (i.e. did not have MTF tier 1 or higher access), compared with 60% of people with higher incomes.⁸

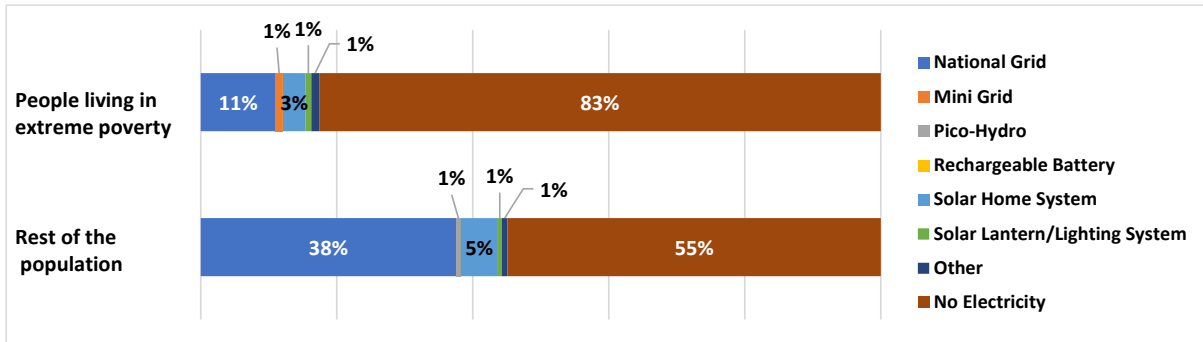


Figure 3: Electricity access by technology (Source: Based on data from World Bank, 2023c)

Based on the 49% general level of electricity access in 2021 reported through the SDG7 tracking process (IEA et al, 2023), and if it is assumed that the ratio between lack of access among people living in extreme poverty and the whole population remains as estimated from the MTF survey data (i.e. 86%:74%), the percentage of people living in extreme poverty in Rwanda who are without electricity access can be estimated at 59%, 4.0 million people.

Less than 1% of the population, and effectively none of those living in extreme poverty, were using clean fuels for cooking when the 2016 MTF survey was carried out (see Fig 4). The overwhelming majority (94%) of people living in extreme poverty were cooking with wood or sawdust, as were 72% of the rest of the population. Only 4% of people living in extreme poverty cooked with charcoal, compared with 26% of the rest of the population. Some of those living in extreme poverty relied on fuels such as peat, crop wastes or dung.

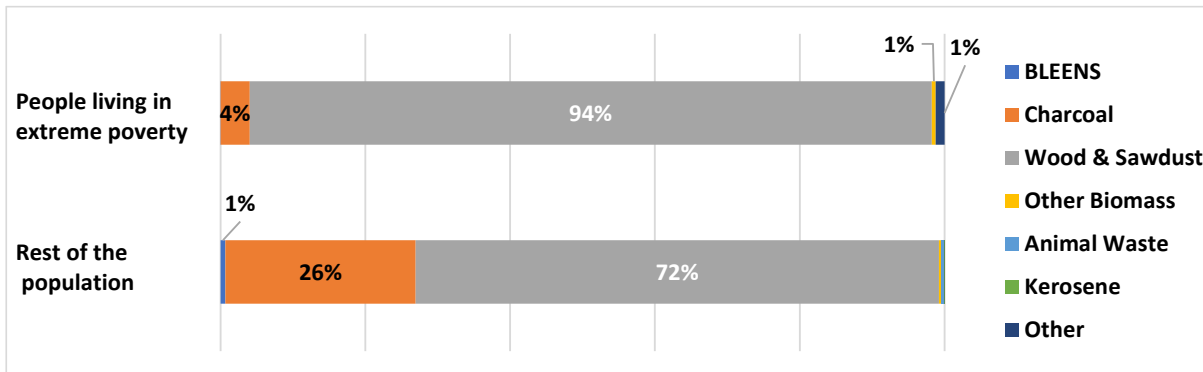


Figure 4: Cooking by fuel used (Source: Based on data from World Bank 2023c)

Based on the 5% national level of clean cooking energy access in 2021, reported through the SDG7 tracking process (ibid), and assuming that the ratio between lack of access among people living in extreme poverty and among the whole population remains as estimated from the MTF survey data (i.e. 100% vs 99.5%), it can be estimated that 95% of people living in extreme poverty in Rwanda, 6.4 million people, lack access to clean energy for cooking.

Energy access levels among displaced people

From surveys carried out among people living in camps and neighbouring host communities in Rwanda, it can be seen that displaced people living in camps generally have limited access to electricity and modern energy for cooking (Practical Action, 2020).

Across camps and host communities, 68% of respondents reported having access to electricity, including grid (10%, almost entirely in host communities), solar home systems (36%), solar lanterns (16%), and rechargeable batteries (6%). This equates to 54% having access to modern electricity (MTF Tier 1+),⁹ compared with the 49% national access level

(IEA et al, 2023). On average, households could access 6 hours of electricity per day with only 24% having access to more than 6 hours per day.

Access to electricity varies between camps. It is highest in Kigeme and Nyabiheke camps where 83% and 88%, respectively, of respondents report having access, largely from solar home systems. In Kiziba and Mugombwa, where access is lowest, 58% and 59% of respondents have access to either a solar home system, solar lantern or rechargeable battery. Virtually no respondents in camp settings reported having access to electricity from the main grid. This equates to between 44% (in Kiziba) and 67% (in Nyabiheke) of camp residents having access to modern electricity, close to the national average level and higher than our estimate of 41% for people living in extreme poverty across Rwanda.

Respondents in host communities neighbouring Kigeme and Mahama camps report having higher access to electricity (84% for Kigeme and 95% for Mahama). This is mainly due to access to the main grid, to which 80% of host communities in Kigeme and 95% in Mahama were connected. This equates to 78% and 89% of these communities having MTF Tier 1+ access. In contrast, host communities residing outside Kiziba, Mugombwa, and Nyabiheke camps report much lower rates of access (43%, 19%, and 55% respectively, equating to 33%, 14% and 55% Tier 1+ access). This reflects lower penetration of solar home systems in off-grid communities outside camps.

Survey data indicates that most respondents (both host and refugee communities) use either a tier 1 (32%) biomass stoves or tier 2 (21%) improved cookstoves. Those using tier 3 improved cookstoves (16%) and tier 4 (22%) stoves almost all reside in Mugombwa and Mahama camps, where use of LPG (at 94% and 100% respectively) is much higher than in neighbouring host communities.

Access to improved cookstoves varies significantly between camps. Kigeme camp and host communities are primarily reliant on improved cookstoves whilst Kiziba and Nyabiheke camps and host communities are reliant on a mix of improved and basic stoves (mud stoves, three stone fires). The main fuels used to cook by respondents also vary. There is a high prevalence of charcoal use in Kigeme, Kiziba, Mugombwa and Nyabiheke camps, and a high prevalence of wood usage in all host communities. Of the households that reported using a secondary cookstove, the majority across all camps were reliant on either mud stoves or three stone fires. The only exception was in Mahama camp in which respondents were far more reliant on charcoal stoves as their secondary stoves.

6. Energy needs of people living in extreme poverty

There is limited evidence to indicate to what extent the energy needs of those living in extreme poverty correspond with or differ from those of the wider population in Rwanda. As part of the Multi-Tier Framework energy access diagnostic survey carried out in 2016 (World Bank, 2023c), people in Rwanda were asked about electrical appliances they would like to be able to use (see Fig 5). Televisions were the appliance most wanted by people living in extreme poverty (14%) while 6% wanted radios. Refrigerators (10%) were their second highest priority for, while 5% wanted to be able to charge computers, electronic tablets or smartphones. Only ~2% of people living in extreme poverty wanted to be able to use power tools, and only about 1% to run fans.

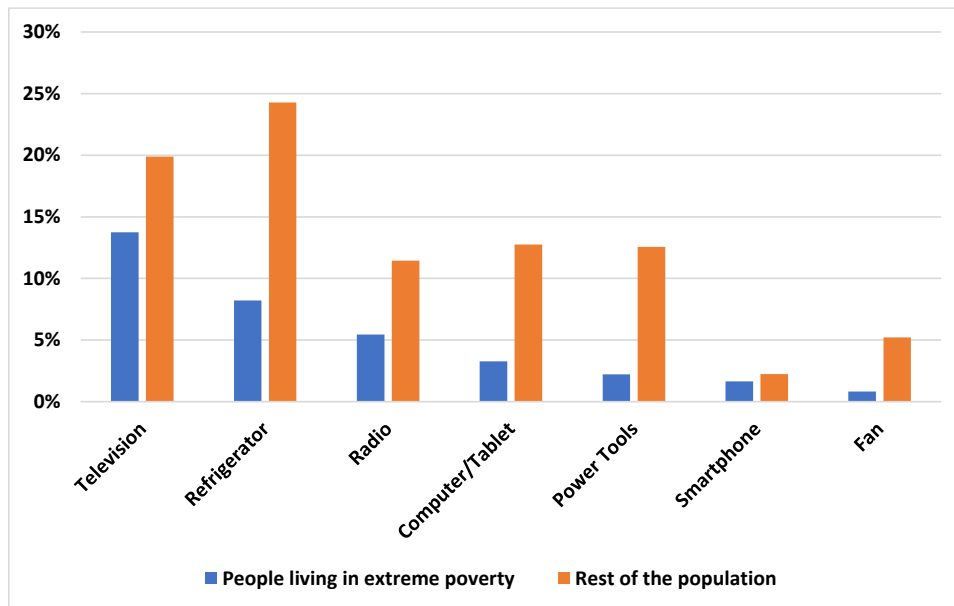


Figure 5: Additional appliances wanted (Source: Based on data from World Bank, 2023c)

The most noticeable difference between the wishes of people living in extreme poverty and people with higher incomes, is the overall lower level of additional requirements expressed by people living in extreme poverty – with those among the rest of the population identifying more than twice as many additional appliances wanted. What lies behind this, and whether it reflects more than greater knowledge and experience among better off people (generally living in urban areas) of a wider range of energy uses is, however, difficult to establish.

Energy needs of displaced people

The fundamental energy needs of displaced people in Rwanda are similar to those of the non-displaced population (Practical Action, 2020). As in other settings, broad energy needs can be classed as either household, productive or communal (ibid).

Surveys conducted in camps and host communities in 2022 found only slight differences in priorities between camp residents and those living in host communities (Practical Action, 2023). When asked to mention the energy services they would mostly benefit from, respondents across all settings identified a mix of household and communal uses: phone charging (70% of mentions) and lighting (60% of mentions) followed by information and communication services such as radios (57%) and TVs (37%). Host communities, especially those in Kigeme and Mahama, tended to be slightly more focused on higher-tier needs (food processing, computing, etc.). However, host communities in Kiziba, Mugombwa, and Nyabiheke tended to have similar needs to those living in camps. Differences in the importance of electricity were attributed partly to host communities' greater experience of the national grid and the impact that energy services could have on their lives (ibid).

There is some suggestion that the importance of productive uses of energy for people living within camps may increase over time. For instance, Practical Action (2020) report an increased focus on developing camps as economic spaces in Rwanda following the launch of a Joint Strategy for the Economic Inclusion of Refugees by the Rwandan Government and UNHCR in 2016. This suggests that energy access for enterprises such as small shops, phone charging points, restaurants and hairdressers, and other income generating activities such as farming is a growing priority for both humanitarian actors and displaced people in Rwanda.

Although fundamental energy needs do not appear to vary much between displaced and non-displaced people, certain forms of communal energy within camps are distinct, notably, the need to power humanitarian operations and facilities, such as administrative buildings, food distribution points, etc (GPA, 2022).

7. Affordability, willingness to pay and other barriers

People in Rwanda were asked, as part of the MTF energy access diagnostic survey carried out in 2016, about their willingness to pay for energy access (World Bank, 2023c). While some people living in extreme poverty were willing to pay upfront for each of a grid connection, solar home system or a basic improved cookstove (see Fig. 6),¹⁰ their willingness to pay was lower than among the rest of the population.

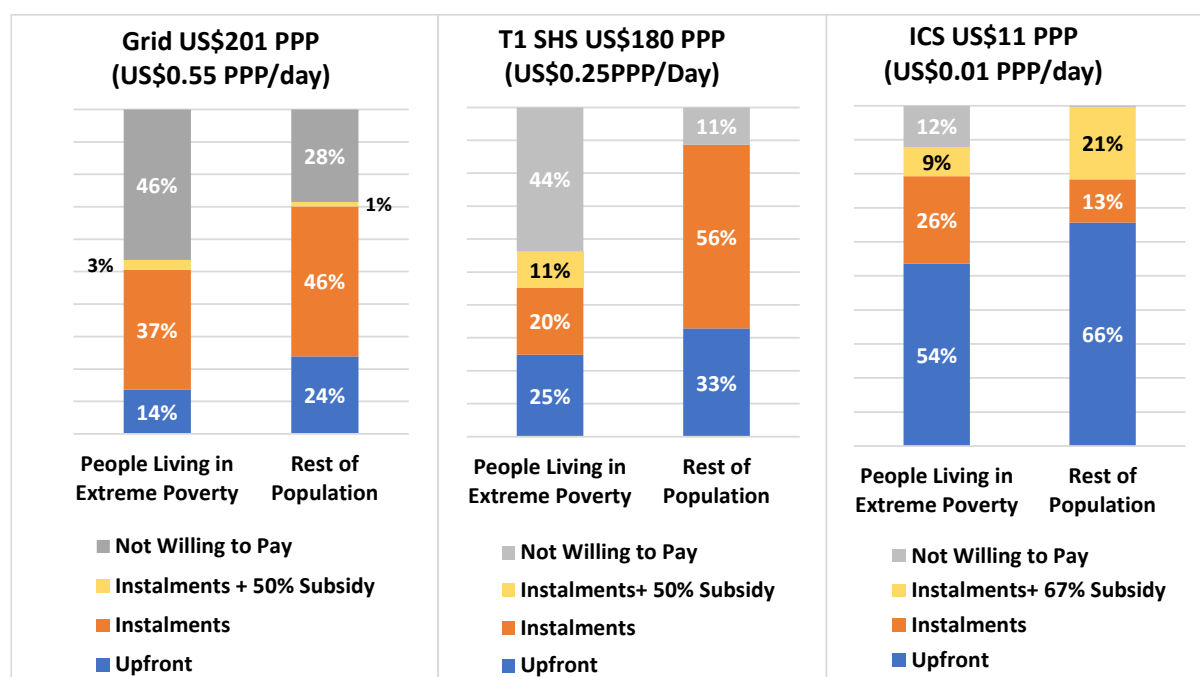


Figure 6: Willingness to pay for grid connection, solar home system or improved cookstove (based on data from World Bank, 2023c)

The option to pay in instalments significantly increased willingness to pay for energy access among people living in extreme poverty, and subsidizing prices increased it further. However even with payment in instalments and subsidies, willingness to pay among people living in extreme poverty remained well below levels among the rest of the population. However, ~45% of people living in extreme poverty remained unwilling to pay for electricity even on these terms. Unusually, a smaller percentage of people living in extreme poverty and virtually none of the rest of the population remained unwilling to pay for an improved cookstove, in contrast to the very low levels of clean cooking energy access in Rwanda. (Though this may simply reflect the basic nature and low cost of the cookstove offered).¹¹

Some 2% of people in extreme poverty who had no connection were waiting to be connected (see Fig. 7). Distance from the grid made connection unavailable for 36% of both people living in extreme poverty and others who were not connected. However, the barrier to connection for the majority (57%) of people living in extreme poverty was the cost. Ongoing electricity costs were the barrier for only 1% of people living in extreme poverty.

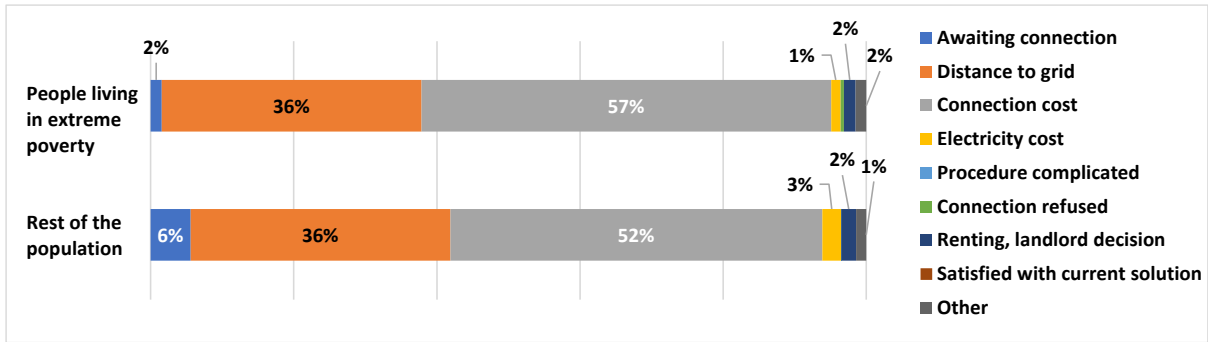


Figure 7: Barriers to grid connection (Source: Based on data from World Bank, 2023c)

The vast majority of both people living in extreme poverty and the rest of the population (85% - 97%) who indicated they would not be willing to pay for a grid connection, solar home system or improved cookstove also said it was because of the cost (see Fig. 8). Only a few people (1-4%) saw ongoing costs as an issue.

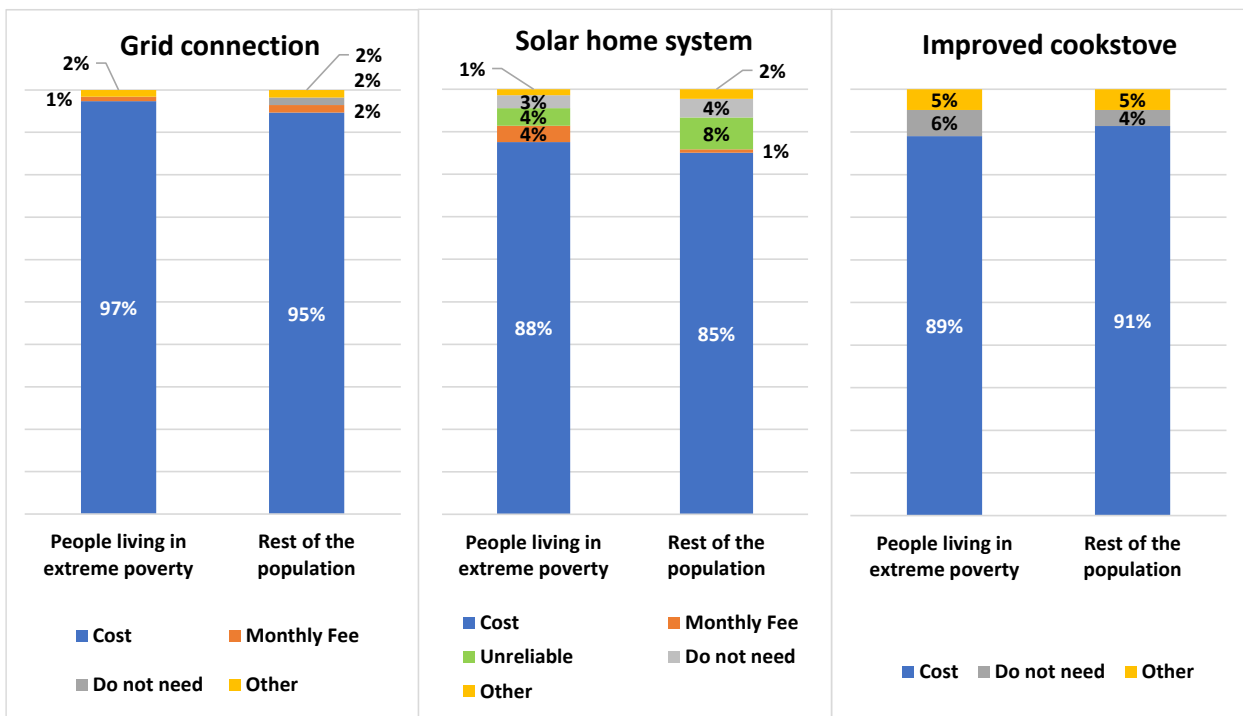


Figure 8: Reasons households were not willing to pay for a grid connection, solar home system or improved cookstove (Source: Based on data from World Bank, 2023c)

About 2% of people living in extreme poverty had been unable to connect to the grid because they did not have their landlord's agreement, but very few (<1%) had been refused connection or found the application process too complicated.

Some 4% of people living in extreme poverty (and 8% of the rest of the population) gave unreliability as the reason they would be unwilling to pay for a solar home system.

Virtually none of those living in extreme poverty without a grid connection, or unwilling to pay for one, said they did not need it. Similarly, just 4% of people living in extreme poverty who were unwilling to pay for a solar system, said they had no need for electricity and 6% said they had no need for an improved cookstove.

Barriers to energy access for displaced people

Affordability was found to be a key barrier to energy services (improved and modern energy cooking, lighting, phone charging and entertainment) in Nyabiheke, Kigeme and Gihembe camps (Practical Action, 2020). Assessments in all 5 camps also found that affordability constrained demand for higher tier services (Practical Action, 2023).

Low affordability is exacerbated by high income variability and limited income opportunities. In camps covered by RE4R phase one, only residents with an additional income source (either employment or remittances) beyond cash allowances could afford the monthly repayments to purchase solar home systems. Households with inconsistent income could only afford a solar lantern. Others could afford ad hoc expenditure on candles or used phones for lighting, but the poorest relied on firewood or had no source of lighting (ibid).

Insufficient cash or in-kind assistance from camp authorities can also compound challenges in accessing energy. For example, refugees in Kiziba, Nyabiheke and Kigeme struggled to meet their energy needs in July 2023 after funding cuts meant that cash assistance could not be provided (UNHCR, 2023). Similarly, cuts in the monthly firewood ration from camp authorities in 2017 meant it was insufficient to meet household needs, with small and poorer households worst affected (Practical Action, 2020). In addition, as monthly cash assistance did not fluctuate in response to changes in charcoal and firewood prices (becoming more expensive in the rainy season), many households were forced to reduce food consumption, take out loans, or go into debt with fuel sellers (ibid).

A lack of targeted subsidies or loan facilities and limited access to finance have been identified as key barriers to energy access for refugees (Practical Action, 2023). In contrast, poorer households in host communities receive subsidies for improved and BLEN cookstoves (BRD, 2023).

Other demand side challenges, identified through assessments for RE4R phase two, include:

- Low awareness of products and their benefits, with information on energy products and services reported to be poorly organised and difficult to access.
- The threat of camp closure or relocation making refugees hesitant to invest in energy access and businesses.
- Limited opportunities to start or grow businesses, including those which would use energy productively, given low availability of land and access to finance (particularly for women), leaving displaced people reliant on finance from other camp residents.

Supply side barriers identified include:

- Limited distribution networks: some companies are reluctant to operate in camps and others' low capacity means that points of sale and after sale services are limited. This has contributed to low availability of high-quality productive use technologies. Few Solar Home System retailers use rental or leasing payment models because most residents lack reliable sources of income and only a minority can afford recurring monthly payments (Practical Action, 2020). Those who can have purchased from host communities (ibid).
- Low technical and financial capacity: companies have limited skilled labour to install, maintain and operate energy systems, especially bigger solar systems or PUE machinery, as well as to design, develop and improve systems to match energy needs and standards.
- Low availability of clean fuels: available clean cooking fuel does not fully satisfy displaced and host community needs. For instance, on its own, LPG provided by UNHCR in the Mugombwa and Mahama camps is insufficient to meet cooking needs, especially for larger families, and there is general shortage of alternatives to traditional cooking.

- Poor quality of electricity supply: electricity from the national grid is accessible in all camps, but the use of productive machinery is hindered by poor quality and voltage.
- Poor quality of energy products: there are issues with the quality of some of the improved cook stoves and fuel sold locally, partly because testing and certification for improved cookstoves has only started recently and is not yet common practice.

8. Factors limiting market mechanism reach

Market mechanisms are intended to overcome affordability, and potentially other barriers, to energy access. However, certain factors may affect the capacity of those in extreme poverty to take up mechanism support (i.e. mechanism's reach to these groups).

Experience with financial support in general

People's experience with financial support is likely to influence willingness or ability to use market mechanisms for energy access. Financial inclusion is high for Rwanda's adult population with 93% (roughly 7 million people) using either formal or informal financial products or services in 2020 (FinMark Trust, 2020). However, certain districts and groups are disproportionately affected by financial exclusion. This ranged from zero exclusion in Gasabo district to 17% in Gatsibo and Rusizi districts in 2020. People living in poverty, those in remote rural areas, youth, women and the elderly population were more likely to be affected (ibid). This is supported by the World Bank's (2023d) findings that only 30% of adults in the poorest 40% of the population had an account at a financial institution in 2017. Limited experience with financial support in general among people living in extreme poverty may limit willingness or ability to use market mechanisms for energy access.

Levels of general and financial literacy

General and financial literacy are likely to affect the extent to which people living in extreme poverty can understand and derive benefit from market mechanisms for energy access. Rwanda's national literacy is 71.24% of adults (as of 2023) compared to a global average of 86.9% (wisevote, 2023). However, financial literacy is much lower at 26% of adults in 2014 (S&P, 2014).¹² Barriers to formal education are likely to affect those living in extreme poverty to a greater extent than the wider population (Global Citizen, 2020). This suggests that understanding of market mechanisms is likely to be lower for this group and there is a need for additional measures to improve understanding so that benefits are obtained.

Experience borrowing from financial institutions

Experience borrowing from formal financial institutions may affect people's willingness and ability to engage with market mechanisms. Data is unavailable for the proportion of adults borrowing from a formal financial institution (World Bank, 2023d). However, 40% of adults in the poorest 40% of the population borrowed from family or friends in 2017 (ibid). A lack of data makes it difficult to assess levels of experience in borrowing from formal financial institutions among those living in extreme poverty in Rwanda. However, it is reasonable to assume that it will likely reflect patterns of account ownership with those in the poorest 40% of the population having less experience borrowing from financial institutions than those with higher incomes. Limited engagement with financial institutions, either saving or borrowing with them, will mean that people are less likely to have credit histories or records of regular savings, potentially hindering the implementation of business models involving repayments. It may also create reluctance to engage with mechanisms where borrowing is involved.

PAYGo infrastructure

PAYGo mechanisms typically involve payment via mobile credit (by sending a text message) (IRENA, 2020). Therefore, their reach is primarily dependent on mobile phone ownership and network coverage. Mobile money account ownership may also influence the ease in which customers can engage with this mechanism (ibid). Conditions for PAYGo uptake are mixed in Rwanda. Nearly all of the population are covered by at least a 2G network (mAccess, 2023) and around 87% of adults (6.2 million people) had access to a mobile phone in 2020 (FinMark Trust, 2020). However, only 15% of adults in the poorest 40% of the population had a mobile money account in 2017 (World Bank, 2023d). This suggests that many living in extreme poverty may face greater challenges in adopting PAYGo without additional support.

Factors limiting market mechanism reach to displaced people

In addition to these general barriers to market mechanism reach in Rwanda, assessments to inform phase two of Practical Action's RE4R programme identified limited experience of using credit for purchases and making repayments among displaced people in some camps as an issue potentially limiting market mechanism reach.

9. Key findings and conclusions

- **At 48%, Rwanda has one of the highest extreme poverty rates in East Africa and the 11th highest across sub-Saharan Africa and the Indo-Pacific.** Poverty in Rwanda (as elsewhere) is concentrated in rural areas and specific groups, including women and girls. The number of people living in extreme poverty, however, at 6.7 million ranks only ~23rd in sub-Saharan Africa and the Indo-Pacific.
- **Lower levels of employment and productive activity mean that extreme poverty rates among the ~133,650 displaced people in Rwanda are likely to be even higher than in host communities.** However, numbers of displaced people living in extreme poverty cannot be estimated because data is not collected.
- **People living in extreme poverty in Rwanda have significantly lower levels of energy access than the rest of the population.** We estimate that ~59%, some 4.0 million, people living in extreme poverty have no effective access to electricity and 95%, some 6.4 million, had no access to clean energy for cooking. It seems clear that targeted market mechanisms will be needed if people living in extreme poverty are not to be left behind.
- **Displaced people in camps on average have higher levels of both electricity and clean cooking energy access than people living in extreme poverty more generally across Rwanda, and in some camps higher than the national access rate.** This is largely due to higher penetration of off-grid solutions and UNHCR provision of LPG.
- **The fundamental energy needs (household, productive and communal) of people living in extreme poverty and of displaced people, appear largely the same as those of the wider population in Rwanda** (though the evidence to support this conclusion is limited).

- **Barriers to energy access for people living in extreme poverty and the rest of the population in Rwanda also appear similar.** This may reflect the high poverty rates in the country and that many of even those with higher incomes are close to the extreme poverty line.
- **Factors such as access to information and companies' reluctance to operate in camps, form additional barriers to energy access for displaced people living in camps,** alongside the barriers faced by other people living in extreme poverty in Rwanda.
- **Cost is by far the main reported barrier to energy access among those living in extreme poverty (including displaced people) in Rwanda,** so it seems likely that market mechanisms which improve affordability could enable many to access energy.
- **The option to pay in instalments increases willingness to pay for energy access among people living in extreme poverty in Rwanda,** but it continues to lag that among the rest of the population. Even with payment by instalment and subsidies, some **45% of people living in extreme poverty remain unwilling to pay for electricity access, indicating that higher levels of subsidy and/or action to overcome other barriers will be needed** if many are not to be left behind.
- **Limited access to finance and lack of subsidies or loan facilities aimed at improving energy access have been identified as a key barrier for refugees,** providing further evidence of the need for appropriate market mechanisms to enabled energy access among displaced people in Rwanda.
- **People living in extreme poverty in Rwanda (and particularly those in remote rural areas, youth, women, the elderly and displaced people) are more likely to be financially excluded;** lack access to mobile payment and banking services; and have had limited engagement with financial institutions. They may therefore be reluctant, or struggle, to engage with market mechanisms which rely on such services or require a credit history.

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11. Endnotes

¹ The other reviews in this series are of Ethiopia, Kenya, Nepal, Nigeria and Zambia

² Defined by the World Bank as those living on less than US\$2.15 per day at 2017 purchasing power parity (PPP) <https://www.worldbank.org/en/news/factsheet/2022/05/02/fact-sheet-an-adjustment-to-global-poverty-lines>

³ We had previously estimated, when looking at poverty rates across the region, based on regional changes in extreme poverty between 2016 and 2019, an extreme poverty rate of 48% and 6.8 million people living in extreme poverty in Rwanda in 2023.

⁴ WFP provides cash assistance for food, with highly vulnerable households receiving RWF 10,000 (US\$9.3) per person per month, while those classified as moderately vulnerable receive RWF 5,000 (US\$4.7) per person per month (increased from RWF 3,500).⁴ UNHCR also provides cash assistance for non-food items, with the average amount per household in 2020 being RWF 11,696 (UNHCR and WFP, 2021). UNHCR (2023c) provides refugees in Kiziba, Nyabiheke, and Kigeme camps with cash to purchase LPG fuel and LPG fuel is distributed free to refugees in Mahama and Mugombwa camps (ibid).

⁵ The ratio of working age members to the number of children, older people or people with disabilities

⁶ 1,082 households (18% from host communities) were surveyed at the end of 2022 with average household size being 6.

⁷ Data from the survey was re-analyzed to compare the responses given by people living in extreme poverty with responses from others, living above the extreme poverty line.

⁸ We estimate, from figures in the Rwanda Beyond Connections: Energy Access Diagnostic Report that 6% of grid connections and 24% of off-grid solutions in Rwanda did not achieve tier 1 electricity access.

⁹ Using the same estimate as above, from figures in the Rwanda Beyond Connections: Energy Access Diagnostic Report that 6% of grid connections and 24% of off-grid solutions in Rwanda do not achieve tier 1 electricity access.

¹⁰ It is recognized that responses given regarding willingness-to-pay cannot be taken entirely at face value, and so percentages of people saying they would be willing to pay at a particular price point may not be entirely realistic. However broad inferences may be drawn from the overall pattern of responses.

¹¹ The MTF survey in Rwanda did not ask about willingness to pay for a more advanced improved cookstove.

¹² S&P's Global Financial Literacy Survey measured the concept in terms of understanding of four key elements of financial decision making: risk diversification, inflation, numeracy and compound interest. A person was considered financially literate if they could answer 3 out of 4 questions related to these topics correctly.