

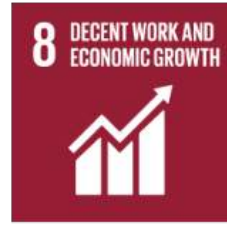
Access to Cooling

Cold Storage solutions for Agriculture
and Animal Husbandry

SELCO FOUNDATION

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+ Cooling



Agriculture & Food Processing



Animal Husbandry



Cold Storage

Horticulture,
Floriculture,
Meat and Fish



Refrigerator

Retail Storage of
Beverages, Animal
Products and Vegetables



Vaccine Storage

Poultry, Goats
and Cows



Dairy

Vaccine Carrier

Portable Storage

Stationary Storage

Milk Chillers

Dairy Product Storage

Agricultural Cold Storage

India is the largest producer of milk, the second largest producer of vegetables, fruits & flowers, third largest producer of fish and fifth largest producer of eggs, all perishable commodities.

- The food spoilage rates (~30%) in India are one of the world's highest due to inefficient cold-chain network (caused by unreliable electricity, poor infrastructure and inaccessibility to small-holder farmers).
- The varied shelf life and storage conditions of commodities makes it difficult for farmers to analyse their production, market dynamics and react to sell their produce. Additional stress on farmers is engaging with harvest during day and travel long distances at night to sell in market.
- There is currently no access to farm/village level cold storages. Large units are quite often located in large cities and often controlled by middlemen. Farm/village level cold storage can assist farmers in aggregation and store produce to ride through price glut.

Access to finance and minimal use of farm cold storage during non-harvesting cycles is a challenge if such farm cold storages are proposed to be bought by individual farmers. Tackling this requires a strategy of financing and owning cold storage solutions using alternative group based/participative community models.

A criminal waste of food

Fruits and vegetables rot as hunger and malnutrition persist in the country

Published: September 17, 2011 00:00
AP



A child picks up rotten tomatoes to be sold to small restaurants at one of Asia's biggest wholesale markets, Azadpur Mandi, in New Delhi, India.

Image Credit: AP

Solan: For Sunil Sharma, a young tomato farmer in northern India, trucking his produce to New Delhi's wholesale vegetable market is a weekly obstacle course — and a race against time.

He must navigate poor roads from his farm in the Himalayan foothills, landslides triggered by monsoon rains and petty corruption by police, all before the crop in the back of his blazing hot truck degrades to worthless rot.

During one recent journey trucking tomatoes for himself and two other farmers to the capital, he was stuck for three days.

"Of the 350 crates of tomatoes I started out with, I could salvage only around 150 crates. The rest had turned to pulp," a despondent Sharma said.

India is plagued by malnutrition and soaring inflation, but it's not for lack of food. It is the world's second largest grower of fresh produce, but loses an estimated 40 per cent of its fruit and vegetables to rot because of a lack of refrigerated trucking, poor roads, inclement weather and corruption.

Gulf News

Currently Available Agricultural Cold Storage Solutions

ECOZEN

Type of structure	0.5 mm steel sheet PPGI
External dimensions (L x W x H)	20 ft. x 8 ft. x 8 ft.
Internal / Storage Volume	760 cu. ft
Cold room insulation thickness	100mm
Storage capacity	5 MT
Pre - cooling capacity	0.75 MT
Refrigeration TR	~ 2.7 TR at - 5 °C Evaporating & 50 °C condensing
Temperature range	4-15 °C (using set point control)
Humidity range	65-95% (using set point control)
Loading rate	10-15% of total capacity (500-750 kg of produce per day)
Door opening	20-30 minutes in a day
Remote monitoring	Yes
Source of energy	Solar or Grid

Cost of the cold storage with Thermal Back up

Rs. 16,00,830/- inclusive of solar, battery & power converters, also 5 years AMC

Solar array capacity	4 kWp
Auxiliary battery	100Ah, 24 V
Backup	Thermal Back up
Storage Capacity	50 MJ
Material for Backup	PCM plates (wall mounted). Uses 100-150kg/INR phase change material as storage medium
Backup duration	24-30 hours (non-door opening & 5.5 kWh/m2/day)
Alternative power source	Diesel generator-5 kVA, Single phase Grid -5 kVA, Single phase or three phase
Warranty	1 year
Availability	India
Models	Lease Model & Full payment
AMC	Rs. 30,000/-
Services provided per year	As requested
Delivery duration	45 days

INFICOLD

Type of structure	ISO Marine Container with Solar Panels Mounted on the roof
External dimensions (L x W x H)	20 ft x 8 ft x 9.5 ft
Internal / Storage Volume	750 cu. Ft
Cold room insulation thickness	100 mm
Storage capacity	5 MT
Pre - cooling capacity	1.25 MT (daily) 3 MT (occasional)
Refrigeration TR	2.25 TR at -5 °C evaporating and 40 °C ambient
Temperature range	4 - 15 °C
Humidity range	90 - 95%
Loading rate	1250 BH kg per day
Door opening	8 per day for 30 sec each
Remote monitoring	Yes
Source of energy	Solar or Grid

Cost of the cold storage with Thermal Back up

Rs. 14,60,000/-

Solar array capacity	7 kWp
Auxiliary battery	100 Ah, 48 V
Backup	Thermal Back up
Storage Capacity	200 MJ (~ 1750 kg of pre cooling)
Material for Backup	Uses Ice as thermal storage medium (1200 Kg of water present in the system)
Backup duration	200 MJ 18 - 24 hours
Alternative power source	3 -ph Grid
Warranty	1 year
Availability	India
Models	Full payment
AMC	Rs. 25,000/-
Services provided per year	4 Service
Delivery duration	30 days

COOL CROP

Cost of the cold storage with Thermal Back up

Rs. 16,00,830/- inclusive of solar, battery & power converters, also 5 years AMC

Internal / Storage Volume	960 cu. ft
Cold room insulation thickness	60mm - 80mm
Storage capacity	5 - 6 MT
Refrigeration TR	1 TR
Temperature range	0 °C - 18 °C
Humidity range	65 - 90%
Loading rate	1200 kgs per day
Door opening	Recommended Twice a day (before 9am & after 6 pm)
Remote monitoring	Yes
Solar array capacity	7 kWp
Auxiliary battery	100 Ah, 48 V
Material for Backup	PCM lined on walls
Backup duration	Custom made depending on the requirement
Warranty	1 year warranty on workmanship, 1-3 years depending on the piece of equipment, 1 year of remote monitoring free of charge, the customer can add additional time to the warranty duration
Availability	India
Models	Full payment
AMC	Rs. 13,140/-
Services provided per year	2 Service
Delivery duration	45 days

PLUSS ADVANCED TECHNOLOGIES

Cost of the cold storage with Thermal Back up

Rs. 16,80,910/- for 5 MT

Type of structure	PPGI
External dimensions (L x W x H)	20 ft x 8 ft x 8ft
Internal / Storage Volume	760 cu. ft
Cold room insulation thickness	100 mm
Storage capacity	5 MT
Refrigeration TR	2.5 TR
Temperature range	2 °C - 8 °C
Remote monitoring	Yes
Source of energy	Solar or Grid
Solar array capacity	4.48 kW
Auxiliary battery	100 Ah, 12 V
Material for Backup	PCM lined on walls
Backup duration	Custom made depending on the requirement
Warranty	1 year
Availability	India
Models	Full payment
AMC	Rs. 13,140/-
Services provided per year	2 Service
Delivery duration	30 days

INNOCOOL

Type of structure	Shipping container
External dimensions (L x W x H)	20 ft. x 8 ft. x 8 ft.
Internal / Storage Volume	1024 cu. ft
Storage capacity	5 MT
Refrigeration TR	-1.28 TR @ - 5 deg 50 deg cond
Temperature range	2 °C - 8 °C
Remote monitoring	Yes
Source of energy	Solar
Solar array capacity	3.6 kW

INSPIRA FARMS

Internal / Storage Volume	323 sq.ft to 1292 sq. ft.
Pre-cooling Capacity	8 to 12 hours
Temperature range	2 °C - 14 °C
Backup	Solar & Grid - 1 phase or Diesel Generator
Material for Backup	Ice as thermal Storage medium
Backup duration	18 - 24 hours
Alternative power type	Diesel generator/ Grid
Warranty	1 year (expandable)
Availability	UK, South Africa, Italy, Mexico, Kenya
Models	Asset Financing & Pay as you chill
AMC	Rs. 13,140/-
Services provided per year	2 Service
Delivery duration	30 days

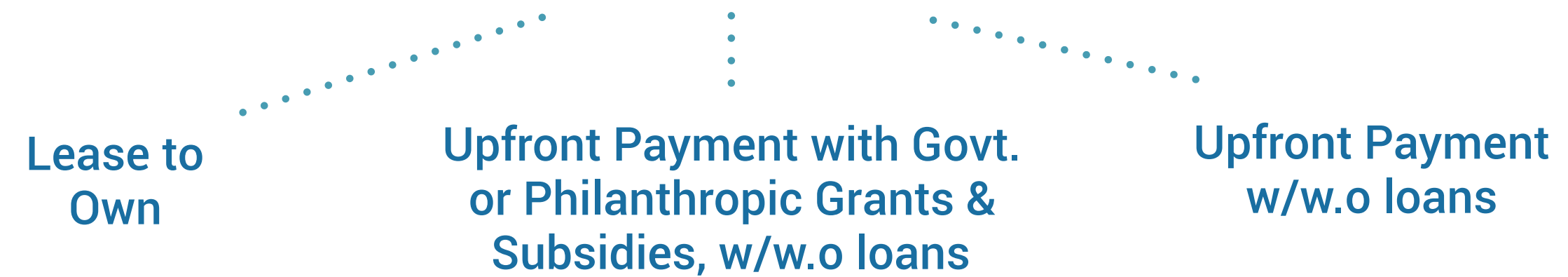
VACKER GLOBAL

Internal / Storage Volume	24 sq. feet (minimum size)
Temperature range	0 °C - 18 °C
Source of energy	Solar & Grid - 1 phase or Diesel Generator
Warranty	2 years (for electronic circuit)
Availability	Middle East & Africa . In not available areas procure normal cold room & only buy electronics

Type of Institution



Type of Procurement Financing



Type of Business



Ownership and Procurement Models for Agricultural Cold Storage Solutions

Policies for Cold Storage Solutions

National Horticulture Mission (NHM)

Cold storage (long term storage and distribution hubs) up to 5000 MT capacity are eligible for assistance under the open ended scheme of NHM/HMNEH (a sub scheme of MIDH). The assistance is extended as subsidies to credit linked projects @ 35% of capital cost of project in general area and 50% in case of Hilly & Scheduled area.

Small Farmer Agri-Business Consortium (SFAC) Assistance to Cold Storage

Setting up of cold storage as a part of a integrated value chain project are eligible for subsidy provided the cold storage component is not more than 75% of TFO (Total Financial Outlay). The scale of assistance as subsidy to projects is @ 25% of capital cost and maximum ceiling to Rs 2.25 crores in general area and 33.33% and maximum ceiling up to Rs 4 crores in case of NE, Hilly & Scheduled area.

Scheme of Cold Chain, Value Addition and Preservation Infrastructure (MOFPI)

For storage infrastructure including Pack House and Pre cooling unit, ripening chamber and transport infrastructure, grant-in-aid at 35% for General Areas and at 50% for North East States, Himalayan States, ITDP Areas & Islands, of the total cost of plant & machinery and technical civil works will be provided

National Agriculture Development Programme/Rashtriya Krishi Vikas Yojana (RKVY)

RKVY Funds will be made available to the States in two installments of 50% each. Eligibility & Inter-State allocation criteria will not be applied for providing funds under the sub-schemes of RKVY or RKVY Special schemes. State Governments will also determine sectoral classification for investment requirements for infrastructure in public, public-private and private sectors and accordingly work out financial support for funding gaps in infrastructure taking into account viability gap which would be based on financial analysis. However, in any case, subsidy will be capped to 25% of total project cost.

Case Study 1

Harsha Trust, Odisha

Markama Agri Producer Company Ltd

INSITUATION

Markama Agri Producer Company Ltd is a Farmer Producer Organisation (FPO) set up in 2016 with an objective to provide an organised market to the farmers of Bissamcuttack, Rayagada, Odisha.

INPUT & OUTPUT LINKAGES

With the help of a NGO - Harsha Trusts set up an agro-business group which supports farmers with agro based input – fertilisers and seasonal vegetables as well as collectivisation, storage and sales of farm produce.

Via the NGO's activities, the farmers were encouraged to carry out extensive vegetable cultivation and aggregation of marketable commodities. Due to the increased influx of produced commodities, prices in local markets took a dip, which increased the dependency of the farmers on local traders for higher returns. To provide a higher share of returns to farmers the agro-business group began the process of collectivisation, cold storage and built market linkages to external markets for higher returns.

The group now also gauges market trends and gives inputs to farmers on which crops to produce for maximum returns.

PROCUREMENT FINANCING

The cold storage unit utilised for procured using a lease to own model using grants issued to Harsha Trust to pilot cold storage solutions for gauging operational processes. Upon viability assessment, Harsha Trust utilised additional grant funds to purchase the cold storage unit after a year of testing.

TECHNOLOGY

The FPO uses Ecozen's Ecofrost - A solar micro cold storage unit which is a small scale - 6 MT, solar powered cold room meant to store fresh fruits, vegetable, flowers, processed food and other perishable commodities. The unit enables both pre-cooling and storage of perishables to preserve their freshness and maximise shelf life.

LEARNINGS

- Green Vegetable Commodities like Cabbage, Cauliflower, Chilli and Cauliflower are less volatile and provide more definite returns compared to more volatile commodities like Tomatoes which may require a higher degree of management and price prediction.
- Avg. Utilisation of units is low, with average storage at 22 kgs/day which provides a monthly average revenue of Rs. 1100. An average utilisation of 200-250 kgs/day would be recommended to generate ample profits, for paying back a minimum of 50% of the capital cost at 5% interest p.a for a period of 10 years



Case Study 2

CINI, Jharkhand

Murhu Nari Shakti Kishan Producer Company Ltd

INSITUATION

A Farmer Producer Organisation set up by CINI an NGO in Jharkhand carries out the cold storage business on behalf of its farmer members.

INPUT & OUTPUT LINKAGES

With the help of CINI, Farmers in Khunti carry out a cold storage business. The group had originally planned to provide a pay per use service to farmers who would want to store their produce for a longer duration of time and gain a higher margin of returns. However, due to low volumes associated with this model, it was soon rejected.

The group now functions as a trader, purchasing vegetables and fruits locally, storing them to gain higher value and thereafter selling the produce in larger markets, thus gaining profits.

PROCUREMENT FINANCING

The cold storage unit utilised for procured using grants issued to CINI to pilot cold storage solutions for gauging operational processes.

TECHNOLOGY

The FPO uses Ecozen's Ecofrost - A solar micro cold storage unit which is a small scale - 5 MT, solar powered cold room meant to store fresh fruits, vegetable, flowers, processed food and other perishable commodities. The unit enables both pre-cooling and storage of perishables to preserve their freshness and maximise shelf life.

LEARNINGS

- Rental models would require a large farmer pool cultivating vegetables and fruits continuously in large quantities to be viable.
- The burden of predicting prices and returns would lie with every individual farmer, inhibiting adoption of the technology.
- Trader models work more effectively to ensure higher capacity utilisations. This could be a bridge program until local farmer produce is increased or could be used as a hybrid model. Via trading 11 Tonnes of tomatoes, cucumbers and chilli, the FPO has gained profits worth Rs. 34000+ in a month, which would be enough to pay for a loan over a ten year loan cycle.



Case Study 3

Karnataka

Samsthana Shree Mahabaleshwar Temple

INSITUATION

Samsthana Shree Mahabaleshwar Temple, Gokarna is well known temple where devotees from all over India will visit and pray for their well-being.

INPUT & OUTPUT LINKAGES

The temple has undertaken Amrutanna Prasad Bhojan section for preparing free food for lunch & dinner for more than 2000 devotees daily. The temple lacks a cold storage unit for preserving Vegetables, Milk & Coconuts due to which they incur huge loss.

Types of commodities stored

- Vegetables – 30 bags of 60 kg; Vegetables are bought on a weekly basis from local markets.
- Coconut – 3000 to 4000 numbers; Coconuts are also bought on a weekly basis.
- Milk – 50 litre to 100 litre; Milk is bought daily.

PROCUREMENT FINANCING

The cold storage unit utilised for procured partially using grants issued to the temple to pilot cold storage solutions for gauging operational processes. 30% of the expenditure was borne by the temple.

TECHNOLOGY

The temple uses Inficold's solar micro cold storage unit which is a small scale - 6 MT, solar powered cold room meant to store fresh fruits, vegetable, flowers, processed food and other perishable commodities. The unit enables both pre-cooling and storage of perishables to preserve their freshness and maximise shelf life.

LEARNINGS

- The wastage of the vegetable and coconut have reduced drastically as before 800 kg of vegetables & 500 pieces of coconut was decaying due to the warm and humid climate
- The temple management is now buying vegetables & fruits in bulk which in turn saves the investment on commodities when purchased in smaller volumes and separately.
- Based on the analysis it can be suggested for further implementation at various other sites like community kitchens, prasad bhojana shalas, in supply chain mechanisms, etc. across various geographies.

Before(Top) and After(Below) cold storage installation at the temple.



Vaccine Cold Storage

Vaccination is the most critical component that plays an important role to reduce livestock mortality and increase the income of the farmer. It is generally seen that almost 15% - 20% mortality in livestock happens due to diseases in some places entire herd is swept away.

The vaccination of above described livestock disease is usually carried out by animal husbandry departments and local NGO's. It has to be considered that the availability of vaccines, required human resource for doing it and the refrigerators for storing these vaccines are essential part of any vaccination program. Often erratic power supply disrupts the cold chain resulting in ineffectiveness of vaccination which results in high mortality despite vaccination. This also has social implications as the end user may lose their interest in vaccination.

Mortality for animal offsprings is a major problem for the small ruminants and poultry like goat, poultry and sheep which counts upto 70% in the normal condition and upto 90% in extreme conditions. Offspring mortality is exclusively due to lack of proper basic animal health care practices like vaccination and deworming. The proper vaccination and deworming can bring the kid mortality down to 20% by following the proper schedule. Managing proper cold chain especially for vaccines is a challenge in the most remote pockets of South Odisha.

Considerations for installing vaccine refrigerator and passive boxes

1. Activity of farmer (Goat rearing or Poultry or both).
2. Numbers of existing farmers in a cluster.
3. Transportation time required for vaccines from central storage to end user.
4. The business models- Operational costs, Profits/Salaries etc.
5. Expansion/replication opportunity.



Case Study 4

Odisha

INSITUATION

An FPO has been now engaged to ensure proper vaccination and deworming of major livestock through village saturation approach by maintaining proper cold chain through solar operated refrigeration system. The producer companies started providing the infrastructure for maintaining the cold chain and a chargeable service offering by creating a successful enterprise.

INPUT & OUTPUT LINKAGES

Harsha Trust an NGO with operations in Bissumcuttuck, Odisha has promoted large scale livestock rearing with landless households through FPOs in areas of South Odisha. To maintain steady income the herd size of the livestock has to be maintained through out the year.

Harsha Trust has producer companies which deploy service providers for livestock vaccination and deworming services around livestock. These vaccines are procured from producer companies or vendors and stored in solar operated vaccine chambers. The village level service provider cadre ensures vaccination of all the goats and poultry available in the village at a time.

TECHNOLOGY

The FPO uses Godrej Surechill - a range of solar direct drive DC vaccine refrigerators. These completely off grids refrigerators offer better temperature and power stability with control. The long battery life and power backup autonomy making them suitable for vaccine storage in off grid areas.



LEARNINGS

- Vaccines are procured from producer companies or vendors and stored in solar operated vaccine chambers. The village level service provider cadre ensures vaccination of all the goats and poultry available in the village at a time.
- Each beneficiary pays Re 1 for deworming per poultry bird and Rs 2/- for vaccination of the birds. Similarly, for goats the prices are Rs 2/- for deworming and Rs 5/- for vaccination respectively. In case of bulk purchase the cost of deworming and vaccination for both poultry and goats is substantially reduced to Rs 0.50 and added to that is the service charge of Rs 0.50.



Milk Chilling

Milk contains numerous nutrients and makes a significant contribution in meeting the human body's needs for calcium, riboflavin, magnesium, selenium, vitamin B12 and pantothenic acid (vitamin B5). It is also one of the few consistent income sources for farmers. However, as soon as milk leaves the udder of mammal, the bacteria in it start multiplying exponentially, which deteriorates the quality of milk by converting the lactose or sugar in the milk into lactic acid. It curdles the proteins and causes souring.

The hygienic quality of fresh milk is determined by milk handling practices at the milk producer level and the cooling practices at the milk collection centers. Poor-quality of milk at the collection level cannot be corrected further up the dairy value chain. Therefore, it is very important that cooling should be done within one/one-and-half hour of milking, after which the naturally occurring preservatives in the milk (including carbon dioxide) stop working.

Case Study 5 Bamul, Karnataka

BANGALORE URBAN, BANGALORE RURAL AND RAMANAGARA DISTRICT COOPERATIVE MILK PRODUCERS SOCIETY UNION LTD. (BAMUL)

INSITUATION

The Milk union in Bangalore currently uses bulk cooling tanks to cool their milk to about 4 degree Celsius at their procurement centres. The tanks is of 3000 liters capacity, keep the milk chilled till the tanker from the dairy arrives.

INPUT & OUTPUT LINKAGES

They collect milk from 55 farmers around 5km radius. The farmers reach the centre 1 hour after milking so it requires an instant chilling to store it longer. Bulk coolers require the electric back-up via diesel generator set as 3 phase electric grid supply is not reliable. 2.5 litre of diesel was required in a day. The diesel generator associated with these coolers are oversized by up to 5 times the rated power of compressor just to handle the startup surge requirements. It results in additional diesel consumption due to part load operation.

TECHNOLOGY

Inficold India Pvt. Ltd.

Footprint (excl. BMC & CDU area)	30 sq. ft
BMC Capacity	upto 3000 L
Max milk flow rates	upto 1500 L/hr
Cooling backup capacity	1000 L
IMC Charging time	6 - 8 hrs
Refrigerant	R404A/ R22
Power supply	1- Ph/ 3- Ph

LEARNINGS

- Annual Fuel savings – 900 litres of Diesel with Generators. Saved diesel of Rs. 5,000 per month (Rs. 60,000 per annum on diesel)
- Milk quality has improved and is now eligible for UHT production - Increased Income of Rs. 7,30,000 per annum on improved milk quality





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