



TECHNICAL PROFICIENCY OF THE INDIAN COLD STORAGES: AN ANALYSIS

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The Indian cold storages are quite traditional in their making and functions. In countries like USA, various fruits and vegetables like avocados, tomatoes, bananas, raspberries, blueberries etc. are available in a very fresh form albeit the fact that many of these products are being imported from many countries. In India, this type of modern facility is out of reach. It is clear from the fact that though India is agriculturally abundant but it still struggles to feed its large population. Till date, only around 4 per cent of India's fresh produce is being transported in cold chain. Moreover out of the total cold storages in India (i.e. around 7000), around half are located in just four states of India. This regional unequal distribution of the cold storage capacity also makes it difficult for the products produced in the non-existent cold storage states to travel safely to the cold storage sufficient states. But the Indian cold chain industry has started giving some glimpses of modern cold storage and cold transportation technology in its cold chain infrastructure. This can be stated as the result of some of Indian government's encouraging policies for attracting international players in the game bringing along international experience, design and international technology. Partnership with technology leaders like Emerson Climate Technologies is also opening doors for new technologies to enter Indian cold chain market. (www.qz.com). But still if one looks at the overall image of the Indian cold storage sector, it is backward in nature. According to the GCCA (Global Cold Chain Alliance), the major players in the cold storage industry globally are USA, China and India. each of these three countries are the only countries having more than 100 million metric tonne cold storage capacity

available in 2016 (www.freshplaza.com). India has the maximum capacity of cold storages followed by USA and China (www.foodengineering.com). But most of the Indian cold storages are traditional in design and technology. The technology and equipment installed is outdated and single commodity based i.e. potato (www.indiacoldchainshow.com/Cold-Chain-Industry-in-India-A-Report.pdf).

The Indian cold storage units must be technically upgraded (Sarma, Ch. R. S., 2018). Apart from enhancing the quality of the product stored, it would also help in cutting the post-harvest losses and promise a better return to the farmers. Most of the Indian cold storages are outdated, outmoded technologies are there and they are energy-inefficient too. It has been stated that out of the 7000 cold storage units in India, around 5000 are having outdated technologies. Apart from technological backwardness, there is lack of attention found on components of cold chain other than cold storage. There is a need of a multi-commodity cold storage system rather than a single commodity base (Sarma, Ch. R. S., 2018). In Figure 1, a traditional look of an Indian cold storage has been shown. Along with the outlook of the cold storage, the traditional bags being used for the storage of potatoes have been shown.

Figure 1 Outside View of a Typical Potato Cold Storage in India/ Potatoes Being Packed in Jute Bags



Source: www.ebook_storage/refrigerated_storage.htm

Figure 2 An Outlook of a Cold Storage in China (Under China Inspection and Quarantine) for Imported-Exported Meat and Sea-Food



Source: www.sctcn.com

Figure 3 A view of a USA based cold storage (Henningsen Cold Storage Co.)



Source: www.henningsen.com

The biggest drawback of the Indian cold storage industry has been seen in the obsolescence of the technology being used in these stores. Around 5300 of the total approx. 7600 cold storages have been built in 1960s and are age old. Around 75 per cent of them are built for the storage of single commodity i.e. potatoes only. But the storage of potato does not yield many profits to the cold storages. Of the total revenue generated, only 20 per cent is being generated by the potato cold storage (www.coolchain.org).

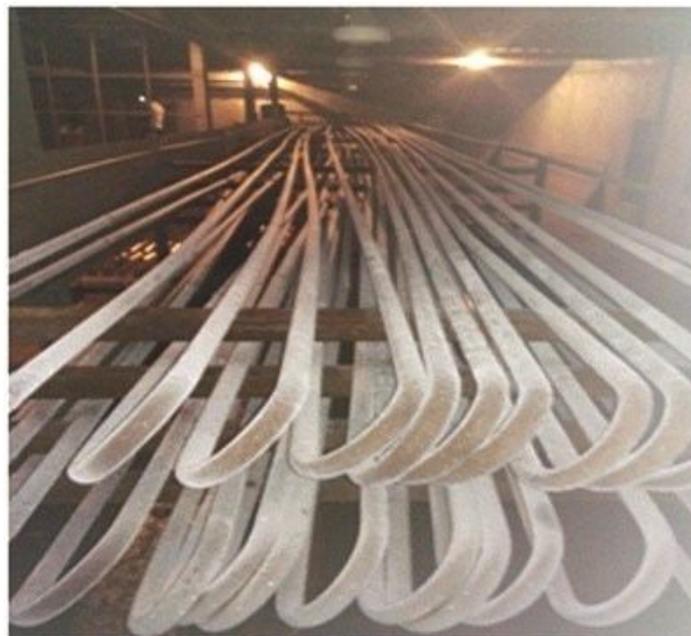
India's cold chain industry is still operating below capacity as most equipment used is obsolete and not technologically upgraded. Utilisation of

obsolete refrigeration system in cold storages of India is there. This fact is even impacting the profit margins of cold storage industry players. Most of the cold storages in India are running on low speed compressors which are based on the ammonia refrigeration system lacking the capacity control mechanism, due to which energy efficiency is considered low for these stores. These old compressors also occupy a big space for the installation of large sized bunker styled evaporator coils or other diffuser units (www.business-standard.com).

Bunker Coils Vs Air Cooling Units:

Most of the Indian cold storage units are using the bunker coil technology to run their units. If this technology is shifted into Air Cooling Units, a lot of energy and money can be saved. The bunker coil system consumes 60 per cent of the space through installation of bunkers and its trays. But the ACUs consume only 10 per cent of the storage space. In case of bunker system, the shrinkage in weight of potatoes is around 4 per cent where in case of ACUs, it is less than 1 per cent.

Figure 4: Bunker Coil System



Source: Kumar, Mahesh and Mahajan B.V.C. (2015) Cooling India e-issue

Figure 5: Fin Coil System

Source: Kumar, Mahesh and Mahajan B.V.C. (2015) Cooling India e-issue

The less space being using by the coil system causes more vacant space for more bags to be stored in the cold storages. Moreover they are factory manufactured having latest techniques so their quality is far superior to the other technology. Stainless tube with aluminium fin technology prevents rusting due to moisture which is present in the cold storages. By installing Variable Frequency Device, Air Cooling Units can even be made energy efficient. The product cooling is much faster in the Fin Coil Units. On the other hand, the bunker coil systems consumer higher power as the product cools in extended time duration. Moreover, oil accumulates in the coil which cannot be drained frequently which causes higher power consumption (Kumar, Mahesh and Mahajan B.V.C., 2015).

Energy Efficiency:

Regarding energy efficiency, as has already been mentioned, most of the cold storages in India are not assembled with energy efficient techniques. The fin coil system which has already started to be adopted in the newly build cold storages is an energy saving technique as compared to the old and bulky bunker coil systems.

Jyoti Garg

As Indian cold chain has to face an additional issue of extreme weather conditions, there is relatively increased use of energy. Emerson Climate Technologies has launched an energy-intensive technology in chilling and freezing. 'Copeland Scroll Compressors' are specifically designed for refrigeration and reduce energy consumption (www.qz.com).

It has been found that most of the cold storage units in India are performing poorly as far as energy efficiency is concerned. Considerable technology up gradation has occurred in the field of cold storages around the world during the previous few decades. As a result, higher energy efficient cold storage units are available these days. The choice of refrigerant is very important as far as the installation of machinery is concerned. For choosing the refrigerant, the Ozone Depletion Potential (ODP), the Global Warming Potential (GWP) and the Total Equivalent Warming Impact (TEWI) factors have to be taken into consideration. The most commonly used refrigerant is Ammonia (NH₃). Ammonia is environment friendly and has excellent thermodynamic characteristics. There are natural refrigerants also like air, water, carbon dioxide and ammonia etc. In fact in future, if energy efficiency in cold storage industry is to be focussed upon, natural refrigerants are the best to be used (Yadav, Vipin 2010). It was even felt necessary by the government of India to have well defined appropriate technical standards for various components of cold storages. So a Technical Standards Committee (TSC) was constituted by the Ministry of Agriculture which have technical standards and protocols for the cold chain industry in India.

This TSC has classified the cold storages in to the following categories:

- (1) Cold storages that do not require pre-cooling
- (2) Cold storages that require pre-cooling
- (3) Controlled Atmosphere (CA) cold storages

Recommendations have been given for the second category of cold storages mentioned above. While giving its recommendations, emphasis has been given on the optimum energy efficient techniques and efficient performance of the techniques used. While selecting technique of production, coefficient of

performance (CoP) has been taken into account (Government of India, Cold Chain Development Centre 2010).

However some potential energy saving techniques which could be used in the Indian cold storage system has been mentioned below:

- (1) There are high efficiency motors for the compressor, condenser fans, evaporator fans and pumps. These premium efficiency motors apart from being more efficient fetch lesser power.
- (2) The size of the evaporator is based on the maximum cooling load for the system and the Temperature Difference. The optimum Temperature Difference minimizes both the evaporator fan and compressor power consumption.
- (3) There are external loads on refrigeration systems which results into heat transmission through the walls, ceiling and floor. Building envelope can result into reduced heat transmission. This can also reduce energy consumption costs.
- (4) High efficient lighting fixtures can reduce the cold storage's energy consumption.

The installation of rapid and automatic door closers can also minimize the energy loss (Kumar, Mahesh and Mahajan B.V.C. (2015) Cooling India e-issue).

CONCLUSION:

The use of technology can be a cornerstone for any business and more so for the cold storage industry which is very much capital-intensive and technology driven. The Indian cold chain industry is slowed picking the pace of the technological development being experienced in this industry at the global level. But the biggest pull-factor in getting technologically fit is the age of the cold storages in India. Most of the cold storages are more than 40 to 50 years old and running on old machineries. Most of the sectors whether it be pharmaceuticals, food processing or horticulture storage etc. are using almost the same technologies being used in the past. But there has been changing trends and technology in the cold storage sector. As in any sector, there is a stiff competition in the cold storage industry also. The consumer wants the best quality services

at the cheapest rate. There has been a major change in the basic machineries being used in the cold storages i.e. compressors, condensers and cooling units. The new technology offers a shift from the traditional models to up-to-date modern cold storage models that provide maximum security and protection during storage. Insulated thermal panels, insulation and modern technologically built doors offer the required protection during storage.

Balancing the temperature inside the chambers is the most important part of work inside the cold storage chamber. Automatic temperature control is the need of the hour so that the temperature required for each and every commodity be set and obtained most accurately. This minimises the risk of products' deterioration. Regarding sustainable technology, many companies in the field of cold storage machinery manufacturing are offering environment friendly and energy saving techniques to be used in the cold storage units. The companies are using recycled by products for the manufacturing. More technical facilities: touch screen technology to be used in the cold storages panels; switching to LED (Light Emitting Diode) models that offers more control on the lighting of the unit, better lighting in areas where required, increased employee and storage performance; enhanced safety; and much longer life than the traditional lighting system (www.anccold.com).

Apart from the above, there are many other new technologies being introduced in the cold storage industry. But the Indian cold storage industry has not adopted these technologies and is still largely obsolete. Though there has been seen a rising trend towards alternator driven refrigeration systems as against traditional diesel systems. In the transport logistics, which is quite underdeveloped in India, some tendency has been seen to adopt hydro-electric power for engineless transport cooling. In the same way, many imported technologies like temperature sensors, GPS tracking, self-reporting alerts for screens both for computers and mobiles, solar cold storage panels, battery free solar cold storage panels and the like. The basic need for an advanced technology is that it should offer sustainable solutions to the need of refrigeration.

"Change is the law of nature". It needs to be adopted. That which is static is not technology. It keeps on changing and offering better solutions. As cold

chain is a capital-intensive and technology-driven sector, the adoption of it is a major factor in its success or failure. Indian cold chain industry needs to modernise and that too extensively and inclusively i.e. not some of the cold storages need to be technologically super but most of them need to be technologically upgraded. This is the need of the hour so that much wastage can be controlled in the field of horticultural products.

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