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GLOBAL LEAP AWARDS

The Global LEAP Awards Off-Grid Cold Chain Challenge

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Cold Chain Market in SSA

40-50% Percentage of food in SSA that perishes before it reaches the customer[1] [2]

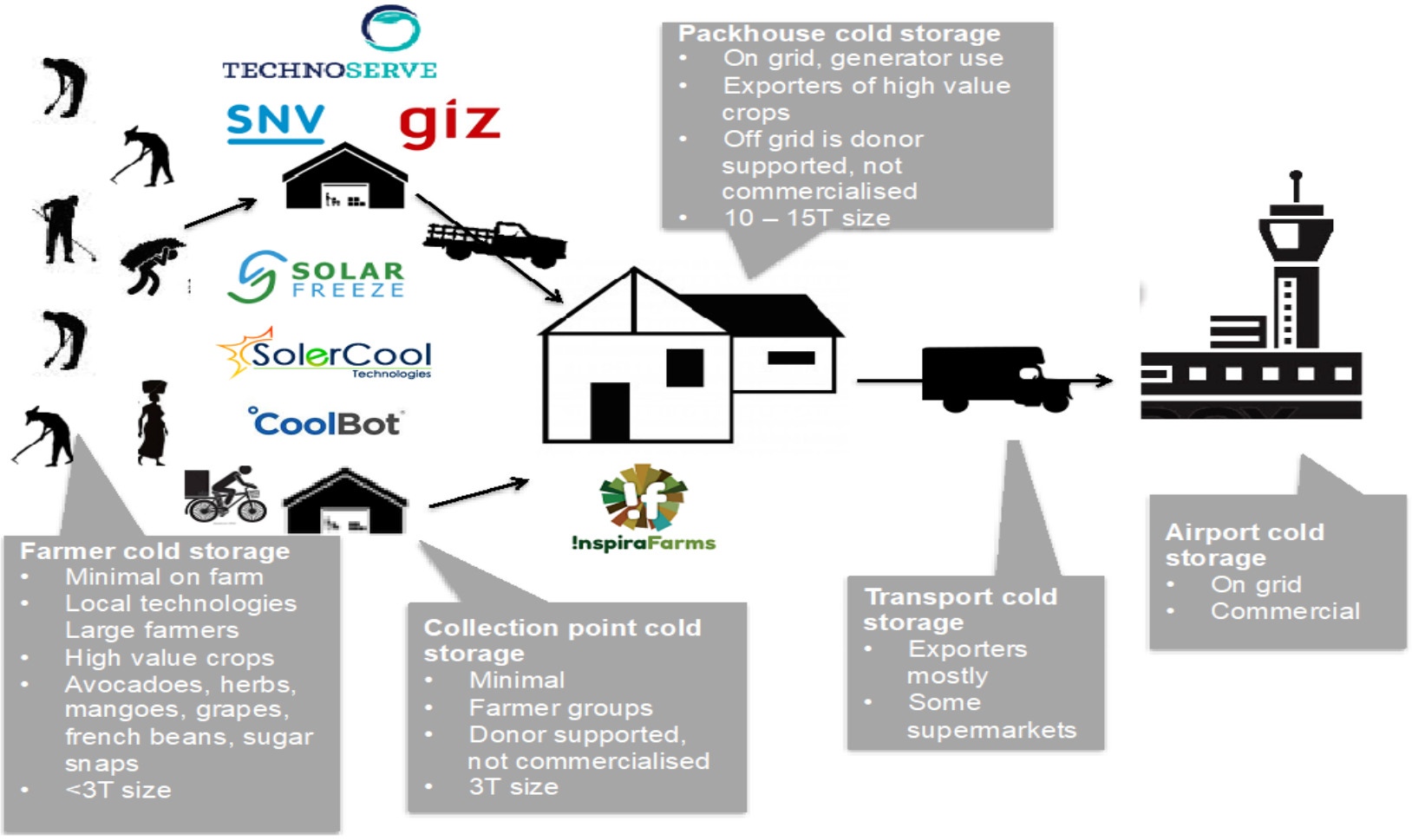
Percentage up to which post-harvest food losses could be saved through cold storage solutions[3] **30%**

1.5m Number of off-grid farmers serviceable with cold storage solutions by 2030[1]

Market opportunity by 2030[1] **US$ 1.32b**

[1] http://www.fao.org/3/a-i3950e.pdf
[2] http://www.inspirafarms.com/whats-new_may2018/
[3] https://storage.googleapis.com/e4a-website-assets/Clasp-SOGAM-Report-final.pdf
[4] https://www.powerforall.org/application/files/8015/9309/0870/TECHNOLOGY_SPOTLIGHT_COLD_STORAGE_FOR_AGRICULTURE1.pdf

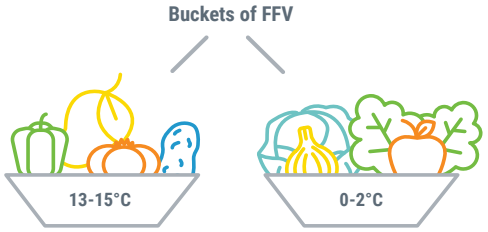
Cold Chain Elements: Kenya example



Types of Cold Chain in Off-Grid Areas

Fresh Fruits, Vegetables, and Flowers

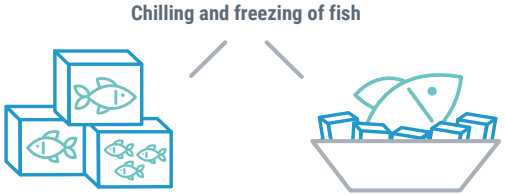
- FFV have significantly different cooling requirements for storage. The following table shows some examples of different cooling requirements for various fruits and vegetables. For example, the recommended storage temperatures for bananas, cucumbers, and tomatoes are somewhere between 10-15°C. However, the recommended storage temperature for apples, cabbages, and lettuce are much lower – close to 0°C.



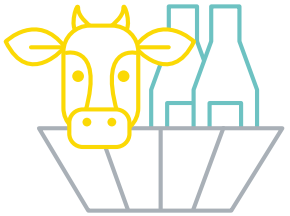
- Pepper, Mango, Tomato, Potato
- Cabbage, Onions, Lettuce, Apples

Meat and Fish

- Meat and fish, once slaughtered and processed, are either frozen or chilled just above freezing as they make the journey to their final resting plate. The cooling process usually begins with one of three approaches: liquid cooling, ice slurry cooling, or combined blast and contact cooling. Fattier fish are typically stored at -21°C while leaner fish is cooled to -18°C. While freezing is the most common approach to fish cold transport, the freezing process can cause ice crystal formation in the protein leading to drip-loss, reduced ability to hold water, and textural deterioration. To avoid the negative effects of freezing some fish cold chains use ice glazes and transport conditions that range from -0.9 – 2°C.

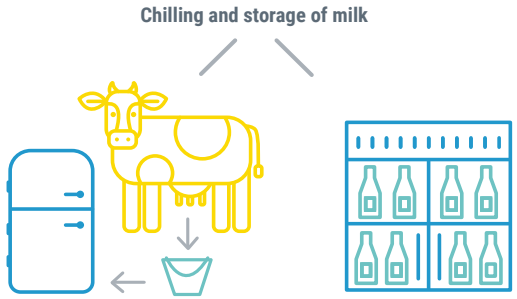


- **Freeze:** -18 to -21°C depending on fat content
- **Chill:** -0.9 – 2°C Flash cooling to just below freezing before transport allows small ice crystals to form limiting textural damage and prolonging shelf life.



Milk Chilling and Storage

- Freshly harvested milk contains few microorganisms. However, the microbial growth will rapidly increase under warm temperature, and international organizations like WHO and FAO have developed detailed guidance on proper chilling and storage of milk to account for this:

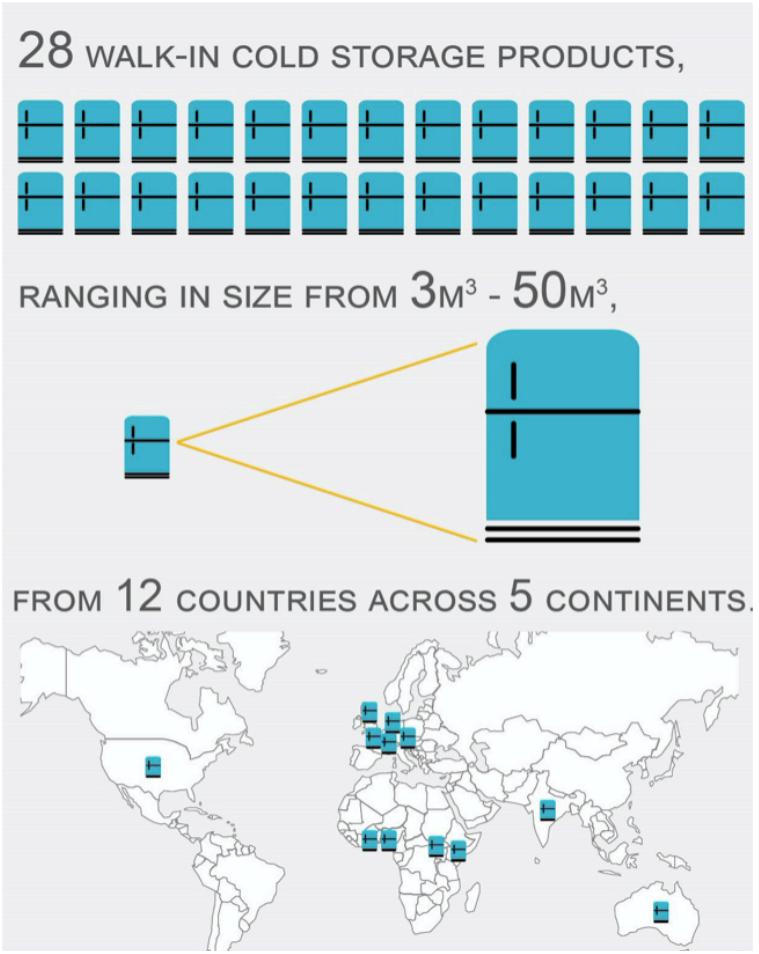


- **Stage 1 Milk Chilling:** Freshly produced warm milk cooled to 10°C within two hours and to 4°C within three to four hours after milking.[1]
- **Stage 2 Milk Storage:** Milk stays cool for at least 12 hours with a temperature rise of no more than 1°C at an ambient room temperature of 30°C.[2]

1. FAO. (2016). Technical and investment guidelines for milk cooling centres. Chapter 6. Refrigerated milk cooling tanks.
2. Ibid.

Overview of the Global LEAP Awards Off-Grid Cold Chain Challenge

- **Goal:** To identify & promote the most energy-efficient, sustainable and cost-effective technologies that can meet the cold storage requirements for various cold chains in off-grid areas
- **Focus**: Walk – in cold storage rooms solutions
- **Deployment Scope**: Nigeria, Ghana, Senegal, Sierra Leone, Burkina Faso, Rwanda, Tanzania, Kenya and Uganda
- **Timeline**: 2 years- Mar 2018 - Nov 2019
- **Structure**:
  - 1st Stage- Written submissions
  - 2nd stage – Field Test Evaluation



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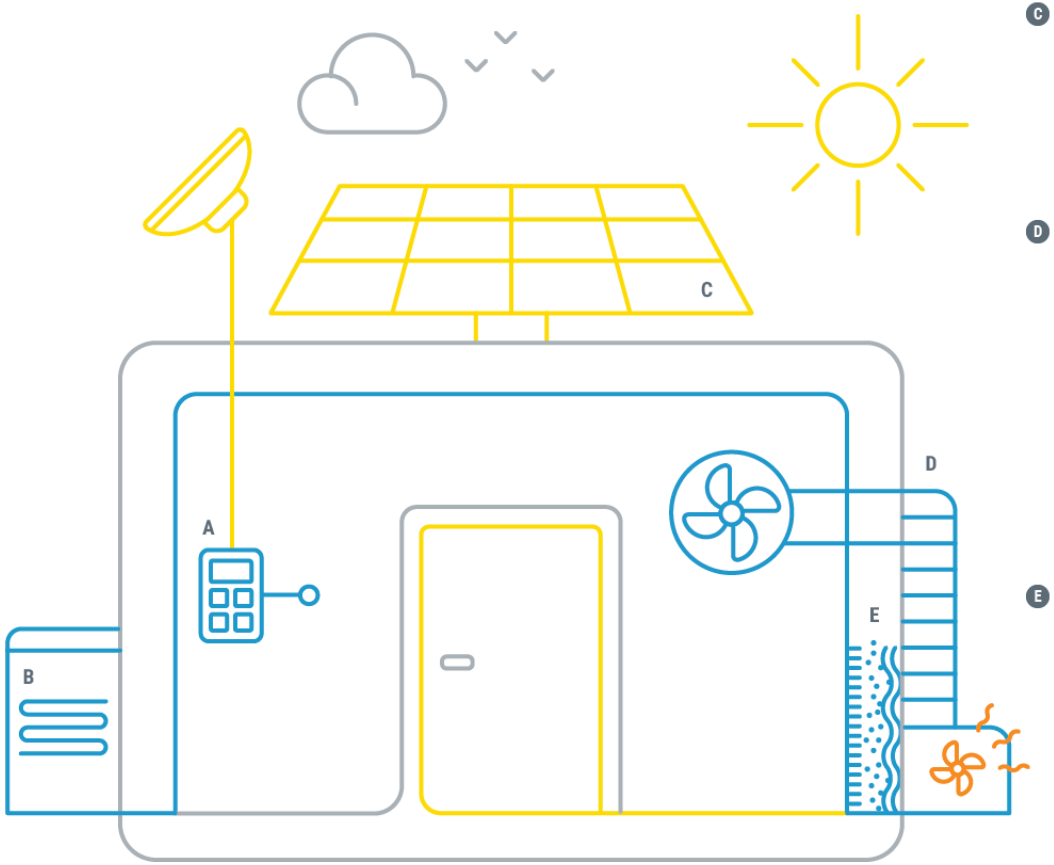
Off-Grid Cold Storage Unit Components

A Remote Monitoring and Sensors

- Door openings
- Humidity and temperature
- GSM enabled for real-time updates

B Thermal Storage

- Phase change material embedded in the unit as thermal plates leading to over 24h autonomy
- Battery storage – battery sizing varies considerably by location



C Solar Array

- Typically positioned over the container to create shade
- Sizing ranges from 1.5kW to 8.9 kW
- Nominal voltage is either 24 or 48V

D Cooling Unit

Two types of Cooling Units predominate this space

- Augmented on the shelf split AC Unit – Several companies have developed a charge controller that overrides the lower limitation on a traditional AC unit allowing the unit to operate at the optimal temperature for a given produce
- Bespoke compressor based cooling unit
- Storage size ranges from 9 cbm to 90 cbm. Smaller units are usually deployed in markets

E Insulation

- Poly Urethane Foam (PUF) siding with Aluminum cladding 80-150mm thick
- Recycled shipping container retrofitted with Spray foam
- Clay Bricks with recycled plastic bottles

Off-Grid Cold Storage Business Models

Cooling as a Service (CaaS)

- Cooling as a Service is a business model whereby the customer pays for cooling on a usage basis rather than purchasing the cooling equipment directly.[1] This model creates incentives that optimize efficiency and maintenance. In off-grid settings this approach to cooling is particularly attractive due to its low capital intensity and minimal technical capacity requirement for the end user. A traditional **unit sale** business model is uncommon outside of donor supported NGOs and governments. In the off-grid cold storage sector we see companies experimenting with two distinct types of service models:

Pay-as-you-store

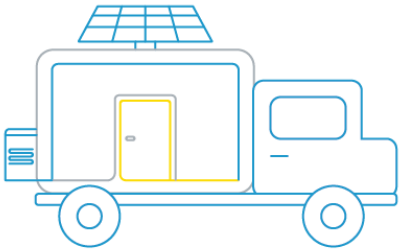
- **Pay-as-you-store models** charge customers per day for an allotted space within the cold storage unit, typically delineated with some type of reusable tray, or crate. This business approach is particularly attractive for small market vendors without access to electricity or safe storage who would like to prolong the shelf life of the perishable goods the sell.

Leasing models

- **Leasing models** are usually offered to larger farms or farming cooperatives that act as aggregators for their members.

- **IoT and Maintenance** - Advanced sensing and IoT controls allow leasing models to be monitored in real time and controlled remotely. This limits leasing risk for the company allows for preventative maintenance. The user benefits from reduced operational oversight, better unit performance and lower operating costs.

- **Portability shared user base** - Some companies build their unit's so they are easily transported. This allows the owner of the unit to take advantage of multiple growing seasons in different geographies, reducing the time it takes to pay off the unit. Users benefit by only paying for cooling during the time of year they need it.



1. KCEP. 2018. Cooling as a Service (Caas). https://wwwk-cep.org/wp-content/uploads/2018/07/Cooling-as-a-service-Knowledge-brief-6.7.2018_Final_online_v1.pdf

Meet The OGCCC Finalists

1st Place - Cold Hubs

2nd Place - EcoZen Solutions

3rd Place - FreshBox

Runner Up - Ecolife

Competition Challenges and Support

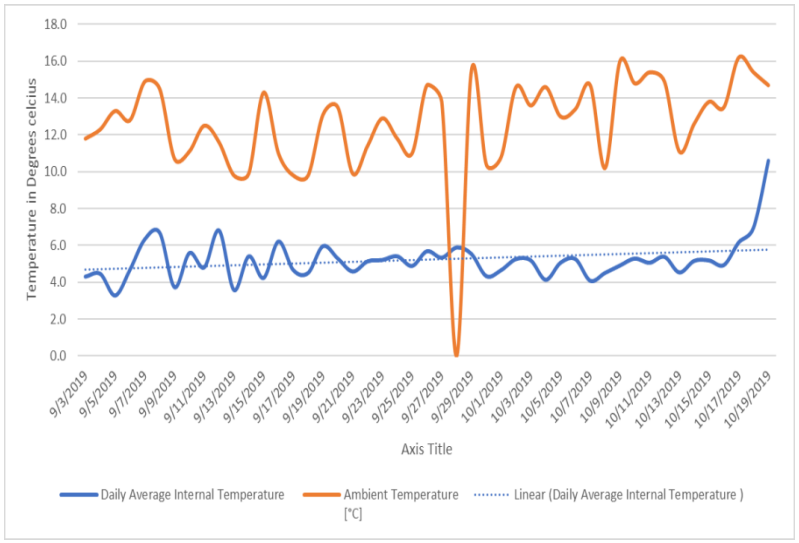
Challenges	Number of Companies
During Deployment	
Inability to find viable local partners	4
Lack of Funding	1
Lack of Support to set up a local presence	1
After Deployment	
Logistics and transport to remote areas	3
Technical issues with cold rooms	4
Unclear importation requirements	2
Difficulty obtaining local permits and security	1

- **Support from the Competition**
  - Advanced cash to companies to help cover deployment costs
  - Extended the project timeline to allow for more time to finalize partnerships
  - Project team support in negotiation custom clearance
  - Feedback based on data collected to address technical issues

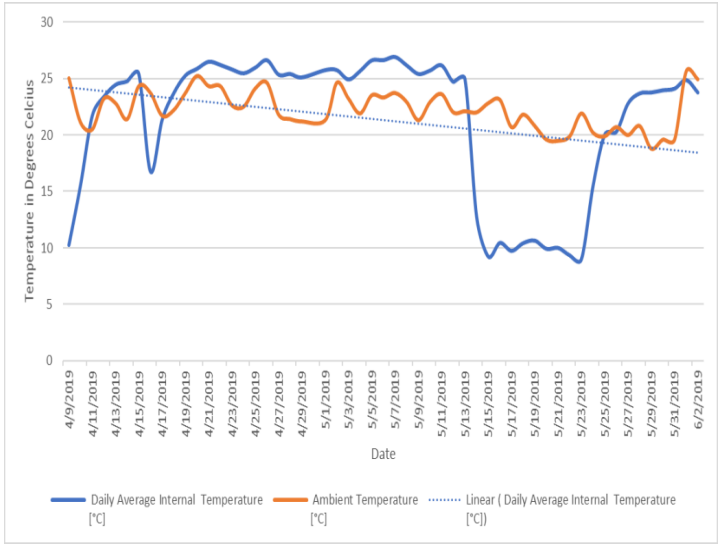
Competition Challenges: Examples

Performance results : Daily Average Internal Temperature and Ambient Temperature over Test Period

Unit A



Unit B



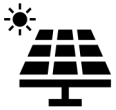
Challenges with the Wider Sector

Value Proposition for End Customers

Business Model Fit

Consumer Education on Technology and Post-Harvest Best Practices

Partnerships

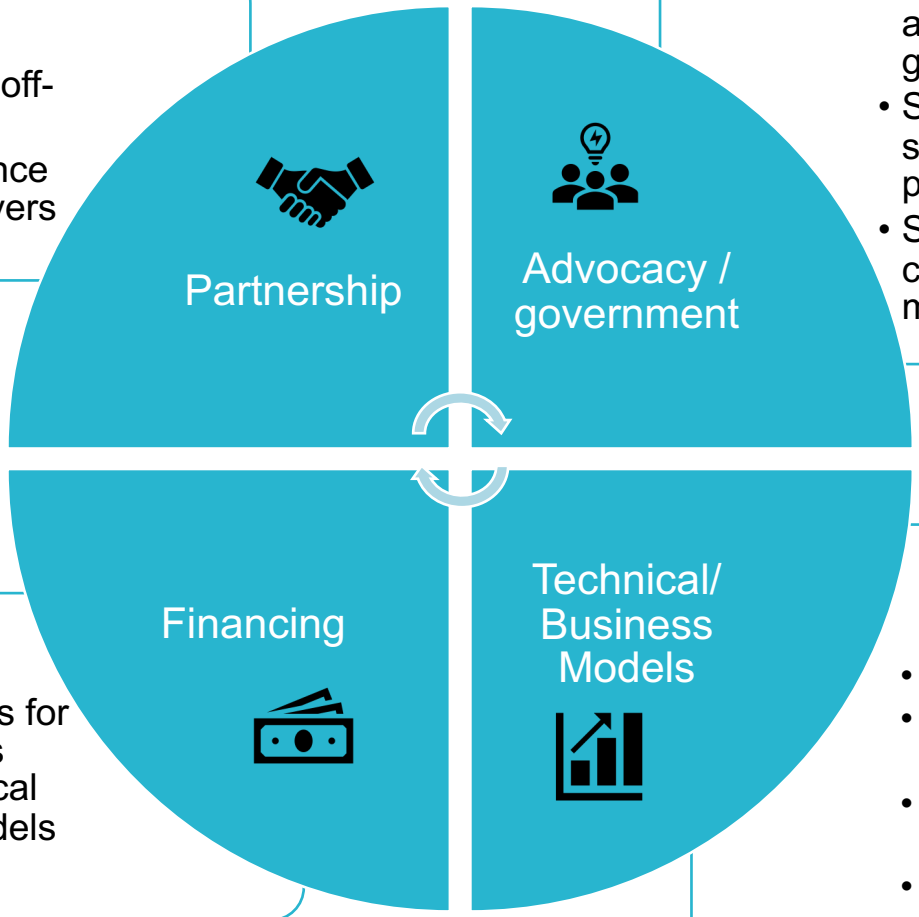


Local Technical Expertise

Quality Vs Price Vs Use Context

Advocacy / Education of investors, governments financial institutions and donors

Learnings & Feedback from the Sector



- Identification of partnerships and market linkages / off-takers
- Planning conference for the sector players

- Awareness creation and advocacy to government entities
- Support governments setting up a cooling plan
- Set policy standards for chilling in emerging markets

- Provision of grants for long-term projects supporting technical and business models

- Mobile cold solutions
- Support companies in higher risk countries
- Focus on high value crops
- Training and capacity building for farmers

COVID-19 Impact on Cold Storage in SSA

Positive Impacts

- Increased cold room usability cases
- Increased demand of cold storage by consumers
- Inclination of companies to invest in vaccine refrigeration

Negative Impacts

- Restricted movement and market closures
- Supply disruptions
- Redirection of funds to COVID-19 relief
- Impact is country-specific

Cold Chain Programmes & Funding Opportunities

Cleanleap have a research program called **The Cold Challenge.** The Challenge is to produce a new cold chain-based model to provide safe, reliable, simple to operate and easy to maintain mechanical based solutions that enable nations to leapfrog over the unsustainable development phase experienced by the mature economies; a 'cleantech leapfrog'.

The **SolarChill Project** aims to demonstrate the reliable and increasingly affordable use of the SolarChill technologies for medical, household and commercial purposes.

Green Cooling Initiative (GCI) aims to establish a global Green Cooling Network, which will accelerate the transfer of environmentally friendly technologies in the refrigeration and air conditioning sectors to and within developing countries.

Cool Coalition is dedicated to inspiring ambition, mobilizing action on clean and efficient cooling to avoid emissions and support Kigali Amendment.

The **Alliance for a Green Revolution in Africa (AGRA)** and UPL Limited, through a major Public Private Partnership today launched the "**Million Tons of Cold Storage in Africa Initiative**". The initiative aims to mobilize USD ``2 Billion in the next decade to set-up cold storage facilities with a capacity of a million tons across Sub-Saharan Africa.

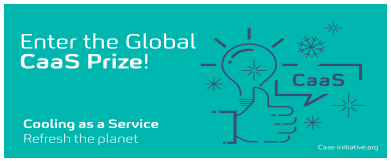
Cold Chain Programmes & Funding Opportunities

The **Global Cold Chain Alliance (GCCA)** is committed to building and strengthening the temperature-controlled supply chain around the world. As part of that mission, GCCA provides specialized cold chain advisory services to government agencies, organizations, and associations.

The **Kigali Cooling Efficiency Program (K-CEP)** is a philanthropic collaborative that works in tandem with the Kigali Amendment of the Montreal Protocol by helping developing countries transition to energy-efficient, climate-friendly, and affordable cooling solutions.

Efficiency for Access coalition invest into Research and Development (R&D) projects that lead to the acceleration of availability, affordability, efficiency and performance of a range of Low Energy Inclusive Appliances that are particularly suited to developing country contexts.

EWB-USA launched an initiative called **The Chill Challenge** to catalyze innovative solutions and bring affordable refrigeration to improve the lives of those far removed from the grid in developing countries.



Cooling as a Service Initiative is a global effort launched in early 2019 by BASE and K-CEP to scale up investments in clean and efficient cooling by mainstreaming the Cooling as a Service business model.

Key Take-Aways & Recommendations

- Encourage provision of more favorably designed financial product offerings that can be accessed by early stage businesses
- Direct more support towards building both technical and business capacity for companies that are early movers.
- Direct more investment and support towards enabling technologies, i.e. digital platforms and quality monitoring equipment
- Undertake assessments and analysis of product target markets
- Build partnerships with other relevant actors operating in the broader agricultural and cold chain ecosystem
- Advocate for more business enabling policy frameworks among governments, especially for nascent technologies aimed at productive use.
- Consumer awareness creation will help demystify solar-powered cold room storage innovations especially in off-grid target markets
- Conduct more and extensive field test evaluations for solar powered cold storage innovations with substantially longer periods

Q&A

- Please post all of your question in the Q&A box and NOT in the chat box

Contact Details

Project team

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