



REFRIGERATORS

Solar Appliance Snapshot

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EFFICIENCY FOR ACCESS COALITION

Off-grid refrigerators represent an emerging appliance with high demand but low market penetration. Improvements in design, price and performance are central to driving market growth.

MARKET INSIGHTS

With greater affordability and increased efficiency, the global market potential for refrigerators is estimated to grow by 10% each year. However, refrigerator [ownership in off-grid areas remains low](#). In rural Africa, approximately 4% of households own a refrigerator, and in rural India, only 16% of households have refrigerators. Affordability is one of the biggest challenges prohibiting refrigerators from reaching consumers at greater scale.

Despite this affordability challenge, there is evidence that the number of brands and models in the market is growing, meaning increased competition and more choices for consumers. Just five years ago, only a handful brands were active in the market. By 2017, 11 refrigerator manufacturers with 20 products participated in the Global LEAP Awards, and by the 2019 Awards, those numbers nearly doubled.

CONSUMER IMPACTS

Refrigerators have the potential to unlock an array of social and economic benefits for off-grid consumers, satisfying both consumptive and productive uses. Refrigerators can reduce poverty by creating new business opportunities, improve food security by extending the shelf life of food and reducing food waste, decrease the amount of time spent food shopping and cooking, and improve health by keeping vaccines and medication viable.

Small shop owners comprise the main customer base for off-grid refrigerators to date. Shop owners primarily use refrigerators to provide new services and expand product offerings, such as selling cold beverages and perishable food.



USD 14.3 billion

In 2018, the obtainable market for off-grid refrigerators was estimated at USD 4.4 billion. This total is projected to reach [USD 14.3 billion by 2030](#).



2.5x

Without financing, the cost of refrigerators can be 2.5x higher than the annual disposable income of the poorest 50% of off-grid households



90%

In a survey of Ugandan refrigerator customers, 90% made the purchase for use at their workplace to improve business, attract customers, and increase income.



US\$4.82

A [survey of refrigerator customers](#) in Kenya found that households estimated saving US\$4.82 per week on average from improved food storage and time saved shopping.

CURRENT SUCCESSES

Refrigerator efficiency has improved by [12% in the last two years](#) – a key consideration for improving the affordability of the solar energy systems needed to power refrigerators. These efficiency improvements are likely spurred by recent innovations in insulation, compressors and controllers.

Some vaccine refrigerator manufactures have also started adapting solar direct drive technologies for household and small business use, which has resulted in price reductions for these products. Between 2017 and 2019, the average price index, or price relative to size, of solar direct drive refrigerators decreased by 83%. These products perform particularly well for autonomy, or the duration of time that a refrigerator can stay cold without power. With continued price improvements, more consumers will be able to access refrigerators delivering high-performing autonomy.

REMAINING CHALLENGES

Refrigerator affordability remains the primary barrier to market growth, and requires balancing efficiency and performance in product design. Further, even if manufacturers bring down production costs, off-grid refrigerators cannot reach greater scale until high import duty rates are lessened. Many countries classify refrigerators as luxury goods and tax them at relatively high rates. In Africa, duties for importing a fully assembled refrigerator can be as high as 50%, with an additional 10-15% VAT.

Distributors new to the off-grid appliance market have reported difficulties finding equipment manufacturers that sell high quality refrigerators at an affordable price. Given that refrigerators are bulky and fragile, distributors also face difficulties bringing products to rural consumers due to complicated supply-chain logistics.

RECOMENDATIONS AND PATHWAYS TO SCALE

The off-grid refrigerator market has shown promising improvements in price, efficiency and innovation, but more work needs to be done to bring these products to scale.



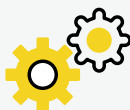
Improve affordability

PAYGo and loans through local financing institutions present a viable route for growing the household refrigerator market. Building economies of scale, where refrigerator manufacturers can utilise the same key components across different brands and refrigerator types, can also increase affordability.



Build consumer awareness

Manufacturers selling high quality off-grid refrigerators often have to compete with low quality, cheap AC refrigerators. Awareness-raising efforts should be applied to educate customers on the benefits and cost savings of using high quality, efficient refrigerators, as well as how to properly use and maintain their products.



Provide after-sales support

Product failure and warranty servicing are key challenges related to refrigerator usability, especially for hard-to-reach consumers in rural areas. Given the technical complexity of refrigerators, customers need to be able to easily access technical support to help with repairs.



Enhance quality assurance

A sector-wide quality standards framework will support procurement programmes and financiers in selecting high quality products. Further, quality standards can be a first step to help countries develop policies specifically for off-grid refrigerators.



Promote field testing

Considering the high variance in performance and user behavior, field testing is important for nascent and complicated technologies like refrigerators. The data would fill key information gaps related to user behavior, socioeconomic impact, use cases, and tax and duties.



Advance donor cooperation

Refrigeration constitutes one of the most mature instances of donor cooperation in the sector. Nevertheless, donor-supported programmes are still needed to scale the refrigerator market, especially investment in R&D and product testing to improve refrigerator technology.