Unlocking Active Cooling Potential

Lessons learnt from our investments in Sub-Saharan Africa and India

Prepared by Open Capital and Accenture Development Partners

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ACRONYMS AND ABBREVIATIONS

3PL	Third-Party Logistics
B2B	Business-to-Business
B2C	Business-to-Customer
B2G	Business-to-Government
CaaS	Cooling-as-a-Service
CAPEX	Capital Expenditure
CASEE	Catalysing Agriculture by Scaling Energy Ecosystems
EAC	East African Community
EAF	East African Fruits
FCDO	Foreign, Commonwealth and Development Office
FMCG	Fast-Moving Consumer Goods
GBP	Pound Sterling
KIC	Keep IT Cool
KRA	Kenya Revenue Authority
LMICs	Low- and Middle-Income Countries
MFI	Micro-Finance Institution
PAYGo	Pay-As-You-Go
PHL	Post-Harvest Loss
PV	Photovoltaic
PUE	Productive Use of Energy
R&D	Research and Development
RBF	Results-Based Financing
SDG	Sustainable Development Goal
SHF	Smallholder Farmer
SHS	Solar Home System
SSA	Sub-Saharan Africa
TAF	Technical Assistance Facility
UK	United Kingdom
UNICEF	United Nations Children's Fund
USD	United States Dollar
VAT	Value Added Tax
VC	Venture Capital
WICR	Walk-In Cold Room

GLOSSARY OF TERMS

Term	Definition
Aggregation Centre	Facility where produce from multiple SHFs is collected for sorting, storage, and transportation; often includes cold storage to reduce PHLs
Asset-heavy Models	Business models that require significant upfront capital investment to acquire and operate infrastructure or equipment (e.g., cold rooms)
Cooling-as-a-Service (CaaS)	A model where users pay for cooling services based on usage, either on a volume or time basis, without owning the cooling infrastructure
Cold Chain	A temperature-controlled supply chain used to preserve perishable produce from production to the point of use
Commercial Viability	The likelihood of a business model to sustain itself financially without ongoing donor or grant support by attracting enough users
Microentrepreneurs (MEs)	Sole proprietorships / self-employed entrepreneurs, including up to two employees
Off-taker	A buyer (often under contract) who commits to purchasing output from a producer, providing price and volume certainty
Pay-As-You-Go (PAYGo)	A flexible payment model where users pay in small increments over time, allowing eventual asset ownership
Passive Cooling	Non-electric cooling systems that use natural processes (e.g., evaporation, insulation) to reduce temperature
Post-Harvest Losses (PHLs)	Losses in quantity or quality of produce after harvest, typically due to spoilage, poor handling, or lack of storage
Productive Use of Energy (PUE)	Use of electricity for income-generating purposes such as cooling, milling, or processing
Results-Based Financing (RBF)	A funding mechanism where money is disbursed upon achievement of verified milestones or performance outcomes
Smallholder Farmers (SHFs)	Farmers managing small plots of land, often using family labour, with limited access to technology and capital
Sustainable Cooling	Essential cooling services such as refrigeration and temperature control using energy-efficient, low-emission technologies suited to off-grid or weak-grid settings
Walk-In Cold Room (WICR)	A large, enclosed refrigerated space used for bulk storage of perishables, typically found at aggregation or distribution hubs

EXECUTIVE SUMMARY

In recent years, cooling for people living on low incomes has emerged as a growing focus for both investors and development actors. Cooling offers a pathway to improve food quality, reduce post-harvest losses (PHLs), and improve incomes for smallholder farmers (SHFs) and microentrepreneurs (MEs). When delivered through energy-efficient, context-appropriate, and low-emission technologies, cooling enables these outcomes in a clean and sustainable way. However, delivering sustainable cooling at scale remains difficult. Adoption is still low, as most low-income populations face high barriers to entry, including limited access to energy, capital, technical knowledge, and market linkages. Meanwhile, achieving commercial viability is difficult for cooling companies due to high capital costs, long return on investments, and inconsistent demand.

Drawing on Shell Foundation's partnership with the Ayrton Fund through the CASEE and TEA programmes, this report outlines our key learnings about what it takes to deliver inclusive, scalable, and commercially viable cooling solutions for people living on low incomes. We showcase five early-stage cooling companies operating across sub-Saharan Africa (SSA) and India, highlighting the diverse business models they pursued, challenges they faced, and strategies they implemented while looking to scale impact and build commercial viability. Ranging from ice crates for fish and poultry SHFs to hybrid solar back-up cooler boxes for restaurants, these examples illustrate what has and has not worked to create to scalable, lasting impact.

Cooling will not Deliver Meaningful Impact in Isolation

Adoption and sustainability depend on (1) alignment with market needs, (2) viable and context-

specific business models and financing structures, (3) supportive enabling policies, and (4) strong ecosystem coordination. The Key Learnings section of the report discusses in detail the following:

1. **Developing Sustainable Cooling Solutions Requires Deep Understanding of the User and the Value Chain**. Cooling must align with the perishability of the produce, use cases, and the user's behaviour, risk appetite, and ability to afford the product.
2. **Cooling is not a Silver Bullet for Increasing Incomes. It is most Effective when Integrated into an Uninterrupted Cold Chain and Paired with Access to Markets and Finance**. Without continuity in cooling technology and connection to upstream inputs and downstream buyers, shelf-life gains do not translate into value
3. **Commercial Viability is Essential for Cooling Impact.** Even the most promising business models will collapse without a clear path to financial viability and sustainable growth beyond donor support.
4. **Financing Needs to be Tailored to the Cooling Sector to Match its Unique Cash Flow Profiles and Long Returns on Investment.** Cooling's long payback periods and asset-heavy models require investment approaches that emphasize long-term value creation – investors providing patient capital should be committed to sustainable growth rather than immediate returns.
5. **Delivering Impact through Cooling Requires more Practical and Enforceable Policies – and Solutions Aligned with Existing Government Priorities.** Policies are most effective when grounded in real market dynamics and institutional capacity, particularly within priority sectors such as dairy and horticulture.

Going forward

To create lasting value for both users and companies, stakeholders need to coordinate efforts to ensure sustainable cooling is embedded within broader agricultural and energy systems and integrated into the way markets, value chains, and livelihood's function. The Calls to Action section of the report offers a roadmap for donors, investors, governments, and companies to achieve this.

1 INTRODUCTION

The Cooling Challenge

A lack of cooling infrastructure contributes to over 526 million tonnes of food loss each year globally, with SHFs losing up to 40% of high-value perishable goods before they reach the market, reducing incomes by as much as 15%.[1,2]

Across Africa and India, the high cost of acquiring cooling solutions remains the biggest barrier for SHFs and MEs. At the same time, inconsistent power supply for MEs in on-grid communities – such as local grocers, small market vendors, and food traders who sell fresh produce – make it difficult to run profitable businesses that are dependent on cooling. By expanding access to affordable cooling solutions, these people living on low incomes can increase their productivity, reduce PHLs by up to 30%, and gain access to premium markets – translating into higher incomes.[2]

Ayrton Fund Partnership

The Ayrton Fund is the UK Government's GBP 1 billion commitment to advance research and development (R&D) in clean energy technologies and business models in developing countries. It targets priority gaps in science, technology, and innovation to accelerate progress towards two Sustainable Development Goals: SDG 7 (affordable, reliable clean energy) and SDG 13 (climate action). Within the Fund's suite of thematic challenges, the Sustainable Cooling for All challenge specifically aims to meet growing global cooling demand in a warming world using sustainable solutions.

Shell Foundation partnered with the UK Government's Foreign, Commonwealth and Development Office (FCDO) through the Ayrton Fund to launch two flagship initiatives:

- **Catalysing Agriculture by Scaling Energy Ecosystems**. (CASEE, 2019): Focused on boosting SHF incomes by scaling productive use of energy (PUE) technologies such as cooling, solar pumps, and more, while attracting private capital to rural markets
- **Transforming Energy Access** (TEA, 2022): Focused on funding innovation and company growth across the clean energy ecosystem, including integrated cold chains (built on the momentum of CASEE)

Through these programmes, Shell Foundation has deployed approximately USD 7 million across five early-stage companies and market accelerators in SSA and India. These ventures, ranging from decentralised cold chain networks and solar refrigeration to digital aggregation platforms, are pioneering inclusive, sustainable cooling business models for underserved agricultural communities.

Shell Foundation's Evolving Narrative on Cooling

Since 2015, Shell Foundation has championed sustainable cooling as a core strategy for climate resilience and economic development in low- and middle-income countries (LMICs). Through research grants and public-private partnerships, we have worked to raise awareness of cooling's role in improving food security, business outcomes, and livelihoods, mobilising stakeholders to build the ecosystem needed for lasting impact.

Historically, our investments around cooling focused on supporting early-stage companies to test their products and business models or expand into new markets. The primary outcome was improved access to cooling for customers. However, in recent years, our focus has shifted from viewing energy access (cooling) as an outcome in and of itself to instead seeing it as an enabler of improved economic outcomes for both SHFs and MEs.

Over the course of our investment journey, the commercial viability of companies we support has also become an increasingly important consideration. Our initial investment thesis was guided by the principles of access, affordability, impact, and scale. Our support of the Cooling-as-a-Service (CaaS) model to improve adoption of solar cooling solutions by SHFs highlights how we sought to intervene in the space.

This report draws on our investments and experience in the sector to share key learnings on what it takes to make cooling work for people living on low incomes, showcasing five companies supported through the Ayrton Cooling for all Challenge. We outline how government, investors, donors, and the private sectors can shift perspectives and behaviours to better design and support cooling solutions that improve livelihoods while also building sustainable companies.

[1] Sustainable Energy for All, Cooling for food, nutrition and agriculture, 2022, Link

[2] World Bank, Off-Grid Solar Market Trends Report, 2022, Link

Figure 1: Considerations for Impactful Coding Solutions

Cooling Companies Supported by Shell Foundation

Inficold

Inficold is an India-based company that delivers solar-integrated, battery-less cooling solutions powered by patented thermal energy storage. Shell Foundation has partnered with Inficold since 2015 to design and pilot retrofittable units for SHFs. Through four funding rounds totalling USD 1.4 million, we have supported product development, manufacturing expansion, and commercialisation. The partnership has enabled Inficold to scale across 11 countries, reach over 150,000 people, and significantly improve SHF incomes and produce quality.

SureChill[3]

SureChill is a UK-based company offering patented refrigeration technology that operates without constant electricity, ideal for off-grid, weak-grid, and mini-grid areas. Shell Foundation's partnership with SureChill started in 2015 to support the development and scaling of off-grid refrigeration for low-income communities. Shell Foundation supported SureChill's non-healthcare business through four deals totalling over USD 2 million. Through these deals, we funded product development, market piloting, resilience during the COVID-19 pandemic, and an Africa-wide scale up. SureChill expanded access through fast-moving consumer goods (FMCGs), microfinance institution (MFI) partnerships, and piloted CaaS models. SureChill went into administration on 7 March 2025.

InspiraFarms

InspiraFarms is a Kenya-based company that provides modular, energy-efficient post-harvest solutions such as pre-cooling, cold rooms, packhouses, and freezers for agribusinesses across Africa. Shell Foundation has partnered with InspiraFarms since 2017 to reduce PHLs and improve SHF incomes. Through four deals totalling approximately USD 2.4 million, we have supported deployment of off-grid facilities, corporate partnership development, and regional scale-up. The latter has enabled InspiraFarms to install over 120 units in 15 countries and strengthen its capacity in underserved agricultural markets.

Keep IT Cool

Keep IT Cool (KIC) is a Kenyan company offering technology-enabled cold chain distribution to improve cooling access for SHFs. Shell Foundation's partnership with KIC began in 2020 under the Catalysing Agriculture by Scaling Energy Ecosystems (CASEE) programme to scale logistics, develop aggregation models, and expand cooling access for fish and poultry farmers. With approximately USD 700,000 in support over two deals, the partnership has helped reduce PHLs by 98% and increase incomes for 3,600 fisherfolk.

East Africa Fruits

East Africa Fruits (EAF) is a Tanzanian agribusiness that aggregates, processes, and distributes produce from SHFs to domestic markets. Shell Foundation began its partnership with EAF in 2020 under the CASEE programme, providing USD 300,000 across two deals to pilot and scale solar-powered cooling for aggregation. The support enabled EAF to reduce reliance on brokers, grow revenues fivefold, reach nearly 8,000 farmers, and create around 160 jobs, positioning the company to serve 10,000 farmers by 2025.

[3] SureChill went into administration on 7 March 2025

2 KEY LEARNINGS

Introduction to Key Learnings

The learnings identified in this section reflect our journey and growth as we supported companies providing cooling solutions to people living on low incomes, including SHFs and MEs. We have evolved from focusing on the mere provision of energy access to people living on low incomes to viewing clean energy as a vehicle for these groups to improve their economic outcomes.

1

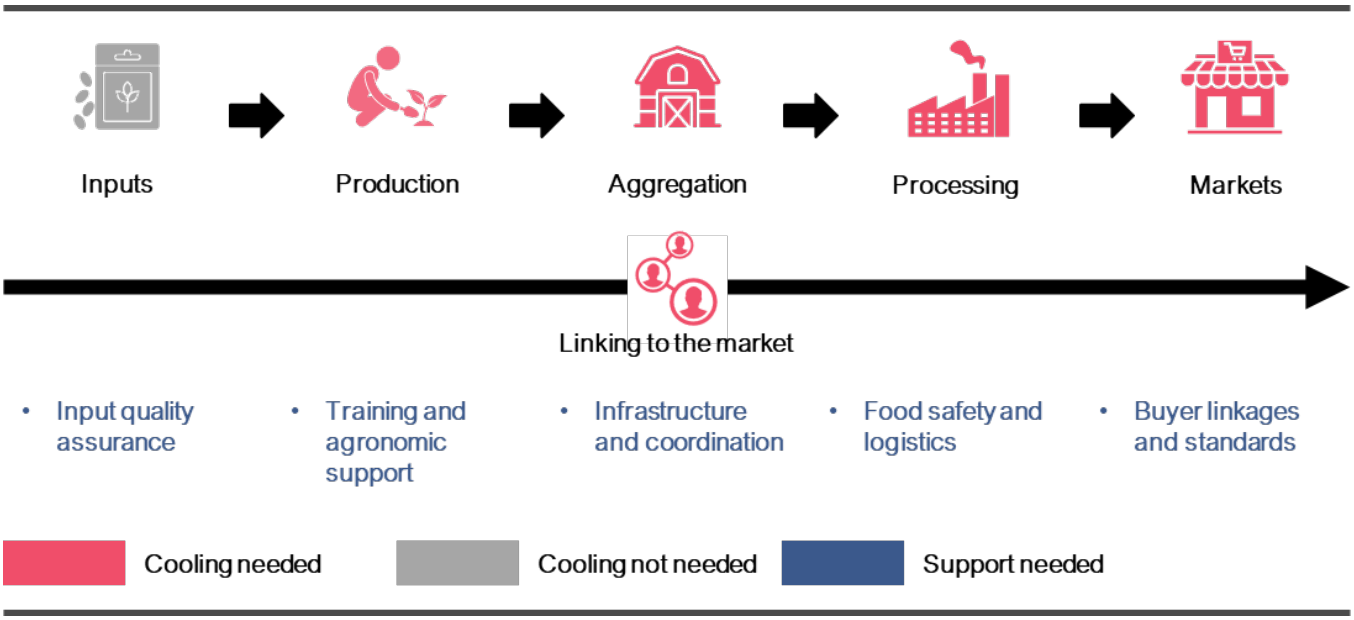
Developing Sustainable Cooling Solutions Requires Deep Understanding of the User and the Agricultural Value Chain.

Shell Foundation's support to cooling solution providers highlighted that the utility of cooling solutions is influenced by the nature of the agricultural produce being cooled and the realities of the user, such as how much they perceive a need for cooling.

(i) Type of Produce and Use Case: High-Impact interventions begin with a clear understanding of where cooling is technically necessary. SHFs in perishable value chains such as fish or dairy will clearly have a greater need for cooling and are more likely to demand such solutions than those working with non-perishable produce such as grains and cereals. However, even for perishable produce, the type of cooling required varies significantly based on the use case. Fish needs to be frozen between -10°C and 0°C, milk must be cooled to less than 2°C, while leafy vegetables require milder temperature control. Therefore, the types of technologies required to service these value chains differ. Fish may require cold rooms where the temperature can be adjusted, while vegetables can be stored using convection-based solar refrigerators with one consistent temperature. We have learned that understanding these distinctions

How Inficold Tailored its Technology to Align with Produce Type and Use Case

We saw this in practice with Inficold, which identified that over 50% of horticultural produce requires precise low-temperature storage, typically between 0°C and 2°C, and that different commodities have different sensitivities to ethylene and chilling injuries. In response, Inficold developed solar-powered cold storage units with multi-chamber systems adjustable from 0°C to 15°C, allowing storage of a variety of produce in one unit. Inficold ensured its solution was flexible for SHFs using it, and that the cold storage units improved the marketable shelf-life of produce, increasing the adoption of its units.



helps avoid misapplication of cooling infrastructure and ensures it is deployed only where technically necessary and commercially justified.

(ii) User Segments: Even when cooling is needed, adoption only occurs when solutions match the realities of the end user. MEs often operate in urban, grid-connected settings with more reliable power, and are therefore likely to stick to conventional, non-solar-powered fridges or freezers given they do not require constant cooling for selling cold drinks; a cheaper traditional fridge that is powered for 3-4 hours a day may be sufficient. By contrast, SHFs are typically located in off-grid areas and do not have access to the grid or ice to cool their produce and therefore are totally reliant on the sun. For these end users, solar cooling is critical and therefore, they are more willing to invest in solar cooling solutions because they have limited alternative solutions.

Furthermore, not all MEs have the same needs. For instance, MEs selling cold beverages prioritize intermittent access to cooling, primarily to meet peak customer demand. For these users, a full refrigerator may be unnecessarily large and costly. Bespoke, compact solar-powered drink coolers, designed specifically to chill beverages over shorter periods, may provide greater utility at lower cost. In contrast, an ME selling fish requires continuous low-temperature storage, often below 0°C, to preserve product quality. This necessitates more robust, energy-intensive cold storage solutions.

These dynamics influence which solutions deliver the most impact and are most commercially viable among different user segments. Providing the right solutions for each user segment increases consumers' willingness to adopt, pay for, and maintain the solution, since they see value in what is provided.

Another important consideration is the affordability threshold of the end user, which poses a challenge for most PUE products. However, given that cooling is required across the value chain, there is an opportunity for cross-subsidisation, where high upfront costs for SHFs and informal traders can be subsidised by larger aggregators and retail players in the chain, who generally have higher affordability thresholds.

How SureChill's Dual Model Reflects Differing User Realities

SureChill delivered off-grid cooling solutions for their SHF users, who were mostly located in rural areas with little or no access to electricity. However, they also sold grid-powered refrigerators that offered reliable cooling for MEs operating in grid-connected environments where power supply was more stable. This segmentation ensured that both user groups accessed solutions tailored to their context and perceived utility. These targeted approaches translated into meaningful results. For MEs, SureChill enabled an 88% increase in drinks sales for trusted retailers. Meanwhile, over 500 fridges were sold to SHFs in off-grid and weak-grid areas.

KIC's Cross-subsidising has Enabled SHFs' Access to Cooling

KIC has successfully leveraged its paying customers with higher purchasing power to subsidise the acquisition and operations of cooler boxes and ice production for fisherfolk. By embedding this affordability mechanism into its model, KIC linked over 2,000 fisherfolk to more than 500 urban markets, reduced PHLs by 98%, and paid SHFs an additional USD 0.09 per kilogram compared to competitors.

(iii) Market Structures: Cooling solutions also are most effective when implemented within the realities of the existing market structures. In fragmented agricultural markets that do not have cooperatives, making cooling business models viable can be more challenging. For example, if farmers or cooperatives do not own or have control over their land, it can lead to issues with installing sustainable cooling solutions.

How Coordination Challenges in Fragmented Markets Made Cooling Unviable for InspiraFarms

When InspiraFarms was exploring opportunities in Kenya's green bean sector, the company encountered persistent challenges trying to coordinate fragmented SHF networks. This was because there were limited cooperatives and growers harvested at different times and delivered inconsistent volumes. These coordination gaps meant that deploying a Walk-In Cold Room (WICR) risked chronic underutilisation. After prolonged efforts to organise the supply base proved unsuccessful, InspiraFarms chose not to install infrastructure and was ultimately forced to exit the sector, despite having spent significant time and money exploring the horticulture market.

Conclusion

Over time, we have come to understand that cooling is not a one-size-fits-all intervention – it needs to match the needs of the user Understanding the type of produce and user needs, and market structures provides companies the information and intelligence needed to make strategic decisions that enhance the utility of their cooling solutions.

2

Cooling is most Effective when Integrated into an Uninterrupted Cold Chain with Access to Markets and Finance

When Shell Foundation began investing in cooling, we focused on expanding energy access by helping companies deploy cooling technologies to low-income communities, often in a fragmented way. Over time, we have come to understand that isolated cooling interventions are not enough. Instead, solutions need to be available at every critical stage – from harvest to transport to market – and SHFs must also have the tools, inputs, and market access required for income uplift. Cooling cannot add value to an avocado that was picked too early or stop the spoilage of a fish that was left in the sun for hours before storage. Likewise, cooling cannot fix a fruit bruised by poor packaging or transport, nor can it increase incomes if there is no buyer willing to pay for higher quality.

To unlock the full potential of cooling, solutions must be implemented with (i) uninterrupted cooling across the value chain and (ii) upstream and downstream support to ensure quality outputs and access to the more viable and premium markets, such as exports.

(i) Uninterrupted Cooling: Through our work, we have seen that installing cooling at only one part of a value chain has a limited effect if the rest of the chain remains uncooled. Produce will still spoil if there is a break in the cold chain during transport or aggregation, cancelling out any benefits gained from cooling. That said, uninterrupted cooling does not always have to be provided through solar-powered solutions. Grid electricity, hybrid systems, or passive cooling may offer more practical and cost-effective alternatives, depending on the context.

(ii) Upstream and Downstream Agricultural Support: We also learnt that the economic benefit of cooling is not only realised but maximised if SHFs have access to quality inputs and buyers who can absorb higher-quality produce. Structured markets, such as exports, are more likely to reward quality and consistency but have strict requirements. SHFs can only meet these through continuous cooling and the integration of upstream support such as access to high quality inputs and training on harvesting best practices.

How KIC Introduced Cooling across the Value Chain to Provide High Quality Produce

We saw this come to life in our engagement with KIC. The company initially focused on transporting produce from fisherfolk at the landing site to the processing and distribution location in Nairobi using cooling vans. However, maintaining produce quality, especially for highly perishable goods such as fish, requires more than just a cold chain beginning at the landing site, and the company did not initially provide additional cooling to the fisherfolk when they were out at sea. To ensure consistent cooling from the moment the fish was taken out of the water, KIC introduced ice crates for fisherfolk to take to sea. This strategy has improved produce quality and market access, contributing to a 98% reduction in PHLs and increased incomes for over 3,600 fisherfolk.

How EAF Combined Cooling with Logistics, Training, and Market Access to Improve SHF Incomes

EAF has benefitted from providing a strong proposition to farmers through value-added services, training, and access to markets. The company partnered with the United Nations Children's Fund (UNICEF) to deliver capacity building and financial literacy training to SHFs. As a result of this training, EAF helped over 500 SHFs secure loans, which enabled them to expand their farms and diversify their crops for better incomes. The integrated approach also allowed SHFs to reduce reliance on exploitative middlemen. For example, the number of SHFs selling banana produce through brokers was reduced by 25%. In turn, this allowed the SHFs to fetch more competitive prices for their produce, boost yields, and reduce PHLs

Conclusion

While not all business models are required to directly provide inputs, training on harvesting techniques, aggregation, and market linkage, our experience highlights that the impact of cooling is maximised when deployed alongside mechanisms that do provide this support. We have found that cooling is not a standalone intervention but rather a critical enabler to unlock higher-value markets, reduce spoilage, and ultimately enhance SHF incomes.

3

Commercial Viability is Essential for Sustaining Cooling Impact

Sustained cooling impact cannot happen without ensuring that the cooling service is provided in a commercially viable manner. Over the past decade, we have seen companies test and deploy several business models across different markets and geographies to make cooling solutions affordable for people living on low incomes. By addressing the upfront and total cost challenges that SHFs and MEs face, models like PAYGo and CaaS have been largely successful in improving adoption of cooling solutions. However, they have not translated into improved commercial viability for the companies providing the cooling products. Without continued access to grant funding to subsidise the cost of the cooling assets, companies have been unable to grow these business models to drive sustained impact.

However, we have seen companies deploy innovative strategies to enhance commercial viability such as leveraging partnerships with microfinance institutions (MFIs) to provide loans to end users, as well as other tailored financial mechanisms.

As you might expect, we have also seen that large buyers can enhance the commercial viability of cooling solution providers, given their stable demand, and most importantly, high purchasing power. We have seen success in models that have entered the market for larger scale players to support their sustainability, rather than focusing on directly serving SHFs.

When it comes to achieving commercial viability, the deployment of cooling solutions not only depends on the business model, but also on several other factors. These include (i) the market orientation, (ii) the geography and infrastructure, and (iii) the technology model.

(i) Market Orientation: Cooling solutions for SHFs who serve local informal markets, which are price-sensitive and fragmented, are extremely challenging due to the lower requirements for high quality produce, thinner margins, and inconsistent demand. By contrast, export-oriented value chains benefit from structured procurement, predictable demand, and high margins, meaning that integrating sustainable cooling into these value chains tends to have higher viability.

(ii) Geography and Infrastructure: Our experience across diverse geographies has shown that commercial viability varies across regions, as well as within countries. As previously mentioned, sustainable cooling solutions are more suited to remote areas

How SureChill Partnered with MFIs to Unlock Commercial Viability

SureChill partnered with MFIs in Kenya to strengthen affordability and improve cash flow. MFIs integrated SureChill's solar-powered cooling systems into their broader energy portfolios, enabling them to finance a diverse user base directly. They paid SureChill the full unit cost upfront, while end users repaid the MFIs over time. This approach helped SureChill maintain commercial viability even while serving users living on low incomes.

How Inficold Strategically Focused on Large Scale Users with High Liquidity

Inficold's deliberate focus on large scale users, such as dairy cooperatives and institutional buyers, enabled the company to achieve operational efficiencies and scale. With stable cash flows and predictable demand, these users did not face the same affordability constraints that typically hinder uptake among SHFs. By prioritising financially stable segments, Inficold was able to accelerate deployments, minimise risk, and maintain healthy cash flow. This strategic targeting has been central to their commercial growth, demonstrating that a viable business model does not have to come at the expense of impact. In fact, by leveraging economies of scale and reinvesting in inclusive channels, Inficold has expanded its reach while ensuring its solutions remain financially sustainable.

with limited energy access. However, poor local infrastructure and road networks inflate distribution costs in these areas. Meanwhile, dispersed demand drives up per-unit logistics expenses, and SHFs' limited ability to pay constrains achievable margins. Together, these factors undermine commercial viability.

(iii) Technology Model: High spec solar cooling systems offer strong commercial viability, but their high capital and operating costs limit uptake among people living on low incomes. On the other hand, passive and low-tech systems like evaporative coolers and zero-energy chambers deliver broader impact due to their affordability and local adaptability. However, passive cooling products generally cannot be used for situations that require rapid cooling or low temperatures.

Conclusion

Cooling solutions for users living on low incomes can have significant social impact. However, long-term success depends on acknowledging that commercial viability is not optional, since this is what sustains scale and impact over time. Each strategic decision, from market orientation and technology design to financing mechanisms, must therefore be shaped by this reality. When commercial viability is embedded from the beginning, cooling interventions can grow beyond pilots and subsidies to deliver lasting, inclusive impact at scale.

4

Capital is Ineffective if it is not Tailored to the Unique Cash Flow Profiles and Long Returns on Investment in the Cooling Sector

Throughout our time supporting the cooling sector, we have seen many companies fail to scale their business models because of a lack of appropriate financing mechanisms and options available in the sector.

Solar cooling solution providers use asset-heavy models with large upfront capital expenditure (CAPEX) required to manufacture, install, and deploy units. This is due to (i) the high cost of specialised key components, (ii) limited economies of scale for smaller companies, and (iii) the lack of local manufacturing in Africa, which in turn increases logistics and tax costs in this region.

In addition, for cooling solution providers serving people living on low incomes, direct and outright sales are not possible due to affordability concerns. Therefore, PAYGo or CaaS models are used, and these either have long payback periods or significant time is required to recover the initial investment.

Finally, despite the large market opportunity for these solutions, there is slow uptake of cooling products due to a lack of consumer awareness and affordability issues, often leading to companies holding stock for long periods of time.

Given these interlinking and nuanced challenges in the cooling sector, we need more focus on developing fit-for-purpose financing models. These models can leverage several types of finance, including patient and concessional capital; sector-specific funds offering long-tenure working capital financing; blended finance stacks; results-based financing (RBFs); and the integration of carbon credits. Currently, most of the financing available approaches cooling with the same assumptions used for asset-light, mass-market solutions with quick turnover, broad consumer appeal, and short cash cycles, such as solar home systems (SHS). These expectations are often misaligned with the realities of cooling, leading to unsuitable financing structures for this sector.

Conclusion

All stakeholders need to work together to change the perceptions of the cooling sector and start developing relevant and appropriate financing structures. Otherwise, we risk setting up companies to fail, even those with all the other ingredients needed to be successful.

5

Delivering Impact through Cooling Requires more Practical and Enforceable Policies – and Solutions Aligned with Existing Government Priorities

Policy plays a vital role in supporting access to PUE technologies, including cooling. With the right government incentives – such as tax breaks, duty exemptions, or import waivers – cooling solution providers can significantly reduce the costs of deploying assets. Lower costs can also drive down prices for end users.

However, we have also learned that having the "right" policy on paper is not necessarily enough. Our experience across markets has surfaced three key insights that have reshaped how we think about the role of policy in enabling cooling solutions for underserved populations:

(i) Aligning Cooling Solutions to Existing Government Priorities and Incentives Enhances Market Uptake. Governments generally set policies based on industries or sectors rather than on technologies. Therefore, there are unlikely to be "cooling policies". However, the cooling sector can position itself as an enabler within government-priority sectors to improve those sectors' competitiveness or reduce PHLs. If a government is already focused on boosting a specific agricultural sector, it is easier to advocate for policies that support cooling as a facilitator for improving productivity and export-readiness in that sector. These policies include import duty waivers and VAT exemptions.

For cooling solution providers, this also means carefully evaluating the sector or value chain they plan to serve and identifying whether any existing government incentives can be leveraged to support uptake and affordability.

(ii) Effective Policies Hinge on Alignment with Real-world Market Dynamics. In many value chains across SSA, produce is traded in open-air markets, roadside stalls, and small-scale collection centres, where regulatory oversight is minimal or non-existent. Imposing strict temperature requirements for the supply chain of produce does little to shift behaviours in these informal markets. This is because traders operating on razor-thin margins may struggle to comply fully with regulations, enforcement is difficult, and consumers concerned with affordability may be less inclined to insist on formal market standards. Policies created to reduce PHLs are most effective when they consider how and where they will be implemented.

(iii) Fiscal Incentives Alone are not Enough; without Parallel Capacity Building, Implementation can Falter. While tax breaks and other policies can significantly lower the cost of deploying cooling solutions and improve their commercial viability, their impact can also be undermined by limited institutional capacity. In some cases, customs officers lack the training and tools to verify eligibility, resulting in inconsistent application of the policy.

How Inficold Leveraged Government Trends

We saw this in India, where Inficold initially focused on horticulture, but later shifted its strategy toward dairy. This shift was informed by the fact that the Indian government had prioritised the dairy sector and introduced incentives and fee waivers that created a more enabling environment. This reinforced dairy as a strategic focus for Inficold and provided a stable foundation for growth. They were able to develop a commercially sustainable model and achieve steady cash flows through the dairy market, the company has since re-introduced its horticulture business.

How SureChill felt the Impact of Limited Enforcement Training

We saw this first hand with SureChill, which faced implementation delays due to gaps in policy interpretation and enforcement. Kenya's National Energy Policy 2025–2034 explicitly waives duties on solar energy development equipment, but after gazetting the policy, the Kenya Revenue Authority (KRA) took nearly six months to update its tariff schedules and train officers on the new exemptions. During that window, SureChill's imports were assessed at full duty, forcing the company to temporarily pass on additional costs to users until proper clearances were issued.

Conclusion

At Shell Foundation, we believe that effective transformation of the cooling sector hinges on focusing on areas that are already priorities for relevant governments, and within those, advocating for realistic and impactful policies. These policies should be paired with targeted capacity-building initiatives to ensure enforceability.

3 CALLS TO ACTION

We have seen encouraging momentum in the cooling sector, from growing investments to a surge of interest in innovation and new business models. Still, there remains significant untapped potential that could enhance the sector's impact and sustainability.
Building on the context and insights presented in this report, this section offers targeted Calls to Action for cooling solution providers, development partners (including donors and foundations), investors, and policy advocacy parties across four key outcomes:

1. Increasing the utility of cooling solutions
2. Building commercially sustainable companies
3. Securing relevant and effective financing
4. Aligning sector needs to actionable policies

These recommendations are designed to help accelerate adoption, improve livelihoods and incomes, and contribute to a more coordinated, inclusive, and commercially viable cooling ecosystem in emerging markets.

Cooling Solution Providers:

Cooling solution providers are at the forefront of designing and delivering impactful and sustainable cooling solutions. Their role is critical in driving innovation, testing business models, and serving people living on low incomes.

Themes	Calls to Action
Increasing the utility of cooling solutions	**Design flexible cooling products** that can either meet the specific needs of customers or that can address multiple needs and use cases to increase the utility of the cooling solution. Modular or adaptable solutions further enable companies to pivot quickly based on customer demand and crop seasonality. **Collaborate with Research institutions, local manufacturers, and product design innovators** to reduce the capital and maintenance cost of cooling units. Lower-cost, high-efficiency technologies can increase affordability while preserving commercial viability. **Forge Partnerships across the Agriculture Value Chain** with aggregators, logistics providers, and training/input suppliers, to ensure cooling is part of an end-to-end service offering. This enhances produce quality and unlocks premium market access for SHFs
Building commercially sustainable companies	**Partner with MFIs and fintech providers** to offer affordable, flexible credit that reflects SHF cash flow cycles and risk profiles. These financing channels improve adoption while ensuring that repayment schedules align with agricultural realities. Additionally, this reduces the burden on cooling solution providers to act as financiers for consumer adoption themselves, allowing them to maintain liquidity and focus their capital on infrastructure. **Pursue B2B partnerships** with anchor clients such as agribusinesses, retailers, or cooperatives to create more stable revenue streams. These larger customers typically offer more predictable demand and have greater purchasing power, enhancing overall financial reliability and affordability. **Build a wider base of customers from higher-income or urban segments and leverage resulting revenue to subsidise services** for people with low incomes. This approach can improve affordability while maintaining financial sustainability for the company.
Securing relevant and effective financing	**Identify and engage investors aligned with the asset-heavy nature of cooling,** recognising that not all investors are suited to finance models with long payback periods. Clear communication regarding cash flow cycles and asset ownership structures can help attract partners who understand and support long-term growth. **Break down the business model into investable segments,** such as asset deployment, service delivery, and aggregation, to enable different funders to support different functions based on their risk appetite. This approach ensures better alignment between capital sources and company operations.

Themes	Calls to Action
Aligning sector needs to actionable policies	**Align product and deployment strategies with national development goals** and agricultural strategies to improve policy compatibility (e.g. targeting the dairy industry as a use case for cooling if it is known that the government in its mandate to promote the industry may provide incentives – such as tax reliefs for organisations operating in the industry) and unlock government support. This can open opportunities for participation in public procurement or subsidised programmes. **Actively engage in public–private dialogue** to ensure company needs and user realities are considered in policy formulation and implementation. Examples include participation in sessions about promoting dairy production output in Nigeria given the government's identification of the dairy industry being seen as strategic to food security.

Development Partners (Donors, Foundations, and Programme Designers):

Development partners play a catalytic role in bridging gaps, brokering partnerships, and de-risking innovation.

Themes	Calls to Action
Increasing the utility of cooling solutions	**Broker strategic partnerships** across the agricultural value chain, linking cooling solution providers with logistics firms, input suppliers, and market actors to ensure cooling solutions are actively used and integrated into SHFs' production decisions. Coordinated ecosystem support is vital for the success of cooling interventions, to increase the utility of cooling solutions through and end-to-end approach. **Ensure internal collaboration** between energy and agriculture teams within donor organisations when designing interventions, so cooling is treated as a cross-sectoral enabler rather than a siloed technical solution. Bundling cooling with market access or agronomic training can significantly boost its effectiveness.
Building commercially sustainable companies	**Create an open-access research hub or knowledge portal** to share relevant market data, value chain analyses, and technical evaluations. This reduces duplication, accelerates learning, and supports smarter business and programme decisions. **Design programmes that expand access to underserved low-income segments, while steering companies toward models that can become viable over time.** Smart subsidies should de-risk innovation and market entry, but with a clear path to long-term sustainability – the goal is to support inclusion without creating market distortions.

Themes	Calls to Action
Securing relevant and effective financing	**Use concessional financing** to provide risk-mitigating capital, such as TA, RBFs, or guarantees that incentivise relevant financing into this sector. Development partners can also create technology-specific funding facilities that can be used to pool capital from various investors (*see investor section below for recommendations for relevant financing*). **Fund business models** that help funders and policymakers understand realistic cash flow dynamics, repayment timelines, and return expectations.
Aligning sector needs to actionable policies	**Provide governments with targeted TA** focused on policy implementation, not just policy drafting. This could be through supporting ministries in designing, operationalising, and enforcing fiscal incentives, regulatory frameworks, and public procurement schemes. **Align programme design with government priorities** to maximise relevance and uptake. When governments are focused on strengthening specific agricultural value chains, for example, programmes can position cooling as a critical enabler. This enhances the case for policy support and increases the likelihood of adoption and long-term sustainability.

Investors

Investors have the capital and experience to guide market-shaping investments and ensure business sustainability.

Themes	Calls to Action
Securing relevant and effective financing	**Develop tailored financial products** that are reflective of the cooling sector's life cycle. Cooling solution providers require longer-term CAPEX and working capital financing that is affordable. Investors can leverage Special Purpose Vehicles (SPVs) to remove assets from a company's balance sheet and create more predictable cash flows that can be financed with more traditional asset-heavy capital. **Form strategic partnerships** with donors and otWher investors to jointly fund end-to-end cooling solutions, including cold storage assets, reliable energy supply, and transport networks. Co-investing can mitigate risks and build investor confidence in complex, multi-stakeholder models.

Policy Advocacy Partners:

While governments have a critical role to play in sustainable cooling, these recommendations are framed for policy advocacy partners, who can bridge public-private gaps and encourage policy that reflects on-the-ground needs.

Themes	Calls to Action
Increasing the utility of cooling solutions	**Promote collaborative cooling policies** that span agriculture, energy, and trade ministries, preventing fragmented efforts while aligning with national development priorities.
Building commercially sustainable companies	**Facilitate dialogue between government and industry** to better match policies to commercial realities. Advocacy partners can help bridge information gaps and ensure that support mechanisms are grounded in real-world needs. **Help companies navigate policy environments** and access existing support schemes, increasing uptake and alignment with public initiatives.
Aligning sector needs to actionable policies	**Promote training and capacity building for policy implementers,** particularly in areas like customs enforcement and rural deployment. Without capacity, even well-designed policies can falter. **Encourage feedback loops between government and market actors** so that policy can evolve in response to on-the-ground realities and improve over time.

3 CONCLUSION

Our work with cooling solution providers across SSA and India has made one thing clear: scalable and inclusive impact demands more than just innovation – it requires coordinated efforts from various stakeholders. From how agricultural produce moves through the value chain to how cooling solutions are financed and supported by policy, all parts of the system must work together. We believe cooling is at a pivotal moment of opportunity. The path forward is to remain committed to this effort and call on others to join us in making cooling a lever for economic opportunity and resilience at scale.

Unlocking Active Cooling Potential

Lessons learnt from our investments in Sub-Saharan Africa and India

June 2025