

# ENERGIZING LIVES, ENABLING FUTURES

## Mini Case Series on Enterprise-Led Renewable Energy Innovation

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*Cases from South Asia, East Africa, and Latin America*

**2025-26**

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# Foreword

Access to reliable and affordable energy is fundamental to improving the quality of life for billions of people in emerging markets, shaping outcomes in health, education, livelihoods, and community well-being.

Yet these are precisely the contexts where energy scarcity is most acute and where conventional market solutions often fall short. Responding to these realities requires more than technological fixes; it demands innovative products, adaptive business models, and deep sensitivity to local social and institutional conditions.

This collection of seven mini cases brings these challenges and innovations to life, highlighting social enterprises in the renewable energy space across diverse emerging market geographies. The cases illustrate how entrepreneurs creatively navigate constraints, forge new pathways to scale, and balance financial viability with social and environmental impact.

Together, they offer rich, practice-grounded insights into the frontiers of sustainable energy innovation. We hope that engaging with these mini cases will not only deepen learning but also inspire fresh thinking and bold ideas for designing inclusive and transformative renewable energy solutions.



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# Introduction



**Access to reliable, affordable, and clean energy** sits at the heart of inclusive economic development. It shapes how households cook, study, work, earn, and stay healthy. Yet for hundreds of millions of people across emerging markets, energy access remains incomplete, unreliable, or unaffordable. In these contexts, energy poverty is rarely an isolated challenge. It is tightly interwoven with financial exclusion, gender inequality, weak market access, climate vulnerability, and fragile local institutions.

This collection of case studies examines how a diverse group of mission driven enterprises and organizations are responding to these realities through innovation that goes well beyond technology. **The cases presented here highlight organizations that treat energy not as a standalone product, but as a platform for income generation, dignity, resilience, and long term development.** Together, they illustrate how renewable energy solutions can be designed, financed, distributed, and governed in ways that work for low income households and small producers.

**The enterprises featured in these cases operate across South Asia, East Africa, and Latin America.** They span multiple segments of the clean energy ecosystem, including clean cooking, decentralized solar mini grids, pay as you go solar, biogas systems, peer to peer energy trading, women led last mile distribution, and energy enabled agriculture and mobility. Despite their diversity, they share a common design philosophy. Each organization begins by deeply understanding local constraints and daily lived realities, then builds business models that align affordability, usability, and long term impact.

Innovation in these cases is multi dimensional. It includes product innovation, such as cleaner biomass cookstoves designed around traditional cooking practices, modular biodigesters adapted for smallholder farms, and smart energy devices that enable remote monitoring and flexible payments.

**It also includes financial innovation, such as pay as you go lending, embedded credit scoring, carbon linked revenue models, and patient capital structures aligned with volatile rural cash flows.** Equally important is innovation in distribution and institutions, from women led energy entrepreneurship networks to community governed mini grids, farmer producer organizations, and digital platforms that allow energy to be shared, traded, or leased.

Impact is measured not only in megawatts installed or units sold, but in changes to household economics, health, gender roles, and resilience. Across these cases, families reduce recurring fuel expenses, gain productive hours each day, improve indoor air quality, and build assets over time. Women increase income, confidence, and decision making power. **Farmers move from subsistence toward market participation. Communities gain greater control over energy resources and local value chains.**

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## CASE STUDY 1

# GREENWAY GRAMEEN

Cleaner Cooking through Design,  
Manufacturing, and Last-Mile  
Reach





# Background

The morning cooking fire begins early in many villages across India. In small kitchens with low roofs, a mud chulha sits in the corner. Wood and dry crop waste crackle, filling the room with thick smoke. A mother squints through the haze as her eyes burn. Her child coughs beside her. By the time breakfast is done, the walls are blackened again. This scene repeats in millions of homes, every day.

Despite expansions in LPG connections, most families must still rely on free or cheap biomass. LPG cylinders are expensive to refill and unreliable in many rural blocks. Electricity, where available, cannot support electric cooking for long durations. For many women, the smoky chulha remains unavoidable.

Greenway Grameen Infra began in 2011 with a simple question. How can families cook the same way with the same fuels they have always used, but with far less smoke, far less wood, and far less discomfort? What started as a design experiment grew into India's largest clean biomass cookstove enterprise, reaching more than three million households and improving daily cooking conditions for over 15 million people.

Greenway's journey combines technical innovation, manufacturing scale, and persistent field-level distribution across India's most underserved markets.



# The Problem

Indoor air pollution is one of the world's deadliest environmental health threats, and India carries a disproportionate burden.

According to national and global estimates:

- Around **650 to 700 million Indians** still depend on solid fuels for daily cooking.
- India accounts for almost one-third of global deaths associated with household air pollution.
- Indoor cooking smoke contributes to over 1 million premature deaths annually in the country.
- Women in rural India inhale the equivalent of **400 cigarettes** worth of smoke every hour spent near a **traditional chulha (WHO analogies)**.

**This exposure increases the risk of:**

- Chronic obstructive pulmonary disease
- Lung infections among children
- Eye irritation and long-term vision issues
- Pregnancy complications
- Cardiovascular disease

**Beyond health, there are economic and social costs:**

- Women spend 1 to 3 hours daily collecting firewood.
- Biomass demand contributes to local deforestation.
- Families spend a rising share of income on purchased wood in semi-urban areas.

Improved biomass stoves are not the final answer to clean cooking, but they can significantly reduce exposure and fuel use for families who cannot yet transition fully to LPG or electricity.

Greenway saw this as a space where design, aspiration, manufacturing excellence, and distribution innovation could converge to create real impact.



## THE INNOVATION

**Greenway's innovation lies as much in listening as in engineering.**

The founders conducted long rounds of household interviews. Women described the heavy pots, the need for varied flame intensity, the irritation from smoke, and the desire for a stove that "looks good" and "feels modern." A stove shaped by users.

**This feedback led to the creation of the Greenway Smart Stove, built on natural-draft principles:**

- A rocket-style combustion chamber that channels air efficiently
- Patented air regulation that improves combustion without moving parts
- A metal body designed to endure daily heat, weight, and movement
- A portable form factor that families can move between rooms or outdoors
- Compatibility with traditional fuels like wood, dung cakes, crop residue, bamboo, and coconut shells

**In field tests, the stove consistently demonstrated:**

- Up to 65 percent reduction in fuel consumption
- About 60 to 70 percent reduction in visible smoke
- Faster cooking for staples like rice, dal, and vegetables
- Lower soot deposition on utensils and walls



# Manufacturing as a Catalyst



Greenway began as a design-and-distribution enterprise. Contract manufacturing was supposed to keep costs low. But quality problems, inconsistent supply, and frequent stockouts threatened credibility.

Greenway made a strategic pivot — it built its own fully automated cookstove factory, one of the first in India.

With this shift the company gained:

- Precision in metal forming and assembly
- Strong quality control systems
- A stable supply chain
- Production capacity of nearly 800,000 stoves per year



Owning manufacturing also allowed Greenway to test new models, experiment with materials, and maintain cost efficiency. It marked a turning point in the enterprise's growth.

## HOW IT WORKS IN THE FIELD

Greenway's work touches households across diverse geographies — tribal belts, flood-affected regions, semi-urban fringes, and remote villages. No single distribution method works everywhere. The company built a flexible ecosystem that mirrors local realities.

### Microfinance and women's groups

In many states, MFIs were the earliest growth channel. Loan officers introduced the stove in women's self-help group meetings. Instalment plans made it affordable. Group trust lowered hesitation.



### **Village retailers and entrepreneurs**

Small retail shops added the stove to their shelves alongside pressure cookers and grain containers. Demonstrations at the shop counter or in courtyards helped families understand how the flame works. Local entrepreneurs earned commissions for every successful sale, creating micro-livelihood opportunities.



### **CSR and programmatic distribution**

Corporates and NGOs integrated Greenway stoves into women's livelihood programs, flood-relief campaigns, and rural development projects. In disaster-prone regions, a portable, efficient stove became a crucial asset for displaced families.

### **Carbon-financed distribution**

Perhaps Greenway's most sophisticated channel is its carbon program.

Reduced biomass use translates into quantifiable emission reductions. Carbon credits help subsidize stove costs for the poorest households while creating long-term revenue for the enterprise.

### **Technology, logistics, and after-sales**

Greenway uses digital tools to manage inventory flows, retailer stock, warranty requests, and user guidance. A multilingual call center supports customers with usage tips and replacements, reducing product abandonment and increasing lifetime impact.

## **Impact In The Household**



**The difference between a chulha and a Greenway stove is visible immediately.**

**Women describe:**

- Less suffocating kitchens
- Cooking without constant eye irritation
- Reduced coughing among children
- Firewood piles that last much longer
- Faster preparation of daily meals
- Easier transitions between indoor and outdoor cooking
- A sense of pride in owning a “modern” appliance

In many homes the stove becomes the center of the kitchen — not just because it saves fuel, but because it creates a more dignified and comfortable cooking environment.

## CONCLUSION

Greenway Grameen shows how a simple idea — a cleaner way to cook with the same fuel — can transform rural kitchens across India. Its approach combines design rooted in user feedback, manufacturing excellence, and an adaptive distribution network that reaches even the hardest-to-reach homes.

While the transition to LPG or electric cooking remains the long-term goal for India, improved biomass stoves provide an immediate reduction in smoke exposure for millions. Greenway's ability to design, build, and deliver at scale positions it as a leading example of innovation serving low-income households with dignity and practicality.





## CASE STUDY 2

**M KOPA**

# Unlocking Energy Access and Financial Mobility Through Digital Loans and Connected Devices



# Background

Evenings in rural East Africa often begin long before the sun sets. In many homes across Kenya, Uganda, and Tanzania, families gather in small rooms lit by flickering kerosene lamps. Smoke hangs in the air and the thick smell of fuel never quite leaves the walls. A mother listens for her children as she cooks in the dim light. They sit close by and try to finish schoolwork. A phone buzzes on the table but its battery is dead. Charging it means walking to a kiosk the next day and paying a fee the family can barely spare.

This is the daily reality for millions of households living beyond the reach of reliable electricity. The lack of lighting is only part of the problem. The bigger barrier is the cost structure of energy itself. Families must pay for kerosene in small, unpredictable amounts. They must pay for phone charging every few days. They must pay for batteries for their radios. Energy becomes a constant drain on household cash. For low income families with no access to credit, even small shocks to income can make the cost of light unaffordable.

In 2011, a team of entrepreneurs asked a different question. What if the power of mobile money, the spread of GSM networks, and the falling cost of solar panels could be combined into a new kind of financial product. What if households could own a solar system without the burden of a large upfront payment. What if each small payment they made could build a digital credit record and open the door to other life improving products.

**That question became the foundation of M KOPA, now one of Africa's fastest growing digital lenders and one of the world's most influential pay as you go solar enterprises.**



# The Problem

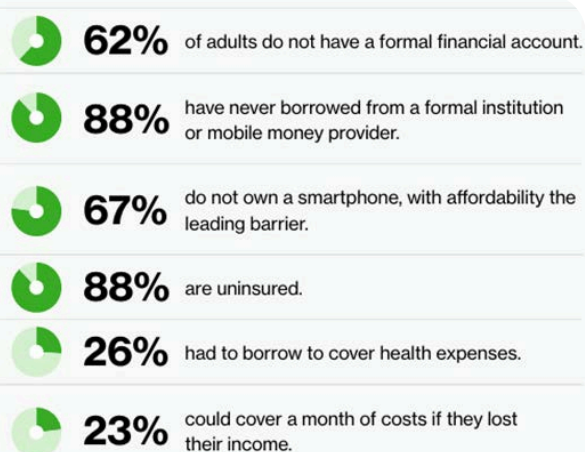
The challenge M KOPA set out to address was much larger than access to light. It was the combined weight of energy poverty and financial exclusion that shaped life in many rural communities.

For decades families depended on kerosene because it was the only option they could pay for in small quantities. Yet this fuel brought heavy costs. Families spent between 10 to 20 percent of their disposable income on lighting. Women and children inhaled toxic fumes every night which caused coughing, headaches, eye irritation, and long term respiratory disease. Fires from overturned lamps were common. Phone charging added another steady expense and forced families to rely on shops or informal operators.

Even where the national grid existed, electricity was often too unreliable or too expensive to meet daily needs. High connection fees and constant outages left many rural families without a dependable solution. According to studies of the Kenyan energy sector, electricity tariffs remained among the highest in Africa, and rural households still spent more on energy than many urban households with grid connections.

At the same time, the financial system excluded most low income families. Banks required collateral, formal employment, and credit history. Rural households had none of these. Without access to credit they could not purchase durable goods such as solar lighting, televisions, or smartphones. Even farmers and microentrepreneurs who worked long hours could not invest in better tools or appliances because the cost had to be paid upfront.

Families were trapped in a cycle. They paid constantly for low quality energy yet could not invest in better alternatives.



1 World Bank Group (2025)

They spent heavily on short term needs yet could not build long term assets. Their lack of credit kept them from improving their income. Their low income kept them from ever qualifying for credit.

Solving this problem required more than solar hardware. It required a new kind of financial model that matched the rhythms of rural life, worked with volatile incomes, and used digital systems to replace the need for collateral.



# The Innovation

M KOPA's breakthrough was not a single invention but a combination of technology, finance, distribution, and data that worked together to create a new pathway for rural households. These building blocks turned a simple solar system into a powerful digital loan product.

## 1. A Solar System Connected by GSM

Each M KOPA system contains a small GSM chip that communicates with the company's cloud platform. This allows the device to be activated or deactivated remotely depending on payment status. It also sends data on usage, battery performance, location, and potential tampering.

This capability is central to the model. It removes the risk of physical repossession which is nearly impossible in rural areas. It assures lenders that unsecured loans can be controlled digitally. It also allows M KOPA to diagnose faults, schedule repairs, and maintain customer trust.

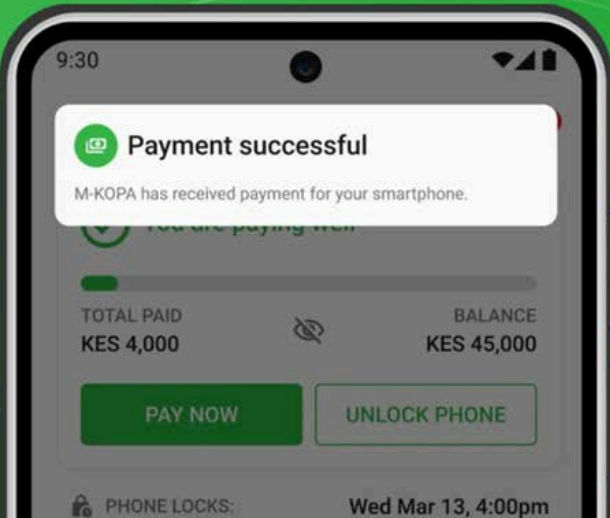
The IoT function is not simply a security feature. It is a credit enabler. It transforms a solar system into a smart asset whose value can be financed safely even for customers with no prior credit record.



## 2. Pay As You Go Digital Finance

Instead of paying two hundred dollars at once, customers pay a small deposit and then daily, weekly, or monthly instalments through mobile money. Most choose to pay about 50 Kenyan shillings per day, which is roughly the same amount they previously spent on kerosene and phone charging. This creates affordability without strain. Payments are flexible and customers can pause during times of low income without penalty. There is no compounding interest and no hidden fees. The product is designed to match the realities of rural cash flow.

Each payment unlocks the device for another period of use. For customers, the system feels familiar because it mirrors the daily purchase of kerosene, only now the energy is clean and the payment builds ownership.



- 01 Instant Access**  
Make a deposit and instantly take home the latest smartphone.
- 02 Pay Easy**  
Make easy daily, weekly or monthly payments.
- 03 Own Easy**  
Own your smartphone and build a credit history with M-KOPA.
- 04 Upgrade**  
Unlock access to a wider range of M-KOPA products and services.

### 3. Data Led Credit Scoring

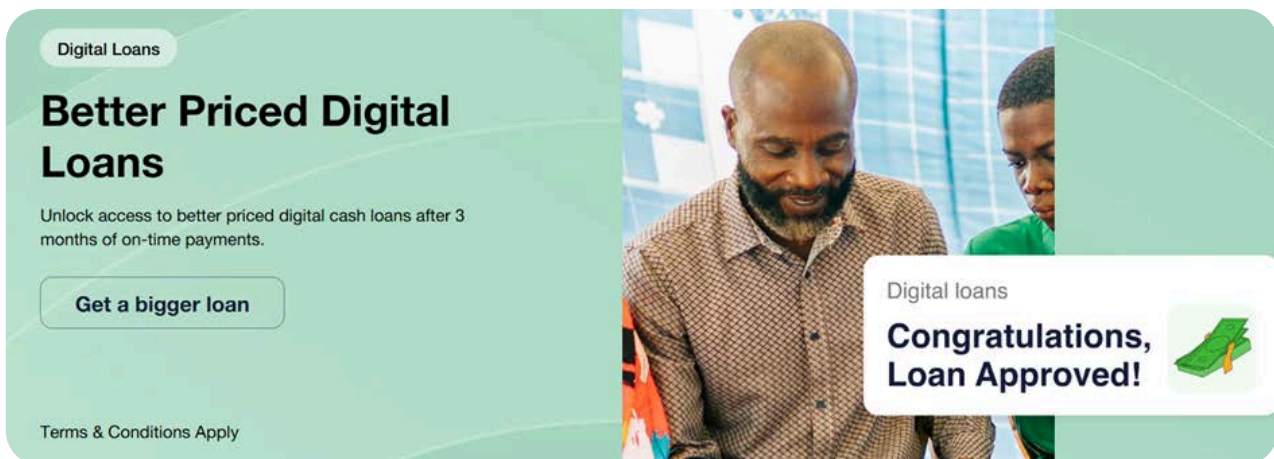
M KOPA analyzes millions of data points generated by customer payments and device activity. This allows the company to segment customers by repayment behavior, predict their ability to take on new loans, and design targeted upgrade offers.

Over time M KOPA shares repayment information with national credit bureaus. This gives customers their first formal credit history. Families that were once invisible to financial institutions begin to appear as reliable borrowers. They become eligible for loans far beyond solar energy.

### 4. An Expanding Catalogue of Affordable Digital Loans

Once a customer has completed payments on a solar system, they can select from a growing list of products that can also be financed digitally. These include:

- Televisions designed to run on low power
- Clean cookstoves
- Smartphones with preloaded data bundles
- Refrigerators built for off grid use
- Water tanks
- Small cash loans
- Insurance and agricultural inputs



More recently M KOPA has expanded to mobility financing for motorbikes. Riders pay daily instalments using income earned from transport services. This model increases economic mobility and has become one of the company's fastest growing segments. This ladder of products transforms M KOPA into a financial platform. A customer's relationship does not end with a solar purchase. It becomes the beginning of a long term upgrade journey that improves income, comfort, access, and opportunity.

### 5. A Deep Field Distribution Network

Technology alone cannot reach last mile customers. M KOPA has built one of the largest sales and service networks in East Africa with thousands of agents, over one hundred retail points, and a 24-hour call center.

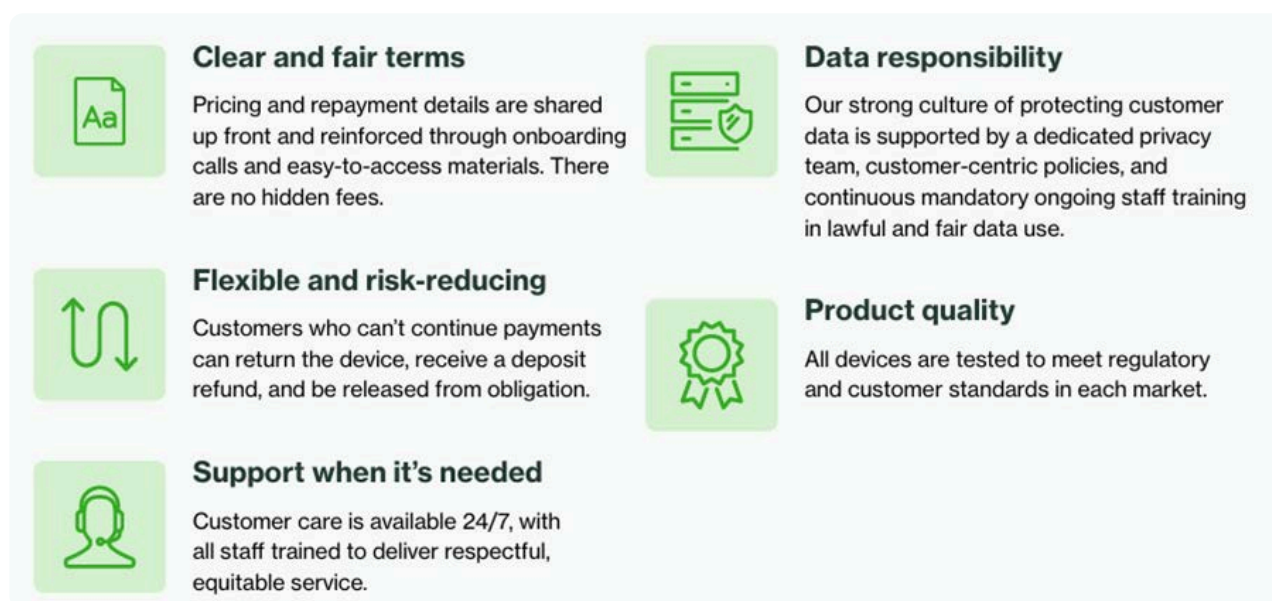
Agents conduct household demonstrations, explain repayment terms, verify identity, and help with onboarding. Local presence is essential for building trust in communities where digital finance is still new and where customers need assurance that someone will help if the system fails.



## 6. A Strong Capital and Risk Management Structure

M KOPA uses a mix of equity, impact investment, and working capital debt to finance product manufacturing and customer loans. The predictability of the pay as you go model, along with high repayment rates, has allowed the company to secure large financing facilities from regional and international banks. This funding allows rapid scale while keeping product costs low for the customer.

## HOW IT WORKS IN THE FIELD



**M KOPA's model plays out differently in each community but the pattern is consistent.**

1. A sales agent visits a household and demonstrates the solar kit. Families often gather around as the agent switches on LED lights and charges a phone instantly. Seeing bright, clean light in a dark room creates immediate interest.
2. If the family decides to purchase, the agent registers them, collects the deposit, and activates the device. The system works within minutes. Children turn the lights on and off with amazement. Parents examine the pay as you go screen and ask questions about repayments.
3. Over the next weeks the family begins to shift away from kerosene. The smoky lamp is used less and eventually not at all. The home becomes brighter and safer. Nights become more productive. People sit together and listen to the radio using solar power. Children study longer because the light is strong and steady.
4. Within months the family is offered an upgrade. Some choose a television. Others choose a smartphone because it allows access to digital platforms and communication with relatives. Some families use the PAYG smartphone to start small online businesses or join local e commerce networks.

The solar system becomes more than a device. It becomes a gateway into digital finance and new opportunities.

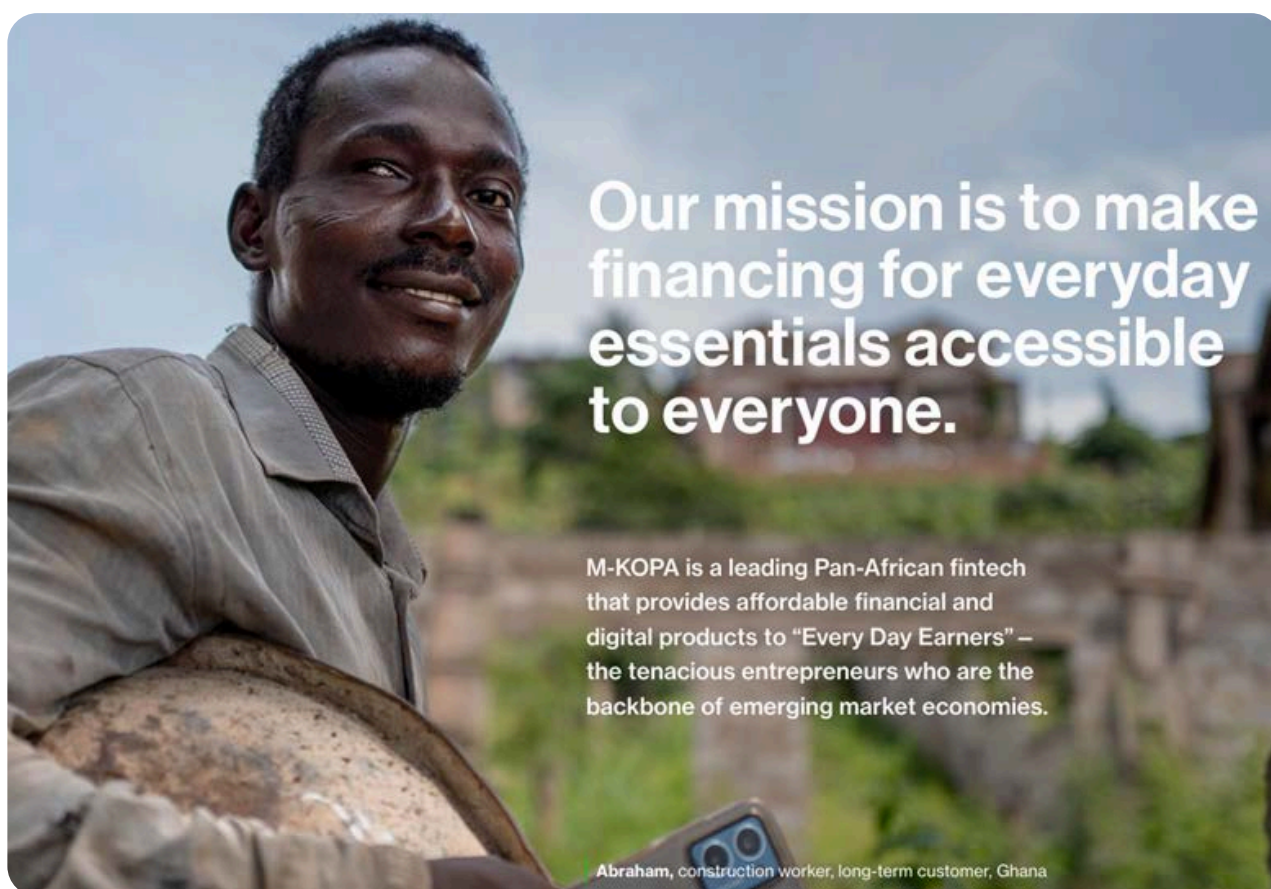


## IMPACT IN THE HOUSEHOLD AND BEYOND

The changes reported by households are immediate and significant.

Families save an average of one hundred and eighty dollars per year by replacing kerosene, candles, and battery charging. Their homes become cleaner and less hazardous. Children double their study time. Women who run small shops extend business hours. Some families start small income generating activities such as charging neighbors' phones or renting out the television for community events.

Surveys in Kenya show that nearly half of M KOPA customers use their systems to generate additional income. Average monthly gains are around sixty five dollars which is a major increase for low income households.



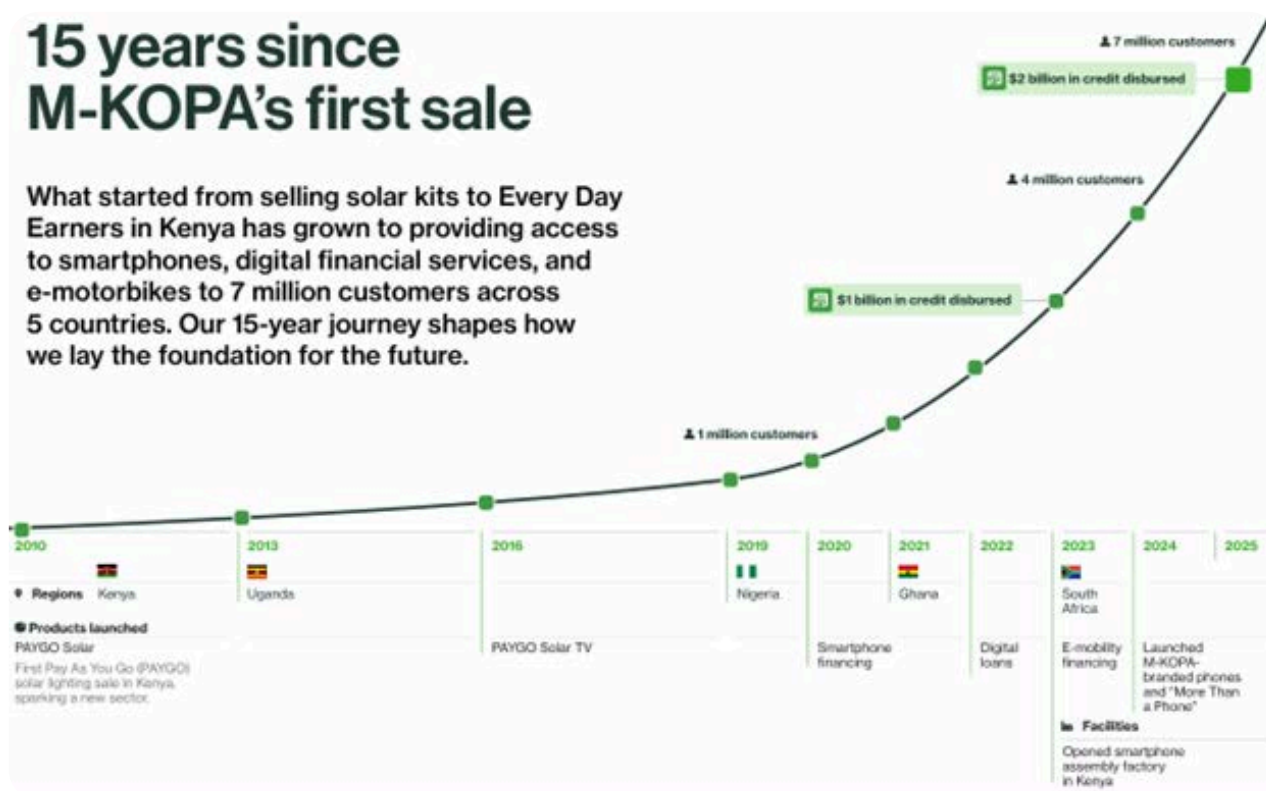
M KOPA has also contributed to broader environmental and health benefits by reducing reliance on kerosene. Millions of people now avoid daily exposure to toxic fumes and thousands of tons of carbon emissions are prevented each year through the shift to solar energy.

The employment impact is equally notable. Thousands of youth have become sales agents, technicians, and service staff. Many are women. This has created new career pathways in communities where stable wage work is limited.

## CONCLUSION

M KOPA demonstrates that solving energy poverty requires more than delivering hardware. It requires a financial model that meets people where they are. By blending solar technology, digital payments, IoT monitoring, and data driven lending, the company has created a pathway for households to move from daily survival spending to long term asset ownership.

What begins as a small solar purchase becomes a stepping stone to broader financial inclusion and economic mobility. M KOPA's approach shows how digital innovation can unlock both energy access and upward economic movement for millions of people who were previously excluded from formal systems. The company continues to expand into new products, new regions, and new forms of digital credit. Its success suggests a future where energy access, financial access, and mobility are deeply connected and where technology makes it possible for even the lowest income households to build brighter and more secure lives.



## CASE STUDY 3

# MLINDA FOUNDATION

Powering Rural Prosperity through  
Decentralized Energy





# Background

Mlinda Foundation began with a simple mission: to bring reliable, clean energy to the people and places that the national grid could not reach. The organization was set up in 2014, combining the Mlinda Charitable Trust's community focus with Mlinda Sustainable Environment Pvt. Ltd.'s technical and operational experience. Together, they design, build, and manage decentralized renewable energy systems that help rural households earn more, save time, and live cleaner lives.

Mlinda's work centers on Jharkhand and West Bengal, where hundreds of small, scattered villages are surrounded by forests and hilly terrain. In these areas, extending the central grid is both expensive and unreliable. Many communities still rely on firewood, kerosene, and diesel for lighting, cooking, and irrigation.

By 2021, Mlinda had installed 49 solar mini-grids in about 50 villages, providing energy access to nearly 7,000 households and around 40,000 people. The organization has created about 1,000 jobs directly and indirectly through installation, operations, and microenterprises powered by clean electricity.

## THE PROBLEM

India's national electrification drive has connected almost every household, but the quality and reliability of supply remain major issues in rural and tribal areas. In Jharkhand, four million people are still without electricity, and another ten million receive power only a few hours a day. Voltage drops are frequent, and entire communities face long outages during the monsoon.

Low-income rural households pay a high price for poor access. Diesel for pumps, lamps, and generators eats into farming profits. Shops cannot refrigerate products. Children study by kerosene light. For women, the burden is heavier — time lost collecting firewood or working around unreliable power keeps them from income-generating opportunities.

Traditional grid-based electrification has struggled to reach these areas because of distance, terrain, and limited returns. Mlinda saw that a local, community-based system powered by solar energy could be both cleaner and more dependable. More importantly, it could become the foundation for rural enterprise.

## THE INNOVATION

Mlinda's innovation is not only in technology but also in how it builds social and economic systems around that technology. The organization developed a four-step model that combines community participation, modular design, and productive energy use.

## 1. Community engagement and site selection

Mlinda begins by working with local leaders, self-help groups, and panchayats (local governance groups) to identify villages that want and can sustain a mini-grid. Teams hold community meetings to explain costs, benefits, and tariff structures, and to assess demand for both domestic and commercial use. This early participation helps avoid resistance later and builds a sense of ownership. Villages are selected using criteria such as potential demand, productive activity, local governance, and willingness to co-invest.



## 2. Demand assessment and grid design

Engineers collect detailed load data from households, shops, schools, and agricultural users. Using this data, they design a modular system that starts at 15 to 25 kilowatts and can expand in 5 kilowatt steps as demand grows. The systems include solar photovoltaic panels, inverters, battery banks, and a three-phase distribution line that can power irrigation pumps and small industrial machines. This modular design keeps costs low and allows each grid to scale with local development.

## 3. Local installation, maintenance, and governance

Instead of bringing external contractors, Mlinda trains young villagers to become solar technicians and operators. These technicians handle daily maintenance, report faults, and manage billing. Local participation ensures faster response to issues and stronger accountability. Mlinda also creates local management committees that monitor usage, payment, and service quality. This community governance structure is one of the strongest reasons for the grids' long-term success.

## 4. Productive use and economic linkage

The final and most critical step is enabling communities to use electricity for income. Mlinda's livelihood team works with farmers, small shop owners, and women entrepreneurs to identify appliances that can improve productivity. They then connect users to equipment suppliers and financing options.

Examples include electric rice hullers, oil pressers, flour mills, and tailoring units. Mlinda also helps form small co-operatives that share machines and reach bigger markets.



The foundation's approach turns each grid into a local economic engine. Reliable energy allows shops to stay open longer, farmers to irrigate more efficiently, and women to run home-based enterprises. The higher the use, the lower the per-unit cost of power. This virtuous cycle makes the model both socially and financially sustainable.

Between 2016 and 2020, Mlinda reduced its system installation cost by about 45 percent through better component sourcing, simplified layouts, and continuous monitoring. These savings were reinvested in expanding service to new villages.

## HOW IT WORKS IN THE FIELD

Mlinda's work in the field is as much about people as it is about technology. Every new grid begins with listening and collaboration.

### 1. Building trust and local ownership

When Mlinda enters a new area, it first spends several weeks in dialogue with the community. Meetings are held under trees or at schools to explain how a solar grid works and what the tariffs will be. People ask questions, compare it with their diesel expenses, and decide together whether to proceed.

Once a village commits, Mlinda recruits local youth and trains them in installation, wiring, and meter reading. These trainees become operators and technicians once the grid is active. Their visible role builds pride and confidence within the community. Many have gone on to form small energy service cooperatives, providing services to nearby villages.



Each household pays a small monthly fee for domestic connections. Commercial users and farmers pay slightly higher rates for three-phase power. Payments are collected locally through digital tools or village agents, keeping money within the community and ensuring a smooth flow of revenue for operations.

### 2. Linking power to livelihoods

Electricity transforms rural work patterns when it is linked directly to earning. In Mlinda's villages, farmers have switched from diesel to electric irrigation pumps, cutting their fuel expenses by nearly 60 percent. The organization works with pump dealers to offer flexible payment plans and with microfinance institutions to provide interest-free loans. Farmers repay these loans from savings made on fuel costs.







In many villages, women's self-help groups run small processing units powered by the grid. They operate rice hullers, oil presses, and grinders. Some have bought sewing machines to start tailoring services. Shops now use refrigerators and lighting to extend business hours.

Mlinda's team also helps these micro-entrepreneurs access regional markets. For example, in Gumla district, farmers using solar-powered mills and dryers have been able to sell surplus rice and pulses to buyers in Ranchi and beyond. This shift from subsistence farming to commercial sales has raised average household income by more than 10 percent.

### **3. Education and social benefits**

Reliable power has improved school attendance and learning. Many of the grids connect directly to hostels where children from remote villages live during the school year. Teachers report better study conditions and fewer dropouts. Health centers in the project areas now store vaccines and operate fans and lights, something that was impossible before.

### **4. Maintenance and monitoring**

Each grid is equipped with smart meters and remote monitoring systems that track performance. Local operators receive alerts about power drops or equipment faults. Mlinda's regional office provides technical backup and supplies spare parts. Routine inspections ensure safety and efficiency. The focus on local maintenance keeps downtime low and builds community confidence in the reliability of solar power.

## **CONCLUSION**

Mlinda Foundation shows how clean energy can lift rural economies from dependency to growth. By linking solar power with local enterprise, training, and community ownership, it has turned remote villages into examples of sustainable development.

Electric light now powers livelihoods, not just lamps. Farmers irrigate fields without diesel, women run small businesses, and children study under bright, steady light. Mlinda's work demonstrates that when rural communities generate and manage their own power, they take charge of their own progress.

## CASE STUDY 4

# SISTEMA.BIO

Turning Farm Waste into Energy,  
Income, and Climate Resilience in  
Latin America



# Background

In the early mornings of rural Mexico, livestock farmers begin their day surrounded by the byproducts of their work. Manure accumulates near homes and barns. The smell is constant. Flies are everywhere. During the rainy season, runoff flows into water sources used for washing and drinking. At night, families cook using LPG cylinders when they can afford them, or firewood when they cannot. Smoke fills kitchens. Women and children cough. Money is spent every week on fuel and chemical fertilizers that never seem to improve soil health for long.

For millions of smallholder farmers across Mexico and Latin America, waste is a daily burden rather than a resource. Animal manure is unmanaged. Energy is expensive and unreliable. Soil fertility is declining. Climate shocks are becoming more frequent. Yet these farms already hold a powerful asset. Organic waste that, if managed differently, could generate clean energy, improve soil productivity, and reduce household expenses.

In 2010, Sistema.bio was founded in Mexico with a simple but radical idea. What if small farmers could convert waste into value using a technology that was affordable, durable, and paired with financing and long term support. What if energy access, soil health, and climate mitigation could be addressed together at the farm level.

From this question emerged one of the world's most influential biogas enterprises, now operating across Latin America, East Africa, and India, and recognized as a global leader in climate smart agriculture and decentralized energy systems.

## THE PROBLEM

Sistema.bio set out to address a tightly linked set of structural challenges faced by smallholder farmers in Mexico and the wider region.

### 1. Poor Waste Management and Health Risks

Each grid is equipped with smart meters and remote monitoring systems that track performance. Local operators receive alerts about power drops or equipment faults. Mlinda's regional office provides technical backup and supplies spare parts. Routine inspections ensure safety and efficiency. The focus on local maintenance keeps downtime low and builds community confidence in the reliability of solar power.

### 2. High and Unstable Energy Costs

Most rural households depend on LPG, firewood, or diesel. LPG prices fluctuate and require cash payments. Firewood collection consumes time and exposes families to smoke related illnesses. Diesel powered equipment is expensive to run and maintain. Energy expenses consume a significant share of household income, especially for livestock farmers.



### 3. Declining Soil Fertility and Costly Inputs

Chemical fertilizers are widely used but expensive and damaging over time. Soils become less productive, yields stagnate, and farmers become trapped in a cycle of input dependency. Organic alternatives exist but are rarely accessible at scale.

### 4. Lack of Appropriate Finance

Biogas systems traditionally required high upfront investment. Microfinance institutions often charged high interest rates and required lengthy approval processes. Farmers lacked access to patient, fit for purpose financing aligned with agricultural cash flows.

### 5. Climate Vulnerability

Methane emissions from manure, deforestation for fuelwood, and chemical fertilizer use all contribute to climate change. At the same time, farmers are increasingly exposed to droughts, floods, and unpredictable weather patterns. Solutions that improve resilience while reducing emissions are urgently needed.

Sistema.bio recognized that none of these problems could be solved in isolation. A viable solution would need to integrate technology, finance, training, and trust.

## THE INNOVATION

Sistema.bio's innovation lies not only in its biodigester, but in the system built around it.

### A Modular, Durable Biodigester

Sistema.bio developed a prefabricated, flexible biodigester made from high quality geomembrane materials. Unlike earlier brick or concrete digesters, this system is lightweight, quick to install, resistant to damage, and scalable across farm sizes. Units can serve farms with as few as two cows or as many as several hundred.



## The biodigester converts animal waste into:

- Biogas for cooking, heating, and productive uses
- Biofertilizer for crops and pasture

Installation typically takes a few hours. Within weeks, the system begins producing gas and fertilizer consistently.

## Integrated Appliances and Productive Use



The system is not sold as a standalone unit. It is bundled with appliances such as biogas stoves and, for larger farms, productive equipment like pumps, milling machines, or milk processing tools. This expands the value proposition from household energy to farm productivity.

## Pay Over Time Financing

Recognizing that upfront cost was a major barrier, Sistema.bio built its own in house financing model rather than relying on traditional MFIs. Through partnerships with platforms such as Kiva, the company offers zero interest or low interest loans with repayment schedules designed so that monthly payments are lower than the savings generated by displaced fuel and fertilizer expenses.

This creates immediate net savings for farmers, often from the first month of use .

## Capacity Building as Core Infrastructure

Every sale is paired with training. Farmers receive education on waste management, system operation, fertilizer application, and maintenance. Follow up visits at 30, 90, and 180 days reinforce adoption and allow for troubleshooting. This long term accompaniment is a key reason for high system uptime and customer satisfaction.

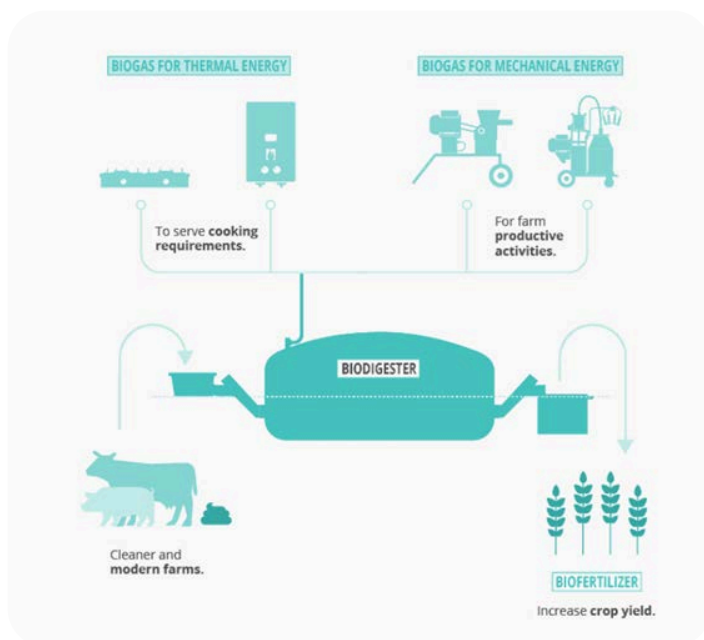


## Data Driven Operations

Field staff use digital tools to record installation data, monitor repayment, and measure impact. This enables real time portfolio management and standardized reporting across regions.

## HOW IT WORKS ON THE GROUND

Sistema.bio's success rests on a tightly choreographed field process that blends technology deployment, behavioral change, and financial discipline. The company learned early that biodigesters fail not because the science is wrong, but because adoption breaks down after installation. Its operating model is therefore designed around long term use, not one time sales.



## Step 1. Community Anchoring and Peer Demonstration

Adoption begins with trust. Rather than mass marketing, Sistema.bio relies on peer to peer validation. Demonstration events are held on the farms of existing users, where neighbors can see biogas stoves in use, smell the absence of smoke, and observe fertilizer application on crops. Farmers hear directly from other farmers about savings, maintenance, and daily routines.

This social proof is essential in communities where previous government or NGO biodigester programs failed and left skepticism behind.

## Step 2. Farm Diagnosis and System Design

Interested farmers receive an on site visit from trained technicians. This is not a generic sales pitch. The technician evaluates:

- Number and type of animals
- Daily manure availability
- Household energy use and fuel spending
- Crop patterns and fertilizer needs
- Distance from service centers

Based on this assessment, a custom system size is proposed along with an individualized payment plan. The objective is explicit. Monthly repayments must be lower than the farmer's current spending on fuel and fertilizer so that cash flow improves immediately.

## Step 3. Financing Integrated into the Sale

Financing is not outsourced. Sistema.bio manages underwriting internally using alternative indicators such as farm cleanliness, animal health, and stability of production. Loans are often structured over 9 to 24 months, with zero or low interest through partnerships such as Kiva. This integration allows the company to move faster than MFIs and maintain alignment with its impact goals.

## Step 4. Rapid Installation and Hands On Training

Once approved, the biodigester is installed in a single visit, typically within a few hours. The system is modular and lightweight, avoiding the delays and failures associated with masonry digesters. Installation is accompanied by hands on training for the household, often involving multiple family members. The message is clear. This is not donated infrastructure. It is a productive asset that requires daily interaction.





## Step 5. Structured Follow Up and Monitoring

Technicians return at 30, 90, and 180 days. These visits reinforce correct feeding of the digester, biogas use, and fertilizer application. They also serve as checkpoints for repayment, performance monitoring, and data collection. Digital tools are used to record savings, energy displacement, and system health. This feedback loop allows Sistema.bio to refine product design and credit models continuously.

## Step 6. Long Term Relationship

Once approved, the biodigester is installed in a single visit, typically within a few hours. The system is modular and lightweight, avoiding the delays and failures associated with masonry digesters. Installation is accompanied by hands on training for the household, often involving multiple family members. The message is clear. This is not donated infrastructure. It is a productive asset that requires daily interaction.

# BUSINESS MODEL

Sistema.bio's business model is built around a simple but powerful insight. Smallholder farmers will adopt climate smart technology only when it improves their economics before it improves the climate.

## Revenue Streams

The company generates revenue through:

- Sale of biodigesters and biogas appliances
- Financing margins from its in house credit portfolio
- Sale of productive use add ons for larger farms
- Services linked to installation, monitoring, and maintenance

While the biodigester is the core product, value is captured across the lifecycle of the asset rather than at the point of sale. Key costs include manufacturing, logistics, field staff, and working capital tied up in customer loans. Sistema.bio has focused heavily on reducing installation time, standardizing components, and improving credit performance. Over time, this has enabled positive unit economics even at small system sizes.

## In House Financing as a Strategic Asset

Rather than partnering fully with MFIs, Sistema.bio built its own credit assessment and collection system. This allows:

- Faster approvals
- Payment schedules aligned with agricultural cash flows
- Better risk management using operational data
- Lower effective costs for farmers

Working capital for lending is raised through a mix of impact debt, concessional loans, and crowdfunding platforms. This creates a scalable credit engine that grows alongside product sales.

In Mexico and Latin America, the company relies primarily on direct to farmer sales supported by community events and local partnerships. In some markets, it also works with governments, cooperatives, and NGOs to reach specific farmer segments, while retaining control over installation and follow up.

## IMPACT

For families, the most immediate change is financial. Spending on LPG, firewood, and chemical fertilizers drops sharply. Cooking becomes cleaner and faster. Indoor air quality improves. Women and children spend less time collecting fuel and more time on productive or educational activities.



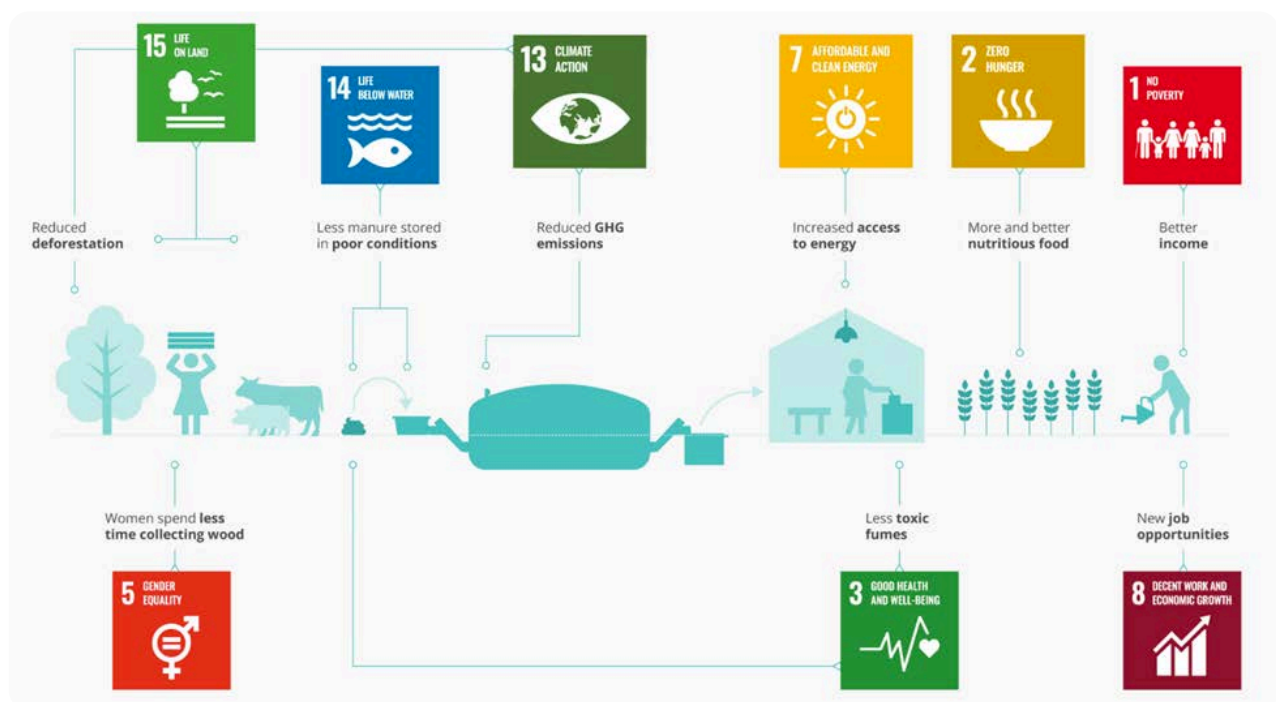
Organic biofertilizer improves soil structure and nutrient retention. Over time, farmers report better yields and reduced dependence on purchased inputs. Larger farms use biogas for productive activities such as pumping, milling, or milk processing, directly increasing income.

By capturing methane from manure, each biodigester significantly reduces greenhouse gas emissions. Reduced firewood use lowers deforestation pressure. Lower fertilizer use cuts nitrous oxide emissions. These climate benefits are measurable and verifiable, making the model attractive to climate aligned investors.

# Sistema.bio Mexico & Central America in numbers



Sistema.bio creates skilled rural jobs for technicians, sales agents, and supervisors. These are not temporary project roles but long term positions embedded in local economies. Farmers themselves become micro advocates and trainers, strengthening social capital. Across Latin America and beyond, tens of thousands of systems have been installed, benefiting hundreds of thousands of people. The company has demonstrated that climate positive agriculture can be both commercially viable and socially transformative.





# WHY THIS MODEL MATTERS

## Challenging Unfounded Assumptions

### 1. Climate Solutions Must Be Subsidy Dependent

This case shows that climate mitigation can be driven by farmer economics, not charity. When savings exceed repayments, adoption sustains itself.

### 2. Small Farmers Cannot Handle Complex Technology

Sistema.bio proves that with the right design and training, smallholders can operate and maintain sophisticated systems reliably over many years.

### 3. Finance Is a Separate Problem from Technology

By integrating credit into its operating model, Sistema.bio treats finance as infrastructure, not a constraint.

More broadly, the model offers a blueprint for climate transition at the last mile. It demonstrates how decentralized energy, circular economy principles, and inclusive finance can reinforce one another. For policymakers, investors, and entrepreneurs, it shows that scaling impact in agriculture requires patience, proximity to users, and deep respect for local realities.

## LOOKING AHEAD

Sistema.bio now stands at a pivotal moment. The company has proven that smallholder farmers will adopt circular energy solutions when the economics work and when long term support is built into the model. The next phase is about scaling without dilution. In Latin America, this means deepening penetration among medium and large livestock farms, expanding productive use applications, and strengthening service and financing infrastructure to support larger portfolios. At the same time, Sistema.bio must professionalize its credit operations, secure longer term and lower cost capital, and maintain disciplined unit economics as volumes grow.

Beyond growth, the company faces strategic choices that will define its role in the climate transition. Carbon markets, off balance sheet financing, and partnerships with governments and agribusinesses offer new sources of scale and revenue, but also add complexity and risk. The central question is whether Sistema.bio can remain farmer centric while engaging with global climate finance at scale. If it succeeds, the company will not only expand its footprint, but help define a new category where waste, energy, agriculture, and finance converge into a commercially viable pathway for climate resilient farming.

## CASE STUDY 5

# SOLSHARE

## Decentralized Solar for Energy and Mobility Access



# Background

Bangladesh is often seen as a success story in solar home systems (SHS), with over 6 million installed and serving more than 20 million people. But when Dr. Sebastian Groh co-founded SOLshare in 2014, it was to fix a glaring inefficiency: up to 30 percent of generated solar power was being wasted in homes that had no way to trade or store surplus energy. The problem was not just about lack of access, it was about lack of flexibility and equity in how energy was shared and used.

SOLshare began as a response to this challenge. The company introduced the world's first peer-to-peer (P2P) solar energy trading platform for rural communities. Its vision was to create a decentralized, intelligent energy network that allowed solar panel owners to sell excess power to neighbors through smart microgrids. Over time, SOLshare has expanded its offerings, moving into urban rooftop solar systems for multifamily buildings and into e-mobility infrastructure, particularly for electric rickshaw charging and battery leasing.

## THE PROBLEM

Despite the success of SHS programs, over 60 million people in Bangladesh still live with unreliable or partial electricity access. In many rural areas, families with solar panels cannot use all the power they generate during daylight hours, while their neighbors may have no panels at all. Diesel generators remain common, especially for irrigation and transportation. Meanwhile, lead-acid batteries, commonly used in electric rickshaws, have short life spans, charge slowly, and are often overcharged or poorly maintained.

This mismatch of generation and demand is not limited to homes. Over 3 million electric rickshaws serve as low-cost transport across Bangladesh. These rickshaws, owned by individual entrepreneurs, rely on informal garages for overnight charging. Most garages use grid or diesel power and have no visibility into energy consumption or battery performance. Drivers pay high fees to replace batteries frequently due to poor quality and overcharging. They make just 10 to 12 dollars a day, and a large part of this goes toward battery-related costs.

At the same time, low-income residents of multifamily buildings in cities often cannot access rooftop solar, even as solar panels become more affordable. With no control over the building's infrastructure, they miss out on energy savings and resilience during outages.





## THE INNOVATION

SOLshare's core innovation lies in decentralizing access to energy, not just generation, but also ownership, trading, and control. The company builds local energy ecosystems that are data-driven, community-powered, and built for scale.

**ISOLgrids:** At the heart of SOLshare's microgrid work is the SOLbox, a low-cost, IoT-enabled device that allows households to become both energy producers and consumers. These SOLboxes are installed in homes with SHS, enabling them to buy or sell energy through a shared DC grid. The system is plug-and-play and does not require users to change their lifestyle or appliances.



### SOLAR MICROGRIDS SOLGRIDS - SOLAR P2P MICROGRIDS

- Interconnects households and micro businesses
- Uses SOLbox : point of interconnection within the peer-to-peer network
- Allows users to sell excess electricity and earn income directly from the sun



Energy flows are managed through smart contracts, which ensure pricing transparency. Households are billed on a Pay-As-You-Go basis, and energy credit is transferred using mobile money systems like bKash. This model not only reduces wastage but also allows non-SHS users to access solar power without owning panels.

**2. SOLmobility:** Recognizing the rise of electric mobility, SOLshare created an IoT-based battery leasing and charging network for electric rickshaws. Under this model, garage owners lease high-quality lithium-ion batteries to drivers using a Pay-As-You-Go system. These batteries are embedded with SOLbat, a device that tracks battery health, usage patterns, and charging cycles remotely.



### MICRO-MOBILITY ELECTRIC 3-WHEELER CHARGING

- PAYG lithium-ion battery leasing model
- Smart metered pit-stop charging stations allows rickshaw pullers to fast charge during the day.
- Risk reduction through IoT intelligence on the assets



Drivers benefit from fast charging, longer battery life, and lower replacement costs. Garage owners gain visibility into operations and can track payments and energy usage. SOLshare earns revenue through software fees and hardware integration, while enabling better financing options for batteries via banks or microfinance partners.

**3. Urban Solar Access:** For city dwellers in multifamily housing, SOLshare has introduced a rooftop solar sharing technology originally developed by Allume Energy. It allows a single rooftop system to distribute power to multiple apartments, each receiving a tailored share based on unit size or agreement. No changes are needed to utility billing systems, as the system operates behind the meter.



**SOLAR ROOFTOP**  
**SOLAR ROOFTOP INSTALLATION SERVICES**

- A photovoltaic system where solar panels are mounted on top of commercial and industrial structures.
- Directly reduces energy costs
- The cost of electricity is lower than utility
- Capacities go up to Megawatt Range



Tenants can monitor their solar usage through a dedicated portal, while landlords can earn a solar access fee. Technology improves the financial case for solar in apartment buildings and supports clean energy equity in urban settings.

**4. SOLbazaar:** All these platforms are integrated via SOLbazaar, SOLshare's digital backbone. This cloud-based platform aggregates data from grids, batteries, and solar systems to provide performance insights, user analytics, and predictive maintenance alerts. It also supports mobile payments, energy trading credits, and performance-based incentives for garage owners and prosumers.

## HOW IT WORKS IN THE FIELD

In a village in the Netrokona district, a woman with a solar home system might find that her battery is full by mid-morning. Previously, this energy was wasted. Now, with a SOLbox, she sells that extra power to her neighbor, who uses it to charge a mobile phone or run a fan during the heat of the day. Payments happen via bKash in real time. Both parties benefit, one earns a small income, the other saves on diesel or kerosene.

In Dhaka's Rajshahi district, a garage owner partners with SOLshare to install smart chargers and lease lithium-ion batteries to 20 electric rickshaw drivers. Each battery is monitored remotely through SOLbat.

Drivers now charge in under 3 hours instead of overnight and drive longer distances with fewer breakdowns. The garage earns steady income from leasing, while drivers report income increases of up to 34 percent due to less downtime and lower fuel costs.



Across all locations, SOLshare uses its digital platform to track usage, monitor faults, and provide data insights. The company also supports training programs for technicians and partners with financial institutions to develop leasing or insurance products tailored for low-income users.





One of SOLshare's pilot projects, Rickshaw VPP (Virtual Power Plant), explores how excess stored power in lithium-ion batteries could be fed back into the grid during peak hours. This turns millions of e-rickshaws and solar homes into mobile energy assets, supporting national grid stability while unlocking new income sources for drivers and homeowners.

## CONCLUSION

SOLshare is not just an energy company, it is building the connective tissue between energy, income, and digital access in Bangladesh and beyond. Its technologies create value at every level of the energy chain, from solar rooftops to rickshaw garages to village microgrids.

By allowing users to produce, share, lease, and trade energy, SOLshare is challenging the idea that clean power must come top-down. Instead, it offers a decentralized, bottom-up model where energy becomes a community asset, not just a service.

With plans to scale to 100,000 vehicles, expand rooftop sharing to more cities, and develop a functioning virtual power plant, SOLshare is showing that the future of energy is not only renewable, it is cooperative, inclusive, and smart.

The SOLshare model can travel. Its components, peer-to-peer grids, battery leasing, rooftop solar sharing, and digital tracking, can be adapted for Africa, Southeast Asia, and Latin America. What makes it powerful is its alignment with people's needs: better income, safer power, and more control.

SOLshare's work reminds us that energy access is not just about plugging in, it's about powering lives.

## CASE STUDY 6

# SOLAR SISTER

Lighting Homes, Powering  
Women, Rewiring Energy Markets



# Background

In many rural communities across sub-Saharan Africa, nightfall still marks the end of productive life. As the sun sets, households rely on dim kerosene lamps. Smoke fills small rooms, irritating eyes and lungs. Children struggle to complete homework by flickering light. Mobile phones run out of charge, forcing long walks and daily payments just to stay connected.

## **For women, the burden is greater.**

Women manage household energy. They cook, care for children, and often run small informal businesses. Yet they are frequently excluded from formal employment, asset ownership, technical training, and access to credit. Energy poverty and gender inequality reinforce one another, locking families into cycles of low income, poor health, and limited opportunity.

In 2009, development professional Katherine Lucey asked a different question. What if women were not treated as passive recipients of energy products, but instead became the primary drivers of clean energy distribution? What if access to energy could be combined with income, confidence, and leadership for women themselves?

That question became the foundation of Solar Sister.

## THE PROBLEM

Across Uganda, Tanzania, and Nigeria, millions of households live beyond the reach of reliable electricity. Even where national grids exist, connection costs, outages, and tariffs make power inaccessible to low-income rural families. Kerosene remains the default lighting source despite its cost and danger.

Households often spend a significant portion of disposable income on kerosene, batteries, and phone charging. These are recurring expenses that never build assets or resilience. Health impacts are severe. Indoor air pollution contributes to respiratory disease, eye problems, burns, and frequent household fires.



**% people in sub Saharan Africa who cook with harmful, costly solid fuels**



**% people in rural sub Saharan Africa who have no access to clean power**

At the same time, women face structural barriers that limit their participation in formal markets. They lack collateral, formal education, mobility, and access to capital. Technology and energy markets are widely perceived as male domains. Even when clean energy products exist, last-mile delivery often fails because it ignores trust, after-sales support, and the realities of women's daily lives.



Many energy access programs focus on hardware delivery rather than market systems. As a result, products break, sit unused, or never reach the poorest households. Solar Sister recognized that solving energy poverty required addressing gender inequality at the same time.

## THE INNOVATION

Solar Sister did not invent solar lanterns or clean cookstoves. Its innovation lies in how energy reaches households and who controls that process.

### 1. A woman-to-woman distribution model

Solar Sister recruits, trains, and supports women to become independent clean energy entrepreneurs in their own communities. These women sell solar lamps, solar home systems, phone chargers, and clean cookstoves directly to neighbors, friends, and relatives.

The model leverages women's strongest asset: trust. Women understand household needs, cash flow patterns, and decision-making dynamics. Selling from woman to woman lowers skepticism, accelerates adoption, and improves long-term product use.

### 2. Business-in-a-bag entrepreneurship

Each Solar Sister Entrepreneur receives a starter package that includes inventory, marketing materials, branded apparel, and ongoing training. Entrepreneurs invest in their initial inventory but are not burdened with large upfront fees or high-interest loans. This lowers risk while reinforcing ownership.

Training covers sales, pricing, record keeping, customer care, basic technical knowledge, and leadership. Over time, entrepreneurs advance into more sophisticated businesses and digital skills.

The model is designed to fit into women's lives. There are no fixed working hours. Sales happen around farming schedules, childcare, and household responsibilities.

### 3. Quality products and after-sales trust

Solar Sister partners with vetted manufacturers such as d.light and Sun King to ensure product durability and warranties. Product selection prioritizes reliability, ease of use, and repairability. Entrepreneurs are trained to troubleshoot basic issues and manage warranty claims. This focus on after-sales support prevents the erosion of trust that has plagued many earlier clean energy initiatives.

### 4. Blended revenue and grant financing

Solar Sister operates with a hybrid funding model. Roughly half of operating costs are covered through product sales. Grants and philanthropic capital support entrepreneur training, network building, monitoring, and innovation.

Bulk procurement enables Solar Sister to offer favorable pricing to entrepreneurs, balancing affordability for customers with viable margins for women-led businesses.

## Gender mainstreaming as core design

Women's empowerment is not treated as a side objective. It is embedded into governance, staffing, training design, data collection, and organizational culture. Most board members, senior leaders, and field staff are women. Training sessions are scheduled around women's availability and delivered in local languages.

All monitoring data is gender-disaggregated, reinforcing accountability for empowerment outcomes.

## HOW IT WORKS ON THE GROUND



Solar Sister's on-the-ground execution is highly structured, even though it appears informal. Field staff, known as Business Development Associates, are embedded in rural and peri-urban regions. Recruitment happens through women's savings groups, religious networks, farming cooperatives, health clinics, and informal markets.

Selection is based on trust, reliability, and community standing rather than formal education or capital. In areas with restrictive gender norms, staff engage husbands, elders, and community leaders early to build social legitimacy for women entering energy markets.

Recruited entrepreneurs are organized into small peer clusters called Sisterhood groups. These groups meet monthly and function as the core operating unit.

### Meetings combine:

- Training and skill development
- Inventory replenishment and sales planning
- Peer accountability and emotional support
- Data collection and market feedback

Training follows a phased curriculum, starting with clean energy basics and progressing toward leadership, digital literacy, and business planning. All sessions are delivered by women, for women, and with women, lowering dropout rates and building confidence around technology.

Entrepreneurs purchase inventory in small quantities, minimizing financial exposure. There are no franchise fees or mandatory debt obligations. Solar Sister bulk-procures products and distribute them through country hubs. Entrepreneurs access inventory at favorable prices while maintaining margins. Pricing is flexible. Entrepreneurs assess household ability to pay and may offer informal installment arrangements based on trust. Social proximity, not contracts, enforces repayment. This dramatically reduces default risk.

Sales occur door to door, at markets, and during community gatherings. Product demonstrations are central. Seeing a lamp instantly light a dark room often convinces buyers. Early adopters become visible proof points, accelerating adoption across communities. After-sales support ensures products continue working, preserving trust and long-term demand

Support continues well beyond onboarding. Entrepreneurs receive coaching, new product introductions, refresher training, and leadership opportunities. Some become trainers or community advocates. Others diversify into new businesses using skills and income gained.



The model prioritizes durable livelihoods over rapid turnover.

## IMPACT

Solar Sister has built a network of thousands of women-led clean energy businesses, reaching millions of people. Women entrepreneurs report increased income, confidence, and influence within their households. Households save money, improve indoor air quality, and create safer environments for children. Education outcomes improve as children study longer under reliable lighting.





Women entrepreneurs generate stable income streams with low startup risk. Many reinvest profits into education, healthcare, agriculture, or secondary businesses. Solar Sister has created an inclusive value chain connecting global clean energy manufacturers to last-mile customers through women-led enterprises.

Solar products displace kerosene use, reducing greenhouse gas emissions and black carbon. Efficient cookstoves reduce fuelwood consumption and deforestation. Repair and recycling initiatives extend product life and reduce waste.

## WHY THIS MODEL MATTERS<sup>43</sup>

Solar Sister's importance extends beyond energy delivery. Most energy access models treat last-mile delivery as a logistics problem. Solar Sister treats it as a relational challenge.

Embedding distribution within women's social networks lowers customer acquisition costs, increases trust, and improves sustained use. The entrepreneur is a neighbor, not an external agent.

### **Solar Sister aligns incentives across stakeholders:**

- Entrepreneurs earn income only when products are sold and used
- Customers buy because products save money and improve daily life
- Manufacturers gain reliable last-mile reach and market feedback
- Donors fund capacity building rather than consumption subsidies

### **This alignment creates a resilient value chain.**

Women become energy advisors, sellers, and business owners. Their visibility reshapes community norms. Girls see women handling technology. Household decision-making shifts as women's incomes grow.

Gender mainstreaming functions as operational infrastructure, not a social add-on. By minimizing upfront risk and allowing flexible work patterns, Solar Sister makes entrepreneurship accessible to women excluded from formal business pathways.

Growth may be slower, but impact is deeper and more resilient. The model applies beyond energy. Any sector where trust, explanation, and after-sales support matter can adopt similar woman-led distribution systems, including health, water, sanitation, agriculture inputs, and digital services.



Solar Sister demonstrates that when women control distribution, markets reach further, last longer, and deliver structural change, not just transactions.

## LOOKING AHEAD

Solar Sister aims to scale its network to tens of thousands of women entrepreneurs and reach tens of millions of people with clean energy. Future priorities include deeper financial services for entrepreneurs, digital tools for training and inventory, expanded productive-use appliances, and stronger policy engagement.

The core insight remains unchanged. When women power markets, energy access becomes inclusive, durable, and transformative.

## CASE STUDY 7

# SWITCHON FOUNDATION

## From Climate Risk to Market-Ready Resilience





# Background

In 2008, husband and wife team Vinay and Ekta Jaju began exploring how clean energy could transform rural India. Vinay brought deep experience in renewable energy systems and rural electrification, while Ekta brought expertise in sustainable agriculture and market systems. They asked a deceptively simple question: how can rural families earn more while becoming safer in a warming world? That question became the foundation of SwitchON.

Over the next decade, SwitchON learned that climate action sticks when it improves household economics. They built a model linking clean energy, water stewardship, and climate-smart agriculture to reliable market access. Today, the foundation works across multiple states with small farmer collectives, self-help groups (SHGs), and Farmer Producer Organizations (FPOs), combining three core strategies: climate-resilient agriculture powered by distributed renewable energy (DRE), women-led value addition and entrepreneurship, and institution building that connects collectives to finance and buyers.

***“We’ve seen again and again that when clean energy and climate-smart practices improve income, adoption takes care of itself.”***

***Vinay Jaju, Co-founder***

## THE PROBLEM

Sistema.bio set out to address a tightly linked set of structural challenges faced by smallholder farmers in Mexico and the wider region.





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***“We’ve seen again and again that when clean energy and climate-smart practices improve income, adoption takes care of itself.”***

***Vinay Jaju, Co-founder***

## THE INNOVATION

### **How does SwitchON make climate-smart irrigation affordable?**

SwitchON reduces the upfront cost of DRE by helping farmers access government subsidies through local banks. Field teams handle paperwork, bank interface, and aftercare so farmers can acquire solar assets without being blocked by credit frictions. This bank-linked route has delivered over 1,200 solar pumps, many paired with micro-irrigation, reaching thousands of farmers.

### **What happens beyond a pump?**

The organization installs and operates DRE-powered Livelihood Support Centres with solar dryers and mills. These serve SHGs and FPOs, de-risking value addition for crops like spices, millets, rice, and oilseeds. Pay-per-use models make these assets accessible to multiple farmers without individual capital investment.



## How are women entrepreneurs moved from training to sales?

Through the Rural Women Entrepreneurship Program, women are incubated across tea, agriculture, livestock, and handloom value chains, and then connected to buyers. In 2023–24 the program trained nearly 3,000 rural women entrepreneurs and linked over 1,000 to schemes for working capital and assets. Buyer–seller meets connect these enterprises directly to institutional markets, with recent events generating interest for around 10,000 metric tonnes of produce worth ₹40 crore.

## Who builds institutions and why does that matter?

SwitchON strengthens FPOs as local business hubs for climate-resilient agriculture. They receive governance training, business planning, and financial literacy. Model Organic Clusters align crop calendars with market demand, train farmers in regenerative methods, and provide access to DRE processing units.

Bankers are trained to understand the business case for solar adoption, and administrative staff are guided to streamline loans. On the entrepreneurship side, the Green Business Innovation Network supports green startups and student innovators, with over 130 startups engaged

Public convenings like the Move for Earth rides and symposiums connect farmers, policymakers, buyers, startups, and financiers. These events align demand, policy, and financing before program rollout, reducing time to scale.

***“We’ve seen again and again that when clean energy and climate-smart practices improve income, adoption takes care of itself.”***

***Co-founder***

## HOW IT WORKS ON THE GROUND





Community mobilization – Field teams run meetings and demonstration plots on climate-resilient agriculture (CRA) and DRE, recruiting early adopter cohorts and planning seasonal pilots.

Institutional strengthening – Integrated Farming Clusters are formed around FPOs, with roles for water stewardship, input supply, and market coordination.

**Skills and practice** – Farmers train in regenerative methods such as organic input production, crop calendars, and micro-irrigation; women and youth are trained in value addition and entrepreneurship.

**Finance enablement** – Staff prepare loan files, align them with subsidy schemes, and coach farmers through the bank process; bankers and administrators are trained to approve faster.

**Productive use of energy** – Solar dryers and mills at Livelihood Support Centres give farmers access to processing and storage without owning the machinery.

**Market activation** – Buyer–seller meets and crop calendars translate production into sales, with data feeding back into planning.

## WHAT CHANGED





## **Outputs:**

- 1,200+ solar pumps installed with bank-linked subsidies
- 421 micro-irrigation systems deployed
- 12 DRE-powered Livelihood Support Centres serving 300+ farmers
- 2,873 women entrepreneurs trained, 1,088 linked to schemes
- Women-led buyer-seller meets generating interest for ~10,000 MT of produce worth ₹40 crore
- FPOs covering over 2,400 acres with strong market linkages

## **Outcomes:**

- Reduced irrigation costs and emissions from replacing diesel pumps with solar
- Improved water-use efficiency and crop resilience
- Increased household incomes through value-added processing
- Greater market access and bargaining power for women entrepreneurs
- Stronger FPO governance and financial health

## **WHY THIS MODEL TRAVELS**

SwitchON's codified playbooks, state-level Program Management Units, and civil society partnerships enable replication. Public convenings build stakeholder networks before launch, reducing costs and accelerating uptake.

## **LOOKING AHEAD**

SwitchON aims to convert more than 100,000 hectares to CRA in the next five years, deploy 1.56 MW of DRE-powered livelihood infrastructure, and incubate over 1,000 green entrepreneurs. Women-led procurement systems will handle 50,000 MT annually, with a 25% reduction in greenhouse gas emissions in target areas. The lean MRV (measurement, reporting, and verification) system will track both income and emissions, giving investors and governments confidence in results.

*“Energy plus agriculture is only half the equation. The other half is entrepreneurs who turn that energy into value. When a woman runs a solar dryer for her cluster and sells on time to a buyer she met at our convening, climate resilience becomes a business model, not a slogan.”*

**Vinay Jaju, Co-founder**



# About the Authors



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Rustam Sengupta is a social entrepreneur, educator, and practitioner focused on community driven development, inclusive markets, and decentralized innovation. He has worked extensively across India, Africa, and other emerging market contexts on renewable energy, last mile distribution, and locally anchored enterprise models that link energy access to livelihoods, resilience, and social equity.

Rustam brings a practical perspective to these case studies, shaped by hands on experience building organizations in resource constrained environments where trust, institutions, and local participation are as critical as technology. As a faculty member associated with the University of Vermont Grossman School of Business, he is committed to translating field level realities into teaching cases that help students understand how impact-oriented business models are designed, tested, and scaled in real communities.



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Srini Venugopal is the Donald and Gabrielle McCree Endowed Professor in Business and the Academic Director of the Sustainable Innovation MBA Program at the University of Vermont Grossman School of Business. His research and teaching focus on innovation, entrepreneurship, and strategy in settings shaped by social and environmental constraints.

Srini brings an academic lens to these case studies, emphasizing how organizations navigate complexity, build adaptive business models, and balance financial sustainability with mission driven impact. His work helps students critically analyze how renewable energy enterprises scale responsibly, engage institutions, and create durable value in emerging markets.



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