

#### Ministry of Agriculture and Farmers Welfare Government of India



Mission for Integrated Development of Horticulture Department of Agriculture, Cooperation & Farmers Welfare

## Awareness Program on Cold-chain Schemes







## <u>Message</u>

As an initiative towards Hon'ble Prime Minister's vision for doubling farmers income by the year 2022, NCCD in collaboration with PHD Chamber and CII-FACE is conducting a series of 'Awareness Workshops' on behalf of the Mission for Integrated Development of Horticulture. The Workshops at State Level, will focus on explaining the concept of coldchain and the schemes of the Government for setting up relevant cold-chain infrastructure.

This booklet is a compilation of various assistance and subsidy schemes made available by Government of India for development of cold-chain in the country. This booklet is intended to give an overview of cold-chain and the schemes for developing holistic farm to consumer Cold-chain under Mission for Integrated Development of Horticulture (Ministry of Agriculture & Farmers Welfare), Ministry of Food Processing Industries, and Agriculture & Processed Food Products Export Development Authority (APEDA – Ministry of Commerce & Industry).

Executive Office of National Center for Cold-chain Development

No.	Title	Page No.
1.	Message 2	
2.	MIDH Assistance for Cold-chain	4
3.	MoFPI Assistance for Cold-chain	6
4.	APEDA Assistance for Cold-chain	7
5.	Glossary of Cold-chain	8
6.	Understanding the Cold-chain	15
7.	General Information	23
8.	MIDH Information Bulletin	28
9.	Subsidy Process under MIDH	29

## Contents





Cold-chain bridges farms with consumers and therefore makes agriculture more gainful and sustainable – cold-chain helps achieve gainful productivity.





## **Cold-chain and allied Components** Mission on Integrated Development of Horticulture (MIDH)

Post-Harvest Management (Normal Storage and Cold-chain Components)			
SN	Description	Cost Norms for MIDH (admissible cost)	
1	Functional Pack House	Rs 4.0 lakh / unit with size of 9m x 6m.	
2	Integrated (modern) Pack houses	Rs 50.0 lakh/ unit with throughput capacity of 16 MT/day, with facilities for conveyor belt sorting, grading, washing, drying & weighing.	
3	Precooling Unit	Rs 25.0 lakh/ unit with batch capacity of 6 MT.	
4	Cold Room (staging)	Rs 15.0 lakh/ unit of 30 MT storage capacity	
5	Mobile Precooling Unit	Rs 25 Lac per Unit.	
6	Cold Storage Type 1 : basic mezzanine structure with large chamber(> 250MT) type with Single temperature Zone	Rs 8000/MT upto 5000 MT capacity. Rs 7600/MT for capacity between 5001 to 6500 MT Rs 7200/MT for capacity between 6501 to 8000 MT Rs 6800/MT for capacity between 8001 to 10000 MT	HB
7	Cold Storage Type 2: PEB structure for Multi-temperature and product use, more than 6 chambers (<250MT) and basic material handling equipment.	Rs 10000/MT upto 5000 MT capacity Rs 9500/MT for capacity between 5001 to 6500 MT Rs 9000/MT for capacity between 6501 to 8000 MT Rs 8500/MT for capacity between 8001 to 10000 MT	HB
8	Refrigerated Transport Vehicles	Rs 26 lakh for 9 MT, pro-rata but not below 4 MT Rs 30.00 lakh for 15 MT, pro-rata between 9 to 15 MT. NHB	НВ
9	Ripening Chamber	Rs 1.0 lakh/MT, ceiling of 300MT	
10	Evaporative / Low Energy cool chamber	Rs 5.00 lakh/unit for 8 MT capacity	
11	Low cost onion storage	Rs 1.75 lakh/unit of 25MT	
12	Pusa Zero energy cool chamber	Rs 4000 / unit of 100 kg	
13	Integrated Cold-chain supply system	Rs 600 lakh/project using two or more of above components	
14	Integrated Post-harvest Management Projects eg. Packhouses, Ripening unit, Reefer vans, Retail Outlets, Precooling, Primary processing, etc.	Rs 145 lakhs per project. Components of postharvest management can be taken up as individual stand-alone projects as guided by norms listed above	HB
Others: Credit Linked Back-ended subsidy at 35% in General areas / 50% in Hilly & Scheduled areas.			

Item 6, 7, 8 above are marked differentiated by capacity for implementing by NHB exclusively. Item 14 marked above under NHB and allows standalone components as per NHM norms

Receipt of application is not equal to subsidy sanction. Minimum system standards must be followed. Applicants can select and multiple components with purpose to develop activity integration with existing facilities.



Details of Cold Chain Add-on Components (for CA and modernisation)		
SN	Description	Cost Norms for MIDH (admissible cost)
1	CA Generator	Rs 125 Lakh Per Unit, maximum of 2 units
2	Specialised CA doors	Rs 2.50 Lakh per door, maximum 20 doors
3	CA Tents	As per original invoice, maximum 5 enclosures
4	Programmable Logic Controller	50% of cost of original invoice, Maximum Rs 10 lakh
5	Dock Leveller System	Maximum Rs 7 Lakh per Unit, max 5 units
6	WRDA System	100 % cost of original invoice, maximum Rs 2 lakh
7	Specialised Packaging lines	100 % cost as per invoice, maximum Rs 15 lakh per project
8	High Reach handling equipment	Rs 17 Lakh per unit, for max 2 units
9	Modernisation of refrigeration	50% of cost, max Rs 100 lakh @ Rs 2500/MT capacity
10	Modernisation of insulation	50% of cost, max Rs 100 lakh @ Rs 1500/MT capacity
11	Reefer Container	Maximum Rs 6 lakhs per 9 MT (20 ft. reefer container)
12	Advanced Grader	100% of invoice cost, max Rs 75 lakhs per line
13	Stacking System	100% of invoice cost, maximum Rs 2000/MT
14	Retail Shelf/Equipment	Maximum Rs 10 lakh per establishment
15	Alternate technology (Vapour absorption, Solar, hybrids, etc.)	100% of invoice cost, maximum Rs 35 lakhs per project

#### Above section applies for technology add-on for all projects under NHB and NHM

Credit Linked Back-ended subsidy at 35% in General areas / 50% in Hilly & Scheduled areas. Maximum permissible subsidy for combination of add-ons is Rs 750 lakhs

Other Cold-chain allied Components		
SN	Description	Cost Norms of MIDH (admissible cost)
1	Retail Markets/outlets (Environmentally controlled)	Rs 15 lakh/unit
2	Static/Mobile Vending cart/platform with cool chamber	Rs 30,000/unit
3	Long distance Transport Solution	Rs 2000.00 lakh NHB

Item 1, 2: Credit Linked Back-ended subsidy at 35% in General area / 50% in Hilly & Scheduled areas. Item 3: Subsidy at 50% of the total cost.

#### **General Information**

**Cost norms:** Designed keeping in mind strategic development requirements and market prices but not directly reflecting the market rates of each component. Cost norms aid allocate focus to specific needs.

System Standards: to guide and allow innovation in development of right-sized and right-type designs.

**Credit linked subsidy**: Subsidy is directly linked to bank loan availed and cannot exceed the total loan amount taken. Subsidy is released after completion of infrastructure with and intention to offset credit burden. Projects must be fully financed, independent of subsidy for availing the scheme.



# MoFPI Assistance सरकारी सहायता

For storage infrastructure including Pack House and Pre cooling unit, ripening chamber and transport infrastructure	<ul> <li>Grant-in-aid @ 35% for General Areas and @ 50% for North East States, Himalayan States, ITDP Areas &amp; Islands, of the total cost of plant &amp; machinery and technical civil works will be provided.</li> </ul>
For value addition and processing infrastructure including frozen storage/ deep freezers associated and integral to the processing	<ul> <li>Grant-in-aid @ 50% for General Areas and @ 75% for North East States, Himalayan States, ITDP Areas &amp; Islands, will be provided.</li> </ul>
For irradiation facilities	<ul> <li>Grant-in-aid will be provided @ 50% for General Areas and @ 75% for North East States, Himalayan States, ITDP Areas &amp; Islands.</li> </ul>

Read more at www.mofpi.nic.in



## APEDA Assistance सरकारी सहायता

Sub Component	Pattern of Assistance
PARTI	
A) Establishment of common infrastructure facilities by APEDA or any other Government or Public Sector agency.	90% grant-in-aid by APEDA and 10% from other government or public sector agency other than land. Calculation of the project cost and Government of India assistance shall not be available for the procurement of land.
B) For establishment of common infrastructure	Operating Guidelines are under
facility in PPP mode	preparation.
<ul> <li>A) Assistance for purchase of specialised transport units for animal products horticulture and floriculture sector.</li> </ul>	40% of the cost subject to a ceiling of INR 7.5 lakh per beneficiary.
B) Assistance for all APEDA scheduled products for:	
1. Setting up of sheds for intermediate storage and grading / storage / cleaning operation of produce.	40% of the cost of equipment subject to a ceiling of INR 10.00 lakh per beneficiary
2.(a) Setting up of mechanized handling facilities such as sorting, grading, washing, waxing, ripening, packaging & palletisation, etc.	40% of the cost of equipment subject to a ceiling of INR25.00 lakh per beneficiary
2.(b) Setting up of both pre cooling facilities with proper handling system as well as cold storage for storing	40% of the cost of equipment subject to a ceiling of INR 25.00 lakh per beneficiary
2.(c) Providing facilities for treatment such as fumigation, X-ray screening and other screening/detection equipments, hot water dip treatment, Water softening Plant	40% of the cost of equipment subject to a ceiling of INR 25.00 lakh per beneficiary
2.(d) Setting up of integrated post-harvest handling system (pack houses with any two or more of the above facilities (see 2(a) to 2(c)	40% of the cost subject to a ceiling of INR 75.00 lakh per beneficiary
3. Setting up of cable cars (covering minimum of 50 ha of plantation) for banana and other crops (as decided by APEDA)	40% of the cost subject to a ceiling of INR 75.00 lakh per beneficiary
4. Setting up of vapor heat treatment, electronic beam processing or irradiation facilities	40% of the cost subject to a ceiling of INR 50 lakh per beneficiary
5. Assistance for setting up of environment control e.g. pollution control, effluent treatment etc	40% of the cost subject to a ceiling of INR 35 lakh per beneficiary
PART III	
Assistance for fresh & processed horticultural produce for Setting up of specialized storage facilities such as high humidity (Relative humidity more than 95%) cold storage deep freezers, controlled atmosphere (CA) or modified atmosphere (MA) storage etc	40% of the cost subject to a ceiling of INR25 lakh per beneficiary



Read more at www.apeda.gov.in

## GLOSSARY OF COLD-CHAIN 1

The common terminology of cold-chain and terms used for the purpose of this study are given as under:

- 1. **Cold-chain:** An environment controlled logistics chain, ensuring uninterrupted care from sourceto-user, consisting only of storage and distribution related activities in which the inventory is maintained within predetermined ambient parameters. Cold-chain does not alter the essential characteristics of the produce or product handled. Cold-chain is not just about the "cold" but that it refers to all logistical process applied, to maintain multiple parameters, during the preconditioning, handling, transport, storage and retail of products. The cold-chain (he insists we hyphenate the words to perceive the compounded concept), includes varied aspects of packaging, atmospheric gases, biology, injury, humidity, traceability, infrastructure, people & product flow, besides temperature. In fact, temperature control can only work with all others in synch
- Pack-House: A modern infrastructure with facilities for conveyer belt system for sorting, grading, washing, drying, weighing, packaging, pre-cooling and staging. Modern pack-houses are the first step in organised post-harvest management for horticulture, and are in effect the first mile sourcing points for this sector. A modern integrated pack-house unit enables small lot sourcing of horticulture produce, and should be built close to farm-gate.
- 3. **Refrigerated Transport:** The refrigerated transport system, with an insulated carrier and equipped with active refrigeration, designed for temperature controlled carriage of perishable products. This can include refrigerated trucks (reefer trucks), vans, rail, containers and ships for transporting perishable products.
- 4. **Storage:** Static infrastructure designed with insulated and refrigerated chambers for long term or transient storage of whole fresh, ready-to-retail, or processed forms of perishable products.
- 5. **Pre-Cooling Unit:** A specialized cooling system designed to rapidly remove field heat from freshly harvested produce and thereby prepares the cargo for subsequent travel in the cold-chain. A Precooling unit can be in the form of forced-air cooling, hydro cooling, vacuum cooling, room cooling, icing, etc. Precooling or post-harvest cooling is the heart of a modern pack-house and is one of the key steps in preparing fruits and vegetables for the extended cold-chain.
- 6. **Sorting:** The activity at source when produce is assorted into target lots basis qualitative criteria viz. as non-edible, as reject or dump, by quality, by shelf-life, by market value, etc. It is the first stage categorisation of received produce and separates them into differentiated value-based flow towards an ascertained and useful end-use. Thus, the process of sorting is key to direct the flow of collected produce into existing and multiple value-based productive use.
- 7. **Grading**: The activity at source for physical segregation of goods into optimal packing lots, after undergoing initial sorting. It is a pre-cursor to effective packaging, performed such that the space in a unit package can be maximised for safe carriage, and leads to efficient shelf space utilisation and graded shelf presentation.



<sup>&</sup>lt;sup>1</sup> Extracts from - NCCD.2015.*All India Cold-chain Infrastructure Capacity (Assessment of Status & Gap),* Delhi. National Centre for Cold-chain Development (www.nccd.gov.in)

- 8. **Cold Room (Staging):** An insulated and refrigerated chamber which serves as a transient staging space, and is a necessary attachment to a Pre-Cooling Unit. Appended to pre-coolers, a staging cold room frees the pre-cooler space for the sequential batch of incoming freshly harvested produce. This component is typically installed at farm-gate as part of a modern pack house, and temporarily stores preconditioned fresh produce, awaiting transport link to a distribution point (a cold store close to market).
- 9. Cold Storage (Bulk): Environment controlled warehousing space with multiple chambers intended for the bulk storage of perishable produce. It is designed for long duration storage of produce so as to build an inventory buffer which will serve to smoothen the episodic production by stabilising & sustaining the supply lines. These are normally constructed in areas close to producing areas (farm-gate) to facilitate quick access to producers for a selective set of crops only.
- 10. **Cold Storage (Hubs):** Environment controlled warehousing space with multiple temperature zones for functioning as a distribution hub. It is designed for short term handling of products so as to serve as a distribution logistics platform for market ready packaged produce and ready to retail products. Cold storage (Hubs) are key to effective distribution of perishable foods and essentially at the front end of the cold-chain, constructed close to consuming centres.
- 11. **Reefer Vehicles:** Road transport vehicles with a fixed insulated body equipped with active refrigeration designed for environment controlled carriage of products. These are effectively cold rooms on wheels or mobile cold stores. The refrigeration on long haul trucks is powered through integrated diesel driven motors, independent of the main truck engine. In case of small vehicles, the use of direct drive systems linked to the vehicle engine or battery powered refrigeration is the norm. Normally Reefer trucks incorporate GPS based location tracking system and are installed with data logging temperature and humidity sensors.
- 12. **Reefer Container:** A multi-modal insulated container with integrated refrigeration equipment. Unlike fixed body reefer trucks, reefer containers can be released from the truck trailer chassis and handled as an independent unit load. This allows the prime mover and/or trailer to be utilized for other hauling operations. Reefer containers are normally used for multi-modal activities where rail-road-sea-air movements are involved in the logistics chain. The equipment is designed to source electric power from a separate generator (power-pack) which is independent of the reefer container. These can also be positioned on site for use as a temporary temperature controlled store utilising external electric power.
- 13. **Batch-Load:** A capacity measurement utilised when the infrastructure is used to sequentially throughput goods after a time based activity or procedure. Usually used for pack-houses where the pre-coolers operate to cool a few tons of produce at a time, in multiple runs or batches per day. For example, a pre-cooler with holding volume of 5 tons can output 15 tons of conditioned vegetables if operated every 6 hours for three times in a day. The batch load in this case would compute to 5 tons/batch in 3 batches/day, or 15 tons per day. Similarly, in case of sorting and grading lines, the batch load is assessed in the volumetric throughput or tons per hour or per day.
- 14. **Holding cycle:** The period of time a specific good is held in a storage or transport chamber. Also called inventory turnover, it is a long period in case of products like potato, apples and few days

in case of tomato, milk, litchi, etc. The handling capacity of a space is in multiples of its size and the holding cycle or rotation of the inventory held.

15. **Holding Life:** Also called Product Life, refers to the Saleable Life Span of a product. In case of Fresh produce, this commences at harvest and extends until the produce perishes. In case of processed food products, this is initiated after the manufacturing process and extends upto the predetermined expiry date. Holding life is divided into time spent in each activity in the supply chain, with Shelf Life being the time spent in the front end, on shelf.

		Holding Life (Saleable Life Span of Produce)	
Harvest	Preconditioning at Pack House	Transport Cold Store	Retail Store/Shelf Kitchen Shelf
P	reparation	Transit	Shelf Life

The holding life of produce is extended with cold-chain, creating more opportunity for producers by expanding the range and accessibility to markets. The Holding Cycle in a space, should always a small part of the total Holding Life of a product.

16. **Storage Size:** The volumetric size of the holding space of a transport or storage chamber (stated in tons or cubic metres). This storage size is a static measure of the space created and is also termed holding capacity. The mass to volume ratio of goods held in cold-chain varies depending on the density of the produce, the packaging used, the storage/stacking system used, space design, etc. For purpose of this report, uniform ton to volume ratios as defined in MIDH Guidelines is used. The storage size of a cold store is a factor of the total volumetric capacity handled by a cold store.

A Cold store, like any holding space, has capacity to handle large volumes, in multiples of its fixed size



## Example: Water Storage Tank

Storage Size fixed volume (*Static*): **1000 litres of water** 

Design usage : daily 1000 litres of water, daily replenished with 1000 litres water.

Handling Capacity (*Total*) per annum: 1000 litres x 365 days = 365,000 litres

17. **Storage Capacity:** The handling capacity or the throughput measure of the goods that pass through a holding space over a specific period of time. This is also called the useful capacity of a space, and assessed on the basis of storage size and the product holding cycle. In case of a weekly



holding cycle, the handling capacity of a space is "storage size x 52 weeks" or a 52x multiple of its holding size. The handling capacity of a storage unit depends on the product type being handled and is the proper characterisation of the capability of a unit. The storage capacity of a cold store is a multiple of the space or storage size created.

- 18. **Front-end-merchandising:** Front-end merchandising refers to the practise of managing products at the last mile selling point to end-use customer. Merchandising involves the display and care at retail end and includes temperature controlled cabinets, street vending carts and other retail platforms.
- 19. **Retail Shelf / Cabinet:** These shelves/cabinets are temperature and/or humidity controlled merchandising units, used for holding of temperature sensitive goods and used to safeguard the on-shelf quality of the food items. These can be designed for fresh foods and processed items.
- 20. Fresh Food (Produce): A produce of nature that is harvested by farmers and where the essential and natural attributes have not been altered. This includes all whole food that is a produce of nature and not a product of industrial process. The harvest may undergo cleaned, sorting, grading, trimming, de-sapping, fumigation, washing, waxing, packaging but does not undergo any process that modifies its natural characteristics e.g., all fresh fruits and vegetables, raw milk, eggs, fresh fish, etc. Conversely a processed food product is manufactured using transformative processes that may involve mincing or macerating, liquefaction, emulsification, cooking (such as boiling, broiling, frying, baking or grilling), dicing or slicing, pickling, preservation, canning or jarring, freezing or drying, refining, grinding, etc. the natural attributes are altered, or ingredients added where the produce is transformed from its natural physical or chemical forms into a new product. e.g., pickles, flakes, ketchup, canned vegetables, juices, pulp, deep frozen goods, chocolates, beverages, etc. Processing industry may also use refrigeration technology (IQF, Blast freezers, etc), such specialised production plants and product lines forming part of manufacturing equipment/components.
- 21. **FIFO (First-In, First-Out):** It is a method of storing and retrieving goods where goods can be throughput in a simple pass-through method. For example, a conveyor belt or where inventory storage period is so short, that applying any other logic is superfluous. FIFO can also be used in cold stores if holding goods of identical nature.



22. **FEFO (First-Expire, First-Out):** It is a method used exclusively to handle perishable goods. This involves intelligent stock keeping and storing so that inventory items that are expected to expire first are the ones to be picked and brought into use. This inventory handling method is most critical to value realisation of perishable goods. In case of fresh food, where no expiry labels are



uses, a mix of FIFO and FEFO is used. FEFO requires a closer understanding of the life cycle of individual batches of perishable goods, including integration of information from source points.

23. LIFO (Last-In, First-Out): It is a method of storing and retrieving goods where inventory is rotated as a part of logistical procedure. This is usually employed where the storage space or warehouse capacity is limited or physical access to the inventory is restricted. In cold-chain, this is most commonly used when following the "stuffing" principle in transport. A staging area is used for preparing goods for LIFO loading onto large transport. This method is not otherwise used when handling perishables.



- 24. **Data logger:** Is an electronic device that records data over time or in relation to location captured via instruments and sensors. Temperature and humidity levels are commonly recorded in case of handling fruits and vegetables. Other measures can include position, gas composition, impact or shock, sunlight, etc.
- 25. **Dock levellers:** It applies to an adjustable metal ramp designed to bridge the gap between the cargo bed of a transport vehicle and the loading platform of a cold-store. It is used for ensuring smooth transfer of goods into and out of cold storages and facilitate the effective operation during loading and unloading
- 26. **Stacking system:** Broadly represents the storage method such as racks, bins and pallets for holding cargo in storage and transport. The use of modern stacking systems promotes standardisation in load handling and brings storage space in synergy with modern packaging systems.
- 27. **Cost-Plus Model:** A business model that relies on a pricing strategy that applies an absolute or percentile mark-up on the cost of the product/service & delivery, to determine fixed market price and profits. This model pursues growth through raising quantum of revenue, by increasing its geographic range and associated supply chain, thereby increasing its margins and returns. This model promotes supply side collaboration and places demand on greater market linked cooperation in the supply chain for arbitrage across geographies.
- 28. **Time-Arbitrage Model:** A business model that relies on holding inventory for timed opportunistic trade, where its margins are assessed on the asset's future demand and on risk premium, on the basis of a number of macro-economic factors. This strategy pursues profits through timing or controlling transactions, by lowering its procurement cost, taking advantage of poor production and the limitations of supply chain. Such a model promotes inventory based arbitration on market demand (hoarding), and can have little interest in sustained long term growth of supply side.
- 29. **Geographical Arbitrage Model:** A business model where higher price realisation is achieved by bridging distances between production locations and demand centres, facilitating faster cash flows and actively expanding the customer base. This model can minimise static inventory, promote demand for greater production and productivity.
- 30. **Reverse logistic**: The return of a transport system to first point of origin. When reverse logistics is planned so as to carry other goods for use at point of origin (reverse haulage), the trade achieves greater economic sustainability through optimisation of resources.



- 31. Last mile: Refers to the front end activities and assets in the overall value chain system. This includes merchandising platforms, delivery vehicles and the cold stores used as distribution hubs.
- 32. **Cross Docking:** Refers to deconsolidating and dispatching or received products with little or minimal period spent in storage between the two activities.

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#### Setting up a Cold-chain

There are two business models for cold-chain namely (i) Food Supply & delivery system and (ii) Inventory holding for off-season. They involve identification of quantum of produce in the region, consumption habits at population clusters, volumetric inflow into market (demand), identifying distance from market (source point) for various identified products and nature of the perishable produce.

#### For setting up Cold-chain infrastructure, following key points are considered:

- Location of Land (suitable for business model and power availability)
- Change of Land use
- Road / rail connectivity
- Design and size of infrastructure layout
- Identification of produce/products to be stored
- Technology to be used in storage and transport
- Distance of Market /Consumption centers
- Financial arrangements- Bank loan, promoters contribution and admissible subsidy

Cold-chain logistics is a thrust area for agriculture development and considered as part of the second green revolution. The Government of India supports development of coldchain through Ministry of Food Processing Industries, APEDA and Mission for Integrated Development of Horticulture (MIDH). MIDH provides the following:

 Subsidy of 35% (Special areas 50%) of the admissible cost for Cold-chain components, details annexed

#### Major components of Cold-chain:

- 1) Modern Pack Houses with Precoolers and a small cold room.
- 2) Transportation (Refrigerated / normal trucks depending on product)
- 3) Cold Storage (Bulk) at farm gates for long term inventory
- 4) Cold Storage (Hub) near Consumption Centres as a distribution platform.

**Modern Pack Houses** consist of facilities for incoming material, Sorting & Grading and Cold Room are set up near Farm Gate. It prepares the produce for movement to Cold Storage (Hub)/ Consumption Centres.

**Refrigerated transport** is necessary to maintain quality of packaged goods products e.g. fruits and vegetables, frozen goods, etc. These can be trucks or containers for trailors.



**Cold Storage (Bulk)** is used to keep single commodities e.g. potato, apple, spices near farm-gate. These commodities can be purchased outright by owner for trading or on rental basis for 6 to 10 months (rental for full year).

**Cold Storage (Hub)** are near markets/consumption centres for short term transitory storage of incoming produce, to distribute on demand from retail.

**Ripening Units** are near markets/consumption centres, mainly used for three major fruit types – banana, mango, papaya. Can be used for own private label or as service to other retailers.

#### Precautions to be taken

- 1) Capacity utilization of infrastructure created. This may be seasonal for a particular product or perennial in case of distribution centres and ripening units.
- 2) Competition with already established Cold storages at low cost.
- 3) Proper and regular maintenance of equipment to mitigate risk of any loss due to operations in storage or transport.
- 4) Use higher insulation to reduce subsequent energy costs during operations.
- 5) Maintain on-site inventory of spares for faster repairs on mechanical failure.
- 6) Keep FSSAI certification updated and maintain hygienic standards.

When designing a cold-chain, plan for handling capacity and not merely for holding size. Handling capacity is multiples of physical size of each infrastructure.



Demand and capacity gap study of cold-chain can be downloaded from www.nccd.gov.in -> Reports Page -> AICIC Study 2015 link (*All India Cold-chain Infrastructure Capacity – AICIC 2015*)



## Understanding the Cold-chain

## **Cold-Chain as an Enabler<sup>2</sup>**

Commonly understood as climate controlled warehousing and transport where the temperature, humidity, air composition and packaging play an important role in food delivery. The cold-chain offers many opportunities, two basic aspects are as follows:

A. Preserving a product's quality. This is best exemplified in case where cold-chain technology is deployed to primarily protect goods from inclement natural or ambient conditions. In this function, the cold-chain has a more of a preservative effect on the cargo it protects – there is no extension of products' storage life, only a function of preserving its state by maintaining predetermined ambient parameters. These product types are ice cream, meats, most processed foods, vaccines, many chemicals and plastics, electronic goods, etc. These product segments have a clear-cut product expiry period, linked to the ingredients added and the production or manufacturing process. The 'expiry-date' or 'sell-by-date' is maintained by subjecting the package to predefined temperature parameters; whereby the predetermined product quality is secured by the cold-chain to great accuracy. The price discovery is pre-ascertained and product is labelled accordingly.

In such cases, the production unit or factory is the origin of the cold-chain and the new value that is created at point of origin is preserved for market realisation by cold-chain services. Here, cold warehousing and transport ensures or preserves the goods in a state of pre-determined expiry, with the value and selling date of each package having been defined during the production process.

**B.** Enhancing the produce's life cycle. When we consider cold-chain for fruits and vegetables in fresh form, primarily living perishables, the cargo under care benefits from an enhanced life cycle. The cold-chain when applied correctly, effectively extends the produce's living cycle and safeguards nutrient quality. Though the produce trends on a perpetual, downward biological life cycle, the ageing process is retarded, buying time to reach consumers. Such cargoes are sold fresh and the value impact is not merely because of the temperature control, but also due to many other aspects, which are akin to biological care.

When handling farm fresh produce, the cold-chain services need to be more accurate in all its practises, as these are not packaged products but packaged freshness; cold-chain has to manage humidity and microbial conditions, requires to maintain oxygen levels at breathable limits, monitor & control degenerative gases, segregate to avoid tainting between living tissues, and all the while continuing to maintain precise temperatures.

Excess cooling is harmful and a couple of degrees warmer means faster product demise; any parameter disruption will impact the product longevity and price realisation, both of which are variable. An accurate measure of the produce life cycle is not always possible



<sup>&</sup>lt;sup>2</sup> NCCD. 2014. *Guidelines & minimum System Standards for Implementation in Cold-chain*, developed by National Centre for Cold-chain Development for Ministry of Agriculture

as it is dependent to pre-harvest conditions too. The cold-chain is merely utilised to retard physiological changes and buy some time. The produce is subject to more dynamic price discovery mechanisms, basis demand, market access and freshness.

In such cases, the cold-chain is used primarily to derive benefit from the temporary enhancement of life cycle, by using this period to connect with more consumers and to balance episodic harvest periods. The pack-house, transport and cold stores system involve superior skills in their operations with knowledge about the produce under care. This is well understood in case of fresh milk, fresh mangoes, fresh grapes, etc. and the sensitivity of these value chains is frequently evidenced. The product being handled is not a product manufactured under controlled processes, but harvested produce with its originating quality being subject to vagaries of nature. Cold-chain should therefore not procrastinate, but hasten the farm to consumer cycle.

The concepts A and B are two ends of a spectrum – one is a preservative function, the other serves to delay senescence and enhance saleable life. The use of either function depends on the product and produce types. A combination thereof of these underlying principles are also seen in use (potatoes, spices, pulses and select apples are examples).

Understanding the principle involved helps users devise suitable designs and networks. Nevertheless, cold-chain is a specialised logistics system that serves as a conduit to carry and safeguard value, which was either manufactured or harvested, from source to end-consumers.

#### **Agriculture-Industry connect**

Cold-chain is a logistics application that has extended itself from a merely protective role into a life enhancing solution for the fresh food sector only recently. Yet globally, the latter and this ability to link fresh foods with markets across vast distance has become its main function. Cold-chains have become the prime link between a long existing production base (the farms) and urban consumption centres.

In case of horticulture, though the farming base is low cost, it can benefit the most from the cold-chain. When handling fresh horticulture produce, the modern pack-house is the key post-harvest point, which prepares the fresh produce to enter the cold-chain conduit. After being conditioned for the cold-chain, the majority of the produce enters the transit phase to markets. This transit requires reefer transport and close

#### **Cold-chain Solution**

#### Right combination of -

- Harvesting
- Routing
- Packaging
- Cooling
- Staging
- Transport
- Storage
- Distribution
- Retail

to market cold storages. At these cold stores, designed as distribution centres, the produce is deconsolidated into demand based lots for distribution to retail outlets for consumers to access.

Each handling component, the pre-conditioning stage, transitory storage and transport, closeto-market storage for distribution and retail, requires special care, besides basic temperature control, as explained earlier. The cold-chain is not essential for the farmers to produce, but is necessary to reach far away markets – it empowers them with the ability to capture a larger buyer base and helps to bring their harvest to more valuable end use. Conversely, an ice



cream factory for example, can exist only with the assurance of a temperature enabled supply link.

#### **Pack-house Origins**

Pre-conditioning of the produce after harvest is of primary importance. As a part of this activity, produce is first assorted by value and designated into market lots, even before the energy application phase of cold-chain. The fresh produce that can realise value in the immediate vicinity is not subject to further energy inputs. This implies that the modern packhouse, as the start-point of the cold-chain, also becomes the originator of other supply links which may not require temperature control. Fresh Produce that can be sold locally is routed

accordingly, that which can be processed into a product goes to the local processing factory, and that which needs to link to distant markets enters the temperature conditioning phase for onward travel.

Pack-house is the point of origin and is the key decision maker for routing of perishable agriculture produce Hence, a packhouse initiates multiple market routing or value realisation options. If the routing requires long travel, then packaging for safe transport is the next necessary step. Packaging lines can be used and the package designs are specific for fresh produce. After packaging, the precooling stage is entered so as to bring both the produce and its package to optimal temperatures so as to retard senescence. Thereafter, the packaged fresh produce is kept in a transitory staging cold room, pending onwards transport to faraway markets. Pre-conditioning is the preparatory activity for travel to market, the first phase in the farm to fork trip.

#### Making the connect

Transport is the next link in this chain. For transport, unitised cargo lots are preferred to facilitate safe as well as speedy handling. Globally, the pallet is the common unit load used. The uniformly sized unit loads, are loaded onto carriers – the reefer trucks or larger unit loads like the reefer container. Reefer containers allow the use of rail, road and waterways without multiple handling of the primary goods (fresh produce).



Uniformity in the load units also allow for harmonisation of the handling equipment and promotes standardisation of operations in the cold-chain.

#### Handle with care

Palletisation of a load facilitates safe multi-modal handling, whilst transporting and when in cold stores. Pallet handling is best done by mechanised means, which ensures quick & easy operations, reducing the loss that occurs due to mishandling. Cold stores are preferred when they are equipped to handle pallet based cargoes, i.e. Fork lift types, roll-on/roll-off ramps, pallet based put away racks, etc.



Modern cold stores, especially those that serve as distribution centres, increasingly use high reach storage systems and deploy dock shelters, ramps and high reach handling equipment. This also assists in better land area utilisation.

At the last mile, retail shops also need strengthening to handle cold-chain routed fresh produce. In all, the complete chain enhances the produces' usable life, retards loss of freshness, sustains nutritional value to the maximum and contributes enormously by extending the value chain system beyond traditional regions and limitations. The most phenomenal gain is drastic reduction in physical loss, through organised practices, when compared to the traditional multi-layered logistics chain.

#### Energising the chain

There is an energy cost to achieve such value gain. The cold-chain is energy intensive, primarily due to the added need to regulate temperatures at desired levels. The other major energy use is at the need for speedy transportation. However, the direct conveyance of farm

fresh value to urban centres can be expected to be a continued key role for cold-chains and various solutions to minimise energy use are available.

Good planning, insulation, automation, and utilising alternate sources of energy or hybrid energy solutions is a way to mitigate the energy load of a cold-chain. Innovations that combine individual energy solutions may seem futuristic, but have become a common stance globally. India's cold-chain needs to have opportunity to align with futuristic trends and be long term leaders in the 'greening' of the cold-chain.

#### Cold warehousing

Some of the crops produced in India can take advantage of long term storage, so as to continue trade even in lean periods. These are mostly those that have a single season harvest across the entire country and are compatible for extended storage periods. Such crop types spend most of their life span inside cold stores, pending optimal demand or price from markets. Such product types enter into cold

### FRESH PRODUCE GOSSIP Blue and purple fruits help your memory. Green fruits help make bones and teeth strong. Yellow fruits help keep you from getting sick. Orange fruits help keep eyes healthy. Red fruits help keep your heart strong. A watermelon contains 92% water, 6% of sugar. I Litchi seeds are poisonous and should not be eaten. Jamun fruit leaves and bark are useful for controlling blood pressure and gingivitis. Sugar-apple seeds should not be eaten as are poisonous. Avocado has more fat content than any other fruit. Pineapples are berries, just like strawberries and blueberries.

storages soon after harvest, in bulk and in sufficient quantity to feed the consumer for the most part of the year. Fresh potato and apples are ready examples in India.



Cold stores intended for long term holding of produce are designed close to production areas. They will source produce during harvest season and store in bulk, without undertaking any retail packaging. During off season periods, the chambers are periodically opened and product released to market. Much before the start of the next harvest season, the chambers start to empty out and finally the entire store is emptied and readied for the next harvest. These cold stores can have sorting, grading infrastructure. Packaging lines may also be installed, for use when produce exits term storage phase, for subsequent dispatch to market. Such cold stores can be termed as farm-gate facilities as they effectively are scaled up aggregation centres at source, with large term storage chambers and other appropriate technology options.

The other cold store type is that at the front end of the cold supply chain. It will be designed for transient storage and enabled for cross-docking (fast distribution) operations. Preconditioned and packed produce enters this store, having already flowed in the cold-chain – the goods would have originated at a pack-house or from a processing unit. Since goods

already arrive in packaged form for retail, there is no need for a pack-house type unit to this infrastructure. In some cases, a large infrastructure which doubles as an aggregation unit for raw produce, will design a preconditioning facility for preparing local produce for cross regional travel.

The front end cold stores are distribution centres or hubs, and are a perpetual hub of activity, receiving and dispatching cargo at a daily or frequent basis and are critical infrastructure to serve connectivity to the market. The ante-room, also known as a staging area, is large in size to allow for multiple activities and movements inside such a cold store. These cold distribution hubs are located close to consumption centres, metros and other steady demand centres such as ports and airports so as to serve as a feeding centre.

Standardisation of handling, packaging and equipment is critical to smooth operations and to minimise operational wastage with the storage aspect taking a back seat. The operational needs of the two main type of cold stores differ, as does the associated technical design and sizing of infrastructure.

#### FRESH PRODUCE FACTS

- Apples float in water as they are 25% air.
- According to the Dead Sea scrolls, cherry seeds have satanic power.
- Kiwi has twice as much Vitamin C as orange.
- An average strawberry has 200 seeds.
- I Pumpkin is a fruit, not a vegetable.
- I The banana is a berry, the strawberry not.
- In the 19<sup>th</sup> century, sailors ate lime to avoid scurvy on long sea trips.
- I Unlike mango, grapes can no longer ripen after they are picked.
- Watermelons were used by explorers as a means to carry water on long expeditions.
- You can speed up ripening of a pineapple by standing it on its head (leafy end).
- Strawberry and cashew are the only fruits to have their seeds on the outside unlike all others which have their seeds inside.
- Avocados are toxic to almost all animals (including cats and dogs). Humans are a rare exception.

#### **Ripe for consumption**

Ripening chambers are a unique component of the cold-chain and used only in the fresh produce segment. In this segment, whereas the cold-chain operates to extend life by slowing the normal metabolism, the ripening chambers do the opposite and advances the physiological activity. Depending on market demand, ripening chambers are used to manipulate the life extension brought on by the cold-chain, by adjusting or tweaking the maturity cycle of the produce.



The produce that enters a ripening facility exits the cold store well within its extended life cycle, and the ripening process is triggered. Climacteric fruits like bananas, mangoes and papayas are normally ripened on demand, to meet market requirements. Normally, the produce would otherwise ripen naturally towards the end of their life span. Ripening chambers can also be used by a non-climacteric fruits like for de-greening of citrus fruit.



Ripening chambers are designed to maintain mildchill temperatures and dose the fruit with ethylene, which is a natural ripening trigger. Air circulation ensures that the dosing is even inside the chamber and allows for a clean look to the ripened product. A ripening cycle of 4 to 5 days is the typical norm. At the end of each cycle, the ripened produce moves out for retail. The shelf life of ripened produce is minimal

and thus, ripening chambers need to be built at the last mile of the cold-supply-chain, close to the consumption base. Ripened produce cannot last long and should not be dispatched for long distant travel.

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## **TWO MAJOR BUSINESS MODELS IN COLD-CHAIN**

### **Option 1 (Food supply & delivery system)**

**Business model:** the above points will typically suggest the following strategic paths:

- i. Front end distribution hub is key access to market.
- ii. Three revenue streams should be optioned
  - a. Own produce sales (high margin business).
  - b. Service/rental business (low margin, filler business).
  - c. Trading of imported products (fluctuating margins).
- iii. Where produce can be procured at farm-gate (fresh whole fruits and vegetables), owning the source (through collaboration or setting up pack-houses) is most profitable segment. Pricing strategy will be skimming model, depending on demand, season, quality and brand building.



- iv. Where product is established (ice-cream, branded foods), the hard asset is used to provide service. The pricing strategy will be cost-plus and competitive as clients will be established product owners (HUL, Amul, Meatza, Haagen-Daz, etc).
- v. Where retail clientele is available, tapping into existing demand for products and trading or partnering with traders will be possible, with ownership of front end infrastructure. Pricing strategy will not be so much opportunistic as volume based.

**Operating model:** Service excellence, be it for own product or for 3<sup>rd</sup> party products will be key. For this, owning and having full control of the cold-chain infrastructure is critical, especially in the initial stages of setting up. In this sector, leasing of infrastructure, puts one in risk, at play of asset owner. The following are key technical DO NOTs:

- i. Design for any one select segment.
- ii. Ignore building-in redundancy safe guards of key equipment.
- iii. Save cost on insulation as this effects holding period during emergencies.
- iv. Ignore transport ownership strategically must own some of the delivery system.
- v. Build in multiple layers better to provide easy and quick access to products.
- vi. Miss opportunity of creating own brand in food products offers high valuations.

The following is a preferred strategic and operational agenda.

- i. Build a platform (distribution centre/hub) close to high paying urban centre.
- ii. Own at least 10% of delivery vans. Outsource remaining needs.
- iii. Initially access low-hanging fruit by earn through providing service for existing trade, but aim for own produce/brand in long run keep at 5% of initial capacity to service own produce.
- iv. Develop with partners own source points (pack-houses). If owning DC at multiple markets, build own sourcing pack-houses.
- v. Enter into fresh produce retail packing unlike finished products from food processing units, for fresh produce no factory is needed. Just source, aggregate and package from farms to establish a fresh food brand (long term value).

### **Option 2 (Hold inventory for off-season):**

Use cold-chain for trading in produce, with minimal service intervention. This model is already evident in case of dried chillies, apples and potatoes. In this case, the produce is essentially sourced at farm-gate, stored in bulk at back-end warehouses for deferred sales. Risk is in holding inventory and in demand variations, since buyers have to reach the supply side (asset owner). In the long run, a successful commodity trader, will also have to reach out to buyers as this segment is getting commoditised.

However, this model requires less management skills and since it is applicable to single harvest crops only, the demand is habitually well established. The earnings are primarily per transaction and this model will have minimal valuation in equity markets.



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Stakeholders operating in the complete cold-chain, frequently complain about delays and bottlenecks on the highways which lead to unnecessary risks and expenses. These bottlenecks range from infrastructure hardships to delays in documentation checks and even roadside extortion. These create a hesitancy to scale up operations by the refrigerated logistics sector.



The Hon'ble Union Minister for Agriculture immediately recognised this as an important e-governance initiative. The program succeeds with the whole hearted participation of the reefer operators as "bhagidaars" as they share and record the bottlenecks faced providing the ability to translate into corrective measures in the future.

## **General Information**

Item	Description	
AMC	Annual Maintenance Contract. System where the vendor / supplier	
	agree to maintain the equipments installed by periodic checkups &	
	replace parts whenever needed. Can be signed with many vendors for	
	different equipments.	
АРМС	Agricultural Produce Market Committee Act. Except for 7 states, all	
	others have APMC to regulate sales and levy taxes on agri-produce.	
Automatic Controller	Automatic control is the application of control theory for regulation of	
	operating machines without direct human intervention. These	
	controllers are linked to sensors to regulate energy usage and running	
	hours depending on various trigger points (temperature, CO <sup>2</sup> ,	
	Humidity, product stored, etc).	
Alternate Power	Used by the facility over and above grid & DG set power	
sources	<ul> <li>Biogas, also known as 'Gobar gas'</li> <li>Biogas, also known as 'Gobar gas'</li> </ul>	
Biomass	<ul> <li>Biomass, agri-waste fueled electric turbines, bollers.</li> <li>Cantura the Sun's anargy thru DV calls &amp; generate electricity.</li> </ul>	
Solar PhotoVoltaic	• Capture the Sun's energy thru PV cells & generate electricity	
Solar Thermal	Capture the sun's energy into heat absorbing medium.	
Wind Energy	• Harness the energy of wind thru windmills & produce power	
Bar code/Coding	An ontical machine-readable representation of data	
bar code/ coding	showing data about the object to which it attaches Can	
	be used for traceability and farm coding	
	1 23456 78901 2	
Bins stacking system	Plastic / wooden bins to store the produce. These are stackable (on	
	on top of other). No half floors for storage are thereby needed.	
Blast Freezer	A special freezer room in which very cold air	
	circulated by blowers is used for rapid freezing	
	of produce like fish, meat, ice cream (< -18 °C	
	products). In fresh farm produce, this is called	
	pre-cooler (for chilled, mild chilled range).	
BTU	British Thermal Unit, a unit to measure energy. BTU is often used as	
	measure of power (as BIU/n) in neating and air conditioning industries	
	(12000B10/n = 1  ton cooling = 3.517  kilowatts)	



Item	Description	
Bunker Coil (open	Open Pipes (single or layered) are used as the prime medium of heat	
tube)	exchange – these are metal surface tubes with no additional fins.	
	Usually suspended from ceiling with normal ceiling fans and occupy	
	entire top floor of cooling chamber.	
	CoilCo ACU's v/s- Bunker Coils	
	15 to 20 % Extra Available Cold Storage Space CollCo - Ammonia Air Cooling Units CollCo - Air Cooling Units need very limited space alog with the wall. CollCo - Air Cooling Units need very limited space alog with the wall. CollCo - Air Cooling Units need very limited space alog with the wall. CollCo - Air Cooling Units need very limited space alog with the wall. CollCo - Air Cooling Units need very limited space alog with the wall. CollCo - Air Cooling Units need very limited space alog with the wall. CollCo - Air Cooling Units need very limited space alog with the wall. CollCo - Air Cooling Units need very limited space alog with the wall. CollCo - Air Cooling Units collCo - Air Cooling Units need very limited space alog with the wall. CollCo - Air Cooling Units collCo - Air Cooling Units coll Storage height and almost the entire floor area. In 64 ft cold storage coll storage is being consumed by bunker colls and fans. The left-out utilized space height is only app. 52 ft. As a result almost more than 20 % is wasted by using the bunker coll system.	
	1/19/19/19/19/19/19/19	
	CONTROLS	
CA Store	Controlled Atmosphere cold store – a special category cold store	
	where the chambers are sealed airtight & oxygen level controlled at	
	very low level. Besides cooling, special CA equipment is also installed.	
	Used in India mainly for long term storage of Apples. Experimental use	
	in other crops types is possible but is mainly recommended for long	
	term storage of fruits such as apples, pears, kiwi.	



Item	Description	
Compressors	The heart or "pump" within an air conditioning system. Various types	
	are used to compress refrigerant gas. The onsite engineer shall advise	
	you on what type of compressors are in use.	
	Reciprocating, Rotary, Screw, Centrifugal (mechanical compression of gases and depend on electricity as motive power).	
	Absorption type: very rare and creates compression like pressure by	
	heating the refrigerant gas or other chemical process. Depends on	
	solar thermal or other heating source for energy.	
Cargo- Material	Equipment used for easy handling, loading / unloading & moving of	
Handling Equipment	$\sim$ 1 ong moving helt carrying items on top of them	
Conveyor beit	• Fork Lift or Counter Balance Truck (Diesel or Battery powered)	
<ul> <li>Hand Pallet</li> <li>Cargo lift / VRC</li> <li>Chain Lift</li> </ul>	Closed loop lift with repeating platforms usually used to move bagged	
	cargo to upper floors.	
Direct Expansion System	Wherein the compressed refrigeration undergoes volume expansion through an orifice or expansion valve, creating a cooling effect. Eg- deodorant aerosol spray. Is used in all domestic air conditioners, fridges, etc.	
Data Logger	Portable instruments used to record temperature and humidity during	
	the transport & storage period.	
	Anergy Temperature & Huminity Logger Model: Allih 101 - 270 e 1 <sup>10</sup> C mit Songe: 0 ti 100 m mit + 300 mit O ti 100 m mit + 300 mit	
DG Set	Diesel Generating set for alternate power. Capacity measured in KVA or KW, each cold store must have at least one.	
Evaporator	Indoor Unit where cooling process or heat exchange takes place.	



Item	Description
Fire Detection &	Devices for detection of smoke & heat
Fighting System	Pic. of a smoke detector
Smoke detectors	
Heat sensors	
Hose / Hydrant	
Extinguishers	
Sprinkler	
Gas based	
Sand box / bucket	
Heat Recovery	Used in ventilation systems to recover energy from vented air.
kVA	Kilo Volt Ampere used to measure source power like for DG sets or grid power (kVA x power Factor = kW)
kW	Kilo Watt to measure electrical load (100KVA = 80 KW, output is 80% of electric input)
Indoor Unit	The indoor cooling unit (usually suspended from ceiling or wall) where
Evaporator types	the cooling effect takes place, usually installed with inbuilt fans.
Open tube	Modern systems are tubes with fins (like in home AC), older types are
Finned tube	open tube (bunker coil type). For cooling fluids like milk a cold plate is
Plate	used as primary heat exchange. Diffuser types use ducts to throw cool
Diffuser	air across floors.
NCCD	National Centre for Cold chain Development. A Govt. of India
	organization under the Ministry of Agriculture. Incorporated by
	sanction of cabinet in Feb 2012 as a think tank for cold-chain.
Pack House	A working area for accumulating, sorting, washing, grading of
	agricultural produce. Can have a staging cold room with pre-coolers.
PEB	Pre-Engineered Building. Metal frame with pre-fab paneled walls.
PUF Panel         Poly Urethane Foam Panel; for insulation of modern cold roo	
Pre-Cooler	items above 0 °C) is rapidly cooled down (within hours) to prepare for
	transport or storage (Blast freezer for frozen items). Usual cooling
	ranges are 4, 7, 10, 15 °C.
RCC	Reinforced Cement Concrete, used to segregate moors in old stores.
Refrigerant Gas	A gas that produces cooling (neat absorbing) effect while expanding of
Ammonia     Freen	technology Ammonia is most common in industrial refrigeration
• Freon	Freon (CEC) is common primarily in domestic refrigeration. Record
• (02	type of refrigerant in use as informed by engineer.
Ripening Chamber	A chamber or room in which unripened / green fruits are ripened in a
	controlled process. Mostly used for green bananas, mangoes, papaya.
RFID	Radio-frequency identification (RFID) -a technology that uses radio
	waves to transfer data from an electronic tag, called RFID tag / label,
	attached to an object, through a reader for the purpose of identifying
	and tracking the object.
Kacking system	A storage system made of metal and designed to
	for vertical space utilization and hence improved
	canacity utilization Goods are placed on each
	shelf space (rack). Usually such stores are single
	floor but very tall.



Item	Description	
Steel mezzanine platform	A half floor (not made of concrete) on which people can walk. Unlike metal racking which is a like a large shelf or rack system.	
Secondary Cooling	Where the primary expansion based cooling is used to cool a second	
system	medium (usually brine water or air), which in turn is circulated to give	
	cooling effect in the target area.	
	In normal home AC's you witness primary cooling system as the primary evaporator (or cooling unit) is inside the space to be cooled indoor unit.	
	But in large hotels and shopping malls, the primary cooling unit is outside, where it first is used to cool the air. This cold air is blown through AC ducts to individual rooms or the target areas – this is example of secondary cooling system. In commercial refrigeration systems, high density fluid (brine water) is first cooled and this is circulated through pipes inside the chamber to perform the cooling in the chambers (secondary cooling).	
Sorting / Grading	Sorting and grading for fresh agri produce. Can be done manually or by using specialized equipment & technology (conveyor belts, optical graders, size matching, etc).	
Sensors / Instruments	Special sensing instruments to automatically check the room	
Temperature	temperature, moisture level and carbon dioxide level in the air. Is used	
Humidity	by many modern cold storages.	
• CO2		
Ventilation	Fresh produce needs oxygen to survive. Vents to refresh air are provided, these can be manual or automated (automatic controller)	
Wooden mezzanineHalf height floor, similar as steel mezzanine except that		
platform are used to make each floor instead of steel.		





### Information Bulletin (Ministry of Agriculture and Farmers Welfare) "Centrally Sponsored Scheme for Cold-chain Projects"



Cold-chain logistics is a thrust area for development, and considered as part of the second green revolution. Cold-chain is an end-to-end logistics bridge and provides for uninterrupted custody of the value harvested at farm-gate, up to end-consumers. The Government of India supports the development of cold-chain through the Mission on Integrated Development of Horticulture (MIDH) of the Ministry of Agriculture and Farmers Welfare. MIDH provides several incentives to interested stakeholders and promoters. Financial assistance of 35% to 50% of admissible cost of projects is granted.

 Who can apply: Private Industry, Entrepreneurs, Cooperatives, Farmer groups, PSUs.
 When to apply: Scheme is demand driven and can be availed all through the year.
 Where to apply: Office of local Horticulture Mission or National Horticulture Board.
 Components: Modern Pack-houses with Pre-coolers, Cold Rooms, Cold Stores, Reefer Vehicles, Reefer Containers, Ripening Units, Alternate Energy, Retail shelves, Vending carts.

*Requirements*: Fully funded project with loan sanctioned from a nationalised Bank. Subsidy is directly linked to credit availed to incentivise owners by reducing their credit burden. The supported components are explained in the scheme Guidelines, and should abide minimum System Standards.

Guidelines & System Standards: See www.MIDH.gov.in or www.NCCD.gov.in

*For more information*: Contact the closest State Horticulture Department or your State's Nodal Officer for Cold-chain Development (NOCD).

### Benefits of investing in Cold-chain

- Low interest loan from Warehousing Infrastructure Fund (NABARD) - 100% FDI through the automatic approval route, and ECB route open -

- Credit linked Subsidy to projects @ 35% to 50% of admissible costs (MIDH) -
- ST exemption on 'erection, commissioning, installation' of Cold storage & transport -
- Service Tax exemption for preconditioning, storing, transporting agricultural produce -
- Rewards of endless Demand, Smart-Bridge between rural & urban, reduce Food loss -
  - Growing market for Fresh Fruits and Vegetables, domestic and international -- Option to avail of Negotiable Warehousing Receipts as per WDRA norms -
    - Investment Linked 150% Tax Deduction (Section 35-AD of IT Act) -



Issued on Public Interest by the National Centre for Cold-chain Development www.nccd.gov.in | www.midh.gov.in

## **Subsidy Process under MIDH**



Projects must be fully financed (with bank + promoter share) before applying for subsidy. Subsidy shall be credit linked and back ended, intended to offset credit burden. Subsidy cannot be more than Bank loan. Approval process can range from 2 to 8 months depending on projects and need not hold back projects from implementation.

(refer Annexure-III of MIDH Operational Guidelines)

Download the MIDH Operational Guidelines from www.midh.gov.in



Notes		
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### Address and websites of Nodal offices

Name	Website	Description
Horticulture Mission (MIDH)	www.midh.gov.in	Contact State horticulture Missions – Head
		office at Krishi Bhawan, New Delhi
National Horticultre Board	www.nhb.gov.in	85, Institutional Area, Sector-18
(NHB)		Gurgaon-122015
Ministry of Food Processing	www.mofpi.nic.in	Panchsheel Bhawan, August Kranti Marg
Industries (MoFPI)		Khelgaon, New Delhi-110049
APEDA	www.apeda.gov.in	3rd Floor, NCUI Building 3, Siri Institutional Area,
		August Kranti Marg, (Opp. Asiad Village),
		New Delhi - 110 016

Above websites will provide the latest contact details of concerned officers and other relevant information to the stakeholders.

For feedback on the content or for a translation of this document into other languages, please register your feedback or request with the event organisers or the State Horticulture Mission.



Contact local State Government officers from Department of Agriculture/Horticulture/Food Processing/Marketing to learn more about coldchain and how you can be an entrepreneur.

Local Industry Chambers will also provide guidance and direction to private enterprises.

Specialised technology awareness and capacity building is provided by NCCD to its members.

Cold-chain companies are advised to register with eNAM to take advantage of unified agriculture market system.

Develop networks of farm-to-consumer supply chains to develop all of India.