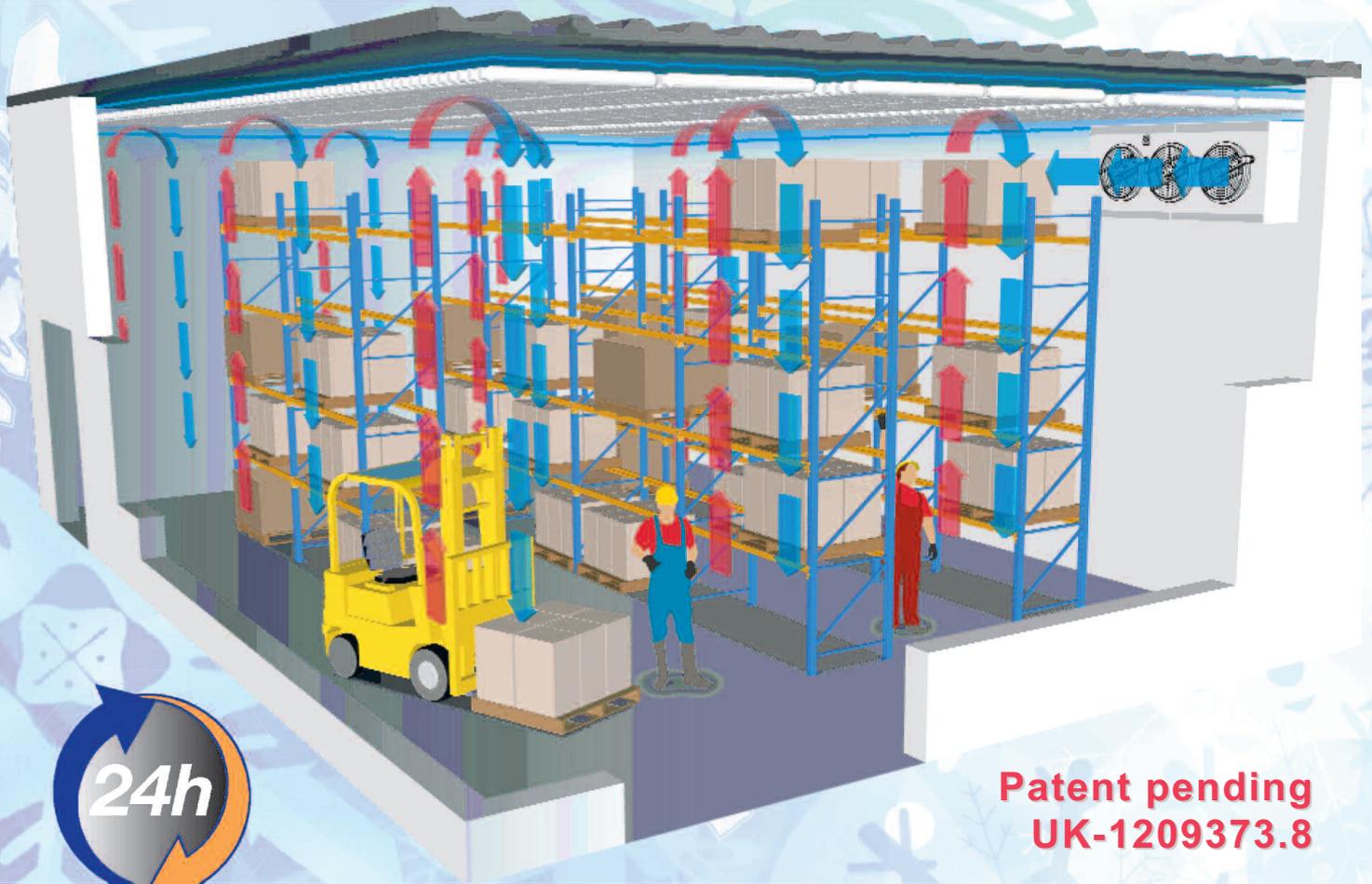


TM

PlusICETM

COLD STORAGE



Patent pending
UK-1209373.8

LOAD SHIFTING & BACK-UP SYSTEMS



PCM

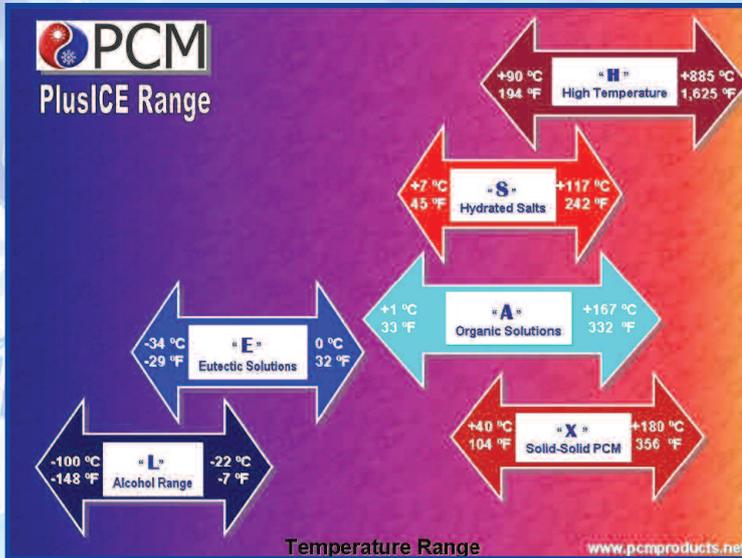
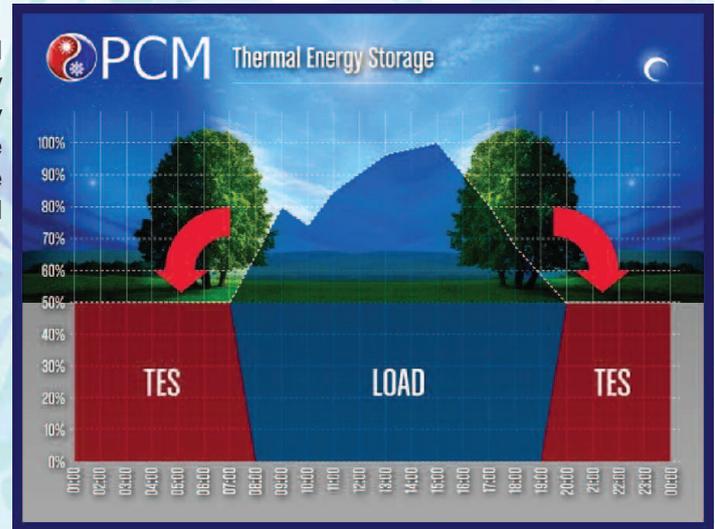
PHASE CHANGE MATERIAL PRODUCTS LIMITED



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INTRODUCTION;

Thermal Energy Storage (TES) is the temporary storage of cold energy for later use. It bridges the gap between energy availability and energy use. A thermal storage application may involve a 24 hour or alternatively a weekly or seasonal storage cycle depending on the system design requirements. Whilst the output is always thermal, the input energy may be either thermal or electrical.



EUTECTIC SOLUTIONS;

Eutectic solutions also called Phase Change Materials (PCM) are products that store and release thermal energy during the process of melting & freezing (changing from one phase to another). When such a material freezes, it releases large amounts of energy in the form of latent heat of fusion, or energy of crystallisation. Conversely, when the material is melted, an equal amount of energy is absorbed from the immediate environment as it changes from solid to liquid.

PRODUCT RANGE;

For the majority of applications, PCM solutions have to be encapsulated in sealed containers. To this end, PCM Products Ltd. have developed many different standard as well as custom-made containers for special applications.

These containers within the cold store create an artificial load to store cold energy effectively shifting the cooling loads from peak to off-peak periods. TES can be applied to any new or existing cold store applications whether secondary refrigeration like Glycol or direct refrigeration like pumped or direct expansion conventional refrigeration systems. PlusICE containers filled with PCM solutions which have operating temperatures between **-40°C (-40°F)** and **27°C (+81°F)** cover all the way from deep freeze to ambient storage & handling applications.

1) FlatICE Containers:

These containers are constructed of blow moulded HDPE and can be filled with any of our PlusICE PCM solutions. When stacked there is a small gap between each container, allowing either air or water to flow easily over the containers while providing a large PCM surface area for heat transfer.



FlatICE

2) TubeICE:

50mm (2") diameter x 1m (3.28ft) long PCM-filled HDPE tubular design enables them to be stacked effectively in both rectangular and cylindrical tanks for either air or water to flow as well as hanging from the ceiling/walls using standard pipe brackets.



TubeICE

3) IcePACKS:

Various size of standard / custom-made ice packs can be filled with any of our PlusICE Phase Change Material (PCM) with operational temperature ranges between **-100°C (-80°F)** and **+89°C (192 °F)** for any cold storage & handling applications.



IcePACKS

4) Pouches:

PlusICE pouches are manufactured using two layers of film and by forcing these two separate layers into linear welding rollers, it is initially formed in strips of 50mm (2") side by side along the width of the film to form a blanket of flexible sheet.



Pouches



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APPLICATION;

By placing the Eutectic products within the cold store one can create a TES facility whereby the excess refrigeration capacity during off-peak periods and lower ambient conditions over-night can be utilised to shift the peak load.

Eutectic TES can either be installed as part of the cold store fabric for example hanging TubelICE on ceiling/walls or alternatively containers like FlatICE can be placed on pallets and stored with the shelves or alternatively using ice packs / pouches Eutectic TES can be incorporated as part of the packaging / palleting.

Although one may over-cool the stored products to create a small load shifting capability but utilising the Latent Heat Capacity of the Eutectic TES one can increase the thermal energy storage capacity by as much as 10~15 times for a given volume.

As the cooling load significantly varies over daily or weekly periods, Eutectic TES enables the operator to spread the load over a 24 hour period which in return offers the facility of running the refrigeration machinery during lower night-time ambient conditions to charge the Eutectic TES. Later during day-time / peak cooling periods this over-night stored energy can be utilised to top up the refrigeration load without the need for full load mechanical cooling.

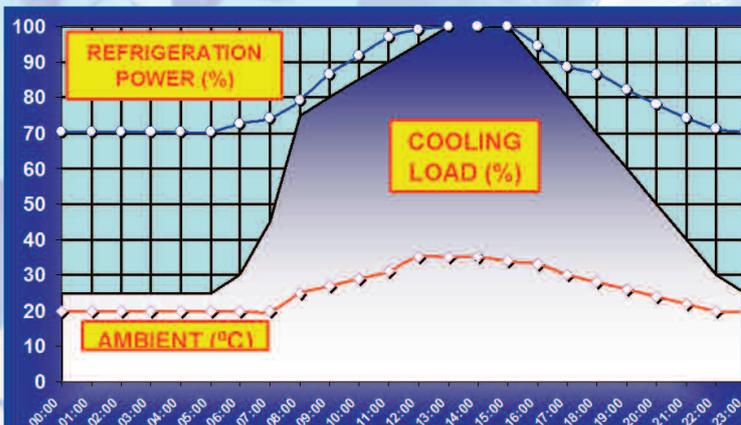
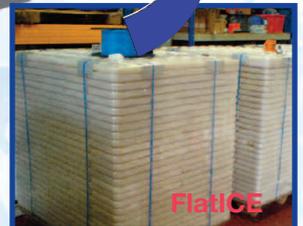
Finally, a Eutectic TES is a static system i.e. no moving parts offering a full stand-by capability in case of any mechanical failures and offers a maintenance free back-up facility.



Before



After



BENEFITS;

REDUCED RUNNING COST

Load shifting provides reliable operation and lower annual electricity / energy running costs. Eutectic TES Load shifting also enables to maximise the use lower night-time tariffs.

REDUCED MACHINERY

Shifting some of the peak load may enable designers to reduce the main machine size for new installations.

INCREASED CAPACITY

As a retrofit application, the additional TES load can increase the system output without any additional machinery.

GREEN SOLUTION

Reduced machinery size and energy consumption results in significantly reduced direct and indirect CO2 emission.

ENERGY SAVING;

By simply running the refrigeration machinery over night-time cooler

ambient periods, one can save as much as **15~25%** electricity consumption due to higher efficiencies of the refrigeration machinery at lower ambient condition as illustrated in this graph.

Reduced actual kWh electricity consumption coupled with the possible cheap off-peak electricity costs may reduce the overall cold store annual running cost by as much as 30~50% depending on the region.

QUICK RESPONSE

The large latent heat energy storage provides quicker response in large and sharp loads.

LOWER MAINTENANCE COST

Machinery runs for longer periods without any start / stop and therefore it offers a far more reliable operation.

FLEXIBLE SYSTEM

The overall machinery capacity and TES capacity can be exactly matched to system loads.

STAND-BY CAPACITY

In case the main machinery fails, the stored energy can be utilised to handle the system loads, hence, providing a degree of back up facility.



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For additional information contact;

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