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# **BEYOND THE NETWORKED CITY**

Policy Brief no.3: Access to Energy in Portee-Rokupa Informal Settlement

SIERRA LEONE URBAN RESEARCH CENTRE

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Beyond the Networked City is a 3-year research project funded by the Economic and Social Research Council, on behalf of the Global Challenges Research Fund. The vision for our research is to improve the delivery of water, sanitation, and energy services to poor and marginalised communities by developing and testing a hybrid economy model of on-grid and off-grid systems in Freetown, Sierra Leone and Kampala, Uganda.

This brief No. 3 has been produced by Sierra Leone Urban research Centre in order to provide insights on the state of energy access, usage and safety in Portee-Rokupa, a coastal informal settlement in Freetown. It also aims to identify challenges related to energy access and to support policy and interventions to address these access and safety concerns.

# Suggested citation:

Conteh, A. et al. (2023). Beyond the Networked City Policy Brief no.3: Access to Energy in Portee-Rokupa Informal Settlement. Freetown: Sierra Leone Urban Research Centre.

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# I. Introduction

Sierra Leone is endowed with energy potential in various forms, which include biomass, hydro, and solar power. While solar and hydro energy potentials remain underutilized, biomass (charcoal and firewood) is in dominant use, and accounts for 80% of energy consumption. Imported petroleum products are the next largest source of energy. They are mainly used for power generation, and they account for 13% of the energy consumption. The electricity grid connections (thermal and hydro) account for the least energy consumption, which is only 7%<sup>1</sup>.

The on-grid energy sector faces multiple challenges in providing safe and stable services for customers. Current on-grid electricity supply is hampered by low generation capacity and seasonal variations affecting capacity of the hydro to supply electricity during the dry season. Moreover, electricity is transmitted through aging transmission and distribution networks which affects stable supply. Estimates show that Sierra Leone has an installed power capacity of 99.6 MW for a population of over 7 million. These factors have caused barriers to electricity access, and even those who access it, high and fluctuating tariffs serve as huge barriers. However, the Ministry of Energy has started an energy transformation strategy which includes policy formulation and extending supply to areas not previously served such as rural areas, using thermal and solar energy sources, bringing rural access to about  $2\%^2$ .

While this new transformation happens, electricity supply in the urban areas remains a challenge. It is estimated that only 10 - 12% of the urban population has access to on-grid electricity<sup>3</sup>. In Freetown for example, the 161 Kilo Volts (KV) transmission line covers about 40% of the energy need of residents<sup>4</sup>. Of the 79.2% of households that are connected to the grid, about 14.5% of households cannot afford cost of connection to access a pre-paid meter, so they receive access through their neighbors<sup>5</sup>.

In terms of cooking energy, charcoal and wood are the most used across the country, although some urban

- <sup>1</sup>https://www.afdb.org/en/documents/country-focus-report-2022-supporting-climate-resilienceand-just-energy-transition-sierra-leone
- <sup>2</sup>https://www.investinginsierraleone.com/energy/
- <sup>3</sup>https://energypedia.info/wiki/Sierra\_Leone\_Energy\_Situation#cite\_note-1

<sup>4</sup>https://www.trade.gov/country-commercial-guides/sierra-leone-energy-infrastructure

<sup>5</sup>https://www.statistics.sl/images/StatisticsSL/Documents/SLIHS2018/SLIHS\_2018\_New/sierra\_ leone\_integrated\_household\_survey2018\_report.pdf

<sup>7</sup>https://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/Country\_RAGAs/Sierra\_ Leone\_RAGA\_EN\_Released.pdf

<sup>8</sup> https://www.iied.org/fire-disaster-makes-more-1000-homeless-freetown

residents have started transitioning to clean cooking energy such as Liquified Petroleum Gas (LPG). Costs to access clean energy for cooking is high however, which remains one of the biggest barriers to access. In informal settlements, access is much worse for most residents who often struggle to prioritise other services such as water, healthcare, and food<sup>b</sup>. For this reason, most residents of informal settlements prefer using charcoal and wood because of low cost and ease of access. This has implications for health and wellbeing for people living in the informal settlements. For example, Charcoal usage in the informal settlements is over 70% followed by fuel wood which is over 28%. As the urban population increases, coupled with the grim economic situation, studies show that charcoal and fuel wood usage will continue'. Beyond the health risks, charcoal and fuel wood usage pose high risks of fire in informal settlements where houses are congested, which provides limited space for intervention by fire responders. Fire outbreaks have also been linked to overloading of meters to provide access to people who cannot afford the cost of a meter through informal networks of friends and neighbours°.

In this study, we focused on energy access for lighting and cooking and the strategies by people living in Portee-Rokupa to enhance access. This brief has been produced to provide insights on the state of energy access, usage and safety in Portee-Rokupa and to support policy and interventions aiming to address their access and safety concerns. We hope to do this through dialogue with policy makers, service providers and community residents.



Figure 1: The coastal settlement of Portee- Rokupa. Photo credit: Amadu Labor

# **Methods**

We conducted mixed methods research involving 385 household surveys, 6 focus group discussions with community residents, comprising landlords and tenants from the formal and informal sections of Portee-Rokupa. We also conducted 25 key informant interviews with community stakeholders and community and municipal service providers, and institutional stakeholders, including policy makers.

<sup>&</sup>lt;sup>6</sup>https://www.un.org/sites/un2.un.org/files/2021/09/energy\_compact\_for\_sierra\_leone\_.pdf



Figure 2: Maps of Portee-Rokupa

Left: Showing the formal & informal sections. Top Right: Location in Freetown. Bottom Right: Showing Portee & Rokupa sections.

Credit: Ansumana Tarawally, SLURC

# Profile of Case Study area: Portee-Rokupa

Portee-Rokupa is a sea front settlement located in the east of Freetown, the capital of Sierra Leone. It is approximately 10 km from the city center and shares borders with Grass field to the west, Congo water to the east, Kuntolo to the south and the Rokel river to the north of the Rokel estuary. The geographic features of the settlement consist of sandy soil and rocky slopes, and it is a vibrant fishing community.

Politically, the settlement is situated within two separate wards (Portee in Ward 355 and Rokupa in Ward 354) divided by the wharf (Jetty). The estimated population of the settlement is 34,502 comprising the formal and informal sections. A 2015 estimate by YMCA indicated that there are over 6,000 residents live in the poorest section of the community, which is often described as informal (YMCA and CODOHSAPA, 2015).



Figure 3: Main source of Lighting

# **II. Findings**

In this section, we have divided the findings into subsections covering energy classification and usage, barriers to access energy and strategies to enhance access and safety.

Energy sources were classified based on usage, which included: 1) energy for lighting and 2) energy for cooking. We explored access, safety, barriers, and solutions to enhance access and safety. Unlike water and sanitation, residents of informal settlements have increased access to different sources of energy. Energy for lighting also referred to as on-grid electricity is provided mainly by the Electricity Distribution and Supply Authority (EDSA) while Coal-pot which is used as the main energy technology for cooking is provided by informal markets. The main source of fuel for Coal-pot technology is charcoal and firewood which are transported from the provinces.

# 1) Energy for Lighting

Lighting energy sources in this study were generally referred to as sources used for lighting homes, and these include: 1) On-grid and 2) Off-grid.

# Access to On-grid lighting

While electricity is not yet accessible by many city residents, residents of Portee-Rokupa stated that access to on-grid electricity has been improving steadily in the last decade. Most respondents (94.3%) mentioned that the on-grid electricity supplied by EDSA is their main source



Figure 4: A floating power plant generating on-grid electricity (KAR-POWERSHIP)



Figure 5: Affordability of on-grid electricity

of lighting. A few other participants reported using other sources of lighting such as battery powered torches (5.2%) while chargeable light bulbs and solar lights were 0.3% respectively, as highlighted in figure 3.

# Affordability of On-grid electricity

In this study, we explored from participants the state of affordability. 62% of respondents mentioned that they can afford to pay the electricity bill. Affordability was based on the user arrangements and payment strategies which are often informal. As highlighted in the next section dealing with payment strategy, electricity bills are often settled through informal structures such as meter owners who connect their neighbours.



Figure 6: Electricity bill payment strategy

# Electricity bill payment strategy

Majority of residents in Portee-Rokupa access and pay for electricity through informal networks. Many settle their bills through landlords and tenants who own meters and were referred to as "meter owners or "meter agents".

"I have access to electricity but with connection from another tenant whom we refer to as meter agent" (FGD-Female tenants formal).

Payments are made monthly and the amount paid to meter owners depends on the number and type of electrical appliances owned by the users. Figure 6 highlights the electricity payment hierarchies based on consumption. However, participants stated that electricity bills paid in the informal section are higher than the formal. Participants stated that the main cause of this difference is that most

residents of the informal section do not own a meter, so their payment is determined by meter owners. Many residents in the formal section have their own meters, so they pay directly to EDSA. Figure 6 shows payment disparities between residents of formal and informal sections of Portee-Rokupa.

### Safety

Participants classified safety into three areas as discussed under the flowing points. These points were highlighted in interviews and focus group discussions to understand safety concerns regarding the use of on-grid electricity.

# Quality of electricity supply

Regarding the quality of electricity, 70% of participants mentioned that the quality is poor, and referred to it as "bad light" and "blackout". In the qualitative studies, most participants pointed out many safety concerns, including low and fluctuating voltage supplies, and frequent power outages.

"Bad light (low and high voltage) is another challenge we face because we have to do frequent replacement and repair of our appliances" (FGD-Landlords informal).

Participants mentioned that unstable power supplies and fluctuating voltage supplies increase the risks of destroying appliances and causing fire outbreaks.

### Household wiring

Safety concerns were also linked to household wirings which many attributed to the frequent fire outbreaks. Key informants from EDSA ascribed the fire incidents to poor connections, use of substandard materials and the hiring of unqualified electricians. However, residents disagreed with the assessment of EDSA, claiming that they take adequate precaution to enhance safety. Many stated that they use circuit breakers to enhance safety during thunderstorms, concealing cables, hiring professionals, and avoiding overload of electrical units as described by a user:

"We ensure that we always use circuit breakers when doing connection to another household. We switch the breaker off when we suspect anything like fire or when there is thunder and lightning" (FGD- Male tenants formal).

With the contested notions of fire risks, it remains unclear

how these risks are generated within. One key area to explore is the supervision and regulation of household wiring which many people believe are responsible for electrical faults and fire outbreaks. This is the case because EDSA key informants stated that the institution does not have direct control over household wiring executed by private contractors.

### Illegal connections

Figure 7(Left): A Prepaid electric meter

Figure 8 (Right): A circuit breaker

Participants mentioned illegal electricity connection as a citywide problem including Portee-Rokupa. However, many said that they consider illegal connection as an offense since it has led to many fire disasters in the community.

"Some people cannot afford to buy meters; they tend to do illegal connections which we see as a taboo because it is one of the things people do that causes fire outbreak" (Male tenants formal).

While EDSA is concerned that illegal connections cause fire risks, they are also concerned about the loss of revenue. This has led to the setting up of a department to carry out impromptu checks, which was going on at the time of data collection. This may have impacted the depth of responses we got from participants because many were reluctant to talk about illegal connections during this period.

# Barriers to access on-grid electricity

During the focus group interviews and key informant interviews, participants spoke about factors impeding access to safe electricity. Some of these barriers such as high tariffs and affordability of meters are part of the residents' key concerns they felt can contribute to illegal connections and electricity theft. Table 1 shows the barriers to electricity.



Table 1:	Barriers	to	accessing	on-grid	electricit	y
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Barriers	Key concerns	Quotes
Affordability of	Bureaucracies increase cost of meters:	<i>"I have an electric meter and it cost me Le2,500,000.</i>
electric meters	bank payment, payment verification,	Other tenants do not have meters because it is very
	inspection of connection before	expensive and the process to get it is very difficult. the
	installation and transportation; high	price is between Le1,500,000 to Le3,000,000." (FGD-
	cost of meters and tips	Landlords formal)
High electricity	High tariffs for prepaid meters;	<i>"We are experiencing high tariffs and Irregular power</i>
tariffs	receiving less tokens after payment	supply. EDSA is charging too much and most of the time
		when I purchase Le100,000, they often give me 40 units
		as a token." (FGD-Landlords formal)

# Alternative Sources of lighting (off-grid)

As indicated above, most residents of Portee-Rokupa have access to the on-grid electricity supply. However, a few participants stated the use of alternative lighting sources due to unreliability of the main lighting source. Battery powered torch (80%) and mobile phone torch (71%) were the highest forms of alternative lighting sources. Other sources of alternative lighting included chargeable light bulbs (15%), candles (11%), rechargeable car and motorcycle batteries (6%), generators and solar lights (5% respectively). Only one participant reported to be using paraffin or kerosene lanterns (0.1%).

"Because we often experience frequent blackouts, we use battery powered torch light for lighting" (FGD-Female tenants formal).

Battery and mobile phone torches were the highest sources of alternative lighting which participants attributed to safety concerns with the use of candles and kerosene lamps and affordability of chargeable light bulbs, rechargeable car and motorcycle batteries, solar and generator lights. Figure 9 shows the alternative energy usage preferences.



Figure 9: Alternative energy sources used for lighting



Figure 10: Alternative energy sources for lighting. Left: A mobile phone torch. Right: A battery powered torch

# 2) Energy for Cooking

Despite the multidimensional impacts of household cooking energy sources on health, the environment, and household expenditures, there seems to be inadequate data pertinent to this subject matter. However, most residents in informal settlements are still utilizing traditional cooking energy. In this study, the cooking energy consumption patterns were generally looked at in two different categories:

1) Cooking fuel, and 2) Cooking technologies.

### **Cooking fuel**

As the use of Biomass continues to increase in most marginalized communities (Informal settlements) in Freetown, charcoal continues as the most used cooking fuel. Highlights from our quantitative survey shows that 95% of respondents use charcoal as their main source of cooking fuel. However, few mentioned using other sources of cooking fuels such as firewood (2.6%), and LPG (0.8%). Others use fish smoking ovens and saw dust (0.8%), and Electricity (0.3%), but they considered them mainly as alternatives due to their high cost and limited access.

"My wife is using charcoal for cooking because we don't have Afrigas, we only have a local stove (Col-pot). Affording Afrigas is very hard, not to mention refilling it. I have never seen any of my tenants using it for cooking because all of them cook outside. They also have a local stove (Col-pot) that uses charcoal as fuel" (Landlord Informal).

Most respondents considered charcoal to be safe. None of the mentioned it having health risks because it does not produce heavy smoke. It can also be accessed easily (94%) and its supply is reliable, hence it is available throughout the year. Shortages are only experienced during the rainy season due to price fluctuation which they considered as the key barrier.

# Cost of charcoal

Respondents stated that the cost of charcoal is affordable compared to LPG and electric cookers. According to most respondents, price fluctuation is their main barrier because households experience lower prices during the dry season and higher prices during the rainy season. From an in-depth discussion, we learnt that it is because of the difficulties faced by the informal marketers to access and transport the charcoal during the rainy season.



Figure 11: Cooking fuel usage



Figure 12: The main energy cooking fuel (Charcoal)



Figure 13: Seasonal costs of charcoal (October 2021)



Figure 14: Alternative energy cooking fuel



Figure 15: Alternative energy cooking fuels. Left: Firewood. Right: Liquified Petroluem Gas Cylinder (LPG)

*"The charcoal costs Le30,000 to Le35,000 per bag but this price changes during the rainy season."* (FGDs, female tenants informal)

During these difficult periods, however, most households tend to purchase charcoal in small volumes (plastic bags) while others use alternative fuels such as firewood (78.9%), LPG (13.5%), electricity (4.5%) and fish smoking oven and saw dust (2.2%). Figure 13 & 14 show the seasonal cost of charcoal and alternative sources used by residents respectively.

"I sell charcoal in two different forms. One is in plastics which cost one thousand leones (Le 1000) and two thousand leones (Le 2000) per packet, also per bag (50kg bags) which cost thirty-five thousand leones (Le 35,000) and sometimes fifty thousand leones (Le 50,000) when there is shortage. The most popular purchase is the small plastic packets that cost one thousand leones and two thousand leones." (KII, Charcoal seller, formal part PR)

"There are others within the community that use firewood when there is shortage of charcoal and some use other sources like for my household, we use the afrigas for boiling of water and sometimes when we want to heat our food at night" (FGD- Formal Male tenants)

# **Cooking technologies**

With its high efficiency rate and easy accessibility, the use of the local cook stove ("Col-pot") is becoming dominant amongst residents of most informal settlements within Freetown. From our quantitative survey, nearly every household within the settlement uses the local cookstove (Col-pot) as their main cooking technology (97%). Nevertheless, more than half of the respondents (56%) stated that the technology sometimes breaks down, which is why they are keen to have improved and long lasting cookstoves that will help to reduce their costs of maintenance. There are different types of cookstoves (col-

pots) with different sizes, which are also used for different occasions within the settlement, and they all use charcoal as fuel with few exceptions using firewood or saw dust.

*"We produce cook stoves for different purposes and of different sizes. The name the cookstoves use for the purpose it is meant to be used and the price is determined by the size of the cookstove"* (KII-Local cookstove producer).

The local cookstove (Col-Pot) is made from scrapped vehicle parts which respondents mentioned can withstand heat and takes time to expand even if it is used for the whole day.

"We choose the body of vehicles over other materials because people use fire in the cookstoves so we need materials that can withstand the heat from the fire. Other materials expand faster because people use the cook stoves two or three times a day, but the body of a vehicle takes time to expand even if the cook stove is used the whole of the day" (KII- Local cookstove producer)

Within the settlement, the data further shows that there are other cooking technologies used by few residents, such as three stones together "firestones" (1.6%), and Afrigas (0.8%) although few also mentioned not using any of the technologies (0.5%). Figure 16 shows the percentage usage of cooking technologies.

### Cost of local cookstove (col-pot) technologies

There are different sizes of "col-pot" and are used for different purposes. However, respondents mentioned that their costs vary depending on their sizes and quality. They are named based on usage patterns and the most popular cookstove (col-pot) is the one that costs Le35,000 which is widely used within the settlement. Figure 18 below shows the varying costs of "col-pots".

"We produce different types of cookstoves, and their costs depend on their sizes and their names also depend on their usage pattern. We produce cook stoves for tea shops (attaya bases), which depend on size and cost between 15,000 and 25,000 Leones; stoves for outdoor restaurants (or cookery shops) called "cookery col-pot" (Le 35,000 to Le 55,000 depending on size), sets for caterers (Le 150,000 to Le 350,000) and domestic stoves (costing Le 150,000) which are totally sealed and suitable for indoors". (KII, cooking stove producer)



Figure 16: Cooking technologies usage



Figure 17: Cook stove technologies.

Left: Afrigas. Middle: A local cookstove 'col-pot'. Right: Three stones together 'fire stone'



Figure 18: Varying cost of "Col-pot"



Figure 19: The local cook stove technologies

Top: Ataya Base 'col-pot'

Bottom: Cookery shops 'colpot'

# Safety of Energy Cooking Sources

Most households (97%) use local cookstoves, commonly known as "Col-pot" as their main cookstove technology and charcoal as their main cooking fuel. Most also consider charcoal safer than firewood because it doesn't produce thick smoke whilst using it, and therefore, it has little or no effects on their health.

Respondents mentioned that they have never experienced fire accidents caused by using these cookstoves and fuel within their community. Moreover, others mentioned receiving special training and sensitization from NGOs and the NFF (National Fire Force) on safety tips and practices to prevent fire outbreaks.

Box 1 highlights the safety tips and practices used by residents to prevent fire outbreak.

Box 1: Safety tips and procedures

Residents of Portee-Rokuba use these measure to protect themselves from fire hazards

- Empty fire from cook stove after use.
- Extinguish charcoal after use before storage.
- Stored used charcoal in 'paint cups.
- Cook outside the house.

# Suggested Interventions or Solutions

As the awareness for energy efficiency interventions continue to increase amongst households in informal settlements, participants identified priorities that will enhance easy access and safety. These priorities are cut crossing for both the formal and informal section as highlighted in table2.

Suggested interventions/solutions	Quotes		
Improvement of customer's services.	<i>"We want EDSA to always respond to us earlier whenever we call them to report faults."</i> (FGD- Female tenants informal)		
Reduction of electricity tariff and implementation of mobile metering system.	<i>"We need low tariff structures so that we can use other electrical appliances."</i> (FGD-Tenants male formal)		
Promotion of alternative energy sources, such as HSS (Home scale solar system), and clean cooking technologies (LPG, electric stoves).	"We need an uninterrupted electricity supply, and use clean cooking technologies, therefore we would like the government and other private sectors to start promoting other energy lighting and cooking sources." (FGD-Landlords formal)		
Government to support regulations to reduce the costs of clean cooking technologies and fuels.	<i>"We want the Government to regulate the cost of Afrigas so that we can afford to buy it."</i> (FGD- Female tenants formal)		
Government to support regulations to improve service provision/delivery and quality assurance in the market for electrical appliances.	"We want the Government and other sectors to support with regulations for good service provision and quality assurance for energy appliances such as cables, elec- tric cookers and other energy technologies." (FGD- Male tenants formal)		
Reduction of meter prices and connection fee.	"The price of a meter is high, and the connection fee is also very high. It will be nice if the price of meters is reduced so that most of us will be able to afford it." (FGD-Landlord informal)		

Table 2: Suggested interventions/solutions

# III. Conclusion

Access to on-grid electricity still remains a challenge for most residents within Freetown. Though electrecity access has been significantly increasing in most informal settlements in Freetown within the last decade, a vast number of consumers are still connected via informal means due to the limited availability of electric meters. However, safety of households wiring, quality of electricity supply and illegal connections remain key driven challenges that have had disastrous effects for most households within informal settlements in Freetown.

Regarding cooking energy, the use of modern energy cooking sources is still on a low level compared to the use of local/traditional energy cooking technology.

These challenges can be resolved through proper planning, monitoring and coordination between policy actors, community stakeholders, and service providers. The Government should also create an enabling regulatory framework for private sector involvement as well as publicprivate partnership for investment in renewable energy generation, while strengthening the capacities of other state owned utilities that are responsible for electricity production, transmission, and distribution.

Investing on cooking technology such as LPG and local cooking technology to enhance safety can be use to improve health within households, and reduce risks of fire.

This brief no. 3 has been produced to provide insights on the current level of energy access, safety, and usage pattern in informal settlements in Freetown. We hope to engender conversation among policy actors, service providers and community stakeholders that have oversights on the current energy situation in Freetown. This we can be achieved through the relationship SLURC has with the Federation of Urban and Rural Poor (FEDURP) and state actors.









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