



National Centre for Cold-chain Development

Issue 6 | August 2014



NCCD Newsletter | Issue 6



The CEO's Desk

NCCD launched a fresh series of skill-based trainings for youth wishing to operate ripening chambers. These sessions were held in seven locations in Karnataka and Chhattisgarh. Additionally, the three day curriculum for advanced training on cold-chain technologies was continued at the Danfoss Learning Centre in Chennai.

An interactive meeting was held with the Federation of Cold Storage Associations of India (FCSAI), where the recent initiatives taken in this sector were highlighted and appreciated by the Federation. NABARD participated in this interaction in preparation of a new scheme to be launched by them. This was a follow-up to an earlier conference by FCSAI at which NCCD was invited

Interactions with CII's task force, mentioned in the previous issue, were taken forward. A meeting was organized by CII on 11-August to arrive at common rationale and for collecting industry inputs for reviewing of the extant standards on cold-

CONTENTS

EVENTS & WORKSHOPS	2
COLD-CHAIN INSIGHTS	4
ABOUT ISHRAE (OP-ED)	6
STRANDED COLD	7
ΤΟΜΑΤΟ ΤΟΜΑΤΟΕ	10
NCCD GLOSSARY	11
LUMINARY SPEAK	BACK COVER

OP-ED INVITATION:

Readers are invited to articulate their ideas, concepts & comments which will be nominated as Op-Ed articles.

chain infrastructure and the newly added components in Government schemes.

In this issue, we will also touch on the concept of "Stranded Cold", on utilising wasted cold from LNG port terminals. It is hoped that development on this front shall lead to energy efficient and highly innovative temperature controlled gateways into India.

-Pawanexh Kohli

EVENTS & WORKSHOPS

In the first edition of this newsletter, we had informed of a set of three specialised trainings, on ripening chamber operations, conducted in Andhra Pradesh. These trainings were triggered after ripening room infrastructure owners expressed demand & concern about their suffering inefficient operations due to a lack of skilled operators. The training primarily targeted unemployed youth and the curriculum developed, also aimed at creating awareness about safe ripening and promoting entrepreneurship in this sector. These trainings were held in Andhra Pradesh in the regions of Hyderabad, Warangal and Vijayawada during January to February of this year.

After completing first set of trainings, subsequent evaluation and impact assessment carried out. NCCD's training cell directly contacted all the participants, almost 100 in number to take feedback on these sessions. It was heartening to learn that the people who attended these operational sessions were not only those seeking employment, but also hopeful agri-entrepreneurs and existing traders. Furthermore, incessant demand was expressed by participants to learn more about the government support for setting-up ripening chambers and on the processes involved to apply to banks for taking loans for such projects.



As a result, adjustments were made during those first trainings sessions. NCCD's implementing partners were its life time members, Samagra Agribusiness Services who ably coped with such dynamic changes to faculty and curriculum. During a recent conclave with Nodal Officers for Coldchain Development from various States, the need for such trainings elsewhere was also expressed.

In August, a fresh series of trainings on ripening chambers were conducted in Bailhongal, Belgaum, Dharwad, Raipur and Bilaspur. A total of 25 sessions are planned for in Chattisgarh, Karnataka, Kerala, Tamil Nadu, Telangana and Andhra Pradesh in coming months. Each session includes one day on-site handling at an existing ripening chamber in the region as well a one day theoretical



National Centre for Cold-chain Development

NCCD Newsletter | Issue 6









workshop. Study material is provided in vernacular language of that region to the participants. These new series of trainings are coordinated by Samagra Agribusiness. Similar trainings in northern States is being assessed & we look forward to other NCCD members who will be keen to implement the same.

Ripening facilities ensure that the fruit output, typically mangoes, bananas, papayas, chikoo, avocado, etc., have undergone a safe and hygienic process and counter the illegal practise of carbide triggered ripening. Use of calcium carbide for ripening can attract a prison term ranging from six-months to life and a penalty in lakhs of rupees. To promote the establishment of modern ripening chambers and to simultaneously spread recognition of carbide ripened fruit, NCCD is considering launching an awareness campaign for youth, school children and agri-entrepreneurs. Readers may be aware that ripening chambers are a component of cold-chain that adjusts and compresses product life of fruits, which was earlier enhanced in the cold-chain, to suit market demand. Creation of modern ripening chambers is

supported under various Government schemes.

Mid-August CII called together members of its task force on cold-chain and

arranged and interaction with NCCD. Luminaries and Leaders from the Industry discussed the draft guidelines published earlier by NCCD and were in large agreement with the changes

proposed. Further detailing on the basis of inputs received is underway and shall be released by NCCD's technical team. This draft document was earlier shared with State Governments and NHB and is on the NCCD website.







In August, NCCD along with various State Governments participated in the annual India Foodex 2014 in Bengaluru. The exhibition held five concurrent events – GrainTech India - grains, cereals, feeds, products & technologies, AgriTech India - agriculture machinery, inputs, technologies and allied sectors, DairyTech India - dairy products and equipment; Poultry & Livestock Expo; MeatTech Asia and FloraTech India, all had a focus to upgrade and organise domestic supply chain, packaging and processing. The grand show got support from various ministries, departments and divisions of the government and was organised by the Media Today Group.

As part of these events a conference by the International Agribusiness Congress debated and discussed about cold-chain, across all segments of agriculture. The 3 day event held at Bangalore International Exhibition Centre (BIEC), attracted participation from 29 countries. Multiple NCCD members took part in the conference and the exhibitions, notably Carrier, Thermolab, Danfoss, ACR, Bluestar, etc. The stall by the Government of Manipur (MIDH team) enamoured visitors and was one of the most beautiful floriculture displays.





National Centre for Cold-chain Development Ministry of Agriculture, New Delhi || www.nccd.gov.in || contact-nccd@gov.in



COLD-CHAIN INSIGHTS

Pawanexh Kohli

Frequently cold-supply-chain strategists are asked to help develop models for a laudable vision, one that envisions a revenue multiplier for farmers-producers. This Vision is typically presented alongside tactical options, those that focus on enabling small farmers to offset their sales by storing their weekly or seasonal produce, thus avoiding peak season price drops. This tactic is also expected to avoid distress sales due to low shelf life of the perishable produce. Ergo the cold-store, viewed as a buffer that can extend the selling opportunity conceivably offering safe storage and extending the sale opportunity onto a more favourable future date.

The full extent of the original vision cannot be served merely by storing produce in cold storages, waiting to 'time the market' for the 'right price'. This tactic lends itself to the core premise that the buying markets will pay a higher value at a later date, when supply patterns are low - the market continues to be the local trader/mandis, specific to the growing region. This concept is true to an extent but does not leverage cold chain technology to the fullest. This can be termed as only a delaying tactic, as the transactional partners remain static. The market continues to be the local mandi buyer and furthermore, the buying price will remain routed through the multi-layered value chain from that same original buyer.

By merely deferring an imminent transaction without any real change to the scope of the transaction, this operating model does not truly contribute as a revenue multiplier – that is best arrived at by reaching out by multiplying the buyers, and in subsequence adding reason to enhance production and productivity. An intervention must lead to creating a win-win situation, one that will achieve enhancement to demand and supply. The strategy to delay a trade does not convert a zero-sum-game into a win-win situation. This is most applicable in case of high perishable goods where short term storing is not an in-depth solution, and such a business notion that needs to be re-thought!

The prime reason for a distress sale must be clearly understood! The first is the perishable nature of the produce. The other, in tandem, is the fact that farmers sell into a monopolistic buyer market – the mandi closest to the farm. The first limitation is eternal; remember that even when within the cold-chain, the produce continues to have a closure date, its stays perishable! What does this mean....that when the produce is timed to exit the cold store, it continues to be subject to the distress of a fast sale, more so if at a delayed date. Any buyer will still assess own demand and will continue to affect final price realisation, intemperate to the seller.

Any concept that primarily focuses on term based storage for local produce will merely continue to serve the same local mandis (and only strengthen any exploitations at these mandis). The concept of delaying a sale through the medium of cold storage is purely short term strategy and precludes the modern concept of market linked supply chains. Simply put, a delayed sale is most likely a delayed recurrence. The distress situation is not alleviated and while the bargain might well be a price higher than first, the associated risk and inventory holding cost is also accordingly raised.



In almost all cases, the cold store is not the complete solution. The majority of perishable crops need to be prepared to enter the cold store, is full advantage is to be derived. In fact, without such pre-conditioning, a cold store entry is in all likely-hood going to lead to poor quality and lead to desiccation and other problems. Have you noticed how imported produce, sourced from far away centres, thrive in our coldchain - but our own domestic produce has a short life span within that same cold-chain network.

The difference is that the first makes a proper entry into the cold supply system and the latter makes a



National Centre for Cold-chain Development Ministry of Agriculture, New Delhi || www.nccd.gov.in || contact-nccd@gov.in

August 2014





half-hearted entry at mandi level. Where our own domestic produce is routed through modern packhouses, case in example grapes for export or bananas, they too do well and growth is visible.

The initiator of cold-chain, in fact the nerve centre, is the first point integrated pack-house where multiple supply lines are decided, prepared for and triggered. A pack-house decides which product flows in the cold-chain, sorts to send some to the normal supply chain and optimises yield by diverting other assortments to food processing factories.

The best use of the cold-chain should be to link fresh produce to a better paying market **today**; then next to assess to store any surplus for a market in the future! Expanding the market means covering distances or linking up with food processors.

The sooner you can sell perishables, the faster you mitigate risk, better the cash flow, and lower the credit burden. When immediate market options are saturated, store so as to take advantage of lull periods in the supply chain or to build capacity for larger volume export options. Aiming for a higher price in the future is an option, getting the right price today is more important, especially when tomorrow is unsure for your perishables.

Farmers need not be conditioned with hopes about timing markets like commodity traders... (many apple storages find sufferance today since the chamber opening times are known and the local



traders again manipulate the buying to the hoarder's detriment – after exiting the storage, the shelf life is again limited and traders take advantage of the fact). In any case, the sensible use of cold-chain is to ensure a steady state of food and health security and not to hoard to time demand gaps, playing off the producer against the consumer.

Clearly the prime focus should be market linkage and direct trade with distant markets at first instance, with supply side storage only as a strategic buffer to maintain supply continuity as per demand patterns. Think of cold-chain as a pipeline that guides the products that keep flowing within. Use cold-chain links to connect the country, rural and urban alike, ensuring a regular and steady flow of food and medicines across sub-continental distances. The cold-chain is used to carry goods closest to shelf. As a first step, rural India needs to be dotted with pack-houses and production units.

To reiterate, the trick to perishable marketing is to sell first, store later. Aim to dispatch production for immediate sale, surplus must be linked first to demand across distances, use the shelf extension to expand the market footprint, use the storage to feed and sustain the supply lines (market linked storage), then repeat the cycle.

Any strategic development must aim to mitigate known risks, ensure higher profitability and lead to a larger market share. By applying technology to only delay a transaction without expanding the market reach is low-grade usage, suffices for some but does not extend technology to full potential.

The strategy to extricate from adversely binding situations is to extend beyond such limiting barriers, to reach a larger market audience! **Storage of perishable fruit is best applied when directly linked to wider market demand** – store only the volume that is surplus to the existing immediate sales cycle and **only after first using all means to expand the scope of immediate returns**. Specially as extended operations in cold-chain can raise the 'risk over time' factor multi-fold.

The glorious vision is served best by planning to expand reach and by connecting all our production areas with all our consumption centres, by developing constant flow of goods across these links, by applying logical network designs that minimise the need to store valuable goods, by moving away from a storage bias to a distribution bias. For the fresh market, **the cold-chain is about motion**!

Zero sum game: universal examples are gambling, futures & options, hoarding - wherever one's gain is another's loss.



National Centre for Cold-chain Development Ministry of Agriculture, New Delhi || www.nccd.gov.in || contact-nccd@gov.in



August 2014

ASHRAE & ISHRAE

Article by Shri Arvind Surange

Refrigeration is heart of the cold-chain machinery and the development of scientifically designed & energy efficient refrigeration is important. ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) was founded in 1894 and is considered the premier international society of engineers & technologists working in HVAC&R (Heating, Ventilation, Air conditioning & Refrigeration). However, their activities were mostly dominated by HVAC sector. For the past few years, 'R' has assumed some importance and as a result, a full 'Refrigeration Committee' has been established of late. The role of the committee is to formulate the road map for refrigeration for the future and promote 'Refrigeration technology and its applications at global level.

Recently ASHRAE published its latest version of Refrigeration handbook in which cold-chain has been given special attention. An important project now undertaken by ASHRAE is the preparation of a 'Sustainable Refrigeration' Guide" which would be a great reference book for development of 'Green Cold Chain projects'.

ISHRAE

ISHRAE is the Indian society, with aims & objectives similar to ASHRAE, of which it is also an international affiliate. ISHRAE was founded in 1981, has more than 10,000 members, over 40 subchapters, and has been serving the members and the community at large for 33 years. Apart from publication of Handbooks on HVAC, Ventilation & Refrigeration, ISHRAE has also published the book titled 'Cold Storage Basics' (authored by A. Surange). Considering the utility of this book in the Indian scenario, ISHRAE has decided to translate this book into 5 to 7 Indian languages.

The mega international project undertaken by ISHARE is the yearly event ACREX, in which organisations show case state-of-art technologies in HVAC, Refrigeration, Cold-chain & building

About the Op-Ed author

CMD - ACR Project Consultants Pvt Ltd.

Author's Email: asurange@vsnl.com

Author is a Category-A member of NCCD. Past National

President – ISHRAE, Fellow ASHRAE & member of ASHRAE's "Refrigeration Committee"

Shri Arvind Surange

services. With Cold-chain heating up in India, the 'Great News' is that in the forthcoming ACREX at Bengaluru (Feb 26th to 28th 2015) a dedicated Cold-chain pavilion has been planned for, along with a seminar and workshop by international and national experts from this field.

Green & Environmentally Sustainable Cold-chain

ISHRAE has been excited to see NCCD promoting and supporting environmentally friendly options in India's cold-chain. Green or Sustainable projects have several features, and I hope to put forth these in a separate article detailing these options.

In this introductory article, it suffices to say that India has started to think 'Green' to meet the challenges of environment & energy. The timing may be right to move forward to formalize GREEN Ratings for the cold chain projects.

As some readers may be aware, the US Green Building Council works to promote LEED ratings for green buildings. The Indian Green Building Council also joined the movement and now we have the LEED rating system as well as Griha rating system in operation for different types of building. Work on the formulation of LEED ratings for refrigerated facilities has also commenced and this is a news item worthy of mention. This is a welcome happening & it is greatly hoped that with NCCD's initiative and help, this will be a development in India too, in the near future.

Veggies on verge of extinction (Brisbane Aug-14) Professor of Behavioural Science Tony Worsley, Deakin-Univ, reports research that showing that vegetables may no longer be recognised as food by some children Addressing the International Horticulture	4000 year old fruit found preserved (<i>Georgia Aug-14</i>) An Early Bronze Age burial mound in Georgia, known as a kurgan, held in its depths astonishingly well preserved wild fruits. Sitting underground for thousands of years left as nourishment for the hungry
Conference in Brisbane, he reported of some children who had never tasted a vegetable & advised steps to pull back F&V from extinction.	souls of the dead, these fruits even exuded the aroma of fresh fruit when researchers sliced into them. They were preserved in honey.

National Centre for Cold-chain Development



CAPTURING STRANDED COLD

Our CEO, Mr. Pawanexh Kohli, explains the concept of reutilising Stranded Cold.

Cold-chain has at its heart the concept of temperature control. This elicits many other requirements, some which are needed to counter the side effects of such thermal regulation. Yet, refrigeration is a primary need and this places a demand for energy, sometimes an inordinate amount, which is converted into the desired thermal change. Usually, the most common form of energy used is electrical, which in turn runs refrigeration equipment. The highest energy load is from compressing a refrigerant, which is later expanded in the evaporator to affect the cooling experience. Electricity is available from our grid – thermal or hydel, from solar incidence, wind power, from fuel cells, fuel powered turbines and generators. This electricity can also be stored in rechargeable cells or batteries.

To affect Vapour Compression Refrigeration (see Issue 3 - May 2014, page 4), electric power is converted into physical force to compress the refrigerant. This in turn undergoes a phase change, which next in turn is released through an orifice, expanding to its natural state once again, and this is used to bring about a temperature change in its carrying coils. Another motor (fan or pump) in turn then circulates the medium (fluid like air or water) to be cooled around these cold coils to transfer the cooling effect to other surroundings. Plenty of steps, and some, which are not mentioned, by the way!

The majority of energy expended goes into managing the refrigerant, expansion of which causes cooling. If a cold fluid can be accessed, without recourse to refrigeration, the entire energy load would drastically come down. One cool energy source is geothermal water – underground water from deep wells are normally around 22°C to 24°C all through the year (temperature of groundwater is generally equal to the mean air temperature above the land surface. It usually stays within a narrow range year-round).

If we required maintaining a room within this temperature range, circulating ground water through cooling radiators (like heating radiators) would be a very low cost method. In fact, cold stores are advised to use this technique to partially reduce their energy load by circulating cool water from underground source (keeping in mind that the water must return to earth in a closed loop). The cold energy from such water, if wasted or lost to air, such as when used to water gardens, can be termed as stranded cold.





Stranded: marooned, abandoned, forsaken, discarded, neglected, cast off, rejected, jilted, disowned

What other sources of Stranded Cold can we tap into and utilise in the process of cold-chain, to optimise or reduce the need to produce cold! How about having a look at LNG terminals!

LNG is liquefied natural gas, the liquefaction being done through the process of active refrigeration. This process is undertaken at production centres, principally converting the natural gas into liquid form, which can then be transported in large quantities on ships. Liquefaction happens at temperatures lower than -160°C, its boiling temperature. LNG carrying ships maintain the LNG cargo at these cryogenic temperatures lower minus -162°C (-260°F). Storing LNG at this temperature is akin to storing water at its boiling temperature or 100°C. At the receiving end, prior to consumption, LNG is regasified and distributed through pipelines as natural gas or in compressed form as CNG.



The process of regasification, simply put, is a reheating process. The acute minus temperature, cryogenic cold, is discarded, carried away through seawater exchange or dispensed into open air. The LNG is boiled off into its natural gaseous form and the gas is brought up to an ambient temperature so that it can be safely handled and carried away in pipes of the gas grid, etc. The amount of energy discarded – the Stranded Cold – is of a very high order. For every million cubic metres of gas, approximately 20MW of cold energy is lost.

Cold-chain operators can conceive of the opportunity in utilising this waste cold, stranded energy, just perfect for cold-chain. Visualise an over-the-fence cold-chain facility adjoining every LNG port terminal, capturing and bringing into use megawatts of cooling, more than could be needed in the whole year. Piping this extreme cold to use it for liquefying air or nitrogen is another option.

In 2013, in discussions with various experts, the idea of waste heat recovery as well as capturing of stranded cold was discussed with NCCD. In April of this year, an





invitation from IMechE was received to participate in debates at the Cool and Clean Summit in London. At the

summit, NCCD proposed certain possibilities - solutions to consider when planning to capture discarded cold energy. This later resulted in exploratory visits to the LNG port terminals of Hazira and Dahej in the second half of July this year.

India's Grapes are in flavour Almost four years ago, EU rejected Indian grapes due to pesticide residues. In the season for 2014, a record breaking 19.2 million tons of grapes have been exported to 94 countries by India. UK and EU received 65,000 tons. This year, exports to Russia are reported to double from previous year and in 2015, Japan may be a buyer for Indian grapes.

Pakistan exports mangoes to Japan

In the last week of August, Tokyo received a maiden mango shipment from Pakistan after 16 years. Japan had earlier given Pakistan a vapour heat treatment plant, which was used to condition the mangoes before export. The importers are the AEON Group, the largest retailers in Japan. The fruit is expected to retail at around US\$ 10-12 per kg.

××× + 8 ∉

National Centre for Cold-chain Development

August 2014

NCCD Newsletter | Issue 6



Capturing Stranded Cold at LNG Terminals

Background:

- Natural Gas when transported on ships, is cooled to below its boiling point, less than -160°C and shipped in liquefied form as LNG (Liquefied Natural Gas).
- This liquefaction process happens at loading terminals and the temperature is maintained during entire transit, including after discharge at receiving terminals.
- The product is used by consumers in gas form and therefore the liquid (LNG) undergoes a regasification process at receiving terminals before distribution.



- Regasification involves warming up the Liquid and the cold is lost during this process (every ton of LNG offers 840 mega Joules of cryogenic energy)
- This regasification or warm-up process can include multiple methods, all of which involves heat transfer to circulating fluid seawater, air, water glycol mixes which in turn is not used.

There are possibilities to recover this waste or stranded cold for use in other applications, including cold-chain applications.

Recovery of Waste Cold:

- 1. The heat transfer fluids from regasification process can be directly circulated to enclosed insulated spaces to utilise the captured cold for storing of temperature-controlled goods.
- 2. Captured cold can be stored as cryogenic fluids including extraction of Liquid Nitrogen or Liquid Air as energy banks for other selected use.
- 3. A combination both above (buffered energy store and direct heat exchange), is expected to be the best option to utilize the high-grade (more than -162°C) energy source.

Other Innovative applications:

A cluster of users of such stored cool energy can be conceived around LNG terminals. This recovery of waste/stranded cold can be used directly for cooling needs and in stored form (as cryogenic fluids). NCCD participated in debate and discussions with Liquid Air Network at IMechE to further develop on this concept such that a user cluster can be developed around the energy recovered. Such a user cluster is seen to comprise of following applications-

- The recaptured cold energy can be piped to across-the-fence, co-located cold stores, applied in lieu of normal indoor cooling units, minimizing the cost of refrigeration.
- Other possible applications include the use the cool energy for freeze-drying of horticultural produce (onions, etc.), for cooling of buildings under human occupancy, etc.
- The cryogenic fluids can be used to power turbines, or for refrigeration equipment on road and rail. Motive engines for vehicles like forklifts using liquefied air or nitrogen are in development, the prime driver (engine) functions without combustion. This is a zero pollution application as 'exhaust' is clean.

Such development opens up scope of developing dedicated port gateways for perishable cargoes with on-location phyto-sanitary checks. Reefer containers can be stuffed/destuffed at such port hubs, instead of incurring logistics delays & demurrage. Specialised road and rail connects can transpire & all this will serve as a future ready platform, as India develops into the food basket of the World.

vas
ion
ally
ed,
w at ita

National Centre for Cold-chain Development Ministry of Agriculture, New Delhi || www.nccd.gov.in || contact-nccd@gov.in





ΤΟΜΑΤΟ ΤΟΜΑΤΟ



Some factoids about our tamaater टमाटर

The Americans and the British might sing songs about the concerned phonetics, but no one will argue that it is a key ingredient to our regular intake. Spoken tomate in French, Portuguese, Spanish, German this botanical fruit originated in the Andes and was called "xitomatl", meaning "plump thing with a navel". When it was introduced into Europe in 1500s, the Germans referred to it as "the apple of paradise" and the French likened it to "the love apple". The Church of Rome banned it for nearly 150 years, as the "devils fruit".

Containing 0 grams of cholesterol, tomatoes are considered heart healthy – as a good source of potassium, they help lower high blood pressure. Tomatoes are an outstanding source of the antioxidant lycopene, high intake of which reduces the risk or severity of atherosclerosis, diabetic complications, asthma, and colon cancer. Lycopene intake also reduces absorption of UV rays, making tomatoes a natural sunscreen. A good source of riboflavin, chromium, calcium and magnesium, consuming tomatoes help reduce migraines, control sugar and avoid acidosis. On the other hand, the leaves are toxic.

Tomato Respiration rate; ethylene production:

◎ 10°C: 6 - 9 ml CO²/kg·hr; >1.5 ul C₂H₄ /kg·hr
◎ 20°C: 15-22 ml CO2/kg·hr; >4.9 ul C2H4 /kg·hr

When cooled from 20° C to 10° C, respiration rates reduce 2 to 3 times. The difference in respiration between 20° C and 25° C is minimal in case of tomatoes.

At 20°C, a ten-ton truckload of mature tomato can generate heat of 9.980 kilo calories per day (equivalent to 39,600 BTUs of heat load per day). At 20°C, this can increase upto 24,400 kilo calories per day. Tomatoes produce ethylene in sufficient amounts to disturb sensitive commodities, and costoring or shipping with items line lettuce and cucumbers (high ethy sensitivity) should be avoided.

Tomato Handling:

- I Ethylene Moderate Producer, moderate sensitivity do not store with ethylene sensitive items.
- Rapid post-harvest Forced air cooling is most effective for optimal keeping quality.
- I Precool the packaged produce to 12°C and commence transport leg to market.
- Post-harvest life potential 14 days at 12°-13°C, and 30 days at 4°C.
- A relative humidity level of 90-95% is recommended to prevent water loss (desiccation).
- Susceptible to chilling injury at temperatures below 10°C if held for longer than a week. Chilling injury is cumulative and results in failure to ripen, off-flavour, pitting and increased decay.

Ripening:

- Tomatoes are climacteric and ripening can be triggered in ripening rooms dosing it with 100ppm ethylene for 24 to 72 hours.
- Ripening is hastened at higher temperatures (18°-21°C). Tomato is one of those fruits that can be slowly ripened (i.e. in transit) safely, kept at 14°-16°C.



Processing tomatoes:

More than 2700 genetic varieties of tomatoes are reported. The Processing variety are distinct from the fresh market variety: fresh-market varieties are juicier and harvested prior to being ripe, while processing varieties contain higher percentages of soluble solids, are vine ripened and typically have a thicker skin than fresh-market tomatoes. Globally, the processing varieties have a lower market value by weight, giving fresh market tomatoes a larger share in crop value. Processed tomato products are most often classified as one of four major subcategories: paste, sauces, ketchup and other products, which mainly consist of puree; whole canned tomatoes; and juices.



National Centre for Cold-chain Development



NCCD Glossary of Cold-chain

Our CEO, Mr. Pawanexh Kohli, has been emphasising on the use of various packaging methods for fruits and vegetable to elongate the product life and maintain the quality of the products up until consumption. Use of advanced technology like Modified Atmospheric Packaging plays an important role in fresh produce cold-chain.

Modified Atmospheric Packaging (MAP) involves passive self-inducement of atmospheric parameters inside any enclosed package. Such specialised packaging exploits advantages of the normal respiratory activity of living fruits and vegetables which cause a change to air composition inside an enclosed pack [much like in a plastic film placed around our head]. The packaging material is designed with semi-permeable material so as to allow a minimal exchange of gases and oxygen with outside air, as a way of keeping the fresh food alive, yet extending its shelf life. MAP does not work to the exclusion of temperature control and both must be used hand-in-hand. Temperature control reduces the respiration rates to a level that can be safely handled by the MAP film or bag.

The simplest form of this technology is the application of a wax coat to the surface of the fruit. Similarly, selectively permeable plastic is used to package fresh produce. In effect, the packaging serves like a molecular sieve and allows for self-induced altering of the atmospheric composition inside the packaging, within specified limits. A MAP package designed for one product cannot be used with another, unless both commodities have the similar respiratory rates and oxygen needs. High humidity levels, important for fruits and vegs (F&V), are easy to sustain inside MAP. In MAP, F&V have advantage of a protected and safe environment, all the way from initial packaging to consumer's hand.



In other cases including meat, fish and processed foods, forcible flushing of the package with gas or creating a vacuum is used to counter microbial build up and preserve the product longer. CO² in carbonated drinks is the most common example. In such cases, the packaging is not permeable.

Ozone Depleting Potential (ODP): Earth's protective ozone layer can get damaged by certain ozone depleting chemical substances. This layer, composed of naturally occurring ozone molecules, extends from about 15 to 30 kilometres in the stratosphere above the Earth's surface and serves to filter 97-99% of the Sun's harmful ultraviolet (UV) radiation. Consequently, any thinning of the ozone layer allows more radiation to reach the Earth's surface - overexposure to UV rays can lead to skin cancer, cataracts, and weakened immune systems. In terms of ecological health, increased UV can lead to reduced crop yield and disruptions in the marine food chain.

Ozone depleting substances (ODS) vary in their capacity to destroy ozone molecules and the Ozone Depleting Potential (ODP) is a ratio of the relative depletion caused by different substances in relation to the value assigned to trichlorofluoromethane (R11 / CFC11) that is assigned the value 1. CFC11 has 3 chlorine atoms in a molecule – each chlorine atom can destroy over 100,000 ozone molecules.

The Montreal Protocol is the first worldwide agreement designed to protect human health and the environment against the adverse effects of the depletion of the stratospheric ozone shield. The protocol is administered by the United Nations Environment Programme (UNEP), which maintains the list of ozone-depleting substances that are targeted for control, reductions, or total phase-outs. India's cold-chain primarily uses ammonia, a natural refrigerant with zero ODP. Yet, with the need to develop more pack-houses and reefer transport units, the use of artificial refrigerants will increase and care has to be taken to only use gases that are permitted with acceptable ODP.





LUMINARY SPEAK



Dr. Harsh Kumar Bhanwala - Chairman, NABARD (National Bank for Agriculture and Rural Development)

NABARD has an enviable reputation of being one of the key institutions that focus on equitable development in rural India. Coldchain is known to be one of the major interventions that links rural source points with consumption markets. Can you please throw light on NABARD's plans for this sector?

This sector is aware that the Hon'ble Finance Minister in his budget speech for 2014-15, announced the establishment of a dedicated fund with a corpus of Rs. 5000 crore in NABARD, for projects related with agriculture commodity storage infrastructure sector. This fund is known as the Warehouse Infrastructure Fund (WIF) 2014-15. During this year, projects related with Dry and Wet storage will be assisted out of this fund and will have a

greater focus on cold chain infrastructure. Besides State Governments, and Government owned entities, SPVs, Cooperatives, Farmer Producer Organizations (FPOs), Federations, Private Corporates / Companies, etc., can also avail loans from this fund for cold chain infrastructure related projects. All components under cold chain infrastructure like pack houses, cold stores, refrigerated (reefer) vehicles, bulk milk coolers, etc., are eligible for loans. We expect that at least 10% of the corpus would be brought into use by cold-chain developers in 2014-15.

What specific advantage can the industry expect from this special window, the WIF 2014-15?

The WIF 2014-15 window will be accessible to all organisations for creating cold-chain infrastructure, provided that the project complies with the standards and guidelines as laid by NCCD. The rate of interest to be paid by the borrowers will be based on Nabard's Prime Lending Rate (PLR) which at present is around 9.25%. A borrower will be assessed and the credit risk estimated. To the PLR, risk premium will be added based on the credit rating parameters. The borrowers can expect a loan at highly competitive interest rates. These loans can also be linked to back-ended subsidy from the Government, if applicable. The loans are generally provided for a term of seven years with a two year grace period.

Cold-chains are most practical when they function as a link with multiple markets across regions. Traditionally, cold-storage projects were developed as standalone infrastructure. Will NABARD consider projects with cross regional footprints?

Yes of course, the clear direction for the country is to develop chains that interlink rural producing centres with consumption centres. At NABARD, we would also be keen on projects that have a large share of capital investment at rural level. This would include pack-houses with pre-coolers and staging cold rooms with associated refrigerated transport units. We believe that these components are most apt for projects that aim to develop holistic cold chains and that such capital inflows will bring greater development in rural India. To help with the planning of such projects the support of NABARD Consultancy Services (NABCONS) can also be taken by the promoters. NABARD also looks forward to closely work with NCCD on all these matters.

