



Creating a More Resilient Food System Through Sustainable Refrigeration



THE PROBLEM

- ➔ **690 million people** go without enough food. What's more, **25–30% of food** is lost or wasted every year.
- ➔ Close to **14% of food** is lost unintentionally between harvest and distribution, meaning a high proportion of food grown never makes it to the market.
- ➔ It's estimated that food loss and waste accounts for **8–10% of global greenhouse gas emissions**. Most of this food loss is due to a lack of effective cold storage, such as refrigerators.

Cold storage technologies are essential to keeping produce such as fruit, vegetables, and milk fresh.

Smallholder farmers produce **one third of the world's food**, yet many cannot access cold storage to preserve their harvest and enable them to reach new markets.

Refrigeration is expensive and low-income farmers cannot afford the high upfront costs. In rural areas, electrical connections are often unstable, so people with access to refrigeration cannot power appliances reliably.

Climate Change and Food Security

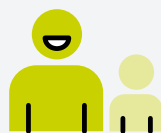
Our global food system accounts for around **20–35% of global greenhouse gas emissions**, contributing significantly to the climate emergency. Climate change causes more frequent droughts and unpredictable weather patterns, impacting crop yields. This places additional strain on smallholder farmers working to grow food and earn a living. In Sub-Saharan Africa alone, nearly **USD 4 billion** worth of food is lost per year, which is enough to feed 48 million people.

Why Solar-Powered Cold Food Storage?

Improving access to cold storage facilities could:



save up to
**14% of global
food production**



help feed **950 million
people every year** by
giving them access to
fresh, safe food



it's estimated that at least
15,500TWh more electricity
will be required by 2050 to
provide access to cooling for
those who need it...



... that's as much as
two-thirds of today's
global power demand

EFFICIENCY FOR ACCESS

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WHAT'S THE SOLUTION?

The [Low Energy Inclusive Appliances \(LEIA\) programme](#) is a research and innovation programme that seeks to double the efficiency and halve the cost of a range of electrical appliances for those who lack access to grid electricity.

Efficiency for Access supports organisations working to advance sustainable cold food storage through the [Efficiency for Access Research and Development Fund](#), which is part of LEIA, and the [Global LEAP Off-Grid-Cold-Chain Challenge \(OGCCC\)](#).

Collectively, they have supported 20 organisations with over £1 million in grant funding.

The Efficiency for Access Research and Development Fund is funded by UK aid and the IKEA Foundation. The Global LEAP OGCCC is funded by the DOEN Foundation, the IKEA Foundation, UK aid, and Good Energies Foundation.

Impacts

BARRIER	Limited research and development into solar-powered cold food storage facilities in low-income markets	Solar-powered cold storage facilities are expensive	Potential environmental impacts
ACTIVITIES	<p>The Efficiency for Access Research and Development Fund has deployed over £945,000 in funding for seven organisations working to improve access to sustainable cold food storage facilities. This helps enable people with low incomes, such as smallholder farmers, to access cold storage.</p>	<ul style="list-style-type: none"> • Efficiency for Access has supported 14 organisations through the Global LEAP Off-Grid Cold Chain Challenge. • This enables companies to test, innovate and strengthen their business models, and identify and build relevant partnerships for their target markets. • The competition helps to identify and promote the most energy-efficient, sustainable, and cost-effective technologies that can meet the cold storage requirements for fresh fruit, vegetables, fish and dairy products. 	<ul style="list-style-type: none"> • LEIA carried out a life-cycle evaluation to determine the environmental impact and performance of solar-powered refrigerators and cold storage technologies. The research offers recommendations to improve product life cycles and reduce e-waste. • The research demonstrates how highly efficient, solar-powered cold rooms could reduce greenhouse gas emissions by displacing fossil use.



Case Study: Tackling Food Loss in Nigeria

In Nigeria, close to **50 million people** lack electricity and access to basic refrigeration, and many farmers cannot access effective cold storage facilities.

- ➔ Around **40–50%** of fresh fruit and vegetables are lost between the farm and market.
- ➔ Over **12%** of the population is undernourished, and **2 million** children suffer from acute malnutrition.
- ➔ Smallholder farmers in Nigeria lose **25%** of their annual income due to food waste.



ColdHubs is a social enterprise in Nigeria working to improve access to solar-powered walk-in cold rooms. Farmers can store their food in its cold rooms, paying a daily flat fee for each crate of produce. In 2018–19, ColdHubs received first prize in the Global LEAP Off-Grid Cold Chain Challenge (OGCCC) competition for its innovative business model, selling cooling as a service.



Joy Franklin

Farmer and ColdHubs user, Nigeria

I feel very bad when our vegetables go bad because even if we couldn't sell it, we still have to pay for transportation and then the people that helped us harvest it. We started using ColdHubs last year and it has been very helpful for us. I know the losses, and I know how it feels to not be able to make profits when you're working so hard.

Since 2019, the Efficiency for Access Research and Development Fund has supported ColdHubs to develop a more affordable and efficient cold room. With the funding, ColdHubs has completed the design and lab testing of its second-generation cold room and achieved the following outcomes:

GREATER STORAGE CAPACITY: with the efficiency gain, ColdHubs can develop larger, 10-tonne cold rooms compared to the previous 3-tonne rooms. Farmers will be able to store more produce, and ColdHubs will be able to support more customers.

IMPROVED EFFICIENCY: the second-generation cold room is up to 200% more efficient.

COST REDUCTION: through the reduction in battery size ColdHubs has reduced the costs required to manufacture the cold rooms.

E-WASTE REDUCTION: it only requires eight batteries compared to 24, resulting in 67% less e-waste.

ColdHubs is participating in the 2021 – 2022 Global LEAP OGCCC competition.

ColdHubs has supported **5,250 farmers, retailers, and wholesalers**, stored over **52,700 tonnes** of fresh fruit and vegetables, and avoided an estimated one million kg of CO₂ emissions.



Success Stories: The People Behind the Cold Food Storage



Jiten Ghelani

CEO, Promethean
Power Systems, India

- ➔ Jiten Ghelani is the CEO of Promethean Power Systems in India. Promethean Power Systems is testing a new model for increasing access to reliable refrigeration for dairy farmers in rural villages across India. The Efficiency for Access Research and Development Fund supports its project.

“*We work to bring reliable access to refrigeration for smallholder farmers in emerging markets, especially in areas where power is unreliable or unavailable. We offer our equipment to a variety of dairy and food companies in India and have now reached over 2000 villages and 75,000 farmers. The funding from Efficiency for Access has really been instrumental for us.*”

- ➔ Hellen Nachuch is a fish trader in Kenya who uses Adili Solar Hubs' solar-powered ice machine to keep her fish fresh. This helps keep the fish fresh for longer, increasing its economic value by up to four times. Adili Solar Hubs is developing its solar-powered ice machine alongside a water purification unit with support from the Efficiency for Access Research and Development Fund.



Hellen Nachuch

Fish Trader, Kenya

“*The fresh fish is sweeter than dried, and attracts better prices. Also, the dried fish needs lots of troublesome preparation, but fresh fish sells easily without preparation.*”



Adebisi Adebayo

Self Chill trainee
and entrepreneur

- ➔ Adebisi Adebayo works as a Solar Cooling Engineering Self Chill trainee and entrepreneur. Solar Cooling Engineering develops key cooling components that can be built locally by small-scale farmers. This allows entrepreneurs such as Adebisi to earn a living and reduces food spoilage at the farm-gate. The Efficiency for Access Research and Development Fund supports its project.

“*I have designed and installed a modular solar cooling system within my institute premises, to address post-harvest losses in fruit and vegetables. Also, as an entrepreneur, I gave onsite technical assistance for the installation of 1 metric tonne solar-powered storage chamber for Ecotutu Nigeria Ltd.*”

Efficiency for Access has helped catalyse over **£200 million** to support technology innovations for energy efficient appliances that are powered by distributed renewables.

Through continued investment, we can create resilient and greener food supply chains for all. To learn more, visit efficiencyforaccess.org