

EFFICIENCY FOR ACCESS RESEARCH AND DEVELOPMENT FUND: INNOVATOR SERIES

Transforming India's Rural Dairy Sector Through Smart Decentralised Cooling



Agriculture is a cornerstone of India's economy, employing 43% of the country's workforce. India has over 130 million farmers with 86% of them smallholders. They earn just 13% of what commercial farmers earn¹. The dairy sector employs around 10 million people full-time, of which 71% are women².

Small dairy farmers in remote, rural Indian villages face challenges accessing equitable dairy markets due to limited reliable electricity and milk chilling infrastructure. Many lack access to cooling, leading to bacterial growth and milk spoilage at the farm gate. Existing cooling facilities are hindered by unreliable and expensive diesel generators, incurring maintenance costs and causing downtime issues. This leaves farmers with little confidence in their milk's quality on its way to market, and discourages investment in improved practices or more livestock to grow their business. The lack of services at the farm gate prevents small-scale dairy farmers from reaching their full earning potential.

Promethean Power sought to address these challenges by providing milk chilling services to smallholder farmers in remote villages that would enhance milk quality, prevent spoilage and increase incomes. With support from the Efficiency for Access Research and Development Fund, Promethean set out to enable a decentralised cold chain for India's dairy sector. This was achieved by developing and integrating a smart remote monitoring system into their efficient milk chilling systems.

DID YOU KNOW?

India dominates global milk production, producing 22% of the world's milk supply annually, mostly from smallholder farmers².

1. <https://www.weforum.org/agenda/2021/06/agri-tech-innovation-can-improve-value-capture-and-transform-ecosystem-for-india-s-small-farmers>

2. <https://www.dairyaustralia.com.au/resource-repository/2020/12/18/dairy-india-overview-pack>

PROMETHEAN POWER

Promethean Power, established in India since 2012, designs and manufactures energy storage systems for distributed cold-storage applications in emerging economies. Their patented thermal energy storage-based solutions enable decentralised refrigeration of milk and produce at the farm gate in rural villages with limited electricity. Promethean has installed over 2,000 systems to date, and its technology is accessed by over 85,000 farmers daily.

Promethean Power

The support from the Efficiency for Access Research and Development Fund was instrumental for Promethean to develop a more viable model for enabling cooling as a service with remote monitoring capability. This has resulted in a more sustainable milk supply chain in India for small scale farmers.

Jiten Ghelani, CEO at Promethean Power

Using thermal energy storage for milk chilling, coupled with innovative advanced remote monitoring, and cooling as a service, Promethean provides a decentralised cold chain solution to off- and weak-grid remote villages. This process guarantees the freshness of the milk and opens up opportunities for business models that focus on supporting and empowering dairy farmers who have, until now, been underserved or lack access to proper infrastructure. This is achieved by setting up refrigeration facilities equipped with milk chillers at a village level.

Villages without access to formal dairy markets are disadvantaged as they cannot benefit from traditional business models. By establishing village-level refrigeration centres, equipped with milk-chillers and the option of cooling as a service, dairy farmers have the opportunity to own and build a business for themselves.

The development of the remote monitoring solution enables installation, operation and maintenance of decentralised milk chilling in remote villages with weak-grid. The remote monitoring system included features such as:

- User-friendly dashboards and interface
- Customisation options to view critical parameters
- Detailed charts for performance analysis
- The ability to monitor multiple products and offer different views defined by the customer

Integrating remote monitoring into its operations means minimum downtime and maintenance by the farmers. The system alerts Promethean's technician to any issues on site and ensures issues are resolved quickly.

TRANSFORMATIVE IMPACTS OF PROMETHEAN'S DAIRY CHILLING INITIATIVE

Promethean successfully demonstrated business models focused on two specific use cases, both of which are now set for larger-scale expansion. The first use case was cooling as a service for smallholder dairy farmers in Maharashtra, India, and the second was on-farm cooling focusing on remote villages with an organic milk company in Karnataka, India.



A Promethean worker pouring milk into a milk chiller

These expansions involve collaboration with large dairies, emerging startups, co-operatives, and farmer groups. Embracing cooling as a service within the dairy value chain in a decentralised model has resulted in several key benefits:

- Enhanced milk quality with reduced bacterial count compared to traditional milk procurement
- Milk freshness preserved, and spoilage reduction
- Efficient transportation: the cold storage facility has significantly reduced milk collection trips leading to time and cost savings
- Milk chilling infrastructure within villages has substantially boosted farmer confidence and generated savings for communities
- Opportunities for farmer collectives to set up milk cooling infrastructure and dairy value chain and link to formal markets to empower farmer communities



Promethean's milk chilling and remote monitoring technology at a site in Tungi



Promethean's milk chilling technology decorated with flowers at a site in Karajgaon

Promethean observed that many villages face up to three hours of power cuts per day during milk collection or chilling. Using a diesel generator during this period would normally require six litres of diesel.

With the easy-to-use, low maintenance thermal storage technology and remote monitoring offered by Promethean, these challenges are circumvented, saving farmers approximately \$6-8 USD (450-550 rupees) per day. With the appropriate infrastructure and cooling systems, dairy farmers can preserve their produce and double their income.

Promethean's on-farm cooling system demonstrates an effective method in producing premium quality milk. This approach empowers smallholder farmers, making it easier for them to grow their business, adopt modern practices and increase profits from milk production. Farmers making use of the system benefit from ongoing support, training and remote monitoring.

LESSONS IN PAVING THE WAY FOR SUSTAINABLE RURAL LIVELIHOODS

In order to create a more viable and economical solution for remote villages located far from larger milk chilling systems, Promethean developed a micro-milk chiller. The transition to this model may be slow and uptake gradual, with some sites requiring relocation. Over time, decentralised cold storage with market access has the potential to significantly improve rural livelihoods. This is particularly applicable for small-scale dairy farmers, the majority of whom are women. It is envisaged that as communities see the benefits of the permanent chilling infrastructure and secure market connections that come with it, they will become more willing to invest in and expand their dairy business.

To best support communities and farmers where the systems are installed, complementary services such as remote monitoring and cooling as a service are needed. Market linkage also empowers farmers to improve and expand their dairy farming, a direct impact observed throughout the project. Scaling up cooling as a service holds promise for improving the resilience, livelihood and food security for farmers. Further, it can create sustainable agricultural chains.

To ensure benefits for farmers, food producers, consumers and the environment, a detailed long-term strategy is needed with the right financial support and community partners.

NEXT STEPS TO EXPAND DAIRY CHILLING SOLUTIONS

NGOs and dairies that supported this project have observed positive outcomes for consumers, farmer incomes and livelihoods as well as improvements in milk quality, reduced food loss and benefits for the environment.

Funding from the Efficiency for Access Research and Development Fund enabled Promethean to further develop remote monitoring technology and cooling as a service, leading to working with large dairies, startups and farmer groups. They are also engaging with leading private dairies, cooperatives and farmer communities, with the goal of reaching 5,000 villages and 250,000 farmers within the next 2-3 years.

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