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COUNTRY PROFILE

OFF- AND WEAK-GRID SOLAR APPLIANCE MARKET

INDIA

JUNE 2020

EFFICIENCY FOR ACCESS COALITION

INTRODUCTION

Insufficient data about off-grid appropriate[1] appliances makes it difficult for manufacturers, policymakers, distributors, mini-grid operators, investors, and other market actors to make informed decisions. These information gaps make it difficult to increase the market penetration of higher quality, more energy-efficient, durable 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.

Efficiency for Access conducted market scoping surveys in 10 countries starting in 2018.[2] Countries were selected based on the population size, solar home systems (SHS) sales volumes[3], and uniqueness of the market.[4] The survey results have informed program decisions, such as selecting products for testing through Equip Data.[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 better utilize this data and share insights from the surveys more broadly, Efficiency for Access is developing a series of four country profiles that share market intelligence and contextualize data with supporting research and stakeholder feedback.

It's important to note that product specifications collected through market surveys are not always accurate. The data cited in this country profile include claimed values provided by shopkeepers or product specifications from consumer-facing marketing materials, such as a product's packaging or user manual. Therefore, the product data presented in this country profile may differ from the product listings on Equip Data, which generates comparable product performance data through rigorous third-party testing. Still, the market survey data shared in this profile provides preliminary and useful observations about local off-grid appliance markets, e.g. common product sizes, average retail prices, warranty.

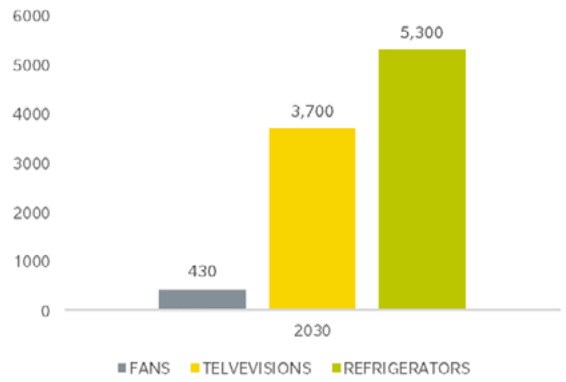
This country profile contains relevant market and appliance technical specification data for India. India is one of the largest off-grid appliance markets in terms of both estimated obtainable market size and market growth potential. This is due to several factors including a large population, relatively high consumer incomes, solar market maturity, local manufacturing, and government support.[6]

The market surveys found that the availability of off-grid direct current (DC) appliances that are designed for use with solar energy systems in India were limited across all product types in local retail shops. In some cases, shopkeepers were unaware DC products existed. Rural customers in India are accustomed to using an inverter with a solar system to power alternative current (AC) appliances. The field consultants reported that AC appliances advertised as "solar-compatible" are gaining more traction among rural consumers. Interestingly, the key driver of DC fan purchases is not for use with a solar energy kit. Consumer decisions are driven by the perception that DC fans are more energy-efficient than AC fans.

MARKET LANDSCAPE

India's electric grid is expanding rapidly in rural areas, but grid reliability remains a challenge.[7] Based on the data reported by the Government of India, almost 100% of the rural households are connected to the grid [8] — but only 22% have access to reliable service.[9] India's potential solar appliance market is larger than other key markets due to its large population living in weak- and off-grid areas.[10] The Indian solar appliance market has moved from a pure off-grid to mainly weak-grid, or a hybrid with weak-grid and solar energy as a backup option. The Efficiency for Access Coalition's 2019 State of the Off-Grid Appliance Market report estimated the obtainable market size for TVs, fans, and refrigerators in India could reach over US$9 billion by 2030.

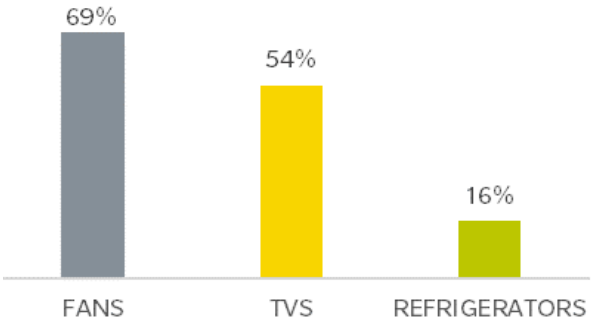
Figure 1: Obtainable market size in India by 2030 (Millions of USD)[11]



1. In this document, off-grid appropriate appliance refer to appliances that can be powered by distributed energy systems like SHSs and mini-grids and 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 on likelihood 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. Equip Data is an online product database that generates and shares performance and quality data of over 350 off-grid appliances. Equip Data is currently being integrated into VeraSol. Starting in July 2020, visit VeraSol to access the data: https://verasol.org/.
6. Efficiency for Access (EforA) Coalition, The State of the Off-Grid Appliance Market Report. 2019. https://storage.googleapis.com/e4a-website-assets/Clasp-SOGAM-Report-final.pdf
7. Heynen, A.P., Lant, P.A., Smart, S. et al. Off-grid opportunities and threats in the wake of India's electrification push. Energ Sustain Soc 9, 16 (2019). https://doi.org/10.1186/s13705-019-0198-z
8. Saubhagya Portal, https://saubhagya.gov.in/.
9. In India, reliability of electricity supply varies greatly between states, from 4 hours in Garhwa to 16 hours in Ranchi. Source: https://www.powerforall.org/resources/fact-sheets/fact-sheet-providing-reliable-and-affordable-electricity
10. Ibid.
11. Ibid.

Ownership of household appliances is relatively high in India—a unique feature distinguishing it from other major off-grid markets in Sub-Saharan Africa. Electric fans have the highest demand and penetration in rural India (69%), followed by TVs (54%) and refrigerators (16%) (Figure 2).[12] For comparison, the appliance penetration in rural households in Kenya remain relatively low with market penetration rates estimated at 19% for TVs and 2% for refrigerators.[13]

Figure 2: Share of rural population who own household appliances [%][14]



Electrification, high average incomes, government subsidies and tax reduction policies, and the availability of local financing structures through micro finance institutions (MFIs) are driving high market penetration rates of appliances in India. For example, India has instituted tax concession rates (5% Goods and Services Tax) for locally manufactured solar modules and appliances to boost the solar manufacturing industry.

PRODUCT AND TECHNOLOGY

Methodology and Sample Sources

Efficiency for Access engaged field-based consultants to conduct surveys in off-grid retail markets. These surveys identified the unique product models sold in the retail markets accessible to off-grid and weak-grid consumers. The survey collected information on: brand, model name/number, appliance size, power input, voltage, warranty duration, and retail price. The data were based on specifications rated on the product packaging or user manual, or from a shopkeeper's general understanding of the product, and thus may not be as accurate as the tested data. Like any market surveys, these datasets may be biased based on surveyors' preference and interpretation when collecting product samples.

To better understand the local market context, the field consultants conducted qualitative interviews with shop owners and appliance consumers. This anecdotal evidence complements quantitative data and may provide more insights on perceived product demand, quality, and performance.

In India, retail markets in Lucknow, Jaipur, and Kolkata were prioritized based on the number of un-electrified households and the availability of off-grid appliances in these regions. New Delhi, a major distribution hub for off-grid products, was also selected as a key market. Many off-grid products are imported into New Delhi and then transported to smaller, more rural markets through the territory. Across four retail markets, field consultants visited over 70 shops and collected data on over 190 product samples.

Figure 3: Geography coverage and type of product data collected

Lucknow, Jaipur, and Kolkata were prioritized based on the number of unelectrified households. New Delhi, a major distribution hub, was also selected. Across four retail markets, field consultants visited over 70 shops collected data on over 190 product samples.

12. Ministry of Health and Family Welfare, India Demographic and Health Survey, 2015-2016.
13. Kenya Demographic and Health Survey, 2015: https://dhsprogram.com/pubs/pdf/fr308/fr308.pdf
14. India Demographic and Health Survey, 2015-2016: https://dhsprogram.com/publications/publication-fr339-dhs-final-reports.cfm

Data Analysis on Appliances

This section analyzes four types of off-grid appliances (TVs, fans, refrigerators, and SWPs) available in the Indian appliance market 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?

According to the 2019 Global Off-Grid Solar Market Report, the total TV sales volume reported by GOGLA and LEIA program[15] affiliates in the South Asia region is estimated to be more than 500,000 units.[16] In India, it is estimated that nearly 54% of rural households own a TV, making it the second most-owned appliance after fans.[17] While field surveys found that TVs are readily available and in demand in retail shops, there is little-to-no market presence of DC TVs, with some shopkeepers unaware that this technology exists.

The TVs are found in the Indian market are a mix of local Indian brands (e.g. Intex, BPL, Aisen, Murphy), international global brands (e.g. Toshiba, TCL, Bush), and non-branded white labeled products. Field consultants shared that LED TVs are viewed as energy-efficient and affordable. Unbranded TVs marketed as LED and are particularly popular among low-income consumers.

The TV market insights that follow are generated based on data from 28 unique TV models surveyed from Lucknow and New Delhi.

Power Type

The majority of the TVs found in the market (89%) are AC TVs. Only 11% of TVs sampled are marketed as AC/DC compatible.[18] Shop owner interviews indicate most consumers with SHS kits use DC to AC adapters widely available in local markets to run their AC TVs with solar power.

Standalone[19] DC TVs were not found in any of the surveyed local retail stores. Most of the DC TVs sold with SHS kits are available through off-grid energy system distributors instead of retail outlets. In addition, shop owners shared that there are two primary reasons for the low presence of DC TVs:

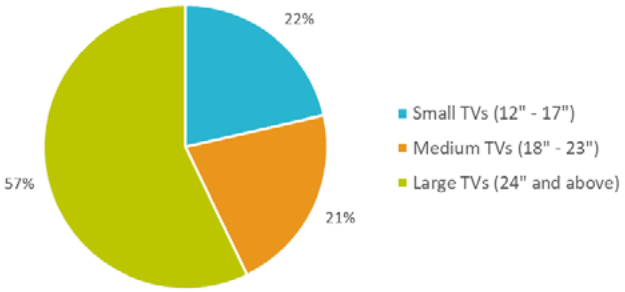
1. A lack of awareness of DC appliances – only a handful of retailers are aware about the existence of DC TVs; and
2. A common perception that AC LED TVs already consume very little power. Consumers therefore believe there is no need to buy DC TVs, even for use with an SHS kit.

However, lab testing results suggest the common perception of AC LED TVs is likely to be inaccurate. In comparing two 19" LED TVs in India, test results found the DC TV consumed only 15 W, while the AC TV consumed 24 W.

Product Size

The most common TVs in the Indian market are 24 inches – nearly 46% of surveyed TVs fell within this range. The collected TV data are broken down into three different size categories (small, medium, large) based on the diagonal screen size, as measured in inches. As shown in Figure 3, large TVs with screen sizes 24" and above are the most widely available (57% of sample) followed by an almost equal split between small TVs (22%) and medium TVs (21%).

Figure 4: Three different TV sizes available in the market (n=28)



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

Retail Price

The price of TVs found in the retail market ranges from USD $36 and USD $354, with size being a key contributor to price. As expected, the TV price typically increases as screen size grows (Table 1). However, the price of TVs can vary significantly even in

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

Nominal Screen Size	Min Retail Price (USD)	Average Retail Price (USD)	Max Retail Price (USD)
Small TVs (12" – 17")	36	70	90
Medium TVs (18" – 23")	68	102	204
Large TVs (24" and above)	93	154	354

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

15. GOGLA members and companies invited by the LEIA program to report sales data.
16. GOGLA, Global Off-Grid Solar Market Report H1 and H2 2019. https://www.gogla.org/sites/default/files/resource_docs/global_off-grid_solar_market_report_h1_2019.pdf ; https://www.gogla.org/resources/global-off-grid-solar-market-report-h2-2019-sales-and-impact-data
17. Ibid.
18. Product are marketed and advertised to be able to run on either AC or DC power supply.
19. Products that are sold as a standalone product and not with an SHS kit.

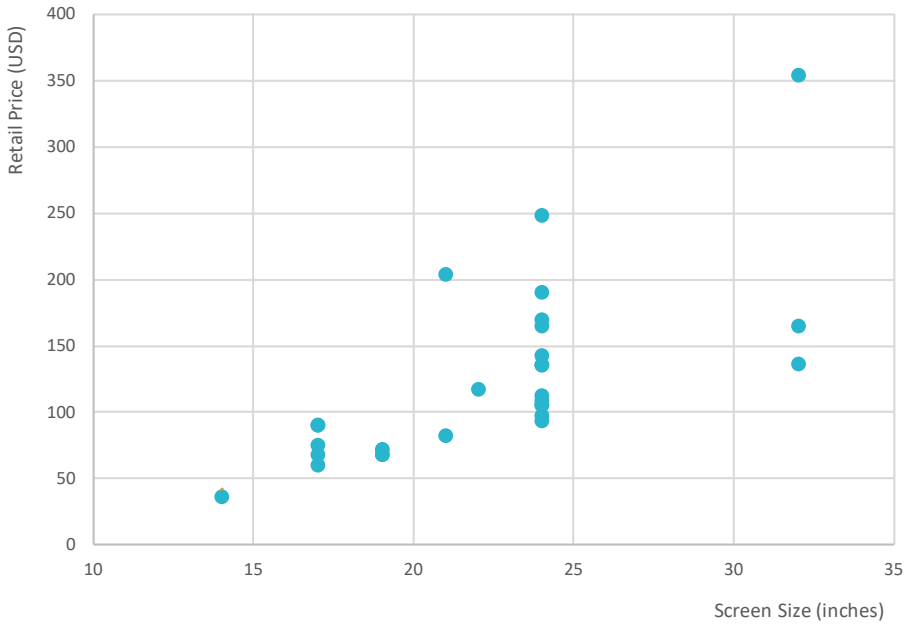
the same size category (Figure 4). In Table 1, the products with the maximum retail price for all three screen size categories are from the same shop in New Delhi. The high price of these TVs is due to a built-in battery that serves as backup power and can be charged with grid electricity or through a solar system.

Warranty

The survey found that all TVs sold in the shop have some warranty coverage, a good indication of consumer protection. 86% percent of TVs included a 12-month warranty. Field consultants found that even for cheap and unbranded white label TVs, a 12-month warranty is standard. About 11% of the TVs surveyed provided an extended warranty period of 24 months, and only 3% of TVs had a 36-month warranty (Figure 5).

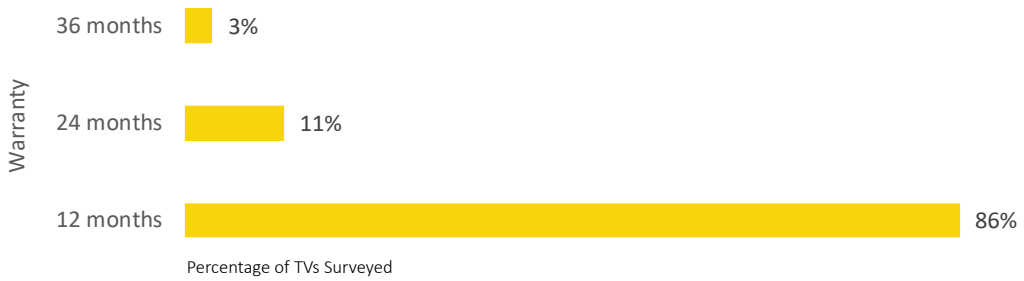
There is no direct correlation between the length of warranty coverage and retail price. However, the surveyed TVs that included an extended warranty are popular brands in the Indian market. The extended warranty beyond the standard warranty length may signal that these TV manufacturers have greater confidence in their product's quality.

Figure 5: Correlation between TV nominal screen sizes (inches) and retail prices (USD)



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

Figure 6: Warranty (months) offered for TVs



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

With 69% ownership in rural households, fans are India's most common household appliance, likely due to low prices and the hot and humid climate of the country. Retailers stated that fans are the most prominent and common DC appliance in their stores. However, shop owners indicated that the main driver for the off-grid fan market is not for use with SHS kits, but the perception that they are energy saving devices. Small mobile businesses, such as street vendors, that lack reliable access to electricity are another important driver for off-grid fan sales. The surveys found that the fan market in India is dominated by local brands, most of which are manufactured in the New Delhi region.

The following fan market insights are generated based on data from 78 unique fan models surveyed in Lucknow, New Delhi, and Patna.

Power Type

The majority of the fans surveyed (88%) are marketed as AC/DC compatible. Only 12% are marketed as DC compatible only. While 53% of the products surveyed in retail markets didn't indicate the type of motor used, a small amount of fans (10%) are marketed to have brushless DC (BLDC) motors and the rest (37%) use brushed DC motors.

Product Type

Table, pedestal, and ceiling fans were common, with more models of table fans available than the other two types (Figure 7). However, during the surveys, shop owners shared mixed opinions about which type of fan is the most popular among their customers. The collected fan data are organized based on product type (table, pedestal, ceiling).

Retail Price

The majority of the fans surveyed (97%) are sold separately from a power system, a few table fans (3%) were sold with in an SHS kit (i.e. battery, charge controller, solar panel).

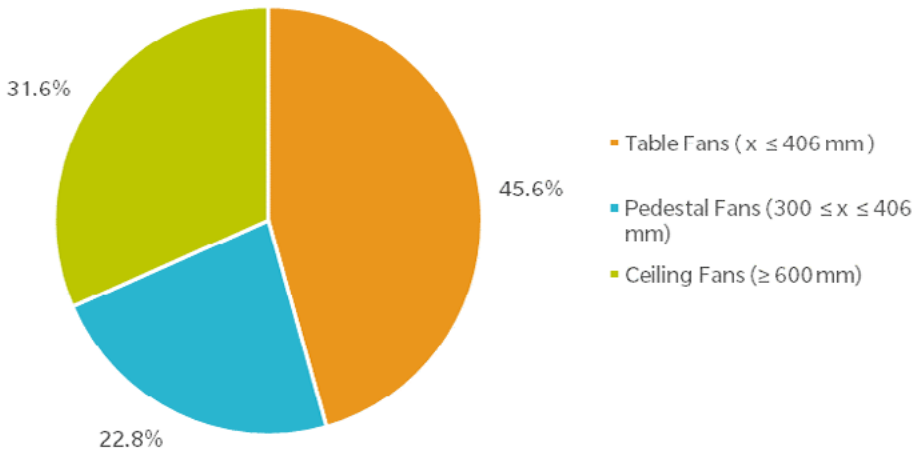
The average retail prices for all three fan types are similar, but the price of ceiling fans is marginally higher than table and pedestal fans. However, unlike TVs, there is no visible trend between fan size and retail price. It is possible that some other key features (e.g. use of BLDC motor, inbuilt battery, etc.) are drivers of fan cost (Table 2).

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

Fan Type	Average Retail Price (USD)
Table Fans (x ≤ 406 mm)	18
Pedestal Fans (300 ≤ x ≤ 406 mm)	16
Ceiling Fans (≥ 600 mm)	21

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

Figure 7: Three different fan sizes available in the market (n=78)

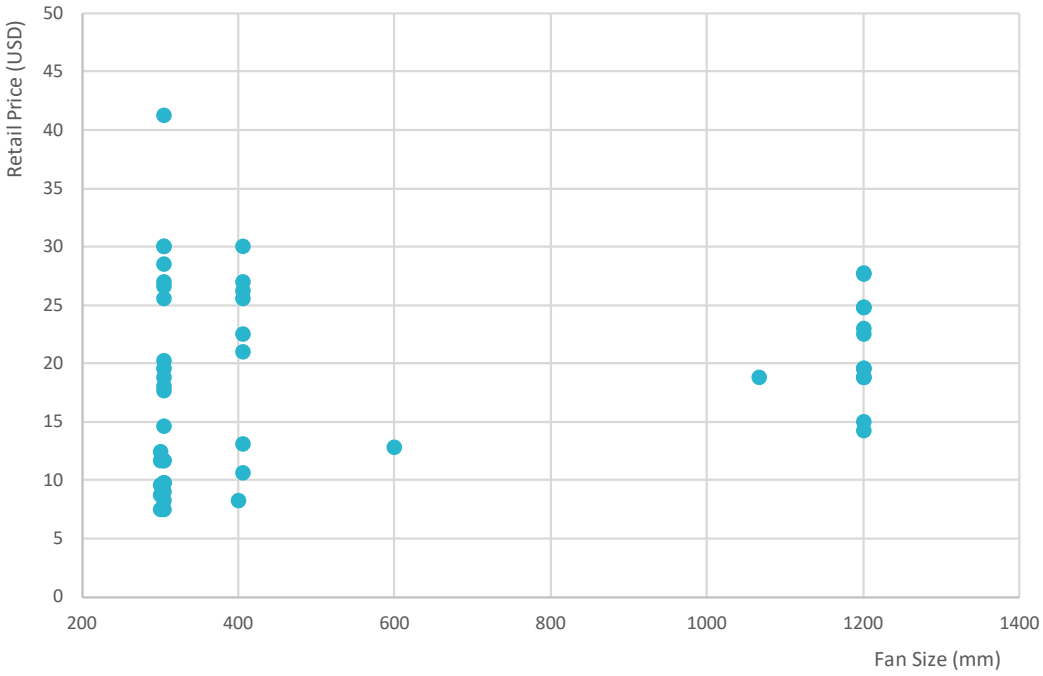


Source: Efficiency for Access, 2017-19 retail market survey data

Warranty

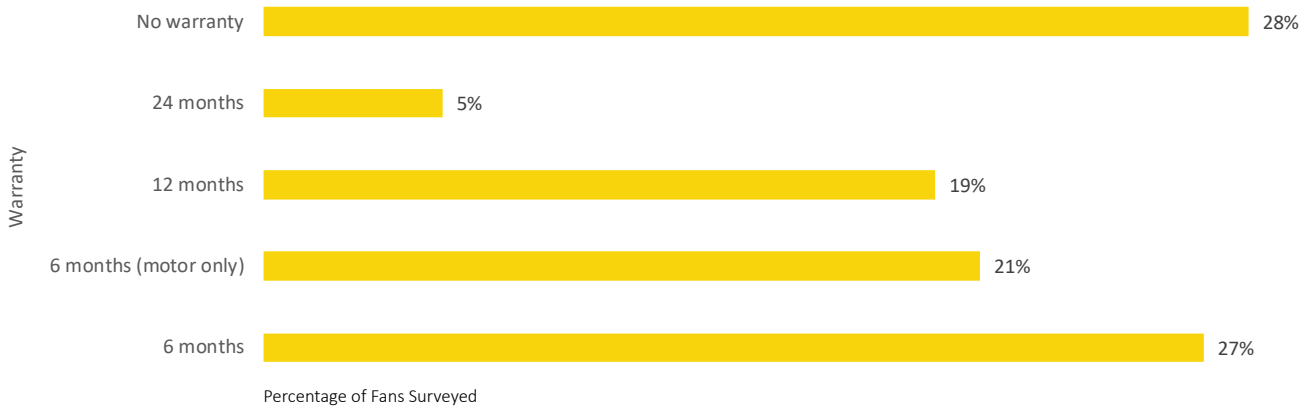
In India, a large share of fans (48%) surveyed come with a 6-month warranty – with 27% of the fan warranty intended to cover one season of use, and 21% only cover the fan's motor. For most products, the retailer is providing the warranty, instead of the manufacturer. While the majority of fans available in the market are covered by some warranty terms, more than 25% of fans surveyed are not covered by any warranty.

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



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

Figure 9: Warranty (months) offered for fans



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

According to the 2019 State of the Off-Grid Appliance Market report,16% of rural households in India are estimated to own a refrigerator.[20] The low penetration rate is exemplified by sales data reported by GOGLA and LEIA affiliates—only 5,400 units of off-grid refrigerators were sold in the South Asia region in 2019.[21] Similar to off-grid TVs, there was limited market presence for off-grid DC refrigerators in the surveyed shops. Very few sellers were aware DC refrigerators existed. Several manufacturers and suppliers in New Delhi offered household DC refrigerators. According to several of the manufacturers and suppliers in New Delhi, they hoped to sell household DC refrigerators, but the cost was too high for consumers and demand was low. While DC refrigerators are uncommon, field consultants noted a market presence of commercial DC-powered deep freezers. Many of those freezers were manufactured locally.

The following refrigerator market insights are generated based on data from 15 refrigerator models surveyed in Lucknow and New Delhi. The low market penetration of off-grid refrigerators in India accounts for the relatively small sample size of products surveyed.

Power Type

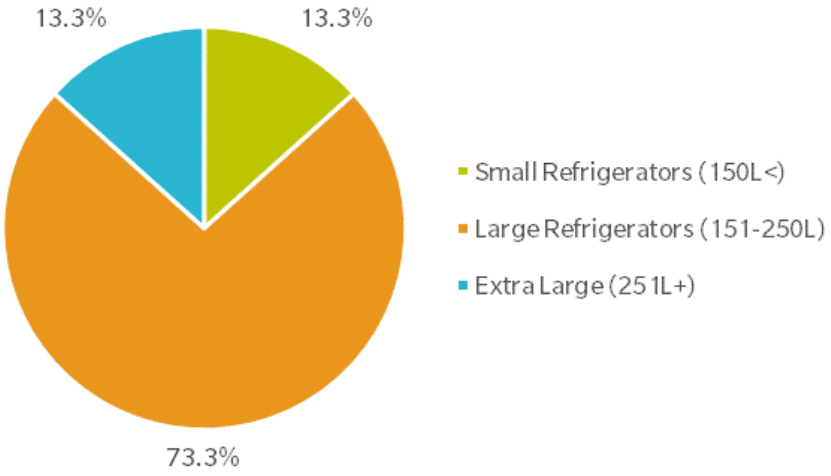
The surveys showed little-to-no market presence of off-grid refrigerators. The majority of the refrigerator samples found in the retail markets are small volume AC-powered refrigerators. Among the 15 refrigerator models surveyed, only 5 models—all from one solar company—are 12V DC refrigerators.

Due to rapid grid extension in India, the shop owners indicated that refrigerator units that are marketed as dual-use, i.e. can run on both AC and DC power, are particularly popular among consumers in off- or weak-grid areas. Refrigerators inbuilt with digital inverters (DI) is a new, emerging technology that is seeing an increase in consumer demand due to lower power consumption and its ability to be connected to grid electricity or solar modules. Samsung's SMART DI series has a strong market presence in rural India and is marketed as solar compatible and able to withstand voltage fluctuations. According to shop owners, the single door 192 L refrigerator with DI technology, which costs around 16,500 INR (around $220 USD), is highly demanded by rural consumers.

Product Size

In general, the refrigerator models found in the Indian retail market are larger than the average size in East Africa (typically around 100L to 150L). Among the 15 samples identified in the survey, two refrigerators are around 50L and the rest are 190L and above (Figure 9). It is unusual to see off-grid refrigerators with a volume greater than 250L, given that larger size refrigerators typically consume more energy and are more expensive. In India, however, two deep freezer models have volumes of 500L and 700L. These models are some of the largest-sized DC freezers available in the off-grid solar market.

Figure 10: Three different refrigerator types available in the market (n=15)



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

20. Efficiency for Access (EforA) Coalition, The State of the Off-Grid Appliance Market Report. 2019. https://storage.googleapis.com/e4a-website-assets/Clasp-SOGAM-Report-final.pdf
21. GOGLA, Global Off-Grid Solar Market Report Semi-Annual Sales and Impact Data, 2019. https://www.gogla.org/sites/default/files/resource_docs/global_off-grid_solar_market_report_h1_2019.pdf

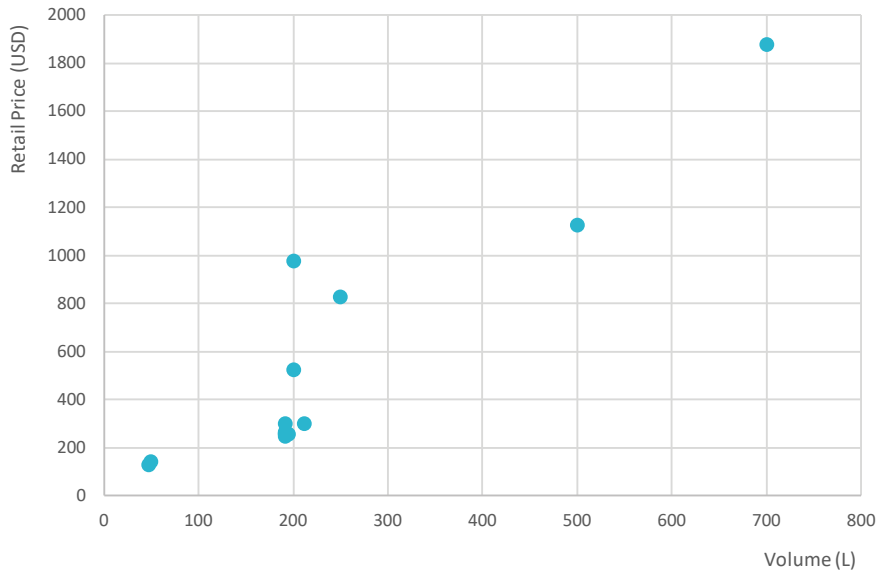
Retail Price

Market survey data find the price of refrigerators available in the Indian market ranges between $128 USD to $1,875 USD, depending on the size. The majority of the products demonstrate a common pattern—the larger the size, the more expensive the refrigerator (Figure 11). However, for a few products, retail prices vary considerably even in the same size category (e.g. 200 L refrigerators), potentially because a few of these products are also marketed as deep freezers.

Warranty

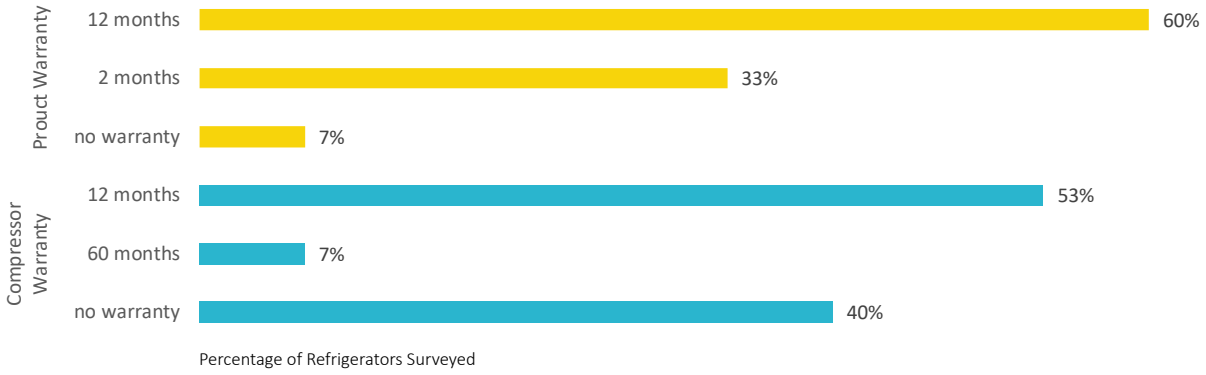
Based on the data collected, most refrigerators (60%) offer a 12-month warranty. A smaller portion (33%) offer a 2-month warranty. The refrigerators that offer a 12-month warranty also offer a warranty for the compressor that varies from 5 to 10 years, with the 10-year warranty for compressors being the most common (Figure 12).

Figure 11: Comparison of Refrigerator Volume (L) and Retail Price (USD)



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

Figure 12: Three different refrigerator types available in the market (n=15)



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

India has the largest, most developed SWP market in South Asia, with over 181,000 pumps installed to date from to government subsidies.[22] The government's KUSUM[23] scheme announced in 2018 aims to install 1.75 million standalone solar-powered pumps by 2022.[24] The SWP market in India is projected to grow significantly larger based on demand. Efficiency for Access estimated 4.2 million farming households have demand for a SWP and can afford one.[25]

Field consultants observed that most pump sellers in India also work as installers or system integrators who can assemble a customized pump system based on individual consumer's irrigation needs. Pump installers and integrators also help their clients to claim government subsidies.

The SWP market insights below are generated based on data from 73 SWP models surveyed in Jaipur and Kolkata. Of these 73 models, 19 (26%) have pump sizes provided in ranges because they can be easily customized. Due to the customization options, it's difficult to compare product models.

Power Type

AC pumps represent 79% of the total pumps surveyed. Only six models are DC and nine models are marketed as "AC/DC compatible." According to shop owners, AC pumps are more popular in Indian markets because AC motors are perceived by rural consumers to have longer lifetimes. Shop owners also shared that DC SWPs are typically sold with low head[26] for low flow rate domestic applications. The interviews with local farmers indicated that they are generally unaware of the differences, limitations, and advantages of DC pumps over AC pumps and rely solely on the installer's suggestions.

Pump Type & Size

Both surface and submersible pumps are found in the marketplace, with 21% of surveyed pumps marketed for use as a dual-use surface and submersible pump. The majority of pumps surveyed were submersible pumps (74%), more commonly available than surface pumps (5%).

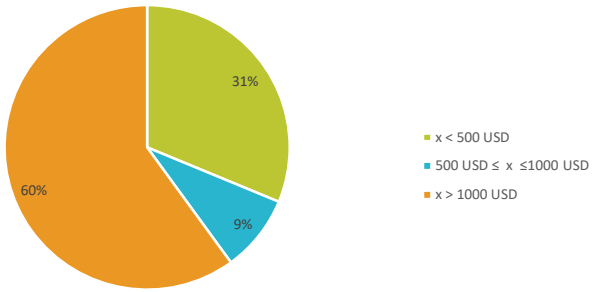
Pumps in India are relatively large in size and capacity. For comparison, the 2019 Solar Water Pump Global LEAP Awards competition[27] reported the rated input power of the pumps ranges from 0.08 kW to 2.8 kW. In India, the majority (62%) of pumps fall in a similar size category, but 38% of pumps' input power ranges from 3.75 kW to 7.5 kW. Anecdotally, the shop owners indicated that industrial and agricultural customers generally prefer size range of 2.2 kW to 3.7 kW, which are also the most commonly sold.

Retail Price

Since most SWPs in India are sold with a solar system that is customized based on the use case (e.g. residential, small farming, etc.), many of the shopkeepers quote the price in ranges based on the different options for head size, solar panel capacity, and other variable components such as wiring and piping. Due to these factors, the price data for SWPs can vary significantly and it is difficult to separate the price of pumps from solar systems. The majority of pumps surveyed (60%) have retail prices over $1,000 USD (Figure 13).

During interviews with local farmers, the field consultants heard that large landowners who own SWPs developed a leasing business model to rent their pump to smallholder farmers on an hourly basis as a way of recouping the high purchase cost. Some smallholder farmers are also sharing the ownership of SWPs with other farmers in the community to save on costs.

Figure 13: Retail Price range (USD) of SWPs sold in the market.



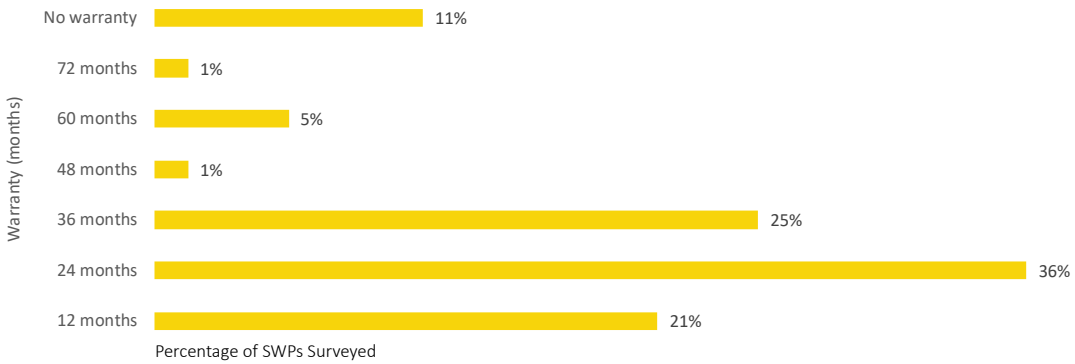
Source: Efficiency for Access, 2017-19 retail market survey data

22. "Adopting Solar for Irrigation – Farmers' Perspectives from Uttar Pradesh," Jain, Abishek and Shahidi, Tauseef, Council on Energy, Environment and Water, 2018 "Overall 181,000 Solar Water Pumps Installed in India," Mercom India, 2020. https://mercomindia.com/over-181000-solar-water-pumps-installed/
23. India's Ministry of New and Renewable Energy (MNRE) launched Kisan Urja Suraksha evam Uhaan Mahaabhiyan (KUSUM) scheme to promote installation of off-grid solar irrigation pumps (SIPs) in rural areas by subsidizing farmers with SIPs in their farms.
24. Natalia Ciecierska-Holmes, Kirsten Jörgensen, Lana Laura Ollier, D. Raghunandan (2019). "Environmental Policy in India" [online] Available at: https://books.google.com/books?id=vcXADwAAQBAJ&newbks=1&newbks_redir=0&dq=how+many+pumps+be+promoted+under+KUSUM+scheme&source=gbs_navlinks_s [Accessed 9 Apr. 2020].
25. Efficiency for Access Coalition, Solar Water Pump Outlook, 2019: Global Trends and Market Opportunities Report. 2019. https://storage.googleapis.com/clasp-siteattachments/Solar-Water-Pump-Outlook-2019.pdf
26. Head is the depth at which a pump can pump water; low head refers to height between 0 to 19 meters.
27. 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.

Warranty

In most of the surveyed markets, shop owners shared that they typically offer a longer warranty period for more expensive products so consumers feel secure before investing a significant amount of money in a product. Considering the high price of SWPs, the majority of the pumps available in the Indian market (89%) come with some type of warranty. Figure 12 shows the various warranty durations for the SWPs surveyed. A 24-month warranty is the most common (36%), followed by a 36-month warranty (25%) and a 12-month warranty (21%). A small portion of pumps (5%) come with a 60-month warranty. It is noteworthy that 11% of the surveyed SWPs do not come with any indicated form of warranty. This represents a high-risk investment for consumers spending a significant amount with no guarantee or protection that products will work. Some of the shop owners also offer two different warranties for the pump and system, and typically the pumps are covered for longer periods.

Figure 14: Warranty (months) offered for SWPs



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

CONCLUSIONS AND KEY TAKEAWAYS

With a strong enabling environment driven by government support, local manufacturing, and a large population, India provides a unique glimpse into a country with a large potential off-grid appliance market. The findings from the surveys correspond with other research about the penetration of different appliances in India. Off-grid fans are the most commonly available products, followed by TVs and refrigerators. Other key findings from the surveys are:

DC appliances aren't commonly sold in retail shops, but solar-compatible refrigerators are seeing an increase in demand. The availability of DC appliances in local retail shops specifically designed for use with SHS kits was limited across all product technologies. Even where DC technologies were available (solar water pumps and fans) their AC counterparts were more common and known. According to shopkeepers, DC fans have a strong market share because they are viewed as energy-efficient, not because customers wish to use with a SHS. Some shopkeepers weren't aware of the existence of DC-powered TVs or refrigerators. However, surveys indicated a noted market demand for commercial DC-powered deep freezers. Given the rapid grid extension in India, appliances that can be powered by either AC grid electricity or SHS, such as the refrigerators with DI technology, are growing with respect to consumer demand.

The price of TVs and refrigerators varied widely due to contributing factors such as size and features available (e.g. inbuilt battery), while fans had little variance in price. TVs price ranges between USD $36 and USD $354. In addition to size difference, some of the higher-priced TVs also have integrated batteries to serve as a backup power supply in the case of a power outage. Similarly, refrigerators surveyed cost between $128 USD to $1,875 USD, largely correlated to the size. Shopkeepers shared that the high price of refrigerators is one of the main factors preventing consumer purchase. Unlike refrigerators and TVs, the price of fans had very little variance. Average prices were reported between USD $16 and USD $21, even within the different size categories (i.e. table, pedestal, or ceiling). SWPs come with hefty price tag for low-income, smallholder farmers. The majority of pumps sold in the Indian market (60%) have retail prices over USD $1,000, a significant financial investment for rural consumers. Government subsidies can make the pumps more affordable for some consumers. Consumers are also finding creative solutions to pay off the product upfront cost, like renting it on an hourly basis or sharing it within their community.

The majority of products surveyed are covered by a warranty, but the coverage terms vary. Warranties are a good indication of consumer protection. The majority of TVs and refrigerators had a 12-month warranty and 38% of SWPs came with a 24-month warranty. Most fans surveyed in the Indian market are covered by a seasonal (i.e. 6-month) warranty, but some of those warranties are limited to the fan motor.

India's solar appliance market is vibrant and uniquely distinguished from other markets due to various contributing factors. The survey data and these observations aim to contextualize the market and provide insights that can help inform the decisions of stakeholders interested in engaging in India.

In 2020, Efficiency for Access will continue to collect market survey data on TVs, fans, refrigerators and SWPs in India and will update the existing dataset to track market progress. These forthcoming surveys may also expand scope to include other productive use appliances that are relevant to the Indian market to inform the next iteration of this country profile.

If you have any insights about the appliance market in India 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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