

# HIMACOL™

## SOLAR COLD STORAGE

With Integrated Phase Change Materials (PCM)  
based on Thermal Energy Storage system



Founded in 1994, Pluss Advanced Technologies started with R&D and manufacturing of specialized polymers. In 2007 Pluss commenced development in the field of Phase Change Materials (PCMs) technology. In 2012, the company raised equity funds from Tata Capital Innovations Funds and expanded R&D, developed and commercialized first of its kind temperature control solutions using proprietary materials, addressed unmet need of temperature control across refrigeration, cold storage, cold-chain logistics, HVAC, and healthcare sectors. The company today has a global presence with its own subsidiary in Netherlands. Pluss has received several awards and recognitions, including CII Innovation award twice, in 2014 and 2017. It has also received the Massachusetts Institute of Technology's Innovators under 35 awards, in 2016 and 2017. Since 2021, Pluss is a subsidiary of Carborundum Universal Limited (CUMI), which is a Murugappa Group company.

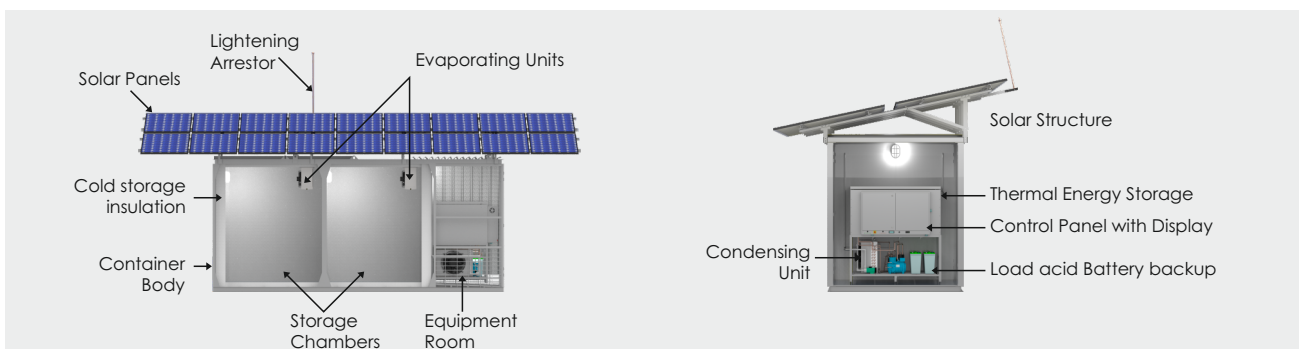


## About Himacool™

Himacool™ is a 24x7 Phase Change Material based solar cold storage which provides cooling at a fixed temperature range, even after sunset. The PCM based Thermal Energy Storage (TES) technology eliminates dependency on electrical batteries for cooling during non-sunshine hours and overcast conditions.

## The Technology

1. Himacool™ functions on solar energy to run the condensing unit during the day and simultaneously, stores thermal energy in the Phase Change Materials. During sunshine hours, electrical energy is produced by solar PV modules. These modules, typically mounted on roof of the cold-store, convert light energy into electrical energy, and this electrical energy powers the refrigeration system. The cold generated cools the cold-store and excess energy is stored in the PCM based TES.
2. The thermal energy storage system gets charged by heat transferring media connected through the condensing unit.
3. The stored energy in the TES is utilized to maintain the temperature inside the cold storage for upto 30 hours in ideal scenarios.




## Phase Change Materials (PCM)

PCM are materials that use phase change (solidify, liquify, evaporate or condense) to absorb or release large amounts of energy at constant temperatures. PCM leverage the natural property of latent heat to help maintain product and environment temperature for extended periods of time.

## Specification

Storage capacity	5MT	10MT	20MT	30MT
Temperature range	0°C to 15°C	0°C to 15°C	0°C to 15°C	0°C to 15°C
PCM based Thermal Energy Storage	200MJ	300MJ	400MJ	600MJ
Solar System	6-7 kW	10-14 kW	18-20 kW	25-30 kW
Compressor	2-3 TR	3.5 – 5 TR	8 – 10 TR	15 – 20 TR
Storage Chambers	1	Up to 2	Up to 3	Up to 4

## Cold storage options

Temperature	Storage capacity	Multiple Product storage	
-25°C to -18°C	Customized Capacity between 5MT to 100MT	Fruits Vegetables Horticulture Produce Fish Meat Frozen food	
-4°C to +4°C			
0°C to 10°C			
4°C to 15°C			
10°C to 25°C			

Manufacturing of Himacool at factory

## Compatibility

If different products are being stored in the same room, there is a risk of transferring odour and release of ethylene. The table below gives the compatibility of produce that maybe stored together.

	Apples	Bananas	Cabbage	Grapes	Oranges	Potatoes	Vegetables
	-	NC	SC	C	C	SC	C
	NC	-	NC	C	NC	NC	C
	SC	C	-	SC	NC	SC	SC
	C	C	SC	-	C	C	C
	C	NC	NC	C	-	C	C
	SC	NC	SC	C	C	-	C
	C	C	SC	C	C	C	-

\*C-Compatible, NC=Not Compatible, SC=Semi-compatible

## Critical Temperature and Storage

All fruits and vegetables have a 'critical temperature' below which undesirable and irreversible reactions take place, thereby resulting in food spoilage. The storage temperature always must be above this critical temperature.

Critical temperatures for some of the important crops are:

Commodity	Critical Temperature (°C)
Apple	-1 - 3
Grapes	-1 - 1
Brinjal	0 - 2
Cabbage	0 - 2
Carrots	0 - 2
Cauliflower	0 - 2
Potato	1.5 - 4
Lime	3 - 10
Beans	4 - 7
Lemons	4 - 15
Cucumber	7 - 10
Mango	11 - 18

## SUSTAINABLE DEVELOPMENT GOALS

### ACHIEVED USING THIS TECHNOLOGY

 <p>2 ZERO HUNGER</p>	Zero hunger
 <p>7 AFFORDABLE AND CLEAN ENERGY</p>	Clean and affordable energy
 <p>11 SUSTAINABLE CITIES AND COMMUNITIES</p>	Sustainable cities and communities
 <p>13 CLIMATE ACTION</p>	Climate action

## Recognition for PLUS<sup>®</sup>



**GITA**- Global Innovation & Technology Alliance - 2022



**FICCI**- DST Lockheed Martin Award - 2015



**WWF**- Climate & Energy - 2021



**TCL**- Supply Chain Innovation Award for Pharmaceuticals - 2018



**DST, GI**- Department of Science & Technology, Government of India - 2020 & 2017



**BIRAC**- Sparsh Grant - 2022



**UNIDO**- FLCTD Innovation Challenge - 2018 & 2022



**MIT**- Innovators under 35 India Award - 2016 & 2017



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