

COUNTRY PROFILE

**OFF- AND WEAK-GRID
SOLAR APPLIANCE MARKET
ETHIOPIA**

MAY 2022

EFFICIENCY FOR ACCESS COALITION



This country profile covers market and appliance performance data for off-grid appliances sold in Ethiopia, based on findings from Efficiency for Access market surveys. The profile explores Ethiopia's overall off-grid appliance market landscape, including the common power type, size, price, and warranty of off-grid appliances sold in retail markets. This publication is relevant for sector stakeholders working in the off-grid solar market in Ethiopia, including policymakers, development programmes, mini-grid developers, manufacturers, distributors, and others.

This profile was developed by CLASP, Co-Secretariat of the Efficiency for Access Coalition, as part of its flagship Low Energy Inclusive Appliances programme. Efficiency for Access is a global coalition working to promote affordable, high-performing, and inclusive appliances that enable access to clean energy for the world's poorest people. It is a catalyst for change, accelerating the growth of off and weak-grid appliance markets to boost incomes, reduce carbon emissions, improve quality of life, and support sustainable development. Current Efficiency for Access Coalition members have programmes and initiatives spanning 54 countries and 26 key technologies. It is co-chaired by UK aid and the IKEA Foundation.

This report was authored by Anna Wright and Riley Macdonald of CLASP, with data collection and input from Efficiency for Access' field consultant in Ethiopia, Dawit Tamrat.

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INTRODUCTION

Efficiency for Access Country Profile Series

Insufficient data about off-grid appropriate appliancesⁱ 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 conducted market scoping surveys in 10 countries.ⁱⁱ The countries have been selected based on the population size, solar home system (SHS) sales volumes,ⁱⁱⁱ and market uniqueness.^{iv} The survey results inform programme decisions, such as selecting products for testing through [VeraSol](#).^v To utilise this data and share insights from the surveys more broadly, Efficiency for Access has developed a series of country profiles that share insights on the off-grid appliance market and contextualise data with supporting research and stakeholder feedback.

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

About Ethiopia

In 2019, just 48% of Ethiopia’s 115 million people had access to electricity.¹ A majority of the country’s population (78%) live in rural areas,² and only 36% of that population has access to electricity.³ Urban populations are well-electrified, with 93% of people having access to electricity.⁴ However, households and businesses experience frequent power outages even in grid-supplied areas. For example, a study from the World Bank found that 80% of surveyed businesses in Ethiopia experienced power outages, and these outages occurred 8 times per month, for 6 hours on average during each outage.⁵ This means that even with grid connection, many people living in urban areas may still need access to backup power sources, such as a generator or solar home system (SHS) and accompanying off-grid appliances.

Ethiopia’s government is working to increase electricity access under its National Electrification Programme (NEP), which aims to provide universal access to electricity by 2025. Under the NEP, 65% of the country is slated for grid connectivity,

and the remaining 35%, or 7.5 million households, will receive electricity through SHSs and mini-grids.⁶ Though some off-grid households will eventually be absorbed into the national grid, very rural, isolated areas will retain off-grid solutions as their primary electricity source. The government is building on this electrification plan with the ten-year development strategy, “A Pathway to Prosperity”, which will further guide the growth of electricity infrastructure and other development from 2020 through 2030.⁷

Sales of solar products reflect efforts from the government and other market actors to increase energy access through off-grid solar solutions. Solar lighting product sales by GOGLA affiliates doubled between the first half of 2018⁸ and the first half of 2021.⁹ Despite COVID-19 and other challenges, Ethiopia represented 12% of the total sales volume of solar lighting products in East Africa in the first half of 2021, second to Kenya.¹⁰ The off-grid appliance market, while more variable, also exhibited growth, increasing from less than 60 appliances sold by GOGLA affiliates in the second half of 2018¹¹ to nearly 860 in the second half of 2020.¹² Continued growth is projected to a nearly 350% increase in television (TVs) and refrigerator sales between 2019 and 2030.¹³ However, economic contractions due to COVID-19 and instability stemming from internal conflict have stalled the growth of the Ethiopian off-grid appliance market.¹⁴

The Efficiency for Access market survey confirms that the solar appliance sector is nascent and highlights obstacles such as high costs that need to be resolved to see continued growth. TVs are the most popular and widespread solar appliance, while the off-grid fan market is nearly non-existent due to Ethiopia’s temperate climate. Larger appliances and productive use of renewable energy (PURE) appliances, such as refrigerators and solar water pumps (SWPs), are available. Yet, sales of these products are low due to a lack of consumer awareness and high costs. In addition, issues with the importation and sale of non-quality verified and counterfeit products, erode consumer confidence in the sector and restrict the growth of the off-grid appliance market.



12%

Ethiopia represented 12% of the total sales volume of solar lighting products in East Africa in the first half of 2021.

i. 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.
 ii. The selected countries are India, Sierra Leone, Uganda, Nigeria, Cote D’Ivoire, Ethiopia, Kenya, Myanmar, Tanzania, and Pakistan.
 iii. Sales volumes of SHS kits can be an indication of off-grid appliance ownership.
 iv. 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.
 v. 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.

COVID-19 IMPACT

The government and development partners have made efforts to support the off-grid solar market during the pandemic, but off-grid appliance sales have fluctuated and the full impact of COVID-19 on this market is yet to be fully understood.

- Ethiopia maintained economic growth through industry and services by adopting less strict COVID-19 prevention measures than neighbouring countries, allowing them to overcome a crippling inflation rate of 20.6% in early 2020.¹⁵
- Ethiopia also managed to grow its economy by 6.1% in 2020, just down from the 8.4% growth it achieved in 2019.¹⁶ Solar appliances sold by GOGLA affiliates in Ethiopia dropped from 1,795 in 2019,^{17,18} to 1,313 in 2020,^{19,20} representing a 27% decrease.
- The second half of 2020 showed signs of the market bouncing back, with 20% growth from the first half of that year,²¹ off-grid appliance sales decreased again to a total of just 333 units sold in the first half of 2021,²² indicating that the market is yet to recover.

Even as the Ethiopian government prioritised public health during this period, they were cognizant of the potential economic downturn and alleviated some of the burdens on product supply and importation.

- The government relaxed several of its economic policies to allow for more value-added tax (VAT) refunds and tax exemptions on products that could lessen the effects of COVID-19.²³ This included off-grid solar products recognised to boost economic resiliency and support public health.²⁴ However, the inconsistent application of these policies restricted their effectiveness.
- Private market development agencies also intensified support initiatives where possible. The Africa Enterprise Challenge Fund (AECF) 'REACT Household Solar Program' provided USD 20.8 million in grant funding starting in 2019 to off-grid companies working in Ethiopia and four other nearby nations to aid with the importation and deployment of products, especially during the height of the pandemic.²⁵ However, any economic growth and market recovery in mid to late 2020 was disrupted when political tensions erupted violently.

MARKET LANDSCAPE

Market conditions

Ethiopia's off-grid appliance market is nascent – as of 2018, only 2% of off-grid households in Ethiopia were projected to own a TV and just 0.4% to own a refrigerator.²⁶ However, Ethiopia has a strong potential for growth due to its large population of prospective customers in off- and weak-grid areas.^{vi} The obtainable market^{vii} for off-grid TVs in Ethiopia has a growth projection of 224% from 2018 to 2030, while the refrigerator market is expected to grow by 567% during the same period.²⁷

There is also significant growth potential for Ethiopia's off-grid PURE sector, particularly agricultural solar products. Agriculture represents 45% of the national gross domestic product and over 80% of employment opportunities in Ethiopia.²⁸ Much of this is tied to smallholder farming, which is highly susceptible to the ongoing drought crisis in Ethiopia²⁹ and can benefit significantly from irrigation schemes. However, just 10% of off-grid farming households practice irrigation farming, and only 13% of that group use motorised pumps.³⁰ As part of the NEP, the government recognises the role of pumps and irrigation in supporting their development goals,³¹ and particularly adopting SWPs to boost agricultural production and incomes in off-grid areas.³²

Despite this growth potential, several factors are stalling progress. Ethiopia is experiencing internal unrest that has compounded the depressive economic effects of COVID-19, which has implications for the off-grid solar market. As of 2019, the region of Tigray was considered a key market for off-grid solar companies due to its position as a population and trade

hub for the country's northern part. The civil unrest there has heavily impacted this sector. Despite sales of off-grid solar products increasing in Ethiopia in mid to late 2020 with the easing of COVID-19 restrictions, numbers fell by 45% in early 2021 due to the political turmoil.³³ This conflict is ongoing and will continue to affect many aspects of citizens' everyday lives, including unstable access to necessities like food and energy.

Government Policy and Programmes

As the government of Ethiopia has recognised the value of solar off-grid technologies in meeting their universal electrification goal, they have also started to identify and dismantle obstacles to the sector's growth.³⁴ Inconsistent regional and local interpretation of tax and importation requirements has impeded the introduction and distribution of products to the market while passing costs on to consumers.³⁵ These high costs have been exacerbated by other financial barriers, including limited foreign exchange (forex) and unclear tax and duty requirements for solar products and appliances. To address this, beginning in 2016 and intensifying in 2019, the government has rewritten policy, conducted training, and opened avenues for private enterprises to stimulate the market.³⁶

To streamline the regulatory process for off-grid solar products, the government of Ethiopia, with the support of the Africa Clean Energy Technical Assistance Facility (ACE-TAF) and the IFC, adopted test methods (IEC 62257-9-5) and quality standards (IEC 62257-9-8) for off-grid solar energy systems up to 350 W in April 2021.³⁷ To support these standards, Ethiopia has implemented a Pre-export Verification of Conformity (PVoC) programme to ensure that imports meet the national standards.³⁸ These efforts will counter the

vi. A grid is considered weak when consumers have access to the AC grid, but it is highly unstable and/or has intermittent electricity supply.

vii. The subset of off-grid and weak-grid households who could afford an off-grid appliance provided they had access to financing and are physically accessible to distributors, making them serviceable for off-grid solar companies.

entrance of counterfeit and low-quality products into the marketplace and boost confidence in the off-grid sector.

The government has standardised economic policies to tackle the inconsistent interpretation and application of taxes and duties on solar products.³⁹ As of 2018, off-grid energy products were also exempt from duty tax, excise tax, and surtax, and those not used for commercial purposes were also exempt from 15% value-added tax (VAT) and 2% withholding tax.⁴⁰ However, inconsistent tax policy interpretation led to additional customs duties for appliances for use in off- and weak-grid areas as their use can be hard to categorise.⁴¹ New updates to the tax code for 2022 formalise tariffs for imported solar products and some PURE, with a 5% duty tax and 15% VAT on all solar products and SWPs, and no duty tax applicable to components of solar systems.^{42,43} Ultimately, the government hopes to use this new tax policy to boost the domestic production of off-grid solar products to meet their electrification goal while supporting local manufacturing.

Market Development Programmes

Donors and development programmes have been instrumental in cultivating the growth of the off-grid solar sector in Ethiopia, although specific assistance for off-grid appliances has been low. Key partnerships with the government, such as ACE-TAF (funded by UK aid), have paved the way for market growth by refining regulatory and financial policy surrounding solar products and adopting quality standards for solar energy kits.⁴⁴ The Ethiopia Electrification Programme (ELEAP), funded by the World Bank, directly supports the NEP's off-grid goals by allocating over USD 15 million towards off-grid infrastructure and piloting incentive and subsidy research from 2018 to 2023.⁴⁵

Between 2021 and 2023, EnDev and the IKEA Foundation's Sustainable Energy for Smallholder Farmers (SEFFA) programme invests EUR 8 million into growing the dairy and horticulture PURE markets in Ethiopia, Kenya, and Uganda.⁴⁶ The programme seeks to strengthen these agricultural value chains and make an economic case for the adoption of solar PURE.⁴⁷

The primary aims of many entities investing in the East Africa region, including Efficiency for Access donor coalition members such as the World Bank, USAID, EnDev, GIZ, and others such as the African Development Bank, are to facilitate mini-grid development, deploy PURE to rural communities, and invest in off-grid technologies to support schools and health centres.⁴⁸ As the government of Ethiopia continues to open national markets to foreign aid and investment, partnering with these groups will be vital in achieving the NEP objectives and growing the off-grid solar appliance market.

Consumer Financing

The devaluation and low exchange rate of the Ethiopian birr make the importation of larger items more difficult and result in prohibitively expensive goods for end-users,

especially for appliances which are nearly all imported.

Consumer financing is, therefore, key to growing the market among low-income households. In 2017, less than 0.4% of adults in Ethiopia owned mobile money accounts,⁴⁹ minimising digital payment options. Therefore, cash sales are the primary payment method in Ethiopia, making up 92% of sales reported by GOGLA affiliates in 2019 and 2020.⁵⁰ However, in 2021, the Ethiopian government and telecommunications firms reached an agreement to establish privatised mobile money account access for consumers.⁵¹ This will enable off-grid solar companies to offer pay-as-you-go (PAYGo) to improve affordability. Raising consumer awareness in Ethiopia of PAYGo will be crucial to its integration into the off-grid solar sector.⁵²

Consumer financing facilities, such as microfinance institutions (MFIs) and savings and credit cooperative organisations (SACCOs), can increase access to financial resources but are limited in the off-grid solar market. SACCOs currently provide small loans in Ethiopia but do not have strong ties to the off-grid sector. MFIs are a powerful source of credit to household and business consumers but may charge high interest and further decrease the affordability of solar products.⁵³ Most financing in Ethiopia is extended by solar companies for their products as they see fit.⁵⁴ Thus, cooperation with third-party finance providers is key to addressing the financial obstacles to market growth. For example, the World Bank's USD 40 million in grant funding disbursed by the Development Bank of Ethiopia has been the primary consumer finance facility driving the off-grid market since 2013.^{55,56} The programme serves to combat unfavourable forex by providing capital to import products and offering credit in the local currency to households and small businesses through MFIs. However, the fund was largely depleted in late 2019.⁵⁷

Product and Technology

Methodology and Sample Source

Efficiency for Access engaged a local field-based consultant to survey key off-grid retail markets in Ethiopia. The survey was conducted in late 2019 to gather information about televisions, fans, refrigerators, and solar water pumps to identify product models sold in Ethiopian retail markets.

The field consultant visited 25 retail shops in Addis Ababa, Ethiopia, to collect data on brand, model name/number, appliance size, power input, voltage, warranty, and retail price. This data was pulled from rated claims on 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. VeraSol has tested several of the surveyed models, and this data is available on the [VeraSol Product Database](#).

The field consultant interviewed small shop owners to collect qualitative evidence and anecdotes. This anecdotal evidence complements quantitative data and may provide more insights into perceived product demand, quality, and performance.

Warranty

We selected Addis Ababa as the key market for data collection as it is the capital of Ethiopia, centrally located, and acts as the national hub for solar products. Most imported products move through Addis Ababa, and their Mercato marketplace is a key source of inventory for smaller regional solar vendors and direct sales to consumers.

Although the surveys were only conducted in Addis Ababa, the field consultant noted two other key markets that would benefit the survey in the future. Bahir Dar, the capital of the Amhara state, is the regional market hub for north-western Ethiopia. Due to abundant agriculture in the region, it mainly serves the solar needs of farmers and could yield valuable information about PURE and solar agricultural products. Mekelle is the capital of the Tigray region and acts as an important trade centre for northern Ethiopia. It is considered a key market for off-grid solar companies, but its proximity to the current civil unrest and humanitarian fallout has hindered market growth there.⁵⁸

Data Analysis on Appliances

The section below analyses off-grid appliances available in Ethiopian retail markets in August and September 2019 and focuses on TVs, refrigerators, and SWPs. The Efficiency for Access team sought to collect data on fans. However, the availability of these products was limited due to a lack of demand, likely due to Ethiopia's temperate climate. Product information was collected at marketplaces in Addis Ababa, and the data was analysed based on the following characteristics:

- **Power type:** Are there more alternating current (AC), direct current (DC), or AC/DC appliances available?
- **Size:** What are the most prominent sizes of the products?
- **Price:** What is the range of retail product price?
- **Warranty:** How many products are covered by a warranty, and how long is the warranty?

BOX 1

AC vs DC Appliances

Appliances may be specified for use with only DC power, AC power, or compatible with both AC and DC power. An end-user may have access to the AC grid, DC or AC mini-grids, or DC SHSs. To power the appliance, an end-user must ensure that the power type (AC or DC) and voltage ranges are compatible with the appliances they are using. When the power supply and appliance are not directly compatible, a power converter – an inverter or a rectifier – is required. An inverter converts DC power to AC power, while a rectifier performs the reverse conversion of AC to DC. Using a power converter drives up power consumption and typically increases the complexity of the system set-up, impacting cost and quality considerations.

TV MARKET INSIGHTS

As with other East African countries, TVs have emerged as a driver of SHS sales and are the most in-demand appliance in Ethiopia.⁵⁹ Despite financial setbacks due to COVID, GOGLA affiliates reported selling 602 TVs in Ethiopia in the second half of 2020, representing 70% of all appliances sold in Ethiopia.⁶⁰ This sales number is still minimal compared to other markets in East Africa during the second half of 2020, including giants such as Kenya (132,000 TVs sold) and more burgeoning markets such as Uganda (8,000 TVs sold).⁶¹ Still, there is an opportunity for the market to recover and continue growing.

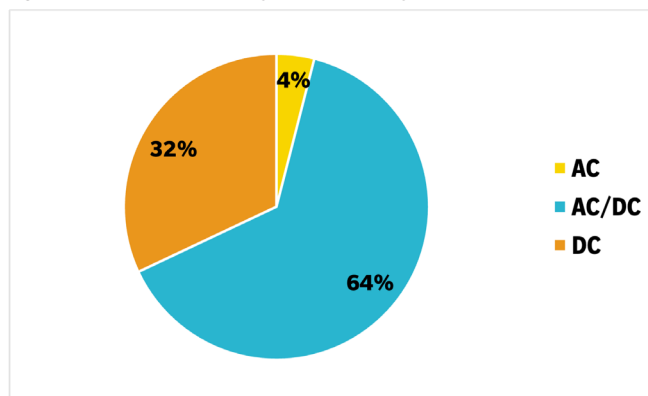
The field consultant collected data on 24 TVs from the Ethiopian market, capturing technical specifications and price data for 19 unique models from 13 different brands. The most common brand surveyed is an Ethiopian company called THS Manufacturing, representing 17% of samples collected. Locally assembled TVs appear to have a strong market in Ethiopia,⁶² with the consultant noting that six of the sampled brands are assembled in Ethiopia. In addition, three surveyed TV models are Global LEAP Award^{viii} Winners and Finalists⁶³ highlighting the availability of high-performing products in the marketplace.

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Power Type

DC TVs designed to work with solar power make up 32% of the surveyed TVs, while most of the surveyed TVs (64%) are AC/DC compatible (Figure 1). These products have an inbuilt inverter or include an inverter that enables the product to work with either an AC grid or a DC solar system. Just one AC TV was surveyed that did not have an inverter. Our consultant observed that Addis Ababa distributors are used to providing adapters or inverters to allow AC TVs to work with solar electricity setups. This enables suppliers to meet customers' needs without importing many solar-specialised DC products. However, this is not ideal as it often increases the energy consumption and complexity of the setup.

Figure 1: Distribution of TVs by input current type



Approximately 46% of the surveyed TVs are sold as standalone products, and 54% are sold with a SHS. This is slightly lower than the global TV sales trend reported by GOGLA affiliates, where 80% of TVs are sold in a SHS package.⁶⁴

viii. 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.

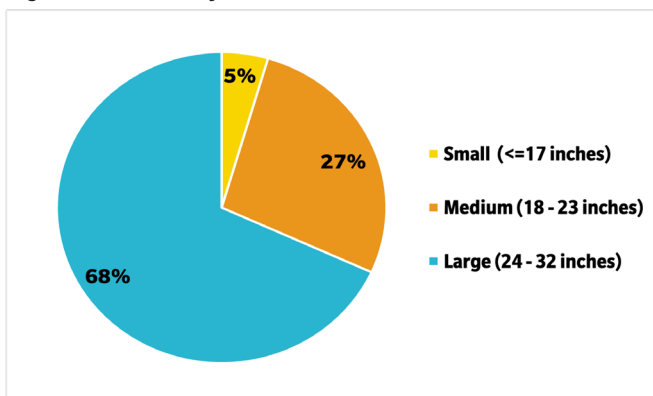


However, all DC powered TVs surveyed are sold bundled within a SHS kit, which the consultant noted is very common for the Ethiopian market. Only 29% of the AC/DC models are sold in a package, with the majority being sold more flexibly as standalone products with inverters included.

Product Size

TVs surveyed in Ethiopia range from 17 to 32 inches, with the data divided into four categories based on the diagonal screen size. Between 24 and 32 inches, large TVs are the most common size, followed by medium TVs (Figure 2). No extra-large TVs over 32 inches were identified. Large TVs were the only ones bundled with a SHS package. This size distribution mirrors other countries surveyed by Efficiency for Access and the general market shift away from small TVs and toward larger sizes.⁶⁵

Figure 2: Distribution by TV size



Retail Price

There is a significant price difference between the small and large sizes, but little average price difference between small and medium. Table 1 may explain the negligible numbers of small TVs in the market, as many can afford to buy the next size up instead. These TV prices are low compared to Uganda, where the minimum average price for each size category exceeds USD 200.⁶⁶ These low prices in Ethiopia may partially be due to some of the models being assembled locally. The locally assembled standalone TVs we surveyed retail for an average of USD 90. Ethiopia's large TVs sold with SHS packages cost an average of about USD 550, with locally assembled versions averaging slightly less at USD 454.

Table 1: Average retail price for TVs sold without standalone by size category

Size category	Average retail price (USD) for TVs sold standalone
Small	80
Medium	95
Large	140

When examining price by power type for large TVs sold packaged with an SHS, AC model pricing averages over USD 200 less than DC models. However, several of the packaged DC TVs we surveyed do not advertise a fixed price as they were offered with PAYGo financing.

Warranty

All TVs surveyed include at least a one-year warranty, with four models offering more extended warranties of two and three years (Figure 3). This rates highly in comparison to other countries surveyed by Efficiency for Access. For example, 6% of TVs surveyed in Nigeria⁶⁷ and 10% of TVs surveyed in Uganda⁶⁸ offered no warranty. Each of the TVs from the Ethiopian market with longer warranties is sold in a SHS package and is provided by either well-known solar companies with established brand recognition or companies assembling locally in Ethiopia. This may indicate that building local capacity for assembling solar appliances will increase solar technical expertise regionally and will allow these brands to offer efficient technical and after-sales support through local agents.⁶⁹ Regardless, these long warranties signal that distributors are working to establish confidence in solar TVs and build brand loyalty, and echo our consultant's observation that most distributors are keen to work with consumers to set pricing, offer installation services, and provide after-sales care.

Figure 3: Warranty period offered for TVs

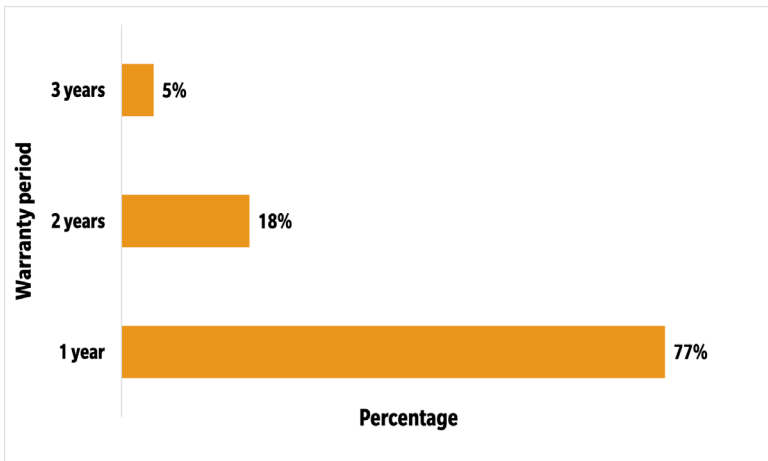
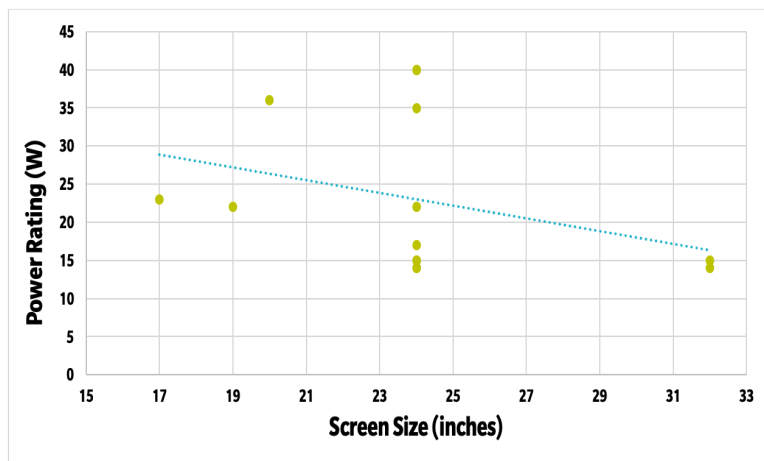


Figure 4: Correlation between a TV's power rating and diagonal screen size



Power Consumption

Manufacturer-reported power ratings were noted from 14 of the surveyed models and ranged widely. A weak negative correlation is observed between TV size and rated power, with the largest surveyed TVs having some of the lowest-rated values (Figure 4). Many large, efficient TVs can consume even less energy than small and medium TVs. This efficient design enables consumers to upgrade to a larger TV size without increasing the capacity of their solar home system.⁷⁰ The low power rated, large TVs surveyed are DC models intended for off-grid use. The most common TV size of 24 inches ranged widely in power ratings from 14W to 40W, with the high end of these being AC TVs sold with an inverter. This indicates that the market includes some solar-specialised models but also continues to adapt less efficient AC models for use with solar energy systems.

FAN MARKET INSIGHTS

As of 2018, just 0.4% of rural households in Ethiopia owned fans, reflecting the very low penetration of this appliance into the market.⁷¹ This is primarily due to Ethiopia's stable, temperate climate compared to other Sub-Saharan African countries. GOGLA's Off-Grid Solar Market Report shows zero fans sold in 2019 and 2020.⁷² The field consultant only surveyed one fan from the Ethiopian market, indicating that the demand for fans is nearly non-existent in Ethiopia. Therefore, we have not included an analysis of fans in this report.

REFRIGERATOR MARKET INSIGHTS

The market for refrigerators in Ethiopia is extremely small. Less than 1% of off-grid households in Ethiopia were projected to own a refrigerator in 2019,⁷³ and GOGLA affiliates reported zero sales of refrigerators in Ethiopia in 2020.⁷⁴ However, the refrigerator market is projected to grow significantly in the next ten years.⁷⁵ This market

could also benefit from the newly minted regulatory and financial reforms to streamline the importation, quality-verification, and distribution processes for off-grid solar products.

The field consultant gathered information on eight refrigerator models from four brands sold by four distributors in Addis Ababa. They reported that it is uncommon for appliance suppliers to have refrigerator stock on hand due to high prices. So, suppliers typically only order refrigerators when consumers put in a purchase order. Additionally, the consultant observed that most refrigerator sales occur in conjunction with government or institutional projects for hospitals and health centres and noted that refrigerators are prohibitively expensive for most household consumers.

Power Type

All surveyed refrigerators are DC powered, which is typical of refrigerators sold for off-grid use with solar systems in Ethiopia. The field consultant noted that AC refrigerators are available but do not typically come with an inverter and are even more costly than the DC models on the market. All DC models surveyed are sold on flexible terms depending on the customer's requirements, with three sold as standalone, one sold in a bundle, and two offered as standalone or in a bundle.

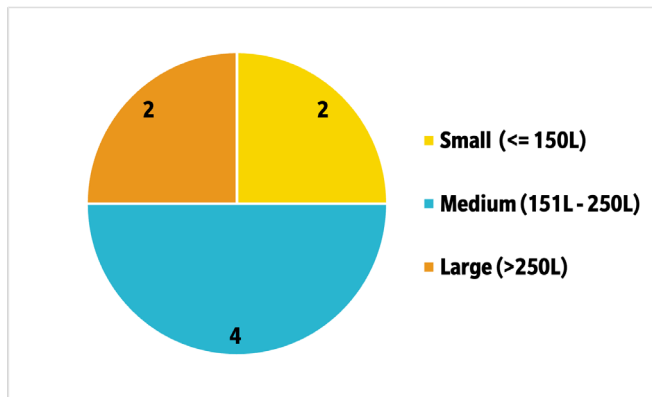
Product Size and Type

Medium refrigerators represent half of all surveyed units, with the rest split evenly between small and large units (Figure 5). Medium refrigerators are likely the most popular size due to the balance of value and capacity. They offer a less expensive option than large refrigerators but provide more volume than a small model, making them flexible for use in a household or light commercial setting. The consultant noted that two brands offer several sizes ranging from small to large (55L to 315L), ordered depending on client specifications.

Seven out of the eight refrigerator models are multi-temperature cabinets that can be used as a refrigerator or a

freezer and include a 2019 Global LEAP Winner.⁷⁶ The final model surveyed is a solar direct drive (SDD) refrigerator specialised for medical use.

Figure 5: Size categories of surveyed refrigerators



Retail Price

Prices for multi-temperature refrigerators sold in the Ethiopian market vary widely. Surveyed units range from USD 1,212 to USD 9,762. This is extremely expensive considering that the average disposable income for energy and appliances is only USD 169 per year for half of the off-grid consumers.⁷⁷ This pricing also differs significantly from refrigerators and freezers sold in a package in comparable markets like Uganda, where the average cost is around USD 900.⁷⁸

The SDD refrigerator surveyed was going for USD 10,300, making it a price outlier, typical for this off-grid-specific technology. However, the model is also bundled in a kit and marketed for medical use, meaning it likely must meet stringent health procurement guidelines, thus resulting in a higher price tag. This model is most likely priced for government purchase for use in health clinics rather than targeting household consumers.

Warranty

All refrigerators surveyed from the Ethiopian market come with a warranty period of one year, which is a better average warranty duration than those of similar markets surveyed by Efficiency for Access, including Sierra Leone, Nigeria, and Uganda. However, Ethiopia lacks some of the more established brands sold in these other countries, offering a three-year or five-year warranty. For such a developing market, a one-year warranty provides baseline after-sales care for consumers and signals manufacturers' commitment to building confidence in their products for future market growth. It is worth noting that because most solar-powered refrigerators in Ethiopia are currently utilised in government or institutional projects, procurement requirements could be guiding the warranty terms offered by sellers.

SOLAR WATER PUMP MARKET INSIGHTS

Due to Ethiopia's abundance of smallholder agriculture and goals to increase irrigated land as part of the Growth and Transformation Plan, SWPs were identified as a key PURE to support and unlock these objectives. There is a large market for fuel-powered water pumps in Ethiopia, with an estimated 220,000 pumps already deployed,⁷⁹ though these suffer from equipment breakdowns and the high recurring cost of diesel to power the systems.⁸⁰ Unencumbered by these obstacles and facilitated by the off-grid electrification of rural agricultural areas, SWPs could fill the demand for an additional 1.75 million hectares of irrigated smallholder farmland⁸¹ and potentially generate USD 1.2 billion in revenue by 2025.⁸² However, barriers exist to realising this potential impact. For example, our consultant noted pump stock and knowledge as a barrier, with shop owners' having fuel-driven pumps on-hand for convenient purchase and supporting consumers with more product knowledge for diesel pumps than for SWPs.

The field consultant sampled 21 pumps from Ethiopian marketplaces, consisting of 17 models from 13 brands. Eight pumps were very large and are likely intended for commercial agricultural or community use. These pumps require more energy than a household or smallholder farmer could generate with a solar array and are excluded from the analysis below. Five of the surveyed pumps were Global LEAP Award Winners and Finalists,⁸³ showing that high-quality pumps are available to consumers in the Ethiopian market.

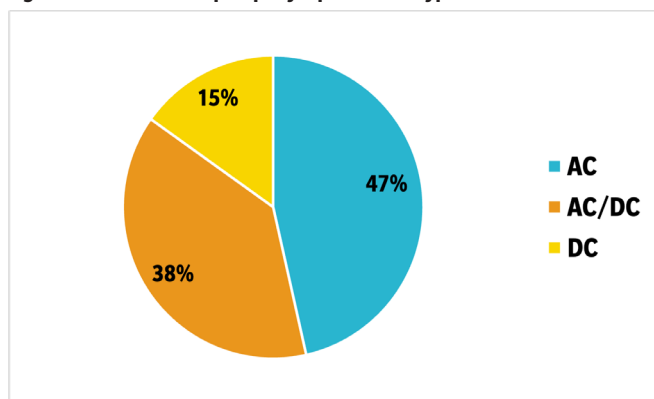


This survey indicates some flexibility in purchasing options, with 71% available as standalone products and 29% offered as part of a SHS kit. As with other large, expensive appliances like refrigerators, SWPs are often not imported or kept in stock unless a buyer is confirmed, which has been noted in research about the pump market in Ethiopia⁸⁴ and was observed by our field consultant at shops they surveyed.

Power Type

The distribution by power type for pumps included all three power types, with DC and AC/DC pumps representing 47% and 38%, respectively, and AC pumps making up the final 15% (Figure 6). This indicates that for smallholder farming, distributors mainly offer DC pumps ready for off-grid use or AC/DC pumps that allow the use of both grid and off-grid sources. In addition, the AC models were not sold with inverters and therefore were not targeted for flexible use with off-grid systems. Furthermore, each power type is offered with submersible and surface pumps, indicating the variance of pumps sold in the Ethiopian market.

Figure 6: Distribution of pumps by input current type



BOX 2

SUBMERSIBLE PUMPS

These pumps are designed for underwater installation, such as in boreholes and wells. Whilst they are generally less accessible, they do not need to be primed. They are not constrained by some of the physical limitations of surface pumps, such as suction lift limits (i.e., the maximum vertical distance the pump can pull water in before pumping it out).

SURFACE PUMPS

Draw water from surface sources, such as streams and ponds. The pump itself is designed to be situated outside of the water source. The accessibility of surface pumps can present a trade-off between the convenience of installation and maintenance and exposure to the elements and potential theft. Some surface pumps are now designed to be mobile to address these concerns.

Product Type and Size

Of the pumps surveyed, the majority (69%) are submersible, and 31% are surface pumps. This echoes the trend seen in Efficiency for Access surveys in Uganda and Nigeria. The pumps have a wide range of power ratings, from 0.05kW to 0.7kW, with an average rating of 1.3kW. Pumps with lower power ratings are generally DC pumps designed for off-grid use to require less energy input and smaller pumping capacity. Pumps with higher power ratings were generally AC pumps adapted for use with solar power. These products are more likely used for more extensive irrigation needs.

Retail Price

The field consultant noted that pumps, like refrigerators, are unaffordable for most small farmers or household consumers. Therefore, the government and development programmes are the primary buyers of these products, and pumps are primarily used in larger commercial settings or offered to lower-income consumers with financing or subsidies. SWP prices on the Ethiopian market vary significantly, with the majority surveyed ranging from USD 370 to USD 4,200, based on pump capacity and type. Our consultant noted several very large models sold with solar panels, ranging from 7.5kW to 37kW, that can cost up to USD 100,000, but these products were excluded from our analysis.

Based on the surveyed models, standalone submersible pumps are, on average, more expensive than standalone surface pumps. For those sold with an SHS, submersible pumps are more than six times more expensive (Table 2). As the average ratings for each category are similar, this price difference is most likely due to submersible pumps containing more complex components to remain submerged in water and pump from deeper sources.⁸⁵

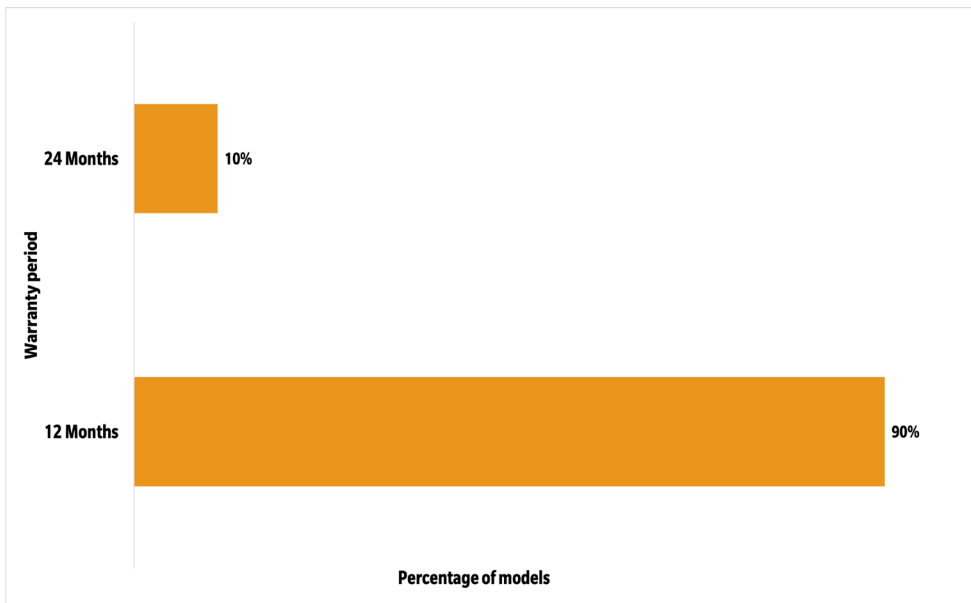
Table 2: Average power rating and retail price for pumps

Pump category	Average power rating [kW]	Average retail price (USD)	
		Pumps sold alone	Pumps sold with a solar system
Submersible Pumps (n=9)	1.3	1,065	2,415
Surface Pumps (n=4)	1.5	719	450

Retail prices for DC pumps, both submersible and surface, are comparable to AC/DC models, though they are nearly half as expensive on average as the surveyed AC pumps. This price difference in surveyed models is most likely due to intended buyers and pump capacity. The lowest-priced DC models surveyed come from Global LEAP Award-winning or nominated off-grid pump brands marketing affordable pumps to consumers. These models provide less pumping capacity but can be powered by small solar systems that households or smallholder farmers can afford and thus present an economical option to grow the market.

As with TVs and refrigerators, all SWPs surveyed are accompanied by at least a one-year warranty (Figure 7). In addition, 10% of models surveyed offer a two-year warranty, and all came from well-known international brands. For expensive PURE used in harsh environmental conditions, after-sales service is crucial to extending the product lifetime and ability to support income generation. In a growing market like Ethiopia, offering after-sales support for SWPs after purchase and robust consulting and installation services is necessary to compete with the established diesel pump market.

Figure 7: Warranty periods for pumps





Ethiopian households slated for SHS and mini-grid electrification.

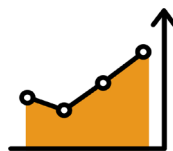
These consumers will have the energy capacity to start investing in off-grid products.

The off-grid appliance market in Ethiopia is nascent and there is high growth potential. However, some obstacles remain. The current off-grid appliance penetration in Ethiopia is low. Still, with 7.5 million households slated for SHS and mini-grid electrification, these consumers will have the energy capacity to start investing in off-grid products. Our survey found that while DC appliances are available in the market, many AC appliances bundled with an inverter are sold to maximise flexibility for use on or off the grid and reduce costs for importation and distribution. Financial constraints continue to stifle the market for distributors, who struggle to import products with limited capital and unfavourable forex and for consumers, who bear these high importation and distribution costs. This makes off-grid appliance ownership of larger, more expensive items like refrigerators and water pumps unattainable for most off-grid consumers in Ethiopia. In addition, although the economy has shown some resiliency to the effects of COVID-19, internal tension has caused instability in the market. Increased governmental and development partner intervention has emerged to combat these challenges and support the off-grid solar market's growth.



Addressing appliance affordability could grow the market considerably.

Recent partnerships between the government and private industry are opening the market to mobile money accounts, which is crucial for improving affordability and financing through PAYGo. In addition, updates to tax policy favouring PURE appliances and local assembly of solar products are helping to address affordability in the market. Our data showed that for TVs surveyed in the Ethiopian market, local assembly of some units has already brought down costs to an average of USD 90 for standalone TVs, which is comparably less expensive than other markets that Efficiency for Access has surveyed.



Ethiopia has recognised the great potential for growing its PURE product market. With millions of off-grid

smallholder farmers and an established market for diesel water pumps in Ethiopia, there is an opportunity for SWPs to fill irrigation needs and help Ethiopian farmers transition to clean energy in the future. Our survey indicates that there is a large variety of pump capacities available in the market, as well as high-quality pumps from well-known solar brands. However, SWPs are still too expensive for most off-grid consumers. Our survey found that the average price of a standalone pump intended for smallholder farmers or households was USD 892, which is a significant expense for low-income households. Although MFIs and PAYGo are making this technology more accessible, expanding financing options through public-private partnerships is needed to lower importation costs and taxes and unlock this technology for rural consumers.⁹⁵



Consumers in Ethiopia have access to high-quality appliance options and are protected from product failure by warranties.

Three TVs, one refrigerator, and five SWPs surveyed from the Ethiopian marketplace were Global LEAP Awards Winners or Finalists, indicating that high-quality products are available to consumers. In addition, all products across the three technology types provided at least a one-year warranty, equating to one of the best baseline warranty landscapes in the countries surveyed by Efficiency for Access. Our TV survey data indicates that the growing capacity for local off-grid appliance assembly in Ethiopia has translated to extended warranties for some TVs and may cultivate local expertise and support better, more convenient after-sales service. Warranties and after-sales services are vital for boosting consumer confidence in solar products and building brand loyalty, though we cannot verify that these warranties are being honoured.

If you have any insights about the appliance market in Ethiopia, 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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