

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

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

Appendix 7.2a

Energy Access among People Living in Extreme Poverty in Ethiopia with a Focus on Informal Urban Settlements



Transforming
Energy
Access

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. Ethiopia was chosen for review because of the large number of people living in the country in extreme poverty who are without access to energy.

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 people living in urban informal areas. This group was chosen as the focus in Ethiopia because of the significant number of people living in informal settlements in the country and availability of relevant information.

Some of the key findings from the research include:

- People living in extreme poverty in Ethiopia have significantly lower levels of energy access than the rest of the population. Of the 30.5 million people living in extreme poverty in the country, an estimated 18.3 million have no effective access to electricity and 29.5 million lack access to clean energy for cooking.
- Affordability and market reach are the main barriers to energy access among Ethiopia's population living in extreme poverty. The option to pay in instalments substantially increases their willingness to pay for energy access.
- Awareness building and behaviour change efforts, alongside technologies better matched to people's preferences and priorities, are needed in addition to market mechanisms bridging the affordability gap, to support transition to modern energy.
- Though residents of informal urban settlements represent a relatively small proportion (less than 10%) of people living in extreme poverty who are without energy access in Ethiopia, they face additional barriers which must be addressed if they are not to be left behind. As with other groups living in extreme poverty, common barriers include affordability; unreliable electricity supply; and low awareness of technologies' benefits. However, unlike other groups, especially rural residents, evidence suggests that settlement structure and legality are more significant barriers to electricity access.

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

Ethiopia is Africa's oldest independent country and its second largest in terms of population (123 million people in 2021), behind Nigeria (World Bank, 2023a). Ethiopia is a federal multi-party parliamentary republic, with a titular president as head of state and an executive prime minister (AfDB, 2023).

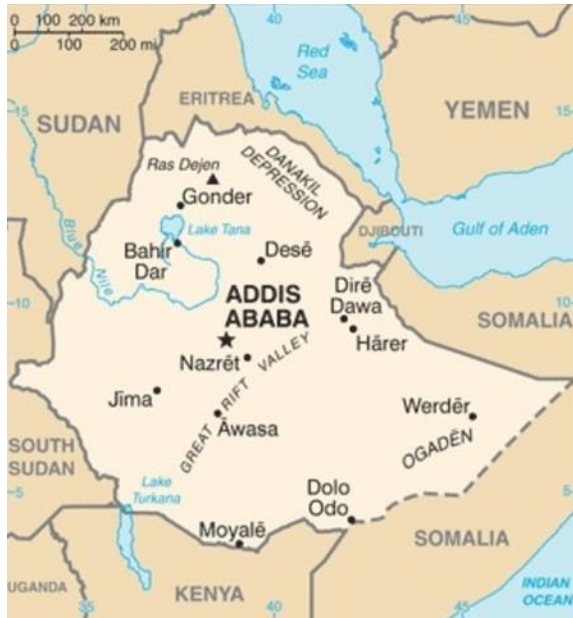


Figure 1 Map of Ethiopia (Source CIA, 2023)

The federal republic comprises nine regional states, each with its own government. The current Prime Minister, Dr. Abiy Ahmed (elected by the House of Representatives) and the first female President, Dr. Sahle-Work Zewde, were appointed in 2018 (ibid).

Ethiopia registered an average Gross Domestic Product (GDP) growth rate of 10.4% per annum from 2005 to 2019, making it one of the fastest-growing economies in Africa (AfDB, 2021).

Growth declined to 6.1% in 2020 due to the COVID-19 pandemic as well as desert locust invasion and conflict in the Tigray region. Current growth is largely driven by industrial and services sectors. However, per capita income remains low at about

US\$900 in 2020 (ibid). Two-thirds of the population are currently employed in agriculture (World Bank, 2023a).

3. Extreme poverty

Ethiopia's extreme poverty rate was 27% (27.2 million people) in 2015 (the last year survey data was collected) and the extreme poverty gap was 7.6% (World Bank, 2023b).

Ethiopia achieved consistently high economic growth over the last decade resulting in poverty reduction in urban and, to a lesser extent, rural areas. However, poverty remains high in pastoral and drought-prone lowland areas, partly because of conflict and drought shocks. Income inequality also grew in this period due to diverging welfare trends between urban and rural areas (ibid).

Reductions in GDP and increasing unemployment indicate a challenging environment for poverty reduction. The World Bank reports that COVID-19, prolonged drought, conflict in the Tigray region, rising food prices and disruption to supply chains as a result of the Ukraine War are likely to have stalled poverty reduction since 2019. However, impacts are thought to have been uneven, with urban and wealthier households being at greater risk of falling into poverty, while rural households had a better chance of escaping it due to income growth (ibid).

We estimate, based on regional changes in extreme poverty between 2016 and 2019,³ that extreme poverty is ~24.1% in 2023. This equates to 30.5 million people, one of the largest concentrations of extreme poverty in any country in sub-Saharan Africa and the Indo-Pacific.

4. Poverty among people living in informal urban settlements

The growth of urban informal settlements in Ethiopia reflects urbanisation and population growth outpacing the provision of land and formal housing as well as regulatory processes and government capacity to manage settlement development (Nibretu et al, 2021). The provision of clean, affordable and reliable electricity is also difficult under these conditions (ibid).

A key driver of poverty in urban informal settlements is limited access to formal employment. Residents who have migrated from rural areas or fled environmental or political crises may also have limited savings. Poverty is perpetuated by poor quality and limited urban services. This includes poor quality and overcrowded housing; risks of eviction due to land tenure insecurity and poor regulation; lack of safe water supplies, sanitation, drainage and solid waste collection; poor access to healthcare, emergency services and policing; and difficulty accessing formal education (IIED, 2023).

It is estimated that 64% of Ethiopia's urban population (i.e., some 18.6 million people) live in informal settlements as of 2020 (World Bank, 2023e),⁴ with informal settlers making up around 18.3% of the population of Addis Ababa (Nibretu et al, 2021).

The World Bank (2023b) reports that the percentage of Ethiopia's urban population living in extreme poverty in 2015 was 11% (roughly 2.2 million people). If it is assumed that urban poverty rates have declined alongside national rates, this would imply that the percentage of the urban population living in extreme poverty in 2023 might be just below 10%,⁵ some 2.8 million people. It is not possible to estimate with any accuracy what proportion of people living in extreme poverty in urban areas were in informal settlements, but it seems likely that the figure lies between 1.8 million and 2.8 million.

5. Energy access

Background

Ethiopia has a total installed electricity generation capacity of 4,500 megawatts (MW) (ITA, 2022). Approximately 90% comes from hydropower, while the remaining 8% and 2% come from wind and thermal sources, respectively. Ethiopia has abundant renewable energy resources and the potential to generate over 60,000 MW of electric power from hydroelectric, wind, solar and geothermal sources (ibid).

Ethiopia is reported as having the second largest market for stand-alone solar technologies in sub-Saharan Africa after Nigeria (ACE-TAF, 2021). GOGLA (2021) reports that the off-grid electricity market is dominated by sales of solar lanterns (representing 77% of sales in the first half of 2021) followed by multi-light systems. The market is characterised by a high volume of cash purchases, with PAYGo representing only 3% of sales volumes in the first half of 2021 (ibid).

Ethiopia's off-grid electricity market is growing steadily due to increasing public and private sector investment. However, declines in sales volumes for key lighting technologies have been reported since 2020 including the COVID-19 pandemic and the conflict between the Ethiopian Government and the Tigray People's Liberation Front. Additional challenges facing the sector include limited access to foreign exchange and local currency working capital for companies as well as affordability challenges, with rural households struggling to

afford standalone solar products, and consumer financing mechanisms currently falling short in improving affordability (ibid).

Key policies and programmes:

The Ethiopian Government aims to achieve universal access to electricity by 2025 through both grid and off-grid connections (GOGLA, 2021). The Government also aims to reach 33% of the population with clean cooking by 2030 (includes improved cookstoves) 21% with modern energy cooking by 2030 (MECS, 2022).

Key energy policies include:

The National Electrification Plan 2.0 (2019): plan for achieving universal electricity access nationwide by 2025 (TTID, 2021).

Refreshed Energy Africa Ethiopia compact (2021): with support from the Africa Clean Energy Technical Assistance Facility, the compact is an implementation plan for achieving off-grid electricity access for 35% of households (ibid).

Sector support programmes include:

- **Access to Distributed Electricity and Lighting in Ethiopia (ADELE) Project:** in 2021 the World Bank approved a US\$500 million credit to support Ethiopia to achieve universal electricity access by 2025 through deployment of solar decentralized renewable energy (GOGLA, 2021).
- **Ethiopia Electrification Programme (ELEAP):** a US\$375 million credit facility, launched in 2018 and due to end in 2023.
- **Africa Clean Energy Technical Assistance Facility (ACE-TAF):** a regional FCDO funded programme to cultivate a market-based approach for delivery of standalone solar systems.
- **The United Nations Capital Development Fund (UNCDF):** supports low-income households and micro-enterprises to access low-cost clean energy through microfinance.
- **Energising Development (ENDEV) Ethiopia:** supports the off-grid solar sector by promoting and financing installation of solar systems at rural health centres and training solar technicians (ibid).

Energy access levels

As of 2021, 54% of people in Ethiopia had access to electricity while 8% had access to clean cooking (IEA et al, 2023). This represents moderate progress from 2017 when 44% of the population had access to electricity and 5.2% of the population had access to clean cooking (ESMAP, 2023). Access to electricity and modern energy for cooking remain geographically uneven. Among urban residents, 94% had access to electricity in 2021 compared to only 43% of rural residents (IEA et al, 2023). Similarly, 27% of urban residents had access to modern energy for cooking but no residents in rural areas (ibid).

When people in Ethiopia were asked, as part of the World Bank's (2023d) Multi-Tier Framework energy access diagnostic surveys carried out in 2017, what access they had to energy, only 17% of people living in extreme poverty had a grid connection (compared to 41% within the rest of the population) (see Fig 2).⁶ In rural areas this was only 12% (compared

with 20% of people on higher incomes), while in urban areas the grid connection rate rose to 85% (compared with 96% connection rate for the rest of the urban population). Use of off-grid electricity solutions was very similar, at ~23% among people in extreme poverty and the rest of the population. Some 33% of people living in extreme poverty, compared with 12% of those not living in extreme poverty, had no access to electricity at all. We estimate that 73% of people living in extreme poverty did not have effective modern electricity access (i.e. did not have MTF tier 1 or higher access),⁷ compared with 49% of higher earners.⁸

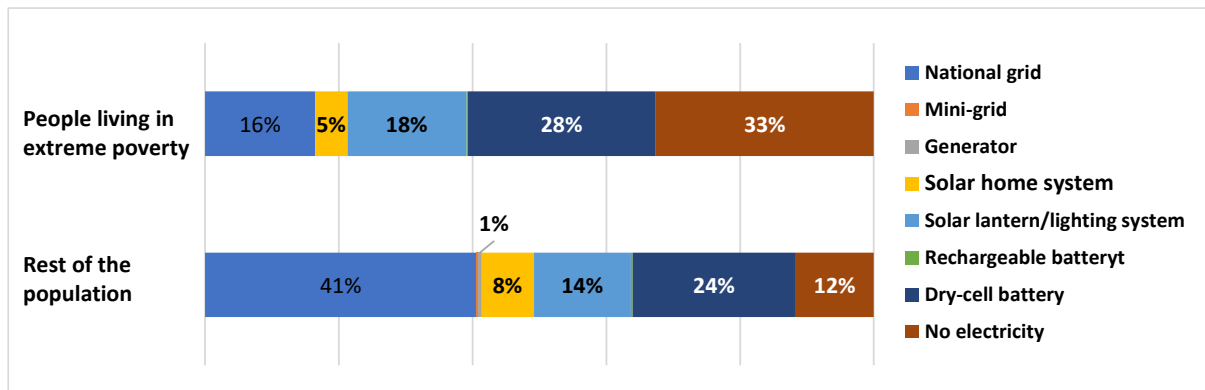


Figure 2: Electricity access by technology (based on data from World Bank, 2023d)

Based on the 54% 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. 73%:49%), the percentage of people living in extreme poverty in Ethiopia who lack electricity access can be estimated at 60%, 18.3 million people.

Less than 1% of people living in extreme poverty, and 5% of the rest of the population, were using clean cooking fuels when the survey was carried out (see Fig. 3).⁹ About 87% of people living in extreme poverty (and 71% of the rest of the population) were cooking with wood or sawdust. Only 4% of people living in extreme poverty (but 22% of people who were living above the extreme poverty line) cooked with charcoal. More of those living in extreme poverty than those above the extreme poverty line (9% vs 2%, respectively) also used fuels such as coal, crop wastes or animal dung.

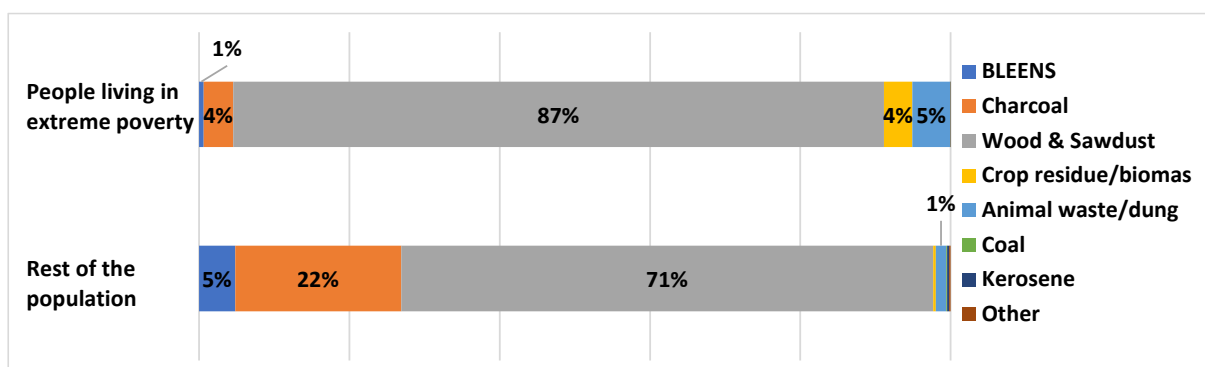


Figure 3: Cooking by fuel used (based on data from World Bank, 2023d)

Based on the 8% national level of clean cooking energy access in 2021, reported through the SDG7 tracking process (ibid), and if it is assumed 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 (ie 99% vs 96%), the percentage of people living in extreme poverty

who lack access to clean energy for cooking in Ethiopia can be estimated at 97%, 29.5 million people.

Energy access levels among people living in urban informal settlements

In general, urban informal settlements in Ethiopia have low levels of electricity use. Informal settlers also predominantly use poor quality traditional cooking fuels (Nibretu et al, 2021). However, energy access studies have focused on rural and urban centres, and urban informal settlements have received little attention (ibid).

In 2021 (the most recent date for which figures are available), 94% of all urban residents in Ethiopia had electricity access. In 2017, 97% of all urban residents, but only 85% of people living in extreme poverty in urban areas had electricity access (Padam et al, 2018; World Bank 2023d). If it is assumed that access rates for those living in extreme poverty in urban areas moved in line with access rates for urban residents as a whole, this would imply that in 2021 83% of people living in extreme poverty in urban areas would have had electricity, leaving about 0.5 million without access.

Similarly, in 2021 27% of all those living in urban areas had access to clean energy for cooking (IEA et al, 2023). In 2017 an estimated 21% of people in urban areas,¹⁰ but only 9% of those living in extreme poverty had clean cooking access.¹¹ If access rates for those living in extreme poverty in urban areas are assumed to have moved in line with access rates for urban residents as a whole, this would imply that in 2021 ~7% of people living in extreme poverty in urban areas would have had access to clean cooking energy, leaving 2.7 million without access.

These figures compare with our estimate of 1.8-2.8 million people living in extreme poverty in informal settlements, but it is not possible to estimate how many people living in extreme poverty in informal settlements also lack energy access.

6. Energy needs of people living in extreme poverty

There is limited evidence of how the energy needs of those living in extreme poverty in Ethiopia align with or differ from those of the wider population. However, people were asked, as part of the 2017 MTF survey, about electrical appliances they would like to be able to use. Televisions and radios were the highest priority for people living in extreme poverty (see Fig. 4). Power tools were their next priority, followed by refrigerators, with some people identifying other appliances (such as computers, smartphones or fans). Broadly, a higher proportion of people living in extreme poverty wanted TVs and radios, while more of those not living in extreme poverty wanted other appliances, particularly refrigerators and computers. However, these figures do not tell us what appliances people already had. Thus, very few people said they wanted lamps, possibly because they already had lights, whereas when they did not choose stoves or washing machines, this may be because they felt no need for them.

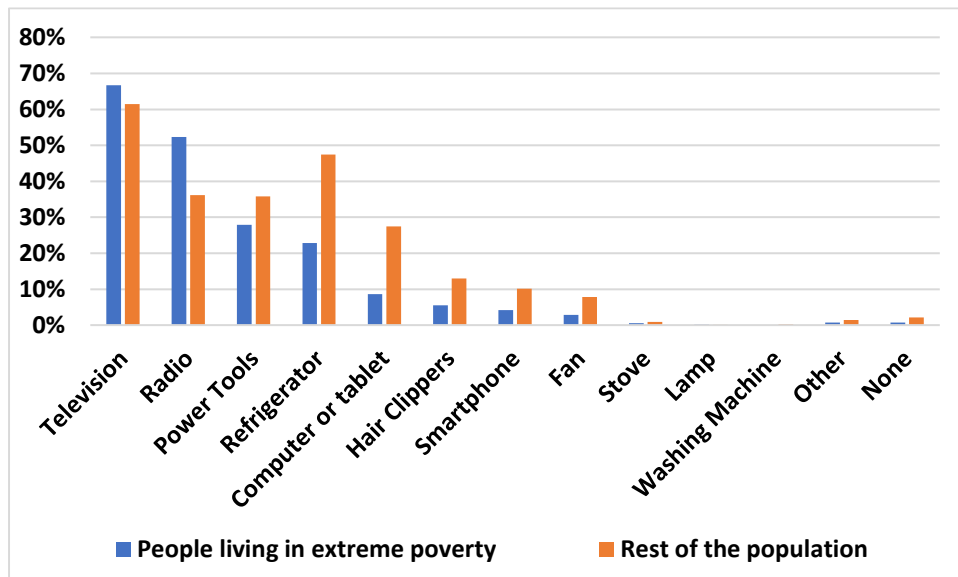


Figure 4: Additional appliances wanted (based on data from World Bank, 2023d)

Energy needs within urban informal settlements broadly mirror those of the wider population. Nibretu et al (2021) report that households choose energy products because of their efficiency and ability to save time and reduce the workload of women and children. As in other settings, women and girls are disproportionately involved in biomass collection and need modern energy for cooking. Households also report that they value clean energy sources such as LPG and electric cookstoves because of their health benefits.

7. Affordability, willingness to pay and other barriers

People in Ethiopia were asked, as part of the Multi-Tier Framework energy access diagnostic survey carried out in 2017, about their willingness to pay for energy access (World Bank, 2023d).

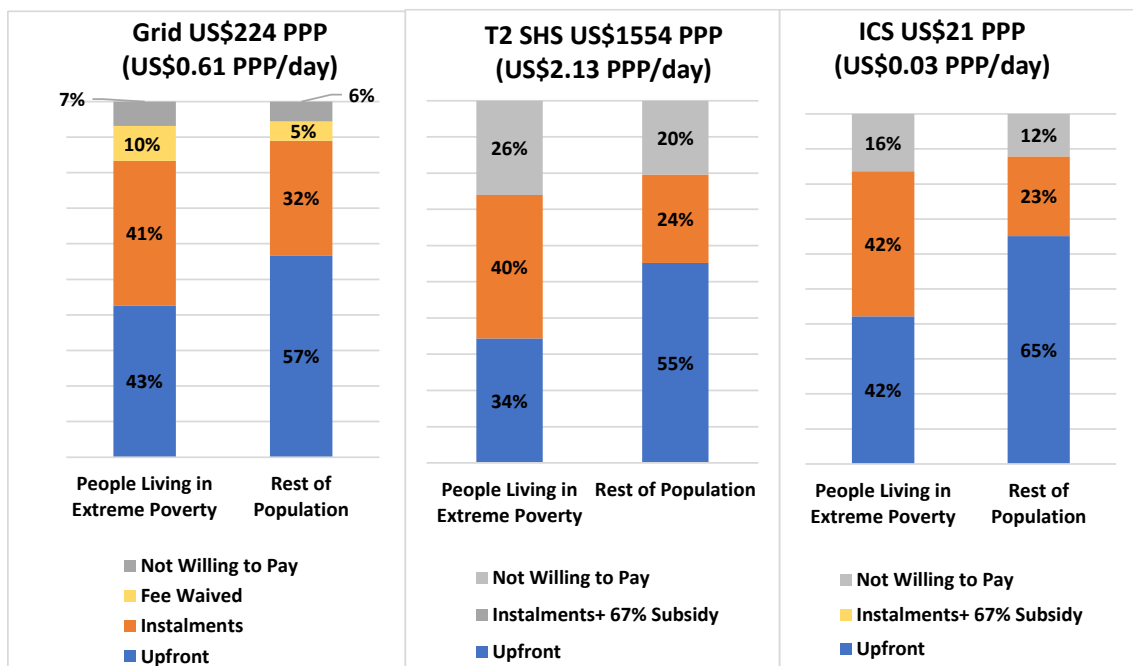


Figure 5: Willingness to pay for grid connection, solar home system or improved cookstove (Source: World Bank, 2023d)

Some people living in extreme poverty were willing to pay upfront for each of a grid connection, solar home system or improved cookstove (see Fig. 5).¹² However, willingness to pay upfront was lower among people living in extreme poverty than among the rest of the population. The option to pay in instalments significantly increased willingness to pay for energy access among both people living in extreme poverty and those on higher incomes. It brought willingness to pay among those living in extreme poverty closer to, but not quite in line with, willingness to pay among people living above the extreme poverty line. Some people living in extreme poverty (7% - 26%) remained unwilling to pay the price asked even in instalments (and, for a grid connection, even if the fee were waived).

A number of people living in extreme poverty who had no grid connection had applied for one, and were just waiting to be connected (see Fig. 6). The majority could not connect simply because of distance to the grid. The cost of connecting was the main barrier for only a relatively small percentage (~5%) of people living in extreme poverty. Virtually none of those asked said that ongoing monthly costs prevented them from connecting.

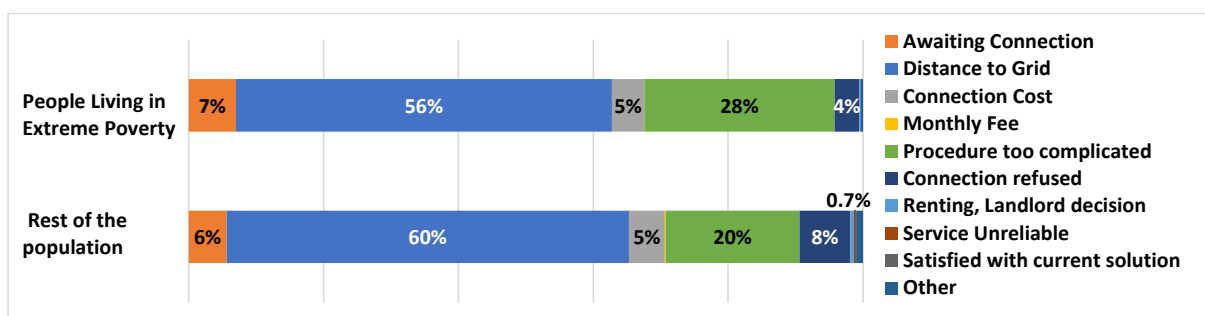


Figure 6: Barriers to grid connection (based on data from World Bank, 2023d)

The majority, however, of those living in extreme poverty who were unwilling to pay for a grid connection, a solar home system or improved cookstove said it was because they could not afford the cost (see Fig. 7).

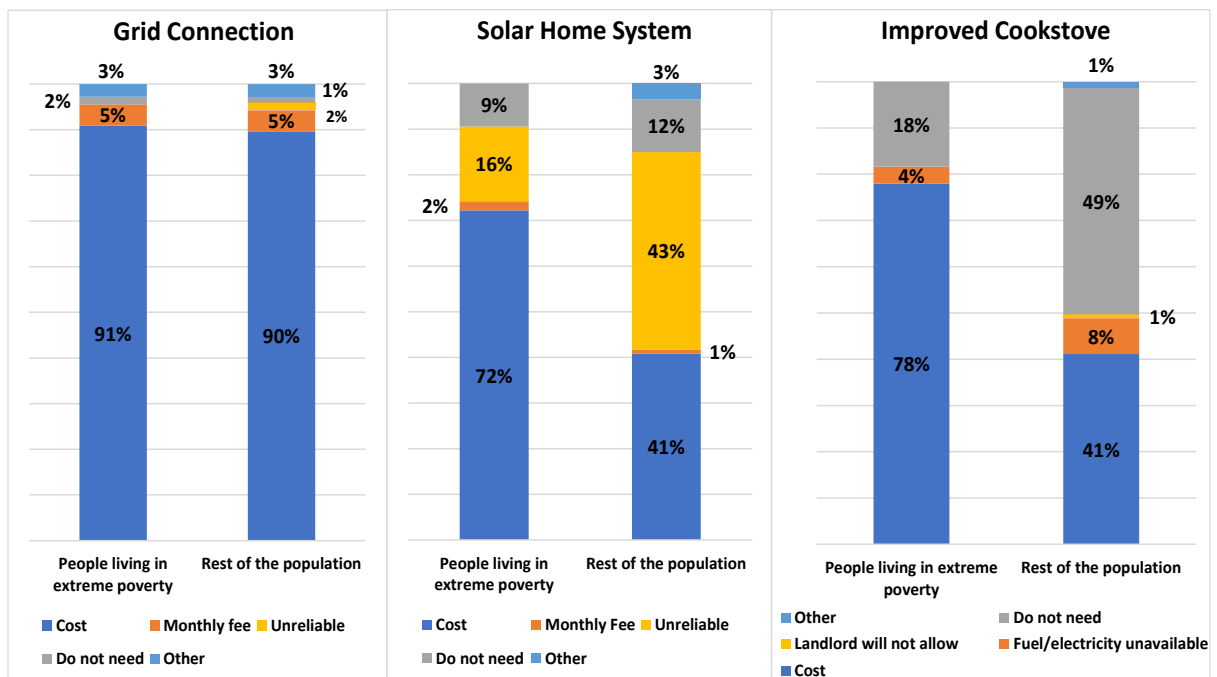


Figure 7: Reasons not willing to pay for grid connection, solar home system or improved cookstove (based on data from World Bank, 2023d)

Ongoing monthly costs were seen as a problem for only a small number of people living in extreme poverty who were unwilling to pay for a grid connection or a solar home system.

The main barrier to grid connection (apart from distance) was the complexity of the application process. In addition, a significant number of people living in extreme poverty had been refused a connection. A far smaller percentage gave the need for their landlord to agree as the main obstacle to grid connection, and this was also flagged by as the reason a small number of people were unwilling to pay for a connection or an improved cookstove.

Virtually none of the survey respondents saw unreliability as a barrier to grid connection, or the reason they were unwilling to pay for a connection, but unreliability was the main reason, after cost, that people were unwilling to pay for a solar home system. Unreliability of fuel (or electricity) supply was also the reason a small number of people were unwilling to pay for an improved cookstove.

None of those living in extreme poverty said that they did not need a grid connection, or were unwilling to pay for one because their existing energy access was satisfactory. However, a significant portion of those unwilling to pay for a solar home system said they did one and an even higher percentage of people living in extreme poverty who were unwilling to pay for an improved cookstove, said they had no need for it.

Barriers to energy access for people living in urban informal settlements

Assessments of energy affordability among people in urban informal settlements in Ethiopia are limited. Nibretu et al (2021) report that informal settlers generally have low energy usage, irregular incomes and poor capacity to pay electricity connection fees and charges.

Affordability is a key challenge in accessing modern energy for this group. One study in Yeka sub-city of Addis Ababa found that the number of households spending on energy sources (firewood, charcoal, kerosene and electric power) rose in line with household income.¹³ Households with monthly incomes below 9,000 birr (USD 163) mainly used firewood and charcoal while those earning above 9,000 birr used charcoal and electricity (ibid).

Electricity connection fees in the study site ranged from 650-10,000 birr (US\$11.7 - 182, or US\$42 – 647 PPP) depending on proximity to electricity lines and connection period.¹⁴ Households with monthly incomes at or above 9,000 birr, especially those with a head of household in formal employment, were more likely to be electricity users than households living on less than 9,000 birr per month due to the greater affordability of connection fees as well as their greater ability to consistently pay electricity bills. Therefore, income variability appears to be a key barrier to energy access for lower income households.

Table 1: Households’ monthly expenditures for energy sources based on electric-use status (Nebretu et al, 2021)

Energy source	Monthly expenditures (Birr)		
	Mean	Min.	Max.
Firewood	402	60	1200
Charcoal	248	50	800
Kerosene	132	20	400
Electric power	301	25	1200

Table 1 shows total monthly expenditure for some energy sources for all households within the study site. Interestingly, there was no clear divide in terms of expenditure between modern and traditional energy sources with average expenditure for firewood being the

highest, followed by electric power, charcoal and kerosene. However, the range of monthly expenditure was much larger for electric power than for traditional energy sources (ibid).

Differences in expenditure reflect differences in demand due to a range of factors, not only cost. Nibretu et al (2021) report that LPG and kerosene were the most expensive energy sources followed by electricity and biomass. Traditional biomass sources, such as animal dung, firewood, and charcoal, were more widely used than modern alternatives due to lower cost. Therefore, high average expenditure on electricity in spite of higher cost reflects high willingness to pay among households. This is also evident from the high number of non-electricity using households willing to share electricity metres with immediate neighbours to pool funding. On the other hand, kerosene was the least used energy source (often only temporarily or in emergencies) and, therefore, low demand and willingness to pay likely explain lower expenditure. Along with lower cost, wide use of traditional energy sources was also attributed to electricity unreliability and personal and cultural preference for biomass cooking. Fuel stacking continued for these reasons among households using electricity (ibid).

In addition to affordability, a range of other barriers affect energy access among urban informal settlers in Ethiopia. Evidence shows that the availability and quality of electricity supply is generally poor (although conditions vary between urban informal settlement) (Nibretu et al, 2021). Power interruptions, fluctuations and outages are a frequent occurrence for many households in Yeka Sub-City as well as oversupply causing damage to household infrastructure.

Nibretu et al (2021) also report an association between housing and land type and likelihood of using electricity. Households living in better quality housing (made of steel, wood and cement/blocks) and households with more rooms were more represented among those using electricity. In addition, likelihood of using electricity was greater for households who had lived in the study site for more than 5 years and had greater land holdings. This is likely explained by higher incomes enabling better housing, more land and electricity consumption. Non-income related factors related to duration and social connections within settlements may also have contributed but were not explored in detail.

Interestingly, physical remoteness, which often drives low access to energy in other settings, was not correlated with electricity use or non-use in the study. Specifically, households using electricity and households not using electricity lived in similar proximities to electricity lines and transformers. This is consistent with the fact that the physical availability of electricity infrastructure tends to be greater in urban areas and is therefore less of a barrier to access than in more rural areas where availability tends to be lower. However, proximity to grid infrastructure in the urban informal site did influence the price of a grid connection.

Common to other settings, education influenced use of modern energy. Specifically, households with a more educated household head were more represented among those using electricity. Greater levels of education were associated with greater knowledge of the benefits of modern energy, such as reductions in health risks, and, therefore, willingness to adopt technologies. This is consistent with findings from other areas that show that low levels of education and awareness are barriers to modern energy adoption (ibid).

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., mechanisms ‘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. Some 46% of Ethiopia’s adult population, but only 35% in the poorest 40%, had an account at a financial institution in 2022 (World Bank, 2023f). Levels of financial inclusion among the bottom 40% are similar to those for Kenya, Nigeria and Rwanda also included in this series of reviews. Those in extreme poverty are likely to be more affected by barriers to financial inclusion than the wider population. The World Bank’s Findex Database (2023f) shows that barriers to account ownership include distance from financial institutions (affecting 19% of survey respondents); financial services being too expensive (10%); insufficient funds (48%); lack of necessary documentation (16%); lack of trust in financial institutions (4%); religious reasons (2%); or someone else in the family having an account (11%) (ibid).¹⁵ Low experience with financial support 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 in extreme poverty can understand and derive benefit from market mechanisms. Ethiopia has the lowest national literacy rate of the countries included in this series of reviews (Ethiopia, Kenya, Nepal, Nigeria, Rwanda and Zambia) at 49% of the adult population (as of 2023), compared to a global average of 86.9% (wisevoter, 2023). Levels of financial literacy are also low with only 32% of the adult population being financially literate in 2014 (S&B, 2014).¹⁶ Barriers to education are likely to affect those living in extreme poverty more than the wider population (Global Citizen, 2020). This suggests that additional measures to improve understanding of how market mechanisms work are needed to ensure benefits are obtained.

Experience borrowing from financial institutions

Experience borrowing from formal financial institutions may affect people’s willingness to engage with market mechanisms. The World Bank (2023f) reports that only 4% of adults in the poorest 40% of the population had borrowed money from either a formal financial institution or using a mobile money account in 2022. This is similar to levels of borrowing in Nigeria (5%) and Zambia (6%) but much lower than in Kenya (32%). A much higher proportion (30%) had borrowed from family or friends (ibid). 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. Conditions for PAYGo uptake are mixed in Ethiopia. Network coverage is good with 85% of the population being covered by a 3G

network in 2019 and (mAccess, 2023). However, only 51% of adults owned a mobile phone in 2022 (World Bank, 2023f) and ownership is lower in rural areas compared to urban (47% of households compared to 87% of households) (CCA, 2022). In addition, only 1% of adults in the poorest 40% of the population had a mobile money account in 2021 (World Bank, 2023f). This suggests that those living in extreme poverty, especially those in rural areas, are likely to struggle to adopt PAYGo for energy access.

Market mechanism reach to those living in urban informal settlements

Information on market mechanism reach to people living in urban informal settlements in Ethiopia is limited. It is not possible to report on factors such as financial institution or mobile money account ownership or experience borrowing from financial institutions. As noted, mobile phone ownership is higher in urban areas relative to rural areas. This is also likely to apply to urban informal settlements given the high proportion of Ethiopia's urban population living in such areas - estimated to be 64% in 2020 (World Bank, 2023e). This suggests that PAYGo opportunities are higher here than in rural areas.

Those living in urban informal areas are likely to suffer from broad challenges to market mechanism reach. These include poor financial service provision (with low incentives for provision due to a perception of informal settlers as risky borrowers given their precarious and temporary status); limited physical access to informal settlements by mechanism providers given poor-quality infrastructure; a lack of formal identity documents and addresses among settlers hindering mechanism adoption; and low trust of financial institutions lowering willingness to engage with mechanism providers.

9. Key findings and conclusions

- **Ethiopia's extreme poverty rate is estimated at 24.1%**, well below the sub-Saharan Africa regional average (34.9%) and ranking 22nd of 68 countries across sub-Saharan Africa and the Indo-Pacific. However, the **30.5 million people living in extreme poverty** in Ethiopia is the third largest number in sub-Saharan Africa and the Indo-Pacific.
- We estimate that **between 1.8 – 2.8 million people may be living in extreme poverty in informal urban settlements in Ethiopia**, (though there is insufficient data to estimate the exact number with confidence).
- **People living in extreme poverty in Ethiopia have significantly lower levels of energy access than the rest of the population.** We estimate that 60%, some 18.3 million, of people living in extreme poverty have inadequate access to electricity and 97%, some 29.5 million people, living in extreme poverty have no access to clean energy for cooking. **Financial support is needed if people living in extreme poverty are not to be left behind.**
- **Cost is the main reported obstacle to adoption of solar home systems and clean cookstoves by people living in extreme poverty in Ethiopia** (though relatively few people saw it as the main barrier to grid connection). **Market mechanisms which address affordability thus have the potential to enable a significant proportion of those living in extreme poverty to achieve energy access.**

- **The option to pay in instalments substantially increases willingness to pay for energy access among people living in extreme poverty in Ethiopia.** It largely removes the differential in willingness to pay between people who live above and below the extreme poverty line. **Market mechanisms which spread costs over time could enable many of those living in extreme poverty to access energy.**
- A significant percentage of people living in extreme poverty are unwilling to pay for energy access even in instalments. **Subsidies and/or removal of other, non-financial, barriers will be needed if they are to achieve access.**
- The **application process, and being refused connection**, appear to represent significant barriers to grid connection for people in Ethiopia. Removal of these barriers could enable more people living in extreme poverty to gain grid access.
- **Unreliability of solar home systems was the second most frequently given reason** why people living in extreme poverty would not buy this energy solution. Improvements to these products will be needed for market mechanisms to be fully effective in enabling electricity access.
- More than a quarter of people living in extreme poverty would not buy an improved cookstove because they do not believe they need one. **Only if people are persuaded of the benefits of cleaner cooking will market mechanisms reach them.**
- Limited and irregular incomes mean **those living in urban informal settlements in Ethiopia struggle to pay for electricity.**
- Wealthier households in informal settlements continue to use biomass for cooking due to poor electricity supply; personal preferences; and cultural cooking practices. **Awareness building and behaviour change efforts are needed, alongside technologies better matched to people's preferences and priorities, to support transition to modern energy.**
- **Barriers related to housing and settlement legality and structure are more significant for people in informal urban settlements** than for the wider population. These factors can prevent access to electricity even when households live near to supply infrastructure.
- **Those living in extreme poverty in Ethiopia are disproportionately affected by factors likely to limit market mechanism reach.** Willingness and ability to engage with market mechanisms is likely to be especially low for this group, who will need targeted support to overcome these obstacles.

10. References

- Africa Energy Technical Assistance Facility (ACE-TAF), 2021. Ethiopia: The second largest addressable market for standalone-solar in Sub-Saharan Africa. [Online]. Available at: <https://www.ace-taf.org/kb/ethiopia-the-second-largest-addressable-market-for-stand-alone-solar-in-sub-saharan-africa/> [Accessed 15/09/23].
- African Development Bank (AfDB), 2023. *Ethiopia Country Profiles 2021*. [Online]. Available at: [Ethiopia - Country Profiles - 2021 | African Development Bank Group - Making a Difference \(afdb.org\)](https://www.afdb.org/en/country-profiles/ethiopia) [Accessed 14/09/23].
- Baye, F., Adugna, D., and Mulugeta, S., 2023. Administrative failures contributing to the proliferation and growth of informal settlements in Ethiopia: The case of Woldia Township. *Heliyon* 9 (1), pp. 1-19.
- Central Intelligence Agency (CIA), 2023. *Ethiopia*. [Online]. Available at: <https://www.cia.gov/the-world-factbook/countries/ethiopia/>. [Accessed 11/10/23].
- Clean Cooking Alliance (CCA), 2021. *Ethiopia Consumer Segmentation*. Washington D.C.: CCA.
- Energy Catalyst, 2020. *Country Guide: Ethiopia*. London: Energy Catalyst.
- Energy Sector Management Assistance Programme (ESMAP), 2023. *The Energy Progress Report*. [Online]. Available at: <https://trackingsdg7.esmap.org>. [Accessed 15/09/23].
- Global Citizen, 2020. *Understanding How Poverty is the Main Barrier to Education*. [Online]. Available at: <https://www.globalcitizen.org/en/content/poverty-education-statistics-facts/>. [Accessed 10/11/23].
- Global System for Mobile Technology Association (GSMA), 2023. *Mobile Money in Ethiopia: Advancing financial inclusion and driving growth*. London: GSMA.
- Global Off-Grid Lighting Association (GOGLA), 2021. *Ethiopia*. Amsterdam: GOGLA.
- IEA, IRENA, UNSD, World Bank, WHO, 2023. *Tracking SDG 7: The Energy Progress Report*. Washington D.C.: World Bank.
- International Institute for Environment and Development (IIED), 2023. *Introduction to Urban Poverty*. [Online]. Available at: <https://www.iied.org/introduction-urban-poverty>. [Accessed 15/09/23].
- International Telecommunications Union (ITU), 2023. *Measuring digital development Facts and Figures: Focus on Least Developed Countries*. Geneva: ITU.
- International Renewable Energy Agency (IRENA), 2020. *Pay-as-you-go models innovation landscape brief*. Abu Dhabi: IRENA.
- mAccess, 2023. *mAccess diagnostic tool*. [Online]. Available at: <https://maccess.digitaldevelopment.org/>. [Accessed 28/09/23].
- Modern Energy Cooking Services (MECS), 2022. *Ethiopia eCooking Market Assessment*. Loughborough: Loughborough University.
- Nibretu, K., Degefa, T., Tamirat, T., 2021. Determinants of Energy Choice for Domestic Use in Informal Settlements of Addis Ababa. *Journal of Science & Sustainable Development*, 8 (1), pp. 33-44.

Padam, G; Rysankova, D; Portale, E; Koo, B; Keller, S; Fleurantin, G, 2018. *Ethiopia - Beyond Connections: Energy Access Diagnostic Report Based on the Multi-Tier Framework*. Washington DC: World Bank.

Tetra Tech International Development (TTID), 2021. *ENERGY AFRICA – ETHIOPIA REFRESHED COMPACT 2021*. Nairobi: TTID.

United States Agency for International Development (USAID), 2018. *Rapid Assessment Framework: PAY-AS-YOU-GO SOLAR AS A DRIVER OF FINANCIAL INCLUSION*. Washington D.C.: USAID.

United Nations International Children’s Emergency Fund (UNICEF) Ethiopia, 2023. Learning and development. [Online]. Available at: <https://www.unicef.org/ethiopia/learning-and-development>. [Accessed 08/09/23].

Wisevoter, 2023. Literacy rate by country. [Online]. Available at: <https://wisevoter.com/country-rankings/literacy-rate-by-country/>. [Accessed 28/09/23].

World Bank, 2023a. *The World Bank in Ethiopia*. [Online]. Available at: <https://www.worldbank.org/en/country/ethiopia/overview>. [Accessed 15/09/23].

World Bank, 2023b. *Poverty and Equity Brief Ethiopia*. New York: World Bank Group.

World Bank, 2023c. *Urban population – Ethiopia*. [Online]. Available at: <https://data.worldbank.org/indicator/SP.URB.TOTL?locations=ET>. [Accessed 08/09/23].

World Bank, 2023d. *Ethiopia – Multi-Tier Framework (MTF) Survey*. [Online]. Available at: <https://datacatalog.worldbank.org/search/dataset/OO41725>. [Accessed 15/09/23].

World Bank, 2023e. *Population living in slums (% of urban population) – Ethiopia*. [Online]. Available at: [Population living in slums \(% of urban population\) - Ethiopia | Data \(worldbank.org\)](https://data.worldbank.org/indicator/SH.UH.SLVS.EG). [Accessed 15/09/23].

World Bank, 2023f. *The Global Findex Database 2021*. [Online]. Available at: <https://www.worldbank.org/en/publication/globalfindex/Data>. [Accessed 18/09/23].

11. Endnotes

¹ The other reviews in this series are of Kenya, Nepal, Nigeria, Rwanda 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 See Methodology section for description of how this estimate has been derived.

⁴ 23% (from <https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS>) of ~126 million total population live in urban areas, of whom 64% live in informal settlements => 18.6 million people in urban informal settlements

⁵ $11\% \times 24.1\% / 27\% = 9.8\%$

⁶ We re-analysed the data from these surveys to compare the responses given by people living in extreme poverty with those from other people, living above the extreme poverty line.

⁷ Tier 1 of the Multi-Tier Framework for Energy Access (MTF) – see acronyms and definitions section in main Literature Review report.

⁸ We estimate, from figures in the Ethiopia Beyond Connections: Energy Access Diagnostic Report that 0.3% of grid connections and 53.2% of off-grid solutions in Ethiopia did not achieve tier 1 electricity access.

⁹ Biofuels, liquefied petroleum gas, electricity or natural gas (BLEN)

¹⁰ Estimated by interpolation from figures reported by IEA et al, 2023 for 2015 and 2021.

¹¹ Based on analysis of MTF survey data

¹² 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.

¹³ 450 households were sampled (of which 229 are electric-users and 221 are non-users of electricity)

¹⁴ This compares with the 1,900 birr up front cost which respondents were asked if they would be willing to pay as part of the 2017 MTF survey

¹⁵ The World Bank surveyed approximately 1,000 people in each of more than 160 countries included in the Findex Database, using a randomly selected, nationally representative sampling method.

¹⁶ 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.