

COUNTRY PROFILE

**OFF- AND WEAK-GRID SOLAR
APPLIANCE MARKET
SIERRA LEONE**

SEPTEMBER 2020

EFFICIENCY FOR ACCESS COALITION



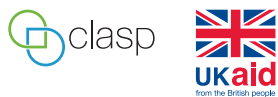
Photo: Simusolar

This country profile covers relevant market and appliance performance data for off-grid appliances sold in Sierra Leone based on findings from Efficiency for Access market surveys. The profile explores the overall market landscape in Sierra Leone, the common power type, size, price, and warranty of off-grid appliances sold in retail markets, and other findings relevant to sector stakeholders working in Sierra Leone.

This profile was developed by the United Kingdom's (UK) Energy Saving Trust and CLASP as part of the Low Energy Inclusive Appliances program, a flagship program of the Efficiency for Access Coalition. Efficiency for Access is a global coalition promoting energy efficiency as a potent catalyst in clean energy access efforts. Currently Efficiency for Access Coalition members lead 12 programs and initiatives spanning three continents, 44 countries, and 22 key technologies. The Efficiency for Access Coalition is jointly coordinated by CLASP, an international appliance energy efficiency and market development specialist non-for-profit organization, and the UK's Energy Saving Trust, which specializes in energy efficiency product verification, data and insight, advice, and research.

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INTRODUCTION

Efficiency for Access Country Profile Series

Insufficient data about off-grid appropriate appliances' makes it difficult for manufacturers, policymakers, distributors, mini-grid operators, investors, and other market actors to make informed decisions and identify high quality, efficient products. To help address this challenge, Efficiency for Access has worked to gather data on the availability of off-grid appropriate appliances in key countries.

Since 2018, Efficiency for Access has been conducting market scoping surveys in 10 countries.² The countries were selected based on the population size, solar home systems (SHS) sales volumes³, and uniqueness of the market.⁴ The survey results have informed program decisions, such as selecting products for testing through VeraSol.⁵ Until now, the results have not been shared publicly, but many stakeholders have requested this “off-the-shelf” market survey data to better understand the types of products available in national markets. To utilize this data and share insights from the surveys more broadly, Efficiency for Access is developing a series of country profiles that share market intelligence and contextualize data with supporting research and stakeholder feedback.

Product specifications collected through market surveys may not be accurate. Some of the data cited in this country profile includes claimed values provided by shopkeepers or from consumer-facing materials, such as a product’s packaging or user manual. As such, it may differ from data generated through third-party testing which is available on the [VeraSol Product Database](#). Still, this data provides preliminary and useful observations about Sierra Leone’s local off-grid appliance market.

About Sierra Leone

74% of Sierra Leone’s population, approximately 5.8 million people, live off the grid. Despite a large off-grid population, the solar appliance market is nascent and the penetration of these products is low primarily due to limited uptake of solar energy systems and low income per capita.⁶ This country profile contains relevant market and appliance performance data for Sierra Leone.

Efficiency for Access’ market surveys found that the overwhelming majority of products available to off-grid consumers were alternating current (AC) appliances that aren’t meant to be used with SHS kits. Still, these products are being used off-grid, powered either by generators or mid-to-large sized SHS kits with inverters. The surveys also found only that only a small number of companies have recently started selling direct current (DC) fans, TVs, and refrigerators that are designed for use with SHS kits. Brand recognition for these products is low, and consumers tend to opt for generic low-cost AC appliances instead.

Market Landscape

Sierra Leone has one of the lowest national electrification rates of any country in Africa. As of 2018, the national average of people connected to the grid was around 26%, with most of these connections being in Freetown and surrounding areas. In rural areas, only around 6% of the population has access to grid connection.⁷

To help encourage the off-grid solar market, Sierra Leone’s government has already adopted several policy measures including exempting solar energy kits that meet the Lighting Global Quality Standards⁸ from import taxes (25%) and goods and services taxes (GST) (15%).⁹ Sierra Leone also participated in the Energy Africa Access Campaign, run in partnership with the UK Foreign, Commonwealth & Development Office (FCDO), to adopt policy measures and other actions to accelerate the household solar market. As a direct response of the Campaign, the country’s first Renewable Energy Association of Sierra Leone (REASL) was established in 2016 to aggregate the key



of people in Sierra Leone live in off-grid communities

1. In this document, off-grid appropriate appliance refers to appliances that can be powered by distributed energy systems like SHSs and mini-grids, or are appropriate to use in weak-grid conditions.

2. The selected countries are India, Sierra Leone, Uganda, Nigeria, Cote D'Ivoire, Ethiopia, Kenya, Myanmar, Tanzania, and Pakistan.

3. Sales volumes of SHS kits can be an indication of off-grid appliance ownership.

4. Uniqueness of market is used as selection criteria to enable data collection on a larger variety of brands and models, and to have a wider geographical scope.

5. VeraSol tests and generates consistent and comparable performance data to support scalable markets for durable, high-performing, and affordable off-grid appliances and productive use equipment.

6. Efficiency for Access (EforA) Coalition, The State of the Off-Grid Appliance Market Report. 2019. <https://efficiencyforaccess.org/publications/2019-state-of-the-off-grid-appliance-market-report>.

7. World Bank, Access to electricity, rural (% of rural population) - Sierra Leone. 2018. <https://data.worldbank.org/indicator/EG.ELC.ACCTS.RU.ZS?locations=SL>.

8. GST is similar to value-added tax (VAT).

9. Learn more about the Lighting Global Quality Standards: <https://verasol.org/solutions/quality-standards>.

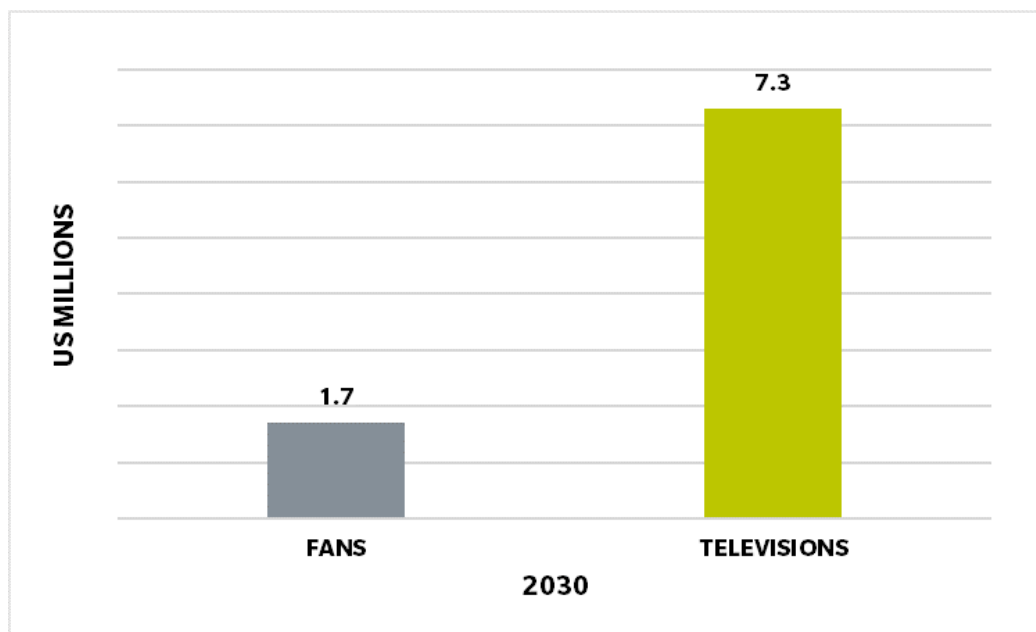
market players to advance the sector and promote streamlined implementation of government subsidies for clean energy technologies.¹⁰ FCDO has also been supporting efforts to increase clean energy access in Sierra Leone through the Rural Electrification in Sierra Leone project. Starting in 2016, this project will install mini-grid systems totalling 10 Mega Watts for small remote rural communities by 2020.

Despite the relatively high number of off- and weak-grid households and a number of government programs to encourage the uptake of off-grid solar energy, the prevalence of SHS kits in Sierra Leone remains low, and many rural consumers are using diesel generators to power their appliances.¹¹ According to the GOGLA sales data for 2019 the overall sales of solar energy lighting products in Sierra Leone, for both pico-solar products and SHS kits, was 38,456 units. The sales in Sierra Leone is lower compared to Togo (50,713 units) and Benin (53,265 units) where the population sizes are similar to Sierra Leone, but both countries have a higher GDP.¹² SHS kits with integrated lighting, charging, radio and TVs retail in Sierra Leone starting around USD\$500 to USD\$600, a high cost for many off-grid consumers considering the minimum monthly salary in Sierra Leone is around USD\$50.¹³ At these price points, pay-as-you-go (PAYG) business models are an essential element to affordability for both urban and rural solar markets to achieve scale.

Sierra Leone is considered a nascent market in the off-grid appliance sector with a market potential of USD\$2 million in 2018 and an obtainable¹⁴ market size of USD\$10 million by 2030 (Figure 1).¹⁵

However, ownership of household appliances is low. GOGLA sales data from the second half of 2019 indicated that 2,000 off-grid solar appliances were sold in Sierra Leone.¹⁶ According to the State of the Off-Grid Appliance Market report, it's estimated only 2% of rural households in Sierra Leone own a TV and less than 1% own a fan as of 2019. Further, Sierra Leone's market is constrained by low levels of disposable income and a low proportion (20%) of individuals with bank accounts.¹⁷ This can make it difficult for customers to access microfinance and PAYG mechanisms to be able to afford solar systems and accompanying appliances. On a positive note, mobile money has become a promising alternative to cash sales, with the number of registered customers using mobile money in Sierra Leone increasing by more than one million from 2017 to 2018.¹⁸ For example, one solar energy kit and appliance supplier, Easy Solar, is tapping into e-commerce, utilizing PAYG and mobile money to expand the distribution of solar products while increasing consumer affordability.¹⁹

Figure 1: Obtainable market size in Sierra Leone by 2030 (Millions of USD)



Source: *The State of the Off-Grid Appliance Market, Efficiency for Access, 2019*

10. Tice, D., Energy Africa Access Campaign Policy Compact Sierra Leone. 2016. https://assets.publishing.service.gov.uk/media/5a6c17b7ed915d42f7c6beab/Energy_Africa_Access_Campaign_-_Policy_Compact_Sierra_Leone_Final_Report.pdf.

11. Herbert Smith Frehills LLP. <http://www.investinginsierraleone.com/energy/>.

12. GOGLA, Global Off-Grid Solar Market Report H1 and H2 2019. 2019. <https://www.gogla.org/global-off-grid-solar-market-report>.

13. Minimum-Wage.org. 2020. <https://www.minimum-wage.org/international/sierra-leone#:~:text=Sierra%20Leone%3Bs%20minimum%20wage,per%20month%20for%20all%20employees.>

14. The total addressable market size is estimated by overlaying affordability on off-grid and weak grid household numbers. The obtainable market is further constrained by the availability of consumer finance and accessibility of the household to off-grid appliance distributors

15. Efficiency for Access (EforA) Coalition, The State of the Off-Grid Appliance Market Report. 2019. <https://efficiencyforaccess.org/publications/2019-state-of-the-off-grid-appliance-market-report>.

16. GOGLA, Global Off-Grid Solar Market Report H1 2019. 2019. <https://www.gogla.org/global-off-grid-solar-market-report>.

17. Efficiency for Access (EforA) Coalition, The State of the Off-Grid Appliance Market Report. 2019. <https://efficiencyforaccess.org/publications/2019-state-of-the-off-grid-appliance-market-report>.

18. State of the Digital Financial Services Market in Sierra Leone, 2018. UNCDF. <https://www.uncdf.org/article/4814/state-of-the-dfs-market-in-sierra-leone-2018>.

19. SIERRA LEONE: Easy Solar launches website for online sales of solar kits, 2020. Afrik 21. <https://www.afrik21.africa/en/sierra-leone-easy-solar-launches-website-for-online-sales-of-solar-kits/>.

Product and Technology

Methodology and sample source

Efficiency for Access engaged field-based consultants to survey key off-grid retail markets in Sierra Leone from May to December 2018. The purpose of these surveys was to identify product models sold in the retail markets. The field consultants visited retail stores to collect data on brand, model name/number, appliance size, power input, voltage, warranty, and retail price. This data was based on rated claims from the product packaging or user manual, or from a shopkeeper's knowledge of the product, and thus may not be as accurate as tested data. The surveys focused on products sold separately from power supply (i.e. not part of a SHS), with the exception of solar water pumps (SWPs). The Efficiency for Access team also purchased several models of the TVs and fans identified during the surveys for lab-testing. Their power consumption was analysed compared to other lab-tested TVs and fans included in the VeraSol Product Database.

To better understand the market context, Efficiency for Access' field consultants conducted semi-structured questionnaires with a range of stakeholders – including REASL, the Ministry of Energy, renewable energy businesses, donors, non-governmental organizations, and large electrical shops. In addition to gathering data on product specifications, the field consultants also conducted interviews with owners of small shops to collect qualitative evidence and anecdotes. This anecdotal evidence complements quantitative data and may provide more insights on perceived product demand, quality, and performance.

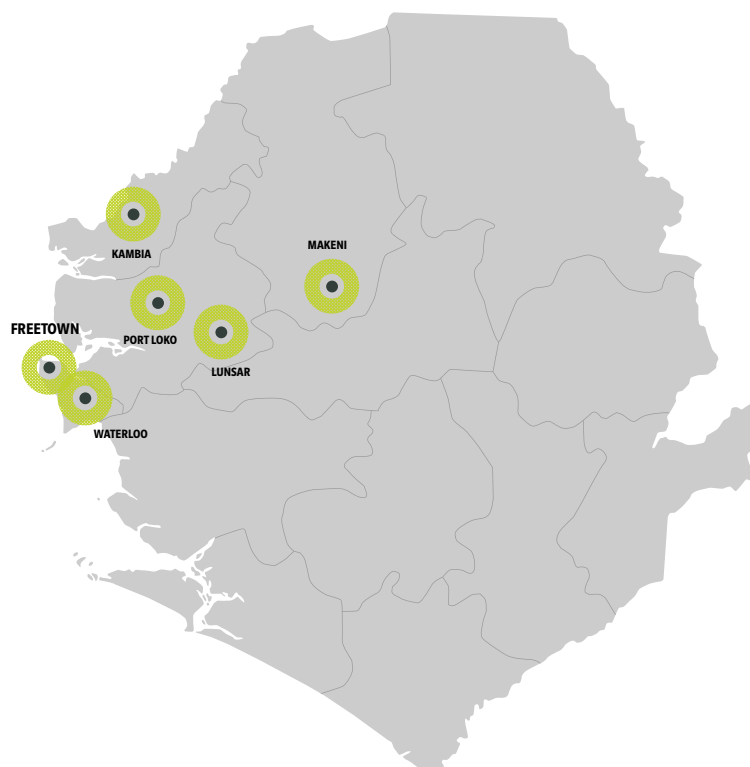
Surveys were undertaken in retail markets in Freetown (the capital of Sierra Leone and where the overwhelming majority of off-grid appliances are available), Waterloo (in periphery to Freetown), Lunsar (cities of Port Loko), Makeni (the largest city in the Northern Province of Sierra Leone), and Kambia (Figure 2). These distribution channels are representative of the range of existing markets, namely the quality solar market, large electrical stores, and street vendors. For SWPs, the teams focused the surveys in markets based where private sector companies are known to operate including Freetown and Makeni. Despite the highest demand being rural off-grid areas, most SWPs are sold in larger cities.

Data Analysis on Appliances

The below section analyses four types of off-grid appliances – TVs, fans, refrigerators and SWPs – available in the appliance markets of Sierra Leone based on the following characteristics:

- **Power type:** Are there more AC or DC appliances available?
- **Size:** What are the most prominent sizes of the products?
- **Price:** What is the range of product price?
- **Warranty:** How many products are covered by a warranty and how long is the warranty?
- **Power consumption (for TVs and fans only):** What is the lab-tested power consumption of TVs and fans sampled from Sierra Leone?

Figure 2: Geography covered



TV MARKET INSIGHTS

GOGLA's Global Off-Grid Solar Market Report 2019 shows that the largest market for off-grid TVs is sub-Saharan Africa, with 272,000 units sold in the second half of 2019.²⁰ A breakdown of specific data for Sierra Leone is not available due to limited reported data on sales volumes.

Approximately 2% of rural households in Sierra Leone own a television.²¹ The field surveys found that TVs are readily available in retail shops, however there is limited demand or



Field consultants captured technical specifications and price data for 127 unique TV models

awareness of DC, or DC-compatible models. The average size of TVs available in the markets was large, with over half of products having a screen size of more than 24 inches.

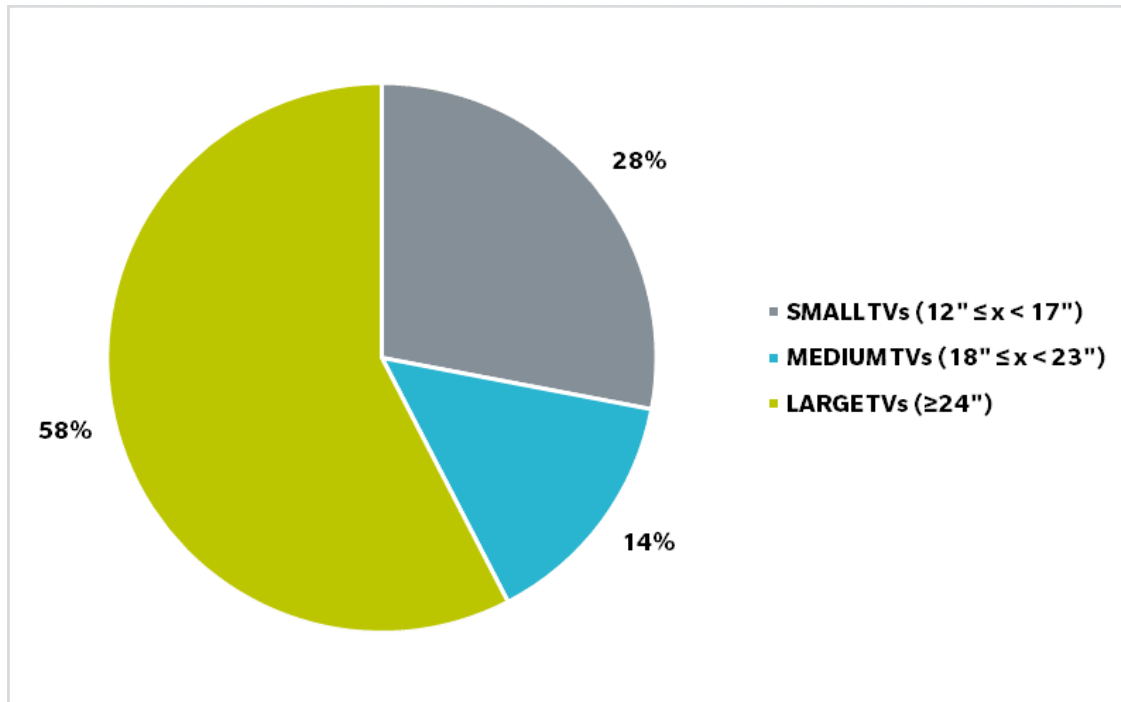
Power Type

The vast majority (85%) of models surveyed during the market visits were AC TVs, with the remaining 15% marketed as AC/DC compatible.²² This finding is consistent with all other products surveyed in Sierra Leone, where most products are AC and designed for on-grid use considering many off-grid consumers are using a generator as their main energy supply.

Product Size

The screen size data is divided into three categories (small, medium and large) based on diagonal screen size, measured in inches (Figure 3). In Sierra Leone, the majority (58%) of TVs available are classified as large where the diagonal screen size is greater than or equal to 24 inches. 28% of models in Sierra Leone surveyed fall in the small (between 12 and 17 inches) category and 14% of models in the medium category (between 18 and 23 inches). The dataset also contained a TV model with a 70-inch screen, however this was removed from further analysis due to lack of suitability or affordability for off-grid domestic rural customers.

Figure 3: Three different TV sizes available in the market



Source: Efficiency for Access, 2017-19 retail market survey data

20. GOGLA, Global Off-Grid Solar Market Report H2 2019. 2019. <https://www.gogla.org/resources/global-off-grid-solar-market-report-h2-2019-sales-and-impact-data>.

21. Efficiency for Access (EforA) Coalition, The State of the Off-Grid Appliance Market Report. 2019. <https://efficiencyforaccess.org/publications/2019-state-of-the-off-grid-appliance-market-report>.

22. AC/DC compatible appliances refer to appliances which can be operated on either AC or DC power, typically using an inverter or rectifier.

Retail Price

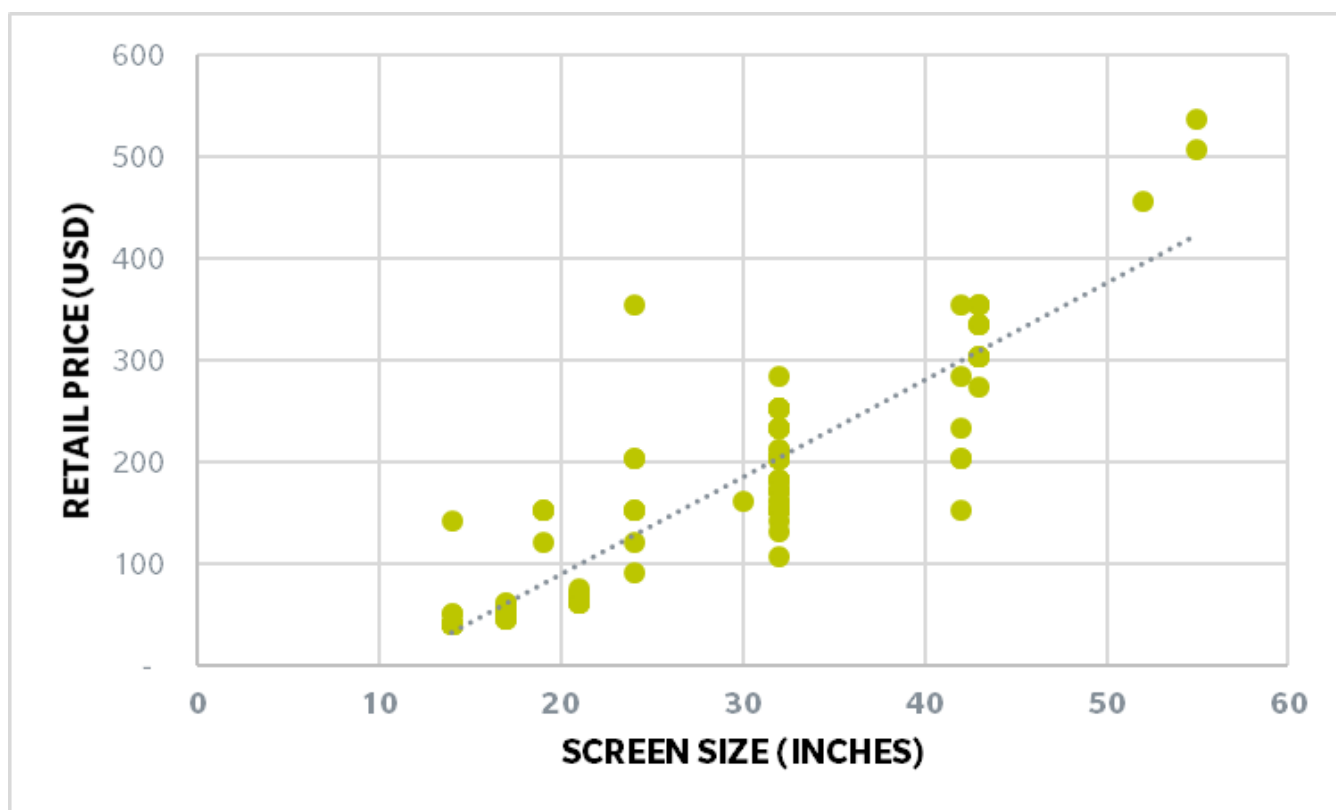
The prices of TVs found in the retail markets range from USD\$41 to USD\$537.²³ Screen size is a key contributor to the product price, with TV price typically increasing with screen size as illustrated by Table 1 and Figure 4. There is also considerable range of prices within the same size categories (Figure 4).

Power supply type may also play a role in price. The average price of DC-compatible TVs on the market is significantly higher (USD\$216.67) compared to AC TVs of equivalent sizes (USD\$135.65). A contributing factor may be that larger companies importing AC TVs are better positioned to import full containers at a lower cost compared to smaller companies importing DC TVs in lower volume shipments.

Table 1: Average, minimum and maximum retail prices of each TV size category

Nominal Screen Size	Minimum Retail Price (USD)	Average Retail Price (USD)	Maximum Retail Price (USD)
Small TVs (12" - 17")	41	50	142
Medium TVs (18" - 23")	61	84	152
Large TVs (>24")	91	230	537

Figure 4: Correlation between TV nominal screen sizes (inches) and retail prices (USD)



Source: Efficiency for Access, 2017-19 retail market survey data

23. Values are converted from local currency Sierra Leonean Leone (SLL) to USD using conversion rates as of August 2018.

Warranty

The majority (61%) of TVs surveyed in Sierra Leone are sold with a warranty of less than one month and 6% do not offer any warranty (Figure 5). The longest warranty offered on the models surveyed was six months, and this was only recorded for one model. The most common warranty was three days, which presumably only allows the customer to take the product home and verify that it works.

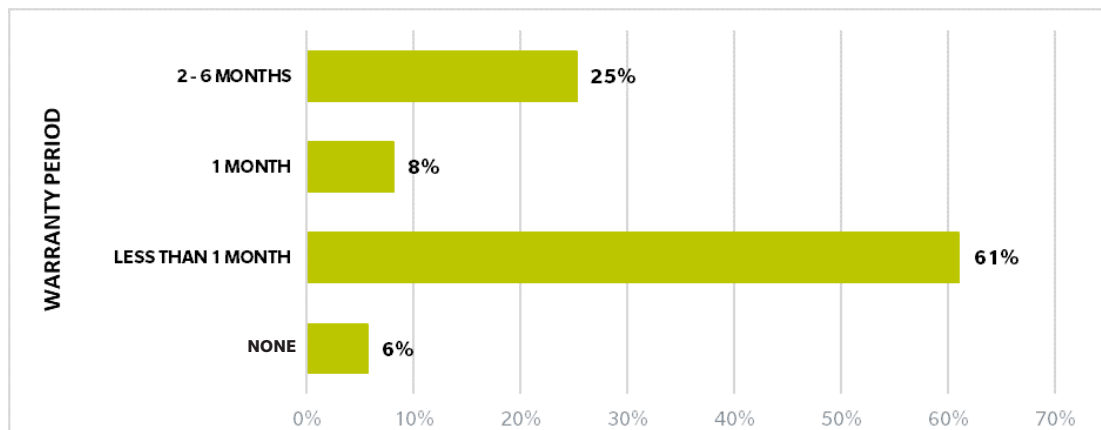
Interviews conducted by Efficiency for Access field consultants found that in markets in Sierra Leone, “brand recognition and appreciation for more expensive but higher quality off-grid appliances is low, and many households are opting for generic low-cost devices and counterfeits”,²⁴ which may explain the short warranty durations of TVs and other off-grid appliances sold in Sierra Leone retail markets. According to the field consultants, another key aspect that prevents sellers

from offering longer warranties is the historically low quality of electricity supply in Sierra Leone. Frequent power outages and voltage fluctuations can ruin appliances and has created a market for voltage regulators and stabilizers.

Power Consumption

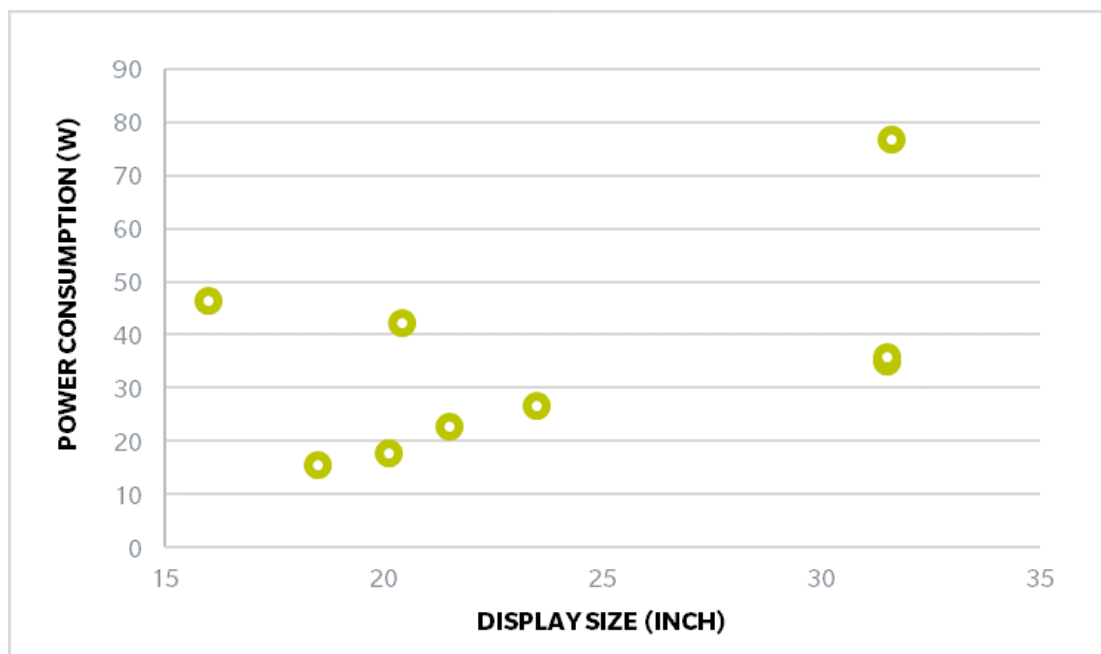
The Efficiency for Access team sampled nine TVs from the retail markets in Freetown and Makeni to conduct performance testing in a laboratory. Figure 6 shows the tested results of power consumption. While the sample size is small, the data indicates the TVs sold in the Sierra Leone market tend to have much higher power consumption compared to the most efficient products in the global market. Based on the VeraSol Product Database, the most efficient 31.5 inch TV consumes only 8.3 Watts (W), while the same sized TVs in Sierra Leone consume between 35 to 76 W.

Figure 5: Warranty period offered for TVs



Source: Efficiency for Access, 2017-19 retail market survey data

Figure 6: TV power consumption

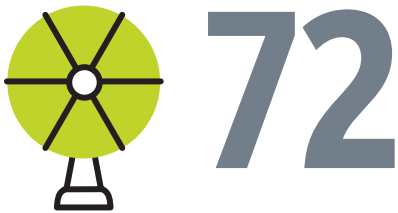


Source: VeraSol Product Database (2020)

24. Efficiency for Access (EforA) Coalition, The State of the Off-Grid Appliance Market Report. 2019. <https://efficiencyforaccess.org/publications/2019-state-of-the-off-grid-appliance-market-report>.

FAN MARKET INSIGHTS

Efficiency for Access’s 2019 State of the Off-Grid Appliance Market Report estimates that the total obtainable market for fans in Sierra Leone 2018 is 20,000 households. According to stakeholder interviews, because the Sierra Leone off-grid fan market is in its infancy, the market potential for fans is quite high, but demand remains low. For comparison, the estimated obtainable market is the same



Data were collected from 72 unique models sold by 48 brands in Freetown, Waterloo and Makeni

as Kenya, a more mature market, despite the population of Kenya being 8 times larger than that of Sierra Leone.²⁵ Climate conditions have been attributed to the stimulation of fan sales in other regions, such as Myanmar, Papua New Guinea and The Philippines, where humidity is much greater than in Sierra Leone.

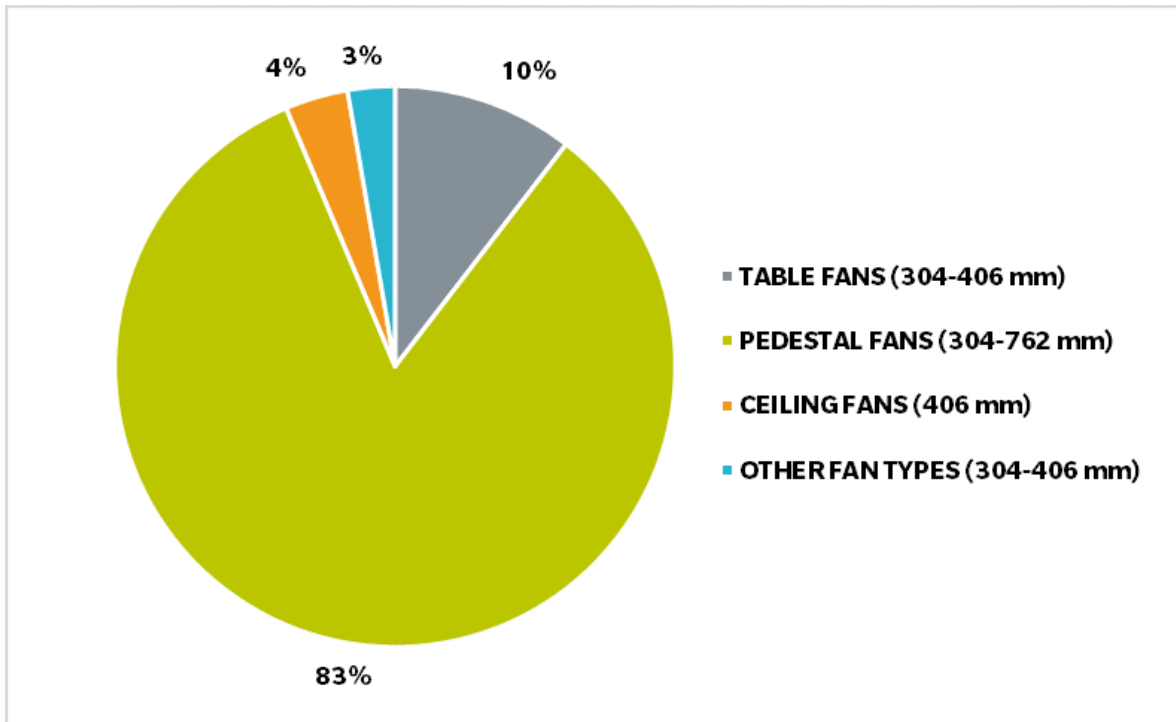
Power Type

The majority of fans available on the market in Sierra Leone are AC products (71%), with 24% marketed as AC/DC compatible and the remaining 5% as DC only.

Product Type and Size

The most common type of fans sold are pedestal fans, making up 83% of the market share (Figure 7). The second most popular are table fans (10%), followed by ceiling fans (4%), and the remaining 3% are other fan types, such as wall, box, or clip-on fans. Only 4% of fan sales in the Sierra Leone market are ceiling fans which is consistent with observations more generally across West Africa.²⁶

Figure 7: Different fan types available in the market



Source: Efficiency for Access, 2017-19 retail market survey data

25. Efficiency for Access (EforA) Coalition, The State of the Off-Grid Appliance Market Report. 2019. <https://efficiencyforaccess.org/publications/2019-state-of-the-off-grid-appliance-market-report>.

26. GOGLA, Global Off-Grid Solar Market Report H2 2019. 2019. <https://www.gogla.org/resources/global-off-grid-solar-market-report-h2-2019-sales-and-impact-data>.

Retail Price

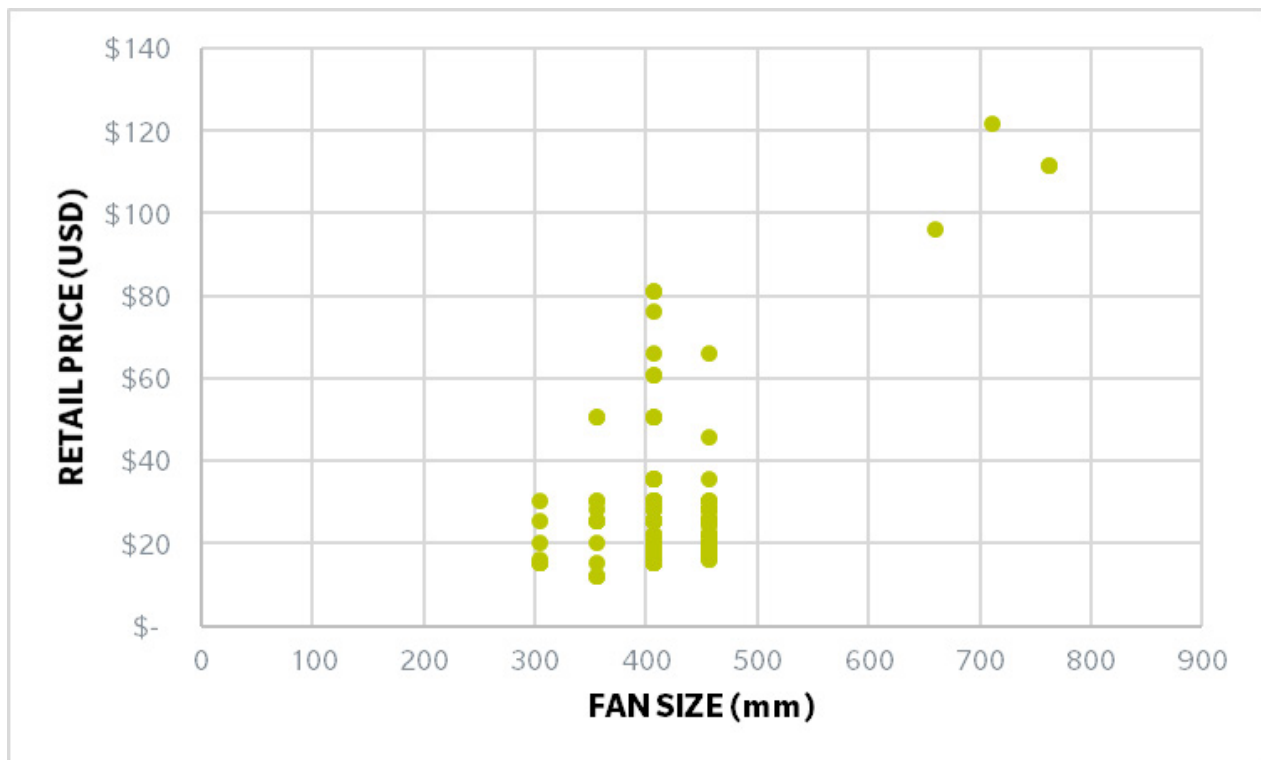
The average retail prices by fan type in Table 2 shows pedestal fans to be the most expensive, however there is not a considerable difference between the different types which range from USD\$20 to USD\$26. Figure 8 shows there are four distinct size categories, but there is not a clear trend to show that larger fans are more expensive. The only exception is the four much larger fans (660 mm to 762 mm) that have higher price points.

Table 2: Average retail prices (USD) of different fan types

Fan Type	Average Retail Price (USD)
Ceiling Fans ²⁷	20
Other Fan Types ²⁸	21
Table Fans	22
Pedestal Fans	26



Figure 8: Correlation between different fan sizes (mm) and retail prices (USD)



Source: Efficiency for Access, 2017-19 retail market survey data

27. Ceiling fans low average retail price may be due to a relatively small sample size of eight.

28. Other fan types include box, wall-mounted, and clip-on fans.

Warranty

More than a third of the fans are sold without any warranty coverage and another third are protected by period of one week or less (Figure 9). The longest warranty period offered is six months. The most common warranty lasts for one week, which presumably allows for the customer to set their fan up in their home and identify any instant faults.



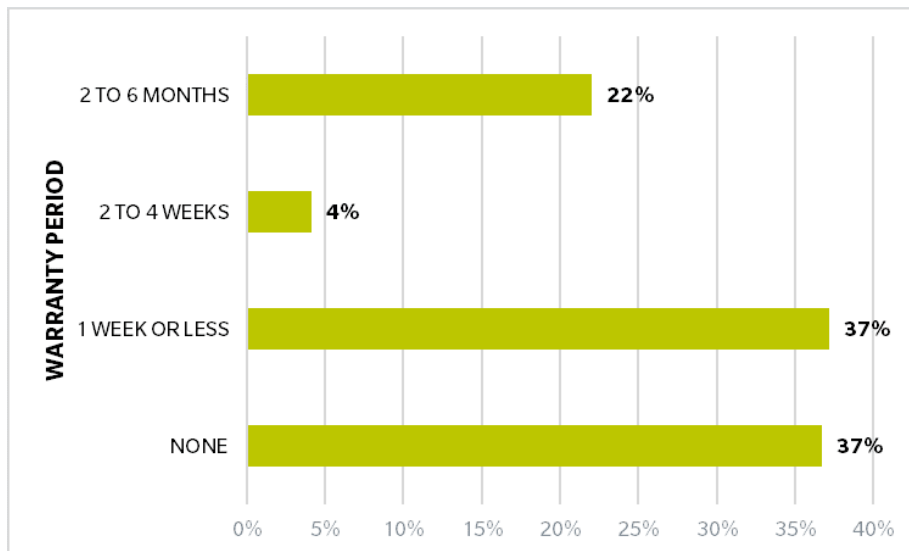
MORE THAN
66%

of fans are sold without a warranty

Power Consumption

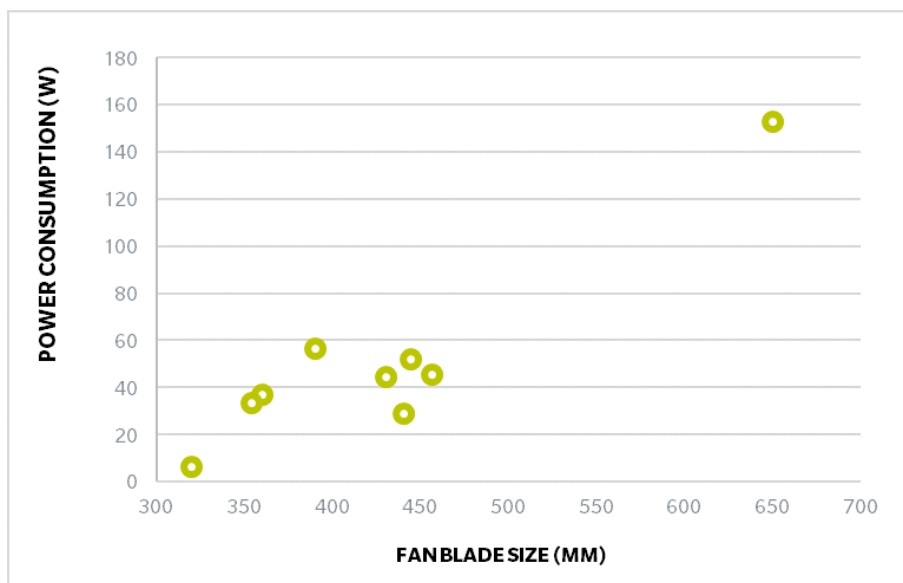
The Efficiency for Access team sampled nine pedestal and table fans from retail markets in Freetown to conduct further performance testing in the laboratory. Figure 10 shows the lab-tested power consumption of fans sampled from Sierra Leone. On average, the power consumption of fans from Sierra Leone consume more energy compared to other fans of similar size included in the VeraSol Product Database. The fans sampled from Sierra Leone had an average power consumption of 38 W, compared to only 20 W for other similar-sized fans included in the database. The most efficient fan from Sierra Leone is a 320 mm DC table fan. Its performance is on par with fans sampled from India, but the price of the Sierra Leone fan is 3 times higher than the Indian fans.

Figure 9: Warranty period offered for fans



Source: Efficiency for Access, 2017-19 retail market survey data

Figure 10: Fan Power Consumption



Source: Efficiency for Access, 2017-19 retail market survey data

REFRIGERATOR MARKET INSIGHTS

According to the 2019 State of the Off-Grid Appliance Market Report, the penetration of refrigerators in sub-Saharan Africa is low (17%); when looking at rural appliance ownership, this percentage drops even lower to 6%.²⁹ The cumulative market potential for refrigerators in sub-Saharan Africa is estimated to be USD\$2.3 billion by 2025.³⁰ There is limited data available on the prevalence of refrigerator ownership in Sierra Leone specifically.

The following refrigerator market insights are generated based on data from 53 unique models of refrigerators from 20 brands surveyed in Freetown and Makeni. The dataset includes refrigerators, freezers, and combination units with refrigerator and freezer compartments.



53

Data were collected from 53 unique models sold by 20 brands in Freetown and Makeni

It's important to note that as the field consultants moved away from Freetown, availability of refrigerators became severely limited, a testament to the nascent stage of refrigeration technologies in the country and especially in rural areas.

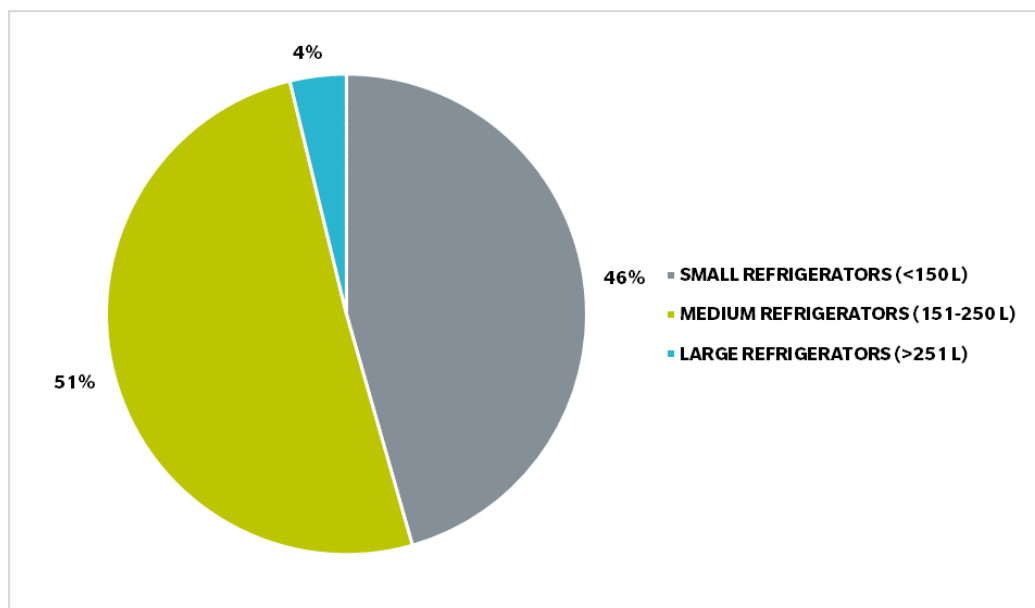
Power Type

The surveys showed little-to-no market presence of DC refrigerators. 92% of the surveyed models are AC with only 7% of the refrigerators recorded as DC, and these were all from one well-known solar refrigerator manufacturer.³¹ The field consultants found that the most common use for refrigerators when purchased to be used off the grid is for households or small restaurants in rural areas, both of which are typically powered by a generator for a few hours every day. Only a handful of solar companies are importing DC fridges, and these are typically trial products or on a per order basis for commercial use.

Product Size

The most common size (51%) of refrigerators found in the markets are medium refrigerators between 151 and 250 litres (L) (Figure 11). 46% of the refrigerators surveyed are in the small category (less than 150 L) and only two models were recorded in the large category, with over 400 L capacity, both of which were chest freezers.

Figure 11: Size categories of refrigerators available in the market



Source: Efficiency for Access, 2017-19 retail market survey data

29. Efficiency for Access (EforA) Coalition, The State of the Off-Grid Appliance Market Report. 2019. <https://efficiencyforaccess.org/publications/2019-state-of-the-off-grid-appliance-market-report>.

30. Ibid.

31. Manufacturer name not included for confidentiality.

Retail Price

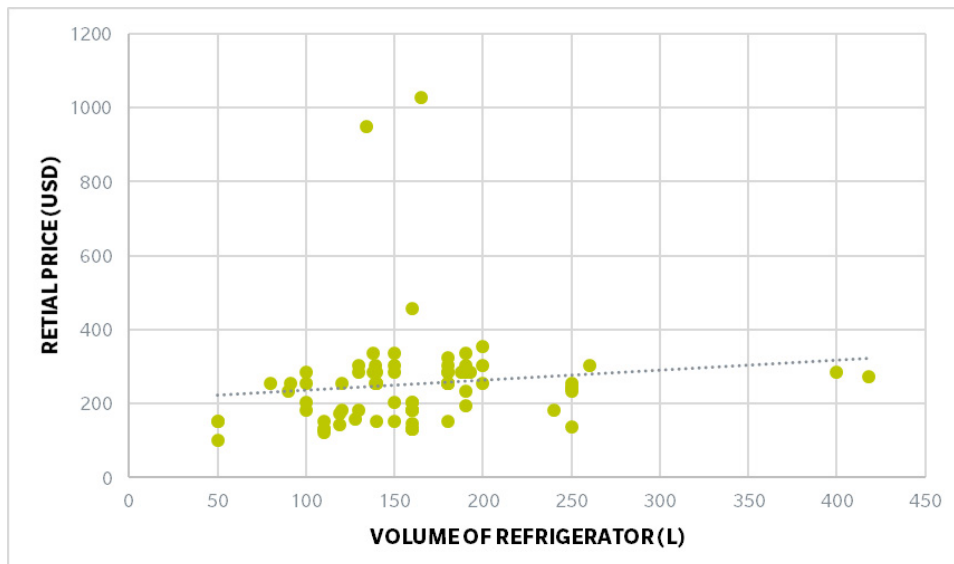
The prices of refrigerators in the Sierra Leone range from USD\$101 to USD\$1,026, varying with size and type (Figure 12). The average retail price is USD\$253.

Figure 12 shows a weak relationship between the price and size of the refrigerators surveyed. The price of refrigerator is primarily differentiated by their type. The surveys found that on average, refrigerator-freezer combination units are the most expensive, followed by freezers, then refrigerators. The two outliers in Figure 12 that show significantly greater price points (the 134 L and 165 L models) are DC products manufactured by a specialised off-grid refrigerator company. The high price of these units can be attributed to high import tax and better efficiency – with rated daily energy consumption of 0.168 kWh, the units consume 3-7 times less than other refrigerators and freezers found in the market.

Warranty

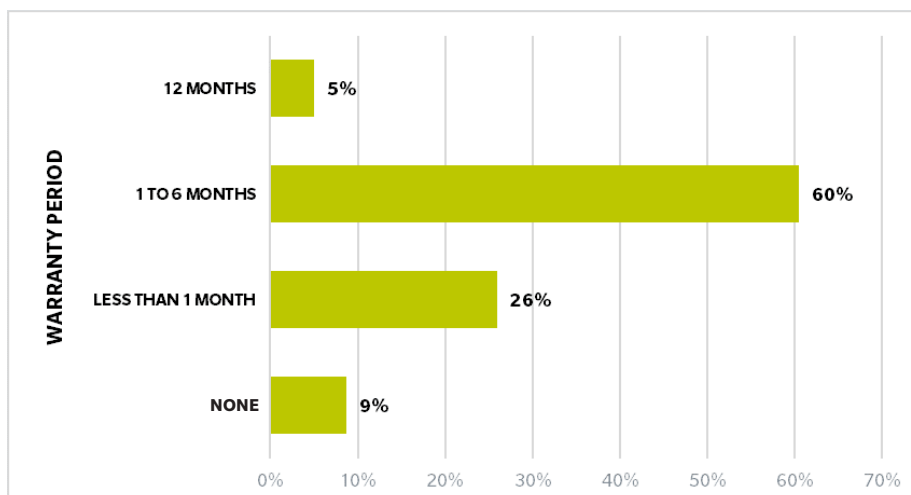
Based on the data collected by the field consultants, only 5% of the refrigerators on the market offer a warranty of 12 months (Figure 13). The majority (60%) have a warranty of 1 to 6 months, with the remaining being less than a month (26%), and 9% not offering any kind of warranty. Considering the high costs of refrigerators for a typical off-grid household, these limited warranties undermine the consumer protection necessary to accelerate the off-grid solar refrigerator market.

Figure 12: Comparison of refrigerator volume (L) and retail price (USD)



Source: Efficiency for Access, 2017-19 retail market survey data

Figure 13: Warranty period offered for refrigerators



Source: Efficiency for Access, 2017-19 retail market survey data

SOLAR WATER PUMP MARKET INSIGHTS

The market for SWPs across sub-Saharan Africa is nascent. 95% of land cultivated by smallholder farmers is reliant on seasonal rainfall.³² Approximately 5,000 SWPs were sold in sub-Saharan Africa in the second half of 2019.³³ The addressable market for small SWPs in the region is estimated at 700,000 households and worth USD\$0.5 billion. It is expected to reach 2.8 million households and a value of USD\$1.6 billion by 2030.³⁴

Sierra Leone suffers from poor water access, particularly in the dry season from December to April.³⁵ Irrigated agriculture is sorely limited by low awareness and knowledge of improved agronomy practices and therein limited uptake of mechanised tools and equipment such as SWPs.



Data were collected from 52 unique models sold by 23 brands in Freetown and Makeni

In 2016, the Government of Sierra Leone and development partners, such as FCDO, began investing in several hundred SWPs installations, primarily for drinking water, cooking, and personal hygiene. Stakeholder interviews found that the institutional market is moving towards SWPs for drinking water, with residual use for small vegetable gardens and very limited uptake for farming. Stakeholder interviews found most SWP installations in Sierra Leone are commissioned by donor-funded projects for rural water supply schemes. A limited, but growing number of SWPs are used for public buildings. SWP distribution and installation is limited to a few specialised companies who also act as installers to provide custom solutions in response to tenders and organisations’ requests.

Despite the shift towards SWPs in the institutional market over the last three years, the domestic market is still largely dominated by low-quality water pumps that represent the bulk of existing stock of water pumps spread across the country. Development partners are also supporting private sector companies to train consumers on how to use SWPs, but access to these technologies remains low. According to Efficiency for Access’ Solar Water Pump Outlook Report, SWP companies are struggling to drive commercial uptake due to a number of factors. These include high upfront system investment costs, highly variable system specifications, and limited company knowledge on how to adapt systems for specialised needs and commercially deliver products and services at scale.³⁶



Photo: Aggrico

32. Efficiency for Access (EforA) Coalition, Solar Water Pump Outlook 2019: Global Trends and Market Opportunities. 2019. <https://efficiencyforaccess.org/publications/solar-water-pump-outlook-2019-global-trends-and-market-opportunities>.

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Power Type

Of the pumps surveyed, 79% are AC pumps, 12% are DC models and 9% are marketed as AC and DC compatible.

This suggests that consumers are using pumps either on the grid, with a generator, or with a solar system powered with an inverter.

Product Type & Size

Submersible and surface pumps are found in the Sierra Leone retail shops, although submersible pumps are much more common, representing 95% of the models surveyed. Submersible pumps typically have a higher average price and power rating than surface pumps (Figure 14).

There is a wide range of pump sizes and capacities available on the Sierra Leone market. The rated input power of the pumps ranges from 0.06 kW to 7.5 kW. For comparison, in the 2019 Solar Water Pump Global LEAP Awards competition,³⁷ the rated input power of the pumps ranges from 0.08 kW to 2.8 kW. As shown in Table 3, most products (54%) are in the 1 kW to 3 kW power rating category.

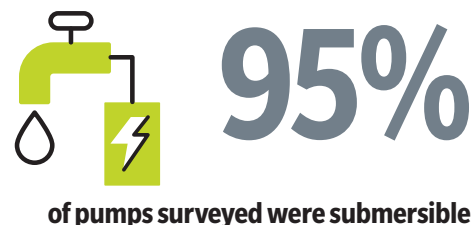
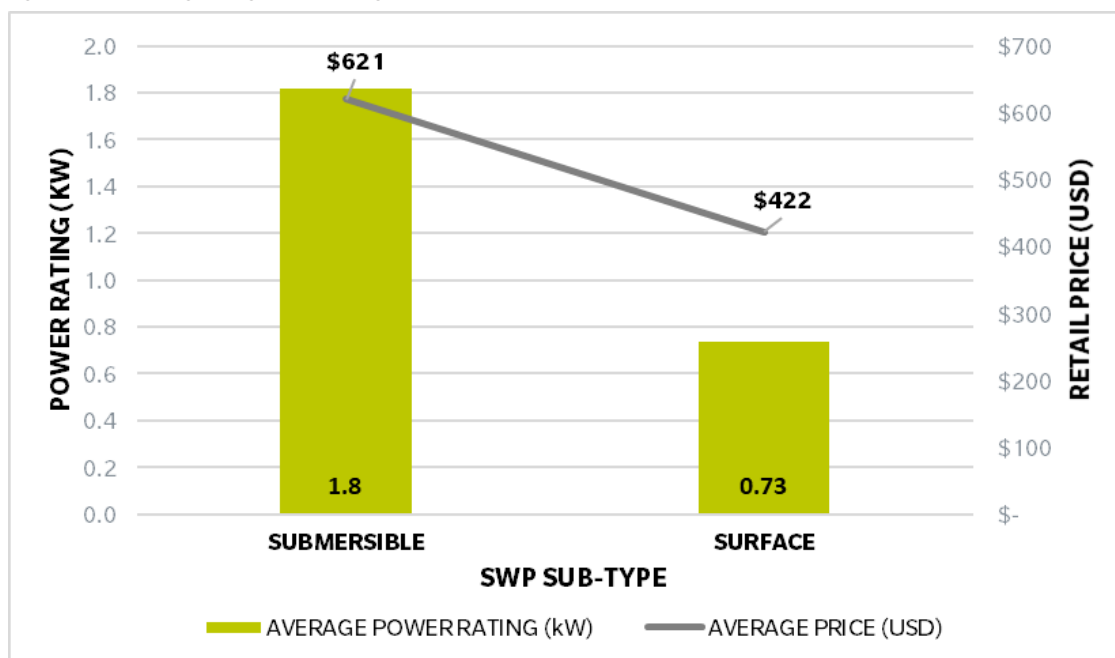


Figure 14: Comparing average power rating (kW) and price (USD) between submersible and surface models



Source: Efficiency for Access, 2017-19 retail market survey data

Table 3: Average retail price broken down by power rating

Nominal power rating for pump (kW)	Average Retail Price (USD)	Proportion of products per power rating category (%)
Less than 1 kW	386	32
Between 1 and 3 kW	549	54
More than 3 kW	1,462	14

37. The Global LEAP Awards identify best-in-class off-grid appliances through a competition-based approach to drive innovation and performance in early stage product markets. Learn more: www.globalleapawards.org.

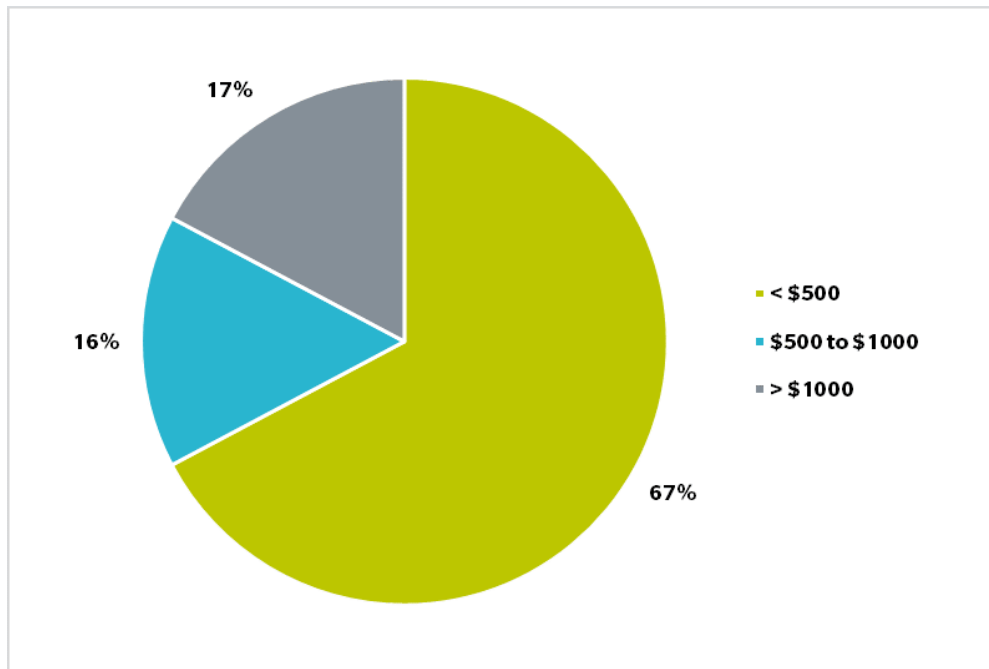
Retail Price

The price of SWPs ranges from USD\$101 to USD\$2,736 (with the average price being USD\$624). This range reflects the customisable options for SWPs (e.g. based size and type). When considering whether the equipment is sold as a package (e.g. with a PV module and battery) or on its own, the average price of the package is almost double that of SWPs that are offered on their own. As expected, pumps that are sold separately tend to have a lower average price (USD\$483) than pumps that are sold as part of a package (Figure 15). There is also a clear trend of increasing average price as the power rating of the pumps increases (Table 3 on page 19).

Warranty

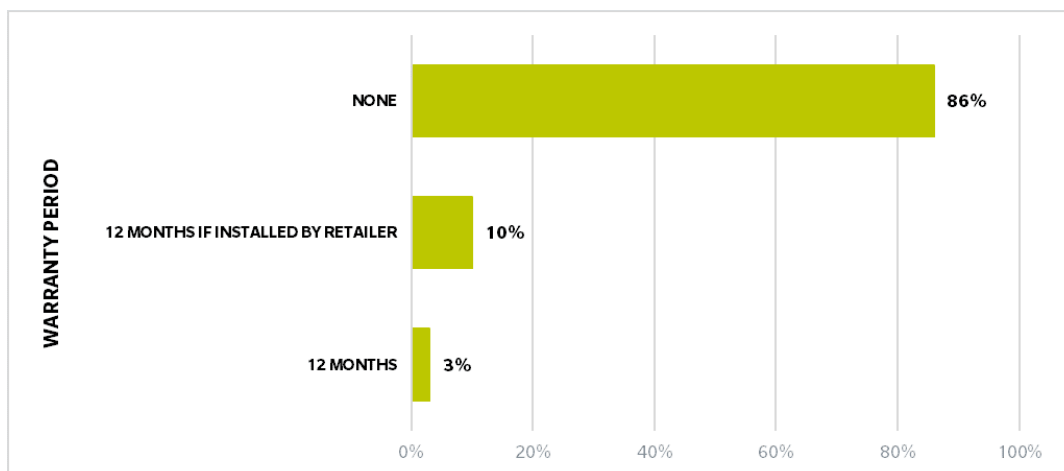
The pumps surveyed are predominantly sold without any kind of warranty (86%) (Figure 16). Products with a warranty are typically for 12 months and may depend on the installation conditions, with 10% of retailers/manufacturers offering a warranty of 12 months only if the SWP was installed by their company. According to interviews conducted by the field consultants, some retailers only offer a warranty on the condition that they install it because they don't trust the capacity of other companies, electricians or customers to install the systems. Some retailers shared that clients have dismantled components of the system, such as batteries, for other uses. Similar to refrigerators, SWPs are an expensive investment for most off-grid households, and it's important that consumers are protected by a warranty.

Figure 15: Retail price range (USD) of SWPs sold in the market



Source: Efficiency for Access, 2017-19 retail market survey data

Figure 16: Warranty (months) offered for SWPs



Source: Efficiency for Access, 2017-19 retail market survey data

CONCLUSIONS AND TAKEAWAYS

The off-grid appliance market in Sierra Leone is nascent and the availability of off-grid appliances is limited, mainly due to low penetration of SHS kits, limited access to credit for customers and companies, and low disposable household incomes. However, there is a sizeable potential demand for SHS and off-grid appliances given that 80% of the population in Sierra Leone is off-grid. There are also encouraging mechanisms to incentivise uptake, such as the exemption on import taxes (25%) and GST (15%) for solar products that meet the Lighting Global Quality Standards, and initiatives for SWP adoption supported by the Government of Sierra Leone and development partners. Key findings from the surveys are:



More consumer awareness is needed on the longer term social and economic benefits of solar technologies. The efforts of Sierra Leone's government are raising awareness on the positive impacts of solar systems and appliances, however the field consultants identified considerable

market spoilage as they travelled away from the urban centres of Freetown, even for solar lighting. Off-grid fans, for instance, have a large obtainable market in Sierra Leone, but demand is low. Proper consumer awareness efforts could help Sierra Leone reach its market potential for certain off-grid appliances.



An overwhelming majority of products sold in Sierra Leone markets are designed for on-grid use. In practice, this results in customers

that are served by unreliable grids or off-grid being required to use petrol

or diesel generators to power their appliances. Only recently, a handful of companies have introduced DC fans, TVs and refrigerators, but prices remain too high for the average consumer. Where DC models are available, the AC counterparts are typically more recognised brands. Brand recognition and appreciation for higher quality, more expensive off-grid appliances is low, and many households opt for generic low-cost devices or counterfeits.³⁸ Market interventions such as results-based financing program can encourage and incentivise manufacturers and distributors to enter a new, under-developed market and create more product offerings to serve the needs of off-grid consumers.



The price of TVs increased with screen size, but for fans, refrigerators and SWPs the variation within size categories indicate that other factors may be more influential. As expected,

SWPs' price largely depended on the customisation and whether or not it was sold standalone or as

part of a solar system. For refrigerators, the type of product (e.g. refrigerator or combination unit) had more of an impact on price than size. Although the overall variation in average price for different fans types was only USD\$6, pedestal fans had the highest average price despite ceiling fans being offered in larger sizes. Established importers in Freetown further highlight affordability as a key barrier to market development. With more than 60% of the population living on less than US\$1.25 a day, consumer financing is key to improve affordability and increase sales.⁴⁰ As mobile money become more widespread in Sierra Leone, there is an emerging opportunity for companies to leverage PAYG business models to tap into the solar appliance market and reach more end-users by improving product affordability.



Many products are sold without any kind of warranty. Where warranties are offered, they are for very short periods of time. The field consultants

noted that retailers do not provide

extended warranties for two main reasons. The first being the low quality of electricity in Sierra Leone (e.g. frequent outages and voltage fluctuations) resulting in burnt appliances, and the second being a lack of energy literacy among consumers which can lead to incorrect use of appliances or tampering. 86% of the SWPs surveyed did not come with a warranty despite this being the most expensive technology surveyed. Where warranties are offered, they require that the retailer completes the installation. Some refrigerators offered a 12-month warranty, but only for 5% of products surveyed. In order to instil trust in solar products and encourage the uptake of solar products, customer services and warranties need to be enhanced and become a common business practices. Measures to promote a fair and competitive marketplace, such as quality standards coupled with importation control and market inspections, can remove lower quality products and improve consumer protection.

Sierra Leone's off-grid appliance market is nascent but shows promising potential. This survey data and observations aim to contextualise the market and provide insights that can help inform the decisions of stakeholders interested in engaging in Sierra Leone. Efficiency for Access will continue to collect market survey data on TVs, fans, refrigerators and SWPs to refresh the existing dataset and track market progress. To find detailed test results of appliances sampled from Sierra Leone, please visit the [VeraSol Product Database](https://www.veasol.org/).

If you have any insights about the appliance market in Sierra Leone or questions about how these surveys were conducted, which shops were visited, or which models were surveyed, please contact info@efficiencyforaccess.org.

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