

Energy for Livelihoods



Centering low-income communities
in the clean energy transition

June 2024



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PEI+ Partners:



Mentorship Partners:



About Energy for Livelihoods



About Energy for Livelihoods

PEII+

The Energy for Livelihoods Accelerator in India is part of Acumen's Pioneer Energy Investment Initiative: Powering Livelihoods Using Solar (PEII+). PEII+ is a five-year, \$25 million initiative that invests early-stage capital in companies that provide renewable energy-powered appliances – from mills and irrigation pumps to electric motorbikes and refrigerators – to micro-entrepreneur and smallholder farmers in India and East and West Africa. Launched in July 2022, its goal is to leverage these technologies to boost incomes and climate resilience in vulnerable communities.

PEII+ doubles down on productive uses of energy innovations that help create thriving, resilient livelihoods powered by affordable, income-generating clean energy products and services. It is built on the foundation of Acumen's 15 years of experience supporting energy access businesses that tackle poverty, encompassing investments into over 40 companies reaching over 220 million people.

Energy for Livelihoods Accelerator India

Acumen's Energy for Livelihoods Accelerator India, developed in partnership with Apple and delivered by Acumen Academy, aimed to build an ecosystem of scalable social enterprises in India committed to improving the livelihoods of people in poverty using sustainable energy.

Through leadership seminars and learning labs, the hybrid learning program taught participants how to test hypotheses, utilize data-driven insights, and communicate

their social and environmental impact while honing the financial and leadership skills essential for developing sustainable solutions tailored for low-income markets.

The four-month Accelerator program in 2023 supported 15 social enterprises to refine and develop their sustainable energy business models to scale, spanning sectors like agriculture, cold chain, off-grid solar, electric mobility, and more. The Accelerator offers a unique platform for founders to exchange insights and overcome challenges through shared experiences.

At the end of the program, participants came together for an in-person showcase event in New Delhi, where founders networked and pitched their businesses to investors, industry leaders, funders, and other stakeholders. Upon graduating from the program, each company in the cohort joined the Foundry, Acumen Academy's global community of 1600+ social innovators who are scaling solutions to global poverty.

Executive Summary



Executive Summary

Around the world, distributed energy businesses are demonstrating how to end energy poverty, reduce pollution, and make electricity affordable to even the most remote communities. India is a focal point for this fast-growing market. Despite the country's progress in expanding its electricity grid, emissions continue to rise while rural communities suffer from persistent blackouts. Now, a new wave of entrepreneurship offers a sustainable pathway out of poverty.

Productive use of energy: putting clean energy to work

The increasing affordability of solar panels and batteries has created a nascent ecosystem of productive use of energy (PUE) appliances: solutions that harness low-carbon energy to improve livelihoods. Solar water pumps, for example, can more than double incomes by reducing costs and improving yields, while off-grid refrigerators can increase incomes while minimizing waste.

PUE appliances remain too expensive for most rural households and microbusinesses to purchase outright, which means businesses need to design their business models to match the needs and resources of low-income communities. Yet this involves risk and technical demands which most companies can't meet on their own. Productive use needs an ecosystem to thrive in.

How Acumen's Accelerator is nurturing the promise of PUE

This gap between potential and opportunity is why Acumen launched the Energy for

Livelihoods (E4L) Accelerator in India, delivered by Acumen Academy as part of Acumen's Pioneer Energy Investment Initiative: Powering Livelihoods Using Solar (PEII+) initiative. With the support of Apple, we brought together 15 India-based clean energy social enterprises to create a new business development, mentorship, and networking platform.

Acumen is documenting what we've learned from this cohort and our five years of investing in PUE: insights on market dynamics, solutions to common barriers, and how to realize the potential of PUE to decentralize value chains and provide democratized access to value creation.

Success factors

Even the most enabling financial and policy environment can only take PUE companies so far. We need to empower business leaders with the tools to persevere and grow in operating environments that remain challenging. Our experience has shown that successful companies prioritize four key factors:

Connecting with customers

Low-income customers need more reassurance and proof that novel PUE solutions are worth the investment, paired with support to transition away from traditional practices. For e-mobility Accelerator company Mowo Fleet¹ reaching women customers meant finding regional and local language platforms more effective than popular digital channels.

Building a business around technology

New technology can make farmers and traders more efficient, but increased productivity needs a market.

Executive Summary

Business models need to be designed to increase end-users' incomes. Kisangas sells and installs biodigesters for dairy farmers, then helps farmers maximize their return on the asset by connecting them with markets for biogas and organic fertilizer.

Making technology affordable

Even inexpensive PUE tools are often out of reach for smallholder farmers. PUE entrepreneurs are working around these constraints by tapping smart subsidies and asset finance strategies. Jaljeevika's Recirculating Aquaculture Systems enable fish farming even for those without ponds. The company lowers the price through subsidies, while also partnering with financial institutions to enable users to pay over time.

Partnering to scale

Partnerships with regional organizations, NGOs, government agencies, and distributors are essential for aggregating and reaching last-mile customers. Aumsat, an Accelerator company that uses IoT-enabled tools to improve irrigation water quality, drove sales by engaging partners at multiple levels, including through government-sponsored water initiatives, patent development with a national agricultural research institute, and educational outreach to farmer networks.

Recommendations

Emerging PUE leaders are well on their way to transforming the way that Indians farm, cook, transit, and buy food. But shifting an entire economy requires creating widespread awareness, affordability, and access. Acumen's work with our investees and Accelerator participants gives us unique insights into how different actors can support this scale shift.

Funders should prioritize the opportunities that PUE unlocks, especially for women, while boosting investment readiness through grants, technical assistance, and later through blended finance structures. Investors can help companies move assets off-balance sheet to raise debt capital. They should also consider investing in sector enablers such as software, firmware, finance, and logistics. Government policies should encourage both impactful products and sustainable business models and establish credibility with lending targets and interest rate schemes.

Clean energy at a crossroads

Companies in our Accelerator are redesigning products and services end-to-end to meet their underserved customers, giving marginalized communities the tools they need to thrive amid economic and climate uncertainty. As these companies progress toward commercial viability, the possibilities are immense. But unless they can access the right kinds of support and capital, the future is far from guaranteed. Stakeholders must be willing to see past the inevitable pivots and setbacks that come with opening up new markets, and provide the Patient Capital and deep support these companies need.

Executive Summary



S&S Technologies

“There is a robust ecosystem of actors working in this space on many different scales, and partnership is a smart strategy – finding connections within different supply chains, what adjacencies can be capitalized upon. Which is why a program such as this is so beneficial – to make those connections.”

Meradith Leebrick, E4L Accelerator facilitator

Introduction



Introduction



Energy shapes our everyday lives. Energy allows us to light our homes, cook our meals, travel for work, and store our food to prevent waste. It powers our economies: there is energy embedded in everything we use or consume. The opposite is also true. When energy is unreliable or unavailable, we produce less. We stagnate.

India has made incredible strides in household electricity access over the past decade, connecting almost every household. However, rural and tribal areas still face challenges such as frequent power cuts or a lack of grid electricity altogether. Almost two-thirds of rural households reported daily power outages in 2020.²

This unreliability is strangling economic activity. More than four million rural microenterprises in the food and garment sectors cite inconsistent electricity as the major bottleneck to the growth of their businesses.³ Despite the increasing affordability of solar panels, batteries, and solar-powered appliances, they remain too expensive for many households or do not meet their specific needs.

This means that millions of farmers and entrepreneurs – many of whom are living in poverty – lack the means to improve their livelihoods and build up resilience to the worsening impacts of climate change.

Introduction

Farmers

India has about 120 million smallholder farmers. Many of these farmers live in generational poverty: their parents are poor and their children are poor.⁴ They are struggling to adapt their farming practices to a changing climate: average temperatures in India have increased by 1.3 degrees, and extreme rainfall events have more than tripled.^{5,6} Farmers face challenges with:

- Lack of reliable irrigation
- Lack of access to cooling
- Reliance on costly diesel-powered machinery

The end result is that as much as \$14 billion in produce is wasted, even as farms continue to produce less than their potential: Indian rice yields are a third that of China, and half that of Vietnam.^{7,8}

Small businesses

There are an estimated 60 million microenterprises across India. A recent survey of 6,000 small firms found that 80% experience regular power cuts, and that almost half (47%) operate backup generators.⁹ This limits the ability of entrepreneurs to generate a profit:

- Irregular energy supply making chilling and freezing difficult
- High generator costs cutting into thin margins

At the same time, the world is heating. Climate change is an existential threat, and a third of India's carbon emissions come from energy production. Although India has only contributed 3% of historical carbon emissions and its per capita carbon footprint is small, Indian emissions grew faster in 2023 than any other major economy.¹⁰

We need a new vision for an energized green economy, a clear pathway out of poverty. In India, we are seeing the beginnings of a transformation. Farmers that can till the land with electric tools and store their harvests in solar-powered coolers. Small businesses using biofuel and solar power to generate more revenue.

Driving this “Energy for Livelihoods” transformation is a group of innovative and impactful companies selling products and services that enable the productive use of energy (PUE), often through the use of distributed renewable energy (DRE). Think, for example, of a biodigester installed on a small dairy farm, which enables that farmer to turn cow manure into compressed natural gas and valuable organic fertilizer. Kisangas creates and installs those assets. Or a network of solar-powered cold rooms, where farmers can store their produce for days and wait for a fair price. CoolCrop is making that a reality.

Powering the transformation: Acumen's track record

Acumen began investing Patient Capital (equity investments that are backed by philanthropy into companies solving problems of poverty) in India in 2004. Since 2019, Acumen has been making investments in PUE companies in India and sub-Saharan Africa. In 2022, based on our initial experience, we launched Pioneer Energy Investment Initiative: Powering Livelihoods Using Solar (PEI+), a \$25 million philanthropically-backed investment facility that focuses exclusively on PUE companies that are changing the way we power the livelihoods of low-income communities.

However, this is a nascent sector, and we are not solely focused on investment-ready firms. Our aim is to grow the overall

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ecosystem. To that end, in 2023, with the support of Apple, Acumen launched its first Energy for Livelihoods Accelerator, bringing together 15 entrepreneurs for a four-month curriculum designed to help them run an impactful, profitable social enterprise. These incredible entrepreneurs, along with our existing portfolio companies, are changing the way that India is powered: putting people living in poverty at the center of the clean energy transition.

This report draws together lessons from our investments and the Accelerator to describe the practical realities of running a company selling PUE products and services in India in 2024. It features stories of companies, describes their potential impact, explores the major barriers for the sector, and offers actionable recommendations for how we, as a sector, can overcome them.

Solution – a green economy

Sustainable energy solutions have the potential to improve farm yields, power small businesses, and save time and money – all of which add up to improved incomes.

The potential for new forms and applications of energy to power livelihoods has been well-described by organizations like the Council on Energy, Environment, and Water (CEEW) and Climate Policy Initiative (CPI). CEEW and Villgro estimate that there is a \$48 billion market for PUE solutions in India, and that companies in this space have already impacted more than half-a-million livelihoods.¹¹

The companies leading this new clean energy market fall into three main categories:

1) Agriculture: companies that provide support to smallholder farmers, ranging from on-farm production all the way to market storage and processing.

- **On-farm**

Examples: solar irrigation pumps, electric weeders, tractors, egg incubators and milking machines.

- **Post-harvest**

Examples: cooling solutions (micro cold storage and bulk chillers), farm gate processing (solar dryers), milling machines and biodigesters.

2) Microenterprise: small businesses that are powering old trades in more efficient ways, or are enabling new business formation.

- **Productive machinery and appliances**

Freezers, cold rooms, sewing machines, looms, commercial power.

- **Mobility and logistics**

Electric vehicles such as motorcycles, three-wheelers, and cars.

3) Enablers: the companies that make the companies work, providing PUE enterprises with the credit, reach, and talent needed to scale their solutions.

- **Finance**

Credit to enable farmers and micro enterprises to pay over time.

- **Distribution and logistics**

Companies that can deliver products to rural areas, or help move goods and services from rural areas to cities.

- **Skills development**

Training for salespeople, technicians, drivers, and a host of other occupations that will be crucial to scaling PUE.

Introduction

Potential impact

For the last 150 years, creating wealth has meant building bigger and bigger at the center, creating monolithic hubs of production and exacerbating inequality. This model has reached its human and ecological limits. Centralized power generation in India has led to an explosion in fossil fuel generation; the share of wealth held by the top 1% in India has tripled in the last 50 years.¹²

The pendulum is swinging back towards decentralization. Industries all around the world are rediscovering the values of flexibility, responsiveness, and diversification.¹³ PUE is enabling this shift in India. For every one factory today, the India of the future could have a thousand. And where old textbooks would have cried “inefficiency,” we now see adaptability and resilience.

Science for Society (S4S) is a paradigmatic example.

Case study:

S4S Technologies, Acumen investee

S4S Technologies was founded in 2011 by seven university friends. Initially, the company started selling solar dryers as a technology. However, it pivoted its model so that the technology was just one part of a larger value chain.

Today, S4S operates a farmer-centric sourcing business that eliminates food waste and reinvents value chains. It begins with the sun: S4S manufactures and sells solar food dryers to female micro-entrepreneurs. It extends to the soil: S4S

helps connect those entrepreneurs to farmers, buying produce deemed too big, too small, or too ugly. The entrepreneurs dry produce at the village level, and then S4S buys it back from them. Dried onions, mangoes, beans, and grains flow into the S4S packaging facilities from farms all over the countryside. When tastes change, S4S has a thousand processing centers sourcing from twenty thousand farmers. They can adapt rapidly. When it rains in one valley, it's sunny in another. They're resilient.

Additional examples

The impact of PUE companies comes from more than just technology. Impact comes from looking for gaps that need to be filled and innovating for them. Within our Accelerator cohort alone, innovations spanned a range of business models and target markets, including:

Suryanirbhar has designed electric agricultural equipment (weeders based on crop types-field crops, plantation, paddy) that reduce work and input costs for smallholder farmers.

Devidayal's solar-powered refrigerators designed for India's weak grid areas.

Saptkrishi, Yotuh, and Arth's products create more efficient and equitable value chains.

Growth of a Sector



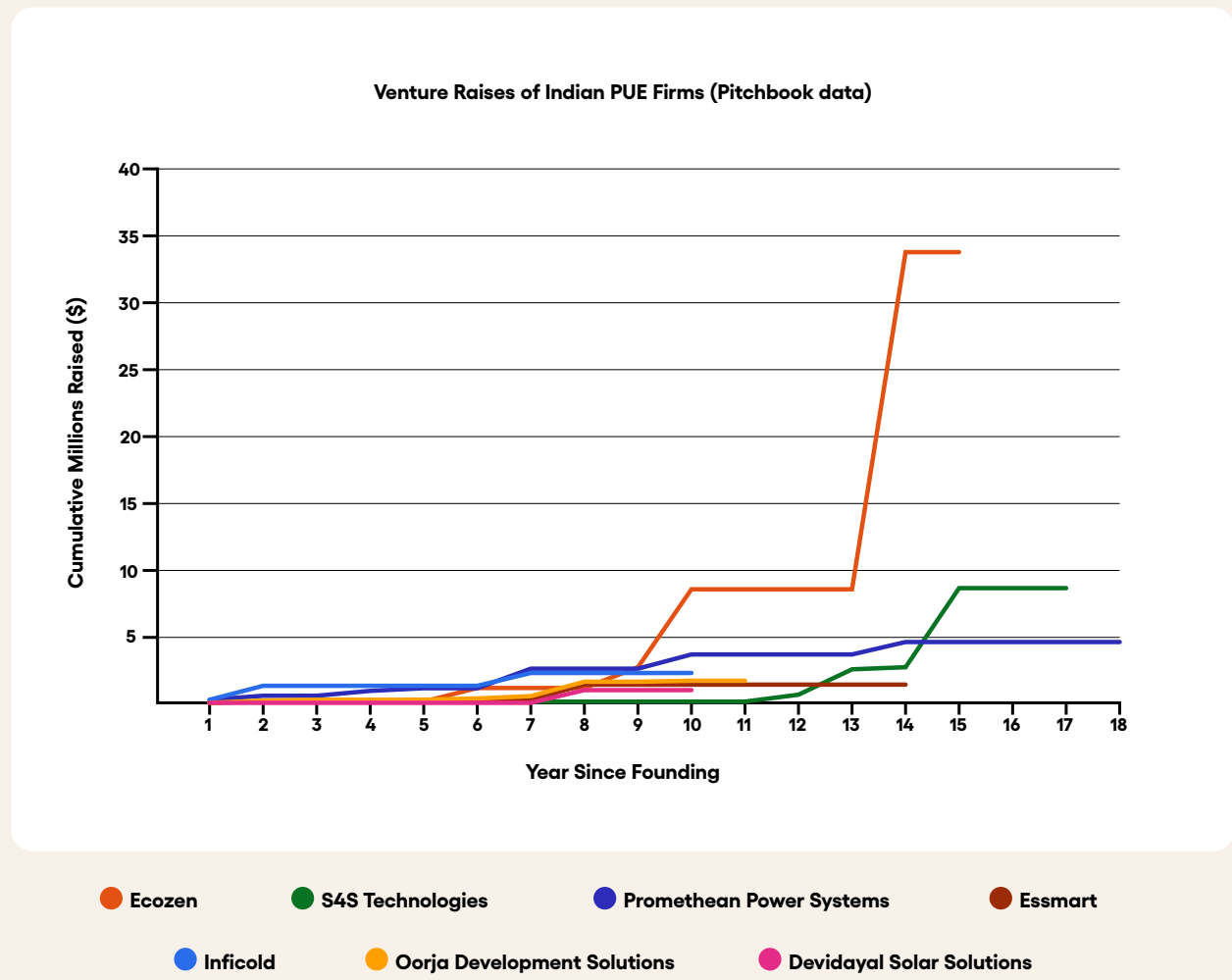
Growth of a Sector

The PUE sector has evolved from conceptual technologies to finding markets for products. This transformation is already visible for assets like solar water pumps, which are now widely used throughout India. As the sector grows and matures, the range of products and services is diversifying into solar-powered lathes, looms, mills, and more.

At Acumen, our initial investments taught us how complex the PUE sector can be. Adapting sustainable energy to work at the last mile is not as simple as slapping a solar panel on traditional equipment. These companies need to redesign from

the bottom up. At the same time, they do not have the luxury of just delivering products to a ready market; they have to build an ecosystem. Companies in our Accelerator are solving for finance, delivering access to the market, and providing high-quality service, just to get a customer to consider the core product.

All of this means that development takes longer than in more established sectors. The chart below shows the fundraising curves for seven successful Indian PUE firms. None of them raised more than \$5 million until they had been in existence for nine years.



Growth of a Sector

Given these timelines, incubation and grant support have been instrumental in building momentum. Concessional funding allows the pioneering firms to experiment, iterate, find an asset and a model that fits a need, and then grow. It's a deliberate approach that works, even if progress isn't always linear. Our experience over the last decade with entrepreneurs and other partners in the ecosystem has come up with innovative ideas to deploy first-time solutions on the ground and make them scale. This model has already achieved significant impact, not only in terms of households and businesses reached, but also through building awareness in the market for innovative products and solutions.

There are promising signs from our Accelerator that growth curves are shortening. Three-quarters of companies in the space were founded within the last five years, and many are already growing impressively. We are seeing a true paradigm shift, as incubators, state governments, and investors are working together to accelerate the sector's development.

That said, much work remains to be done to build an ecosystem that can meet a growing nation's demands for productive, applicable renewable energy. Here's how we take the next steps:

Infrastructure: many companies are focused on products, but we need more innovation in PUE enablers: internet of things (IoT) connectivity and monitoring, pay-as-you-go metering, and manufacturing.

Last-mile distribution: companies like Frontier Markets and EMP Bindi, which help female entrepreneurs in rural areas to stock and sell productive assets, are giving

PUE firms rapid paths to scale. We need more of them.

Finance: whether partnerships with financial institutions for end-user asset finance or off-balance sheet structures, financial innovation is crucial for a CapEx-intensive sector.

Patient Capital: there remains a need for grants and Patient Capital – to help companies develop sustainable models, distribution channels, and after-sales service; and to build awareness and increase affordability through economies of scale.

Success Factors



Success Factors



Mowo Fleet

Through this Accelerator, we aimed to bring to the forefront the impressive variety of productive energy solutions that social enterprises are launching to benefit both people and the planet. Despite a diverse cohort, many faced similar challenges in scaling up their models.

Through our investments in three PUE companies, our diligence of half a dozen more, and our conversations with companies in the Accelerator, we have seen that success in PUE depends on four key factors:

1. Reaching customers (overcoming physical and behavioral barriers)
2. Building a business model around productive technology
3. Making technology affordable
4. Partnering to scale

This section explores each of these factors in detail, and offers case studies of PUE firms (both established and new) that have found new approaches to success.

Success Factors

Adoption and product-market fit

Adoption and product-market fit

Convincing new customers to adopt energy appliances that will benefit their livelihoods requires both time and evidence. PUE products are impactful, but largely unknown. As Divya Gaur, Programme Associate with the Powering Livelihoods programme at CEEW, put it, “there is a need [for PUE appliances], but not enough demand. We need a long-term focus on consumer awareness.”

We have seen that two primary barriers hinder the widespread uptake of these solutions for low-income smallholder farmers and microentrepreneurs: physical challenges and behavioral barriers.

On the physical front, there’s the formidable task of building out distribution networks for single products, especially in remote or underserved areas where infrastructure may be lacking. One Accelerator company serves customers who are two days away from the nearest stock point. These hurdles require innovative solutions, such as targeting specific geographic clusters and/or leveraging digital marketing channels such as YouTube. Partnerships with distributors and organizations that aggregate customers are invaluable (and discussed below).

Additionally, there’s a behavioral barrier: the concept of “seeing is believing.” Many potential adopters need tangible evidence of the benefits before committing to new technologies. Increasing awareness of these new products and services becomes essential for any go-to-market strategy. This involves not only introducing these innovations but also changing established behaviors and practices that have been in place for decades.

In the Accelerator cohort, successful companies shared how they overcame this skepticism and drove adoption by incorporating demonstration projects, testimonials, and clear evidence of improved outcomes. A few companies, like Mowo Fleet and CoolCrop, had to change the way they communicated with their potential customers and beneficiaries – from leveraging new digital tools and platforms to fine-tuning their customer outreach.

Lastly, building strong relationships with key regional stakeholders – local leaders such as Sarpanches – and government agencies is another strategy for increasing awareness of their products. Quality standards, set through public-private collaborations, can build consumer confidence.

Case study:

Mowo Fleet, Acumen Accelerator

Mowo Fleet is defying stereotypes in Hyderabad, where societal norms confine women’s work to their homes. By empowering women to take the front seat of electric two or three-wheelers to earn an income, they’re challenging tradition and sparking behavior change. Yet, breaking this mold demands a monumental shift in mindset and awareness. The ultimate hurdle is convincing these women of their worthiness and capability to earn independently.

Mowo Fleet aims to attract both female drivers who are searching for livelihood opportunities, and women who have never driven a motor vehicle in their lives. Their research showed that there



Success Factors

Adoption and product-market fit

were female drivers interested in the jobs Mowo Fleet could offer, but reaching them was a challenge since they would not use LinkedIn or other job platforms. Many were using Facebook, Instagram, and WhatsApp, but social media also became a challenge as men would disguise themselves as women.

When Mowo Fleet started, out of 1000 applications, only 100 were women. Mowo Fleet's strategy? They flipped the script, leveraging heatmap-based ads, tailored filters, WhatsApp groups in local languages, and YouTube campaigns to connect with women authentically.

Case study:

CoolCrop, Acumen Accelerator

CoolCrop addresses the systemic issue of post-harvest losses by delivering solar-powered clean cooling solutions and processing systems near the farm gate. They deploy solar-powered cold rooms in a Cooling As A Service (CAAS) business model, which enables affordable access to near-farm clean cooling technologies to smallholder farmers in Self-Help Groups (SHGs) and co-op groups to earn better incomes, without the need for upfront capital investment on their part. Initially, they had limited success offering women SHGs small refrigeration solutions for daily use of fruits and vegetables: there was little traction to their scaling plans and some of their assets were underused. But CoolCrop experienced a breakthrough when a YouTube video showcasing their work in Himachal Pradesh resulted in multiple paid & CAAS service model installations in the area.

Case study:

Saptkrishi, Acumen Accelerator

Other companies were able to demonstrate the business case to customers: showing how PUE would increase their revenues, cut costs, and ultimately grow their profits. Saptkrishi caters to smallholder farmers and street hawkers, each earning less than \$143 USD a month. They developed "sabjikothi" – a portable bag-like solution for the storage of fruits and vegetables. Sabjikothi creates a microclimate, extending the shelf life of produce, cutting food waste, and boosting profits. Attracting attention from potential customers wasn't easy, but Sapkritshi found the key: illustrating potential daily earnings.

Outside the office of a local Sarpanch (elected leader), Saptkrishi will place 50 kilograms of fruits and vegetables. Next to it they place a sabjikothi, with the same amount of produce inside. After just one day, the "outside" produce will have lost five kilograms of weight to dehydration and rot, while the produce inside the sabjikothi loses almost none. Daily waste equates to a staggering loss of INR 12,000 (\$120 USD) monthly for hawkers; Saptkrishi's systems pay for themselves within four months on average. Farmers and hawkers eagerly commit 60% upfront, driven by the promise of increased revenue.

Lastly, building strong relationships with key regional stakeholders – local leaders such as Sarpanches – and government agencies is another strategy for increasing awareness of their products. Quality standards, set through public-private collaborations, can build consumer confidence.

Success Factors

Tech innovation and model innovation



Kisangas

Tech innovation and model innovation

It is absolutely essential to adapt existing tech to meet the needs of farmers and entrepreneurs working in remote regions or with unreliable, low-voltage electric grids. Appropriate technology can lower costs, improve reliability, and link disconnected actors in a value chain.

Additional examples

Many of the accelerator cohort companies have innovated and come up with technology to specifically serve the unserved:

Suryanirbhar Agritech: is filling an unmet need for an economically and environmentally sustainable way for

performing post-sowing activities, especially for smallholder farmers. Their technology works without emissions, is suitable for women and reduces dependency on labor, oxen, and weedicides.

Eidikos: is tackling the lack of indigenization and self-sufficiency in India's electric vehicle infrastructure by designing and manufacturing charging solutions that work for electric 2-wheelers, 3-wheelers, cars, and trucks.

Yotuh Energy: 100% electric truck refrigeration system was innovated to reduce the cost of cold chain logistics by enabling microentrepreneurs to enter the cold chain with small commercial vehicles and EVs for the first time.

Success Factors

Tech innovation and model innovation

Beyond innovation

However, technology alone is not enough. Increased productivity needs a market to translate into increased incomes. Without a buyer for additional produce, or someone who will pay a premium for higher quality, renewable assets may not create a return on investment.

Successful companies are not just providing improved products; they are helping their customers to market their new skills or increased produce. We've seen this through the work of Acumen portfolio companies like Promethean Power Systems and S4S, which are deploying productive assets as part of a larger strategy that includes buying directly from farmers and selling to premium buyers. Similarly, companies within our Accelerator cohort are experimenting to push the bounds of that innovation further.

Case study:

Kisangas, Acumen Accelerator

Kisangas designs and installs biodigesters for use with small and commercial-sized dairy farms. The Indian dairy industry is the largest in the world: 61 million cows and 80 million farmers produce a quarter of the world's milk.¹⁴ However, cows create two main outputs: milk and manure. Only one of those has a ready market, but Kisangas is looking to change that.

An installed biodigester can transform cow manure into (a) biogas, and (b) organic fertilizer. Kisangas helps farmers to market both of those. It collects fertilizer from small farmers and helps them sell it to organic farms nearby. And it works with larger farms to compress biogas and sell it to nearby restaurants as Compressed Natural Gas. The improved income

streams pay back the biodigester, and help the local economy run on a natural resource it has in abundance.

Case study:

Jaljeevika, Acumen Accelerator

Jaljeevika developed a low-cost Recirculating Aquaculture System (RAS) to promote livelihoods in the fisheries segment. Farmers who do not have access to ponds to carry fish farming, can now use the low-cost, solar-powered RAS for fish farming in their backyards. During and after COVID, the company devised a number of products to support farmers:

- Remote monitoring systems to ensure optimal water quality for fish.
- Offline seed farms to provide reliable access to fish fry (young fish) for RAS tanks.
- RAS fish farming training to equip farmers with the skills to succeed
- "Aquamart" online marketplace to ensure farmers have a market for fish.
- Cold storage solutions (via Devidayal and Saptkrishi) to extend shelf life and increase fish prices by expanding the supply chain and exportability.

The company has ensured accessibility for farmers by linking the product with available subsidies under the federal Ministry of Fisheries and the Rural Livelihood Mission. In addition, Jaljeevika has developed partnerships with financial institutions that will enable the user to pay for the product over time.

Success Factors

Affordability

Affordability

All of the innovation and potential new markets count for little if customers cannot afford the product. The promise of PUE is to charge economic opportunity for people living in poverty. But those same people have hard limits on their ability and willingness to pay for innovation. Jonathan Clowes, Senior Manager at Carbon Trust told us, “Price is a huge challenge point, and so getting the correct financing mechanisms in place that make products suitable for customers is crucial.”

In the PUE space, making products affordable often requires a combination of well-designed subsidies and asset finance.

Well-designed subsidies

The word “subsidy” often triggers strong emotions among entrepreneurs, investors, and funders. It conjures up fears of a bottomless bucket – negative-unit economics that are made positive through perpetual grants and distorted markets.

In reality, well-designed, purposeful subsidies have shown to be efficient and effective at bringing Energy for Livelihoods to market. We see subsidies primarily implemented at four levels:

R&D: Small-scale grants, often funneled through universities and incubators, can help technologists and entrepreneurs design around specific problems, and create technological solutions that are more efficient or accessible than the status quo.

Finding product-market fit: Once a technology exists, pilot grants can be used to find the optimal customer set and use case for the product: who does it work for, and how?

Proof of concept: A certain number of sales or installations are required to show proof of concept to financiers, including equity investors like Acumen. The economics of serving these early adopters will not be positive, hence the need for support.

Inclusive scale: Some critically important products may be more expensive than low-income households can afford for years. Alternative models that leverage long-term cross-subsidy may be needed, where those who can afford to pay more would do so?

Whether given as grants from an NGO or results-based payments from a state government, these subsidies are vitally important to building evidence, increasing awareness, and developing companies. Well-timed grants can have an immense social return on investment, as long as they are well-designed.

What makes a subsidy “well-designed”? There is no hard and fast rule, but in general, it is preferable to have programs that (a) enable widespread adoption, helping products reach poorer customers, and (b) operate with the ultimate aim of achieving positive unit economics to create scalable and profitable businesses.

Financing

The conversation around affordability is larger than just subsidies. In markets such as the US, productive assets are typically sold on credit or leased to businesses. These financial arrangements allow the enterprise to amortize the payment over months or years, and align the cash flows of repayment more closely with the cash flows of their business.

Success Factors

Affordability



S4S Technologies

In India, this type of asset finance is required to be provided by a licensed financial institution, usually a bank or Non-Banking Financial Company (NBFC). While partnerships with such institutions can be challenging to establish, several Energy for Livelihoods companies have been able to scale on the backs of such partnerships.

Case study:

S4S Technologies, Acumen investee

Acumen's investees in the PUE market, like S4S Technologies, are charting a roadmap to scale for our Accelerator cohort. They developed an entire business around that dryer, but that business was still reliant on a woman owning the asset. And that created a problem.

In India, most asset companies are not licensed to offer consumer credit.

So S4S sought out and formed a partnership with Maharashtra Gramin Bank (MGB), the State Bank of India and the National Bank for Agriculture and Rural Development (NABARD), that has been invaluable to their growth. In this partnership, S4S identifies potential entrepreneurs, who are willing to put money down for a solar dryer. They then originate a loan application for MGB which, if approved, allows the entrepreneur to pay for the dryer over 3-5 years, aligning the cash flows with their new business.

The Indian government requires banks to hold a portion of their assets in agriculture loans, which helps bring partners on board. In addition, another program (AIF) was used to subsidize the interest rate, bringing down the cost of financing to affordable levels. S4S later added other financing partners such as the State Bank of India. Creating affordability through credit has been a key aspect of their journey to scale.

Success Factors

Affordability



Oorja Development Solutions

Case study:

Oorja Development Solutions, Acumen investee

Solar pumps are a technologically mature product that have been on the market in India for a long time. There are even large-scale government programs to subsidize their capital costs. Yet despite this support, due to the high upfront cost of pumps, they remain prohibitively expensive for smallholder farmers to invest in. As a result, many of those farmers rely on operationally expensive and labor-intensive diesel pumps. Diesel irrigation is far more costly and this limits their ability to access timely irrigation.

Oorja's model of Pay-Per-Use irrigation services, driven by solar pumps, makes irrigation available year-round and affordable for low-income farmers. Oorja operates solar pumps that are used by groups of smallholders. It installs the pumps, owns them and also manages operations and maintenance – turning solar pumps from a product into an

affordable service. And it does not stop with irrigation: Oorja is offering services like solar milling when pumps are not running in order to maximize the utilization of the solar installations.

Pay-per-use

Lastly, the business model itself can drive affordability, if users are not expected to pay the full cost of an asset themselves. Providers of larger productive assets (cold rooms, group irrigation, dairy chillers) often use those assets to provide a service to a group of customers, each of whom pays at the time of use.

These “asset-as-a-service” models can be more efficient in the long run, as they create affordability while striking a mix between centralized models and individual ownership. However, they also require longer-term capital, as their CapEx is usually higher and their payback periods longer.

Success Factors

Partnerships

Partnerships

Through just the 12 most mature PUE sectors, over 47 million people on farms and in small businesses could have their livelihoods improved.¹⁵ No company can tackle that challenge alone. Collaborations with organizations that already work with target groups allow companies to reach more customers, faster. These include Farmer Producer Organizations (FPOs), NGOs, local governments, and specialized distributors. All of these have relationships with farmers or small businesses, and each of them can help reach the last mile. As Srinivas Marella, COO of CoolCrop, told Acumen: “Aggregation of both farmers groups and marketable surplus farm produce is the fundamental requirement for us.”

Case study:

Promethean Power Systems, Acumen investee

An Acumen investee since 2019, Promethean offers a range of solar and electric milk chillers with thermal energy storage to improve the dairy value chain in India. Their chilling technology is supporting over 100,000+ farmers to reach wider markets, in no small part thanks to their ability to forge lasting partnerships.

To reach dairy farmers, Promethean relies heavily on its partnership with rural NGOs such as with Swayam Shikshan Prayog (SSP). SSP brings farmers together into FPOs, and works with Promethean to help a subset of those FPOs access the technology and training they need to get the most out of their dairy farming. Promethean provides a mini dairy chiller at the village level, which is owned and

managed by the FPO. The FPO buys from local farmers (including their own members), and sells to larger dairy buyers with support from Promethean.

Promethean only makes this model work through its partnerships with larger dairies, who rely on Promethean to source high-quality, unspoiled milk. Promethean has guaranteed buyers, and is working to add additional farmer services and support FPOs to develop more value-added milk products.

Case study:

EMPBindi, Acumen Accelerator

Multiple DRE technology companies incur significant costs for sales through distribution channels and after-sales services. EMPBindi operates a network of 700+ “Sakhis” – rural women who are trained by EMPBindi to repair solar products – in 11 states, 65 districts with 417 villages. Not only do they train the Sakhis (which means “companions”) for after-sales service of DRE products, but also in customization of DRE products for use in rural areas for generating livelihoods.

The Sakhis network also provides marketing, lead generation, technical and supply chain support to product manufacturers. This company is filling a huge gap: they provide a last-mile channel for all sorts of PUE enterprises, enabling them to reach an exponentially wider market. As a result, EMPBindi is already partnering with multiple cohort members to support their products on the ground.



Success Factors

Partnerships



Aumsat

Case study:

Aumsat, Acumen Accelerator

The communities in Indian regions affected by hard water – containing high levels of dissolved minerals – face several challenges. Individuals deal with health issues, while farmers suffer yield losses due to water's inability to penetrate the soil. However, Aumsat, with its patented IoT solution for intelligent water management, offers a game-changing approach. Their solar-powered water conditioner tackles the issue of hard water by effectively removing excess minerals and transforming it into soft water. This innovation not only enhances irrigation water quality but also reduces the need for water and fertilizers.

After having demonstrated the evidence of their impact, Aumsat managed to grow

sales by integrating regional strategies with the government and tailoring their approaches to specific areas:

- Government contracts under safe drinking water initiatives like the Jal Jeevan Mission provided a crucial foundation.
- Conducting effective engagement with local leadership such as Sarpanches and utilizing videos for product demonstrations has proven successful.
- Securing a patent in collaboration with the Pusa Institute – India's national institute for agricultural research and education – and connecting with over 3,000 farmers through Krishi Vigyan Kendra (KVK) networks also facilitated widespread adoption, with monthly meetings serving as platforms to pitch the technology through intermediaries.

Success Factors

Partnerships

Case study:

Devidayal Solar Solutions, Acumen Accelerator

Devidayal Solar Solutions (DD Solar) focuses on the design, development, and sale of renewably-powered cold chain solutions. To open up this market, DD Solar collaborated with Rajeevika, an organization exclusively comprising women members, to execute a transformative initiative with Saras Dairy. The project involved allocating franchise opportunities to Self-Help Group (SHG) members for establishing retail outlets, with a proposal submitted to Villgro seeking a 50% subsidy for Saras booths and tribal women. The approval from Villgro for 50 Saras booth allottees with the promised subsidy was pivotal. Rajeevika's significant contributions, including member identification and commitment to providing loans for the remaining 50% of the project cost, played a crucial role in the project's success.

Completed in just five months, the initiative introduced solar refrigerators in areas with poor grid connectivity, enabling women to initiate businesses and augment their income. The collaborative success not only expanded Saras Dairy's outlets and sales but also brought benefits to DD Solar, showcasing the positive outcomes of strategic public-private partnerships in socio-economic development.

Public-private collaboration

There remains significant room for experimentation on partnerships. Government and larger businesses can help with aggregation. Extension networks,

both through traditional and digital means, could help spread the word. As discussed in the Model Innovation section, partnerships are also needed to monetize the growth that PUE creates. Establishing contracts with bulk purchasers can offer the guaranteed market that de-risks adoption.

Building these partnerships takes time to establish and care to maintain. Partners come with expectations: that products will arrive on time, that produce is of a certain quality, and that impact is being achieved. But we've seen that delivering on these partnerships makes all the difference in PUE. And there are encouraging signs that this Accelerator could create new partnerships: in the end-of-program survey, 10 out of 15 enterprises said pursuing partnerships with other cohort companies after the accelerator was a priority.

Success Factors

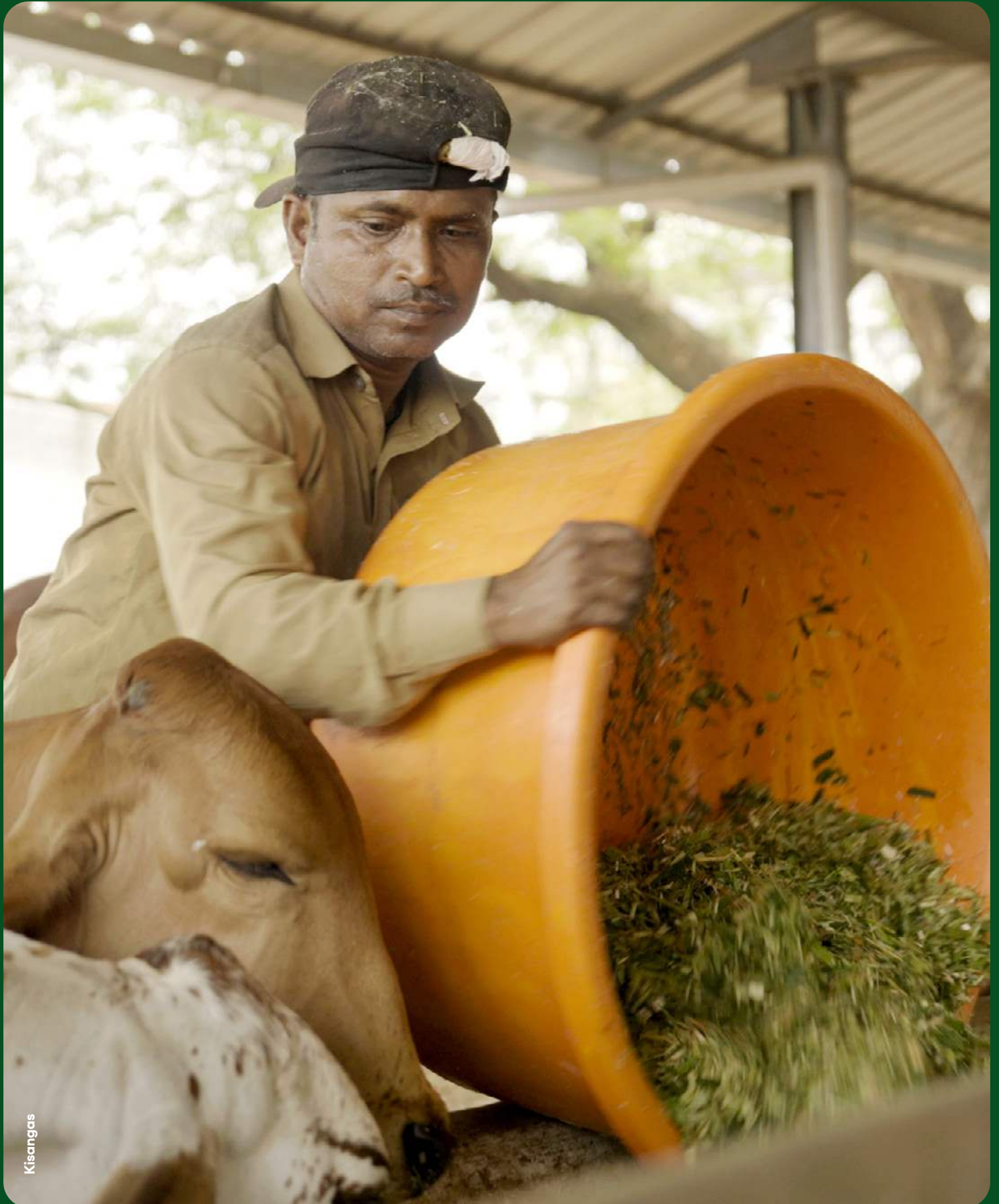
Partnerships



“There is a need [for PUE appliances], but not enough demand. We need a long-term focus on consumer awareness.”

Divya Gaur, Programme Associate with the Powering Livelihoods programme at CEEW

Recommendations



Recommendations



Mowo Fleet

A shift in scale

The 15 companies who just completed our Energy for Livelihoods Accelerator and Acumen investees such as S4S Technologies, Oorja Development Solutions, and Promethean are well on their way to transforming the way that Indians farm, cook, transit, and buy food. But shifting an entire economy will take dozens more firms, and it will require some of those firms to become very, very large. That combination of quantity and scale is what will create awareness, affordability, and access.

Here's our view on what different actors can do to create that scale shift in Energy for Livelihoods.

Funders

Prioritize interventions

The sheer number of solutions can create a strain on the ecosystem. Convene and develop a set of roadmaps to widespread adoption for high-priority subsectors, that can be implemented by collected actors, such as those in both the energy and agriculture sectors.

Be proactive in considering the gendered impact of PUE

New means of powering business and agriculture hold outsized opportunities for women, and examples such as S4S Technologies, EMPbindi, and Mowo Fleet can inform others.

Recommendations

Build a commercial sector, not a development sector

Given the longer development timeline of this space, funders can expand grant programs for early-stage firms, create effective technical assistance facilities for investment readiness, and then develop blended finance structures for early-stage investment.

Investors

Be realistic about time horizons and nuanced on subsidy

The potential markets for PUE are significant, but they will require time to scale. And investors who are scared off by public-private partnerships will miss out. The important factor to evaluate is: how is the firm using subsidies, and what are they building towards?

Supporting companies to finance their scale

PUE is an asset-heavy space, and verticals with major growth potential (e.g. cold chain) are also those with the highest CapEx needs. Investors can help companies to deliver high-quality products while moving assets off-balance sheet to raise debt capital.

Look at enablers

Opportunities for scale are also present in software, firmware, finance, and logistics firms. All will help catalyze the PUE transition, and have major breadth potential.

Keep one eye on the exit

While it is early to discuss liquidity, it pays to initiate these discussions proactively. Convening potential commercial investors and acquirers should be an early priority, to give them visibility into the sector.

Governments

Prime the pump

Policy support for innovation and scale can help companies develop both impactful products and sustainable business models.

Generate initial demand

Help to build awareness. Work with the sector to excite customers through quality standards and publicity campaigns.

Take advantage of existing pathways

Build partnerships for distribution, subsidy, and extension by leveraging existing assets and programs.

Encourage access to credit

Help establish the lending credibility of the sector through Priority Sector Lending targets around PUE, and interest rate subvention schemes.

Conclusion

Tying these points together, it is clear that we need to increase coordination across funders, investors, government, and entrepreneurs to meet the needs of this sector. Lack of coordination can lead to less-effective programs, and we have little time to lose.

We could not be more excited for the next wave of growth. The companies that have completed this Accelerator have demonstrated an impact in improving the livelihoods and resilience of people living in poverty by leveraging clean energy. Now is the time to double down on these enterprises, to scale and replicate these models, and to raise the visibility of this promising sector in India and beyond.

Endnotes

¹ See Appendix

² Council on Energy, Environment and Water (2020) State of Electricity Access in India

³ Gogoi A, Gaur D (2024) Are DRE technologies the future of rural livelihoods?

⁴ The World Economic Forum (2020) The Global Social Mobility Report 2020 Equality, Opportunity and a New Economic Imperative

⁵ The Climate Reality Project (2022) How the Climate Crisis is Impacting India

⁶ Roxy M. K., Ghosh S, Pathak A, Athulya R, Mujumdar M, Murtugudde R, Terray P, Rajeevan M (2017) A threefold rise in widespread extreme rain events over central India | Nature Communications

⁷ Shrivastava R (2021) India grows more food, wastes more, while more go hungry

⁸ The World Bank (2012) India: Issues and Priorities for Agriculture

⁹ Observer Research Foundation (2023) Evaluating Readiness for Renewable Energy Adoption in India

¹⁰ Global Carbon Budget 2023

¹¹ Council on Energy, Environment and Water and Villgro Innovations Foundation (2023) Decentralised Renewable Energy Technologies for Sustainable Livelihoods

¹² World Inequality Database (2019) India

¹³ S4S Technologies (2021) How can solar-powered decentralised food processing increase value chain efficiency, inclusiveness and resilience?

¹⁴ Statista (2024) Dairy industry in India

¹⁵ Council on Energy, Environment and Water and Villgro Innovations Foundation (2023) Decentralised Renewable Energy Technologies for Sustainable Livelihoods

Appendix



Appendix

Cohort companies in the 2023 Acumen Energy for Livelihoods Accelerator:

Arth

Arth's innovative machines recycle cow dung into eco-friendly, wood alternative prayer/ritual essentials and cremation logs, which saves trees from deforestation. This waste-to-worth model reduces pollution in waterways and creates additional income for farmers.



CoolCrop

CoolCrop addresses the systemic issue of post-harvest losses by delivering solar-powered clean cooling solutions and processing systems near the farmgate. Their affordable cooling-as-a-service business model enables data informed remunerative market linkages that help smallholder farmers earn better incomes.



Aumsat Technologies

Aumsat offers a patented IoT solution for intelligent water management. Their solar-powered water conditioner removes excess minerals to transform hard water into soft water, which enhances irrigation water quality, decreases requirement for water and fertilizers, boosts yields by 38%, and prevents limescale to extend the life of farming equipment.



Devidayal Solar Solutions Pvt Ltd

DDSolar provides access to energy and sustainable livelihoods through solar refrigeration solutions. The solar units displace diesel-powered refrigerators and freezers, reducing emissions and food spoilage.



BluPower

BluPower generates clean and renewable energy from existing water infrastructure through a modular hydro plant. BluPower's modular generation unit provides 24x7 clean energy generation by channeling incoming water flow through nozzles.



Eidikos Business Enterprises Pvt Ltd

Eidikos works across Electric Vehicle (EV) charging infrastructure, designing, engineering, and manufacturing EV charging station products and solutions for the needs of today and beyond.



Appendix

EMPBindi International

EMPBindi International empowers women in rural communities with solar training and entrepreneurship support for sustainable livelihoods and clean energy solutions.



LinkITBlueCollar

LinkITBlueCollar is a mobile-first, tech-enabled platform providing Electric Vehicle skills and guaranteed jobs for low-income communities of women and youth.



Jaljeevika infotech pvt ltd

Jaljeevika works with fish and agriculture farmers to enhance their livelihood through solar-enabled aquaculture systems, working towards end-to-end solutions to enhance their farm produce and income.



Mowo Fleet

Mowo Fleet trains women to drive electric two and three-wheelers, helping them access jobs by providing safe and zero-emission-rides for urban Indians and last-mile logistics solutions.



Kisangas

Kisangas enables farmers to turn their organic waste into clean fuel and organic fertilizer with its patented digester technology — a pre-fabricated and decentralized biogas plant. Fed with organic waste and through anaerobic digestion, the plant generates two main products: biogas, which is used as a clean fuel, and liquid slurry, which is an excellent organic fertilizer.



Saptkrishi Scientific Private Limited

Saptkrishi's Sabjikothi cart and e-cart models are microclimate-based storage solutions. Targeting small, marginal farmers and street hawkers, the carts maintain freshness and extend the shelf-life of fruits and vegetables up to 30 days without chemicals, preservatives, or refrigerants. This storage solution requires minimal wattage, has battery backup, and can be solar powered.



Appendix

Acumen investees featured in this report:

Suryanirbhar Agritech LLP

Suryanirbhar Agritech designs and develops low-power electric agri implements for post-sowing inter-row and inter-crop operations like weeding, inter-cultivation, ridging, spraying, and secondary tillage activities. Run by DC motors and powered by batteries, they are chargeable through both grid and solar panels.



S4S Technologies

S4S Technologies created and patented a Solar Conduction Dryer (SCD): a portable, solar-powered machine that dries vegetables and spices while retaining their nutrients. S4S partners with rural women, supplying them with a SCD, and purchasing lower-grade produce from local smallholder farmers and brings it to these women entrepreneurs to dry, which is then packaged and sold by S4S.



Vanya Environmental Services

Vanya empowers India's small farmers to become climate heroes. Using satellite data, remote sensing, and blockchain, they provide farmers with tools to check carbon levels in their soil, helping them farm sustainably, trap carbon, and generate income from selling carbon credits.



Promethean Power Systems

Promethean Power Systems is addressing the issue of rural cooling with off-grid milk refrigerators powered by efficient, thermal batteries. Promethean's bulk refrigerators reduce the cost of remote refrigeration by two-thirds, making it financially possible for dairy companies to run local milk collection centers.



Yotuh Energy

Yotuh Energy is solving the problem of low cold chain penetration in India by eliminating the use of fossil fuel-based solutions, reducing the CapEx and OpEx of cold chain solutions. They've developed electrifying refrigeration systems for cold chain transportation vehicles, saving up to 80% of refrigeration running costs and increasing customer profit margins by 2X.



Oorja Development Solutions

Oorja is a Farming as a Service company that provides solar-powered irrigation, milling and cooling services to smallholder farmers on a pay-per-use basis. Oorja installs, owns, operates and maintains decentralised solar energy systems at the farm level, with no upfront cost charged to end-users.





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