

# Household transition to cleaner energy in rural Sierra Leone

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## In brief

- In Sierra Leone, just 5 percent of the population in rural areas has access to electricity.
- The United Nations Office for Project Services (UNOPS) is supporting the Government of Sierra Leone to increase access to clean electricity through the Rural Renewable Energy Project (RREP).
- The number of households connected to the mini-grid has been increasing over time, and have started benefitting from access to cleaner (non-fossil) energy – moving up the so called “energy ladder”.
- The RREP project has been successful in increasing access to cleaner (non-fossil) energy in rural communities. About half of households in RREP communities are connected. Usage however is low: daily average residential electricity consumption was just 0.28 kWh. For commercial connections average consumption is just 1.10 kWh per day.
- The assets most commonly powered by the mini-grid were light bulbs, phones, and radio.
- Compared to households not connected to the mini-grid in the same communities, mini-grid connected households were more likely to own more electrical assets and were more likely to spend more money on food and skip fewer meals.
- It will still take time for this transition to have a significant impact on the environment, livelihoods, and use of clean energy for cooking and lighting.
- The brief points to policies which can improve the implementation of the programme in Sierra Leone and elsewhere, contributing to a faster household transition to cleaner energy.

## Policy motivation for research

In the clean energy transition, developing economies such as Sierra Leone aim to increase economic growth and prosperity, while utilizing cleaner energy sources. Research in other emerging economies has shown that transitioning to clean energy has the potential to reduce the health impact of fuel sources, increase energy affordability, and create jobs, among other benefits.<sup>1</sup> The use of fuels such as biomass, coal, and kerosene for energy result in household air pollution, the primary cause of noncommunicable diseases (including stroke, lung cancer and heart disease) among women in low- and middle-income countries. In 2012, household air pollution caused 4.3 million premature deaths, 60 percent of which were among women and children, who are disproportionately exposed to household air pollution.<sup>2</sup>

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<sup>1</sup> Babayomi, Oluleke, and Davo A. Dahoro. 2021. “Energy Access vs. Energy for Prosperity: A Reassessment of Africa’s Strategies and Priorities.” In *2021 IEEE PES/IAS PowerAfrica*, 1–5. <https://doi.org/10.1109/PowerAfrica52236.2021.9543177>.

<sup>2</sup> World Health Organization. “Burning opportunity: clean household energy for health, sustainable development, and wellbeing of women and children.” (2016).

In 2019, only 1.3 percent of global installed solar capacity was located in Africa.<sup>3</sup> Currently, just 5 percent of Sierra Leone’s rural population has access to electricity. In this context, the United Nations Office for Project Services (UNOPS) is supporting the government’s goal of ensuring universal access to electricity by implementing a Rural Renewable Energy Project (RREP) project worth over UKP40 million. This project – funded by the UK Foreign, Commonwealth & Development Office (FCDO) – is an ambitious electrification effort that aims to provide access to off-grid solar electricity in up to 97 communities in Sierra Leone.

The project’s implementation is being conducted in multiple phases. This policy brief focuses on findings from the impact evaluation of the first and second phases of the project, which provided communities across 14 districts of Sierra Leone with access to off-grid solar electricity through the construction of 97 mini-grids.

## **Overview of the research**

The findings are based on data collected during baseline (2019) and follow-up (2021) surveys to evaluate RREP’s impact on key development outcomes. To do this, a representative sample of households in communities where mini-grids have been installed was compared with a representative sample of households in statistically similar communities where no mini-grid was installed.

In total, the impact evaluation team interviewed 6,010 households across 14 of Sierra Leone’s 16 districts to understand the transition to cleaner energy in rural Sierra Leone.

## **Key findings**

### **Electricity sources in comparison and RREP communities**

We see that 50 percent of households in our sample’s RREP communities have access to electricity, while just 7 percent of households in comparison communities report having access to electricity.

1,436 households in our sample reported being connected to the mini-grid at follow-up, or 43 percent of households in RREP communities. A typical connection fee was SLL 150,000 (approximately \$13.64). Households paid approximately USD 0.30 on average per day on electricity consumption. In first phase communities in our sample, 65 percent of households were connected to the mini-grid. In second phase communities, 35 percent of households are connected. Since less than half of the RREP communities are electrified, this percentage is encouraging.

In comparison communities, the most common electricity sources are generators and stand-alone solar power. The most common cooking heat source in both RREP and comparison communities is collecting firewood, followed by purchasing firewood and charcoal. In interviews and focus group discussions, respondents stated they would only switch their methods of cooking if all items were available nearby in their communities and they were the same cost, or cheaper. The convenience of attaining the cooking heat source was also an important consideration for respondents.

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<sup>3</sup> Babayomi, Oluleke O., Davo A. Dahoro, and Zhenbin Zhang. 2022. “Affordable Clean Energy Transition in Developing Countries: Pathways and Technologies.” *IScience* 25 (5): 104178. <https://doi.org/10.1016/j.isci.2022.104178>.

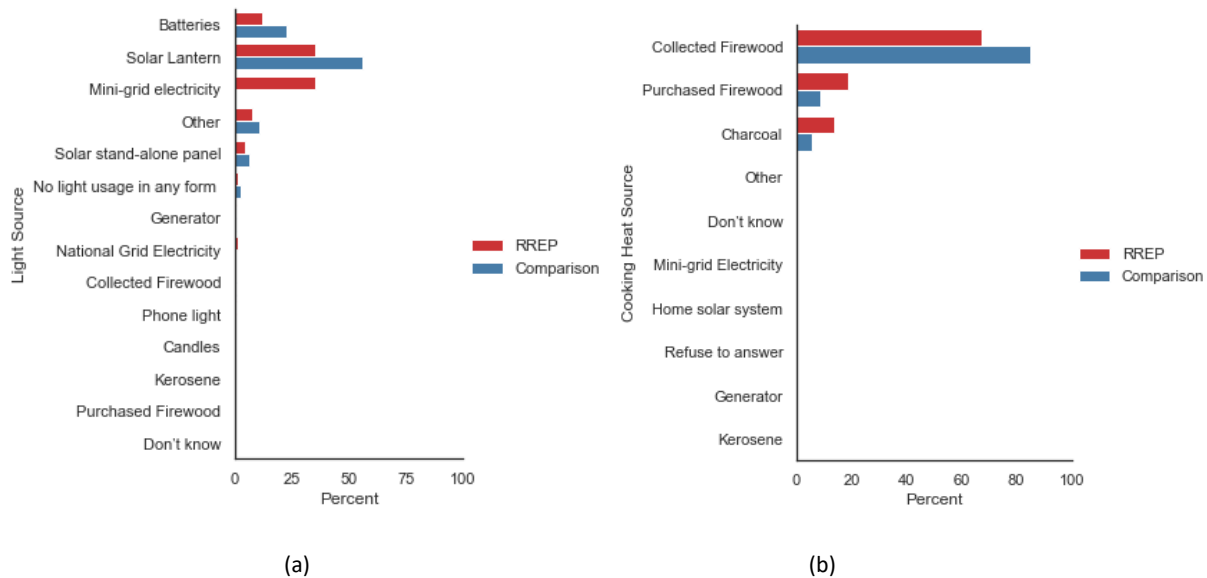
*“The only reason for us to switch our methods of cooking is if we are proven that the alternative is a cheaper method. Otherwise, we are going to continue with what we know as it is affordable and we understand it.”*

– Town Chief FGD participant

Connected households spend less money on fossil fuels. The most common lighting source in comparison communities is the solar lantern, followed by batteries.

In RREP communities, the most common lighting source is mini-grid electricity and the solar lantern. Households in communities with access to the mini-grid were 43 percentage points more likely to have light through the mini-grid. Mini-grid connected households are more likely to have access to light and less likely to use diesel generators for lighting.

Despite these positive signs, it will still take time for this transition to have a significant impact on the environment and livelihoods. Average usage rates are low: daily average residential electricity consumption was just 0.28 kWh. For commercial connections average consumption is just 1.10 kWh per day. There’s not yet a significant reduction in the use of other high-emissions energy sources, such as kerosene or firewood for both cooking and lighting. According to interviews with the mini-grid operators, the main reduction in CO<sub>2</sub> will be seen when residents are transitioning from generators to the use of solar power.



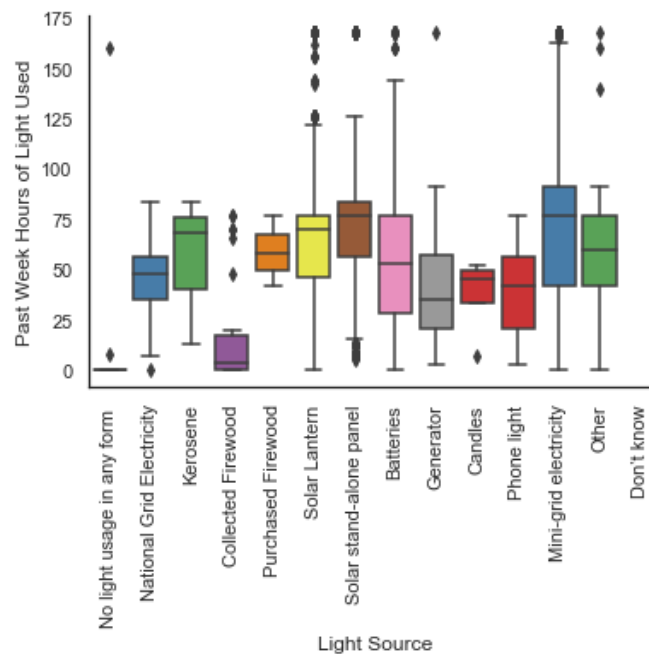
**Figure 1. Lighting and Cooking Sources Used at Follow-Up**

(a) shows the lighting source in RREP and comparison communities at follow-up. (b) shows the cooking heat source for RREP and comparison communities at follow-up. We see that in comparison communities, the solar lantern is the most used lighting source (56 percent), while in RREP communities the mini-grid (35 percent) and the solar lantern (35 percent) are the most common lighting sources. In RREP and comparison communities, firewood and charcoal remain the most common cooking heat sources.

## Energy use

Compared to households that are not connected to the mini-grids in the same communities, connected households were more likely to:

- Have a male household head
- Have more adults living in the household
- Be self-employed
- Own more electrical assets (freezers, mobile phones, radios, electric fans, stereo systems, televisions, etc.)
- Spend more on food and less likely to skip meals



**Figure 2. Number of Hours of Light Used in Past Week, by Light Source**

Households that used mini-grid electricity or a stand-alone solar panel have the highest median hours of light used in the past week, while households that collected firewood for light have the lowest median hours of light used in the past week.

In Figure 2, we see that households using mini-grid electricity have the highest median hours of light used in the past week. Households that collected firewood for light have the lowest median hours of light used in the past week.

## Owned assets

The mean number of electric assets in RREP community households is 2.25, while the mean in comparison community households is 1.76. The assets most commonly powered by the mini-grid were light bulbs, phones, and radio. In RREP communities, some electric appliances are more commonly owned than in comparison communities, such as freezers, electric fans, mobile phones, television, stereo, and DVD equipment.

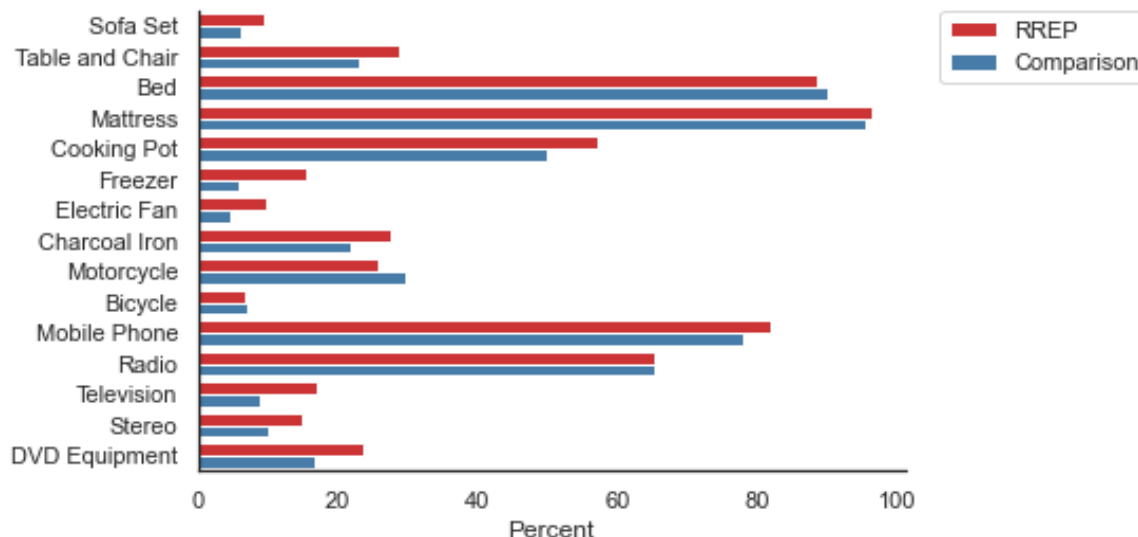


Figure 3. Household Assets Owned

This figure shows that the most commonly owned household assets are the mattress, bed, and mobile phone. Mobile phones, televisions, electric fans, freezers, televisions, stereos, and DVD equipment are all more commonly owned in RREP community households than comparison community households.

## Policy recommendations

Below are four recommendations targeted at both policymakers and UNOPS for continuation of work on the RREP and future projects.

1. **Provide clarity and communication on potential electricity uses.** In interviews, we found that, when probed, respondents mentioned that having an electric stove would make it easier for female petty traders to run their business while cooking at the same time. However, the respondents did not see this being a realistic option since they had never seen it before. To improve the take up of productive electrified assets, it may be helpful to demonstrate their use to electrified households.
2. **Increase electricity affordability.** When respondents reported disconnecting from the mini-grid or not yet being connected, the most common reason given was not being able to afford to be connected to the mini-grid. Through programs to increase the affordability of the mini-grid, more people will be able to reap the benefits of being connected to the mini-grid.
3. **Increase access to markets and productive electrified assets (e.g., freezers, mobile phones, radios, electric fans, stereo systems, televisions, etc.).** While we observe high rates of connection to mini-grids, self-employed individuals in RREP communities are not more likely to use electricity in their business.

We recommend developing a better understanding of the barriers to the adoption of productive assets and designing interventions that could help people in electrified communities overcome these barriers. The introduction of these assets should be planned to correspond with the available load capacity of the mini-grid.

4. **Invest in longer-term impact evaluations.** The transition to clean energy use will take time to manifest. Changes in ownership and use of productive assets will require investment and time. Lack of access to credit markets, poor public infrastructure, and lack of technological familiarity all increase the time it takes to catch up to improvements in energy infrastructure. Through longer-term impact evaluations, we will better understand the impact of mini-grid implementation on the clean energy transition.

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