



PERMANENT MAGNET MOTORS

Solar Appliance Snapshot

AUGUST 2021

EFFICIENCY FOR ACCESS COALITION

Electric motors are the primary movers in most appliances; therefore, introducing permanent magnet (PM) motors in off-grid appliances plays a crucial role in promoting energy-efficient appliance use.

MARKET INSIGHTS

The current [PM motor penetration rate in South Asia and Sub-Saharan Africa is estimated at 60% and can reach 100% by 2025](#). The motors' higher energy efficiency and better compatibility with solar technology are key drivers of their adoption for appliances.

In addition to their use in household and productive-use appliances, PM motors are also popular in electric-2 and 3-wheelers. In South Asia, the annual [sales of PM motors were estimated at 0.74 million units in 2020](#), representing a thriving market with the potential to grow further as the demand for 2W and 3W vehicles rises.

CONSUMER IMPACTS

Households switching from conventional appliances to permanent magnet motor appliances will [save 30% on the net cost of their solar energy system, even after accounting for a 20% price premium](#). These savings deliver significant cost savings to the consumer and offer growth opportunities to the market.

Aside from cost-related benefits, superior functional performance and value-added features attract consumers driving PM motors-based appliance sales. For example, PM motors can enable quieter operation of washing machines, refrigerators and fans.



1.6 m units

In 2019, the total sales of brushless direct current (BLDC) fans in India and Pakistan were estimated at 0.6 million units (1.15%) and 1 million units.



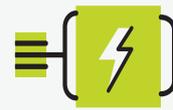
<1%

PM motors are an untapped market opportunity. In 2017, PM motors comprised less than 1% of the total market for motors.



92%

The average Energy Efficiency Index (EEL) of fans with PM motors was 92% greater than brushed motor fans and 32% for pedestal fans.



33 out of 37

As of August 2021, the majority of the pumps listed in the VeraSol Product Database (97%) use PM motors.

CURRENT SUCCESSSES

Manufacturers and consumers value the efficiency gains PM motors offer, driving the adoption of the motors in applications. The motors are already popular in off-grid settings for solar appliances and are gaining traction in grid-connected households that seek to reduce energy costs.

Development advancements such as sensorless designs, minimized torque ripples and the integration of control electronics contribute to reduced costs and improved performance reliability for PM motors. Additionally, research is ongoing to determine alternative materials for optimal magnets that achieve a balanced tradeoff between cost and component performance.

REMAINING CHALLENGES

PM motors are more expensive than induction/brushed DC motors. High upfront costs and financial limitations for many off-grid customers poses a sales challenge. Additionally, there is little consumer awareness of the benefits of energy-efficient appliances.

In key off-grid markets, the penetration of PM motors for appliances is low. This discourages local start-up manufacturers from investing in and developing PM motor-based devices. Supply constraints for rare materials such as dysprosium and neodymium used in PM motors lead to volatile magnet market prices and is another challenge.

RECOMENDATIONS AND PATHWAYS TO SCALE

Growing markets in Sub-Saharan Africa and South Asia offer opportunities for manufacturers to adopt PM motors. Reducing upfront costs, increasing consumer awareness, maturity of B2C supply chains and stability of market prices are essential to lowering existing barriers to adoption.



Lower upfront costs

Developing demand aggregation and bulk procurement models for PM motor-based appliances and introducing fiscal incentives and subsidies can bring down the high upfront cost for consumers.



Strengthen standards & labelling programs

This can promote high-quality, high-performance products that deliver expected services to users, boosting PM motors adoption.



Improve consumer awareness

Improved regulations and awareness campaigns by governments and industry bodies can increase end-users understanding of the benefits of energy-efficiency appliances.



Standardise designs & manufacturing processes

Standardised designs will enable specialist motor manufacturers to emerge and operate at scale, as in the induction motor industry. This will also improve interoperability and compatibility challenges.



Manufacture locally

A strong local manufacturing base for PM motors can bridge the supply chain gap for sourcing motors and motor accessories, stabilising the fluctuating prices for PM motors.



Increase consumer confidence & experience

Delivering quality post-sales services at a more affordable cost can provide value for money to end consumers and boost the general satisfaction from PM motor-based appliances.