

EFFICIENCY FOR ACCESS RESEARCH AND DEVELOPMENT FUND: INNOVATOR SERIES

A SUSTAINABLE SOLUTION FOR PAKISTAN'S OFF-GRID COOLING CHALLENGE



Pakistan is an extremely hot country with summer temperatures regularly exceeding 45° Celsius. To keep cool, most families use hand fans, DIY air coolers, and local stand fans. Air conditioners meanwhile can cost as much as a typical rural family's three-month income. The make-do mentality forces them to compromise on quality and, on average, replace appliances every two years. 10% of a rural household's income is spent on meeting their basic energy needs (lighting, mobile charging, cooling and ventilation).

Due to unreliable or non-existent electricity, most people buy 12V direct current (DC) fans. The problem is that most of these fans in the market are made from low-cost used motors and very inefficient. Harness Energy's field research has shown that the average DC fan uses 40W of power. This resulted in an Energy Service Value (ESV) as low as two, which makes running a fan to keep cool at night very difficult. Those who can afford solar panels and batteries make use of these, but most still cannot. As a result, many are forced to sleep outdoors on traditional woven beds, typically on rooftops.

Harness Energy wanted to create a product that would provide a significant lifestyle improvement and sustainable cooling to these people, at an affordable

price tag. With its partnerships with MFIs (Microfinance Institutions) the challenge of consumer financing was solved. But it needed to create a superior product.

DID YOU KNOW?

Over 20% of people in Pakistan still live in off-grid areas, which are also the poorest in terms of resources.

HARNESS ENERGY'S SPECIALITY

Harness Energy was founded in 2016 with the aim to resolve the energy access problem in rural Pakistan. Over the years it has grown to become the biggest distributor of VeraSol-certified products in Pakistan, including solar lanterns and lighting kits.

Though it started with only lanterns and lighting kits, since 2018 Harness Energy has shifted its focus towards larger systems, such as 80-200W Solar Home Systems (SHSs) as solar demand in Pakistan is driven primarily by fans. Its goal is to play a leading role in helping Pakistan achieve SDG7 (Sustainability Development Goal 7).

Harness Energy is a team of 13 people, based out of Lahore, the second biggest city in Pakistan. It currently works in eight districts the of Punjab and Sindh regions of Pakistan. Most of its target customers cannot afford to pay for their products with cash, so it works closely with six micro-finance partners to make them affordable via equated monthly installments (EMIs). This, along with a high-quality after-sales service has helped the company maintain a strong Net Promoter Score since its inception.

Harness Energy is a qualified (and the most active) supplier of the largest off- and weak-grid focused solar programme currently in Pakistan — the KfW-funded PRIME programme (www.pmic.pk/prime).

HARNESS ENERGY

The support from the Efficiency for Access Research and Development Fund helped us leapfrog inefficient motor technology to develop a far superior product, which will ultimately provide sustainable cooling and improve the lives of over two million Pakistani households. Without the grant, our dream would not have been so grand.

Muhammad Shehryar, Founder and CEO

ADAPTING THE PROJECT TO THE NEEDS

Originally, Harness Energy only planned to make a super-efficient rechargeable fan. But during the project it realised that there is also a large demand for non-rechargeable fans, as many customers already have batteries. So it decided to develop two versions.

It used the innovative brushless DC (BLDC) motor in both models because of the numerous advantages it offers compared to conventional induction motors, including;

- Lower power consumption
- Lower noise
- Better performance at unstable voltages
- Minimum maintenance and much longer lifetime

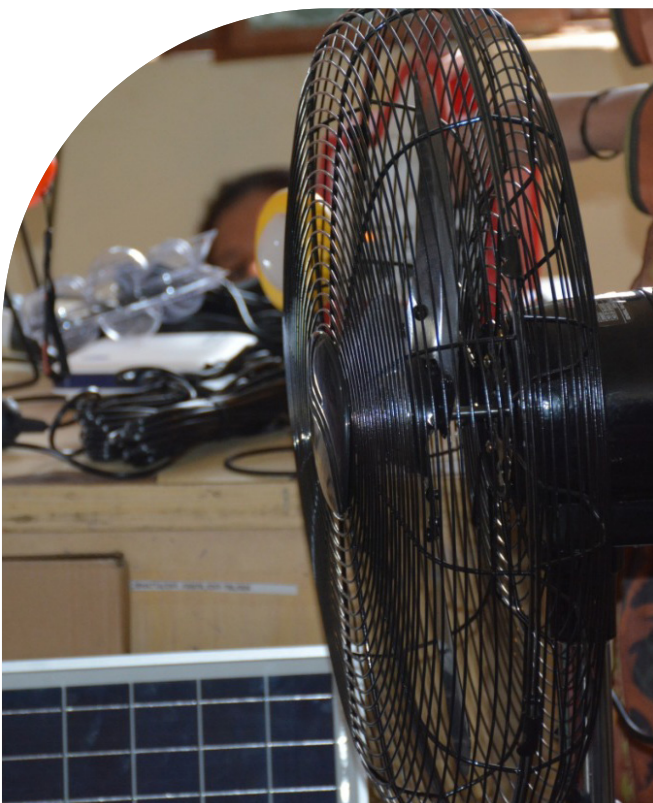
To save costs, the motor was designed and imported from China. After weeks of hard work, the power consumption was lowered to 20W without compromising on the high airflow that most Pakistani people want.

All the other parts — base, rod, blade and main body housing — were manufactured by Harness Energy.

Moulds were made for these parts through a slow process, and the injection moulding was outsourced to contractors in Lahore. The grill sets, batteries, and hardware were sourced from the local market. In summary, Harness Energy localised 60-65% of the entire fan. It is estimated once demand exceeds 40,000 fans per year, it would be cost-effective to make more parts locally and increase localisation to 75-80%. Currently, no fan manufacturers in Pakistan make rechargeable stand fans.

In the summer of 2021, Harness Energy rented a warehouse to store parts, and a partially equipped assembly line to assemble the fans. Machinery and tools were either purchased or rented to plug in the missing parts in the assembly line. The company acted as the importer and distributor until receipt of the grant from the Efficiency for Access Research and Development Fund, marking its first experience in manufacturing. The team came to appreciate the challenges of manufacturing and a newfound respect for the business model.

Once the fan was ready, the team pitched it to the MFI partners, and marketed it primarily via field events and a rented van. So far there has been an overwhelmingly positive response, with the main critical feedback being a request to introduce a metal body version as well.



A conventional ‘baleno’ motor 12V DC fan available in the market

MAIN FEATURES OF THE PRODUCT

Both fans can run on three inputs:

- A 30-50W solar panel
- Any 12V battery
- An AC/DC adapter

This functionality covers all possible customer segments, including off- and weak-grid, and those with a stable grid connection. Most customers in off- and weak-grid areas were interested in the standard model, which costs only \$30. Some purchased it separately to use with their own batteries, while others preferred it bundled with a solar system. With the most popular SHS offering, this fan runs for over 10 hours at night.

The rechargeable model has built-in batteries and a 5V USB port for mobile charging, making it a standalone appliance that provides solid backup during power outages. This product is in high demand in cities, as grid-connected households typically need it to run for three to five hours daily during power outages. Its higher price point of \$72 also reflects its additional features.



Field marketing event in district Sanghar, Sindh

KEY ACHIEVEMENTS

Overall, Harness Energy is happy with successfully creating a largely locally made rechargeable solar-powered fan.

It aimed to provide an affordable and sustainable way for people to stay cool. This would reduce dehydration, prevent sleep interruptions, and save money on energy costs. These goals were successfully achieved, with its fan being about 18% cheaper than a similar imported model, which is significant for a low-margin product.

Until 2019, Harness Energy was a solar distributor with no previous experience in manufacturing. But it was dissatisfied with the local fans being bundled with its systems. This grant fund allowed it to take matters into its own hands.

Without the support from the Efficiency for Access Research and Development Fund, the company would not have been in a position to take its innovation forward, and would still be facing the challenges of low quality local fans.

Pakistan is higher up on the energy access ladder compared to most other under-electrified countries in Sub-Saharan Africa and South Asia. The main energy access challenge is to ensure every household has a cooling appliance to use during the hot summers. The trial orders for this project have enabled Harness Energy to provide tier two energy access to over 60 households using its standard model with a 50W, 80W, or 170W SHS. Including customers who received standalone rechargeable fans, this number increases to 85 serving more than 510 people.

LESSONS LEARNED

Harness Energy learned that innovation does not always come from established producers, especially when the target market is very price-sensitive.

The company found manufacturing motors, particularly brushless ones, to be quite challenging. Some mould manufacturers also chose to increase previously agreed upon prices, leading to project delays.

Harness Energy saw a bottom-up approach to product development, with constant customer input, as the best way to commercialise an energy access product. Being aware of the target household's need, their incomes, and the conditions they live in was very important from a design perspective.

For example, no matter how much back-up time Harness Energy's fan provided at night, if the airflow was below a certain threshold, the fan would not sell. The same was true if its price was over a certain threshold. So the team carried out reverse calculations in both cases to reach the optimal power consumption and price.

During the marketing process, Harness Energy learned that even customers with very modest incomes are willing to pay a premium price if the product distinguishes itself on quality and after-sales service. It offers a six month warranty on the fan motor and battery (if applicable), and has received very generous feedback.

NEXT STEPS

- Bundle the fans with all current plug-and-play and component-based SHSs at a discount compared to local fans. Harness Energy currently bundles a BLDC motor fan from another vendor with its solar packages.
- Create a separate team for fan manufacturing and sales, as it differs from Harness Energy's core solar distribution business. This will involve making some project contractors permanent and hiring four to five additional salespeople.
- Reach higher-income customers, stock the rechargeable model in department stores in major cities. Partner with consumer financing companies to offer easy installment plans.
- Use the latest fundraising and MFI partnerships to expand to three more districts in Punjab, introducing the fans to underserved households.

FURTHER PRODUCT DEVELOPMENT

- Develop a metal-body fan powered by a BLDC motor. This involves redesigning the fan to include a metal body and creating two new moulds, while keeping the motor, printed circuit board and wiring. The base, rod, and grill set are available from vendors at competitive prices. Although this fan will use 23-24W of power due to the heavier metal blade, it remains highly attractive compared to market alternatives that use 40-45W.
- Create a BLDC motor-powered air cooler as a cost-effective alternative to air conditioners. This cooler will be priced similarly to the rechargeable fan and will use only 30W of power. Current market coolers use low-quality 50W 'baleno' motors.

GET IN TOUCH

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Training session with a microfinance partner on bundling Harness Energy's new fan with various SHS products

