PHASE CHANGE MATERIALS

NEW TECHNOLOGY: PCM IN SHIP HVAC INSTALLATIONS

HEINEN & HOPMAN

How can Phase Change Materials keep us cool?

INTRO

Thermal energy is available in different forms at different times, but unfortunately not necessarily at the time it is needed. Thermal storage is a way to preserve thermal energy so that the stored energy can be used at a later time, when the energy is actually needed.

Thermal energy often comes as excess heat from various processes on board a ship. This energy could be both low temperature energy (cooling) and high temperature energy (heating).

Use thermal energy when needed.

CHAPTERS

WHAT ARE PCMs?

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Phase change materials (PCMs) are substances that can adsorb or release thermal energy while the material changes its phase from solid to liquid or the other way around.

When altering from a solid to a liquid state, PCMs can absorb high thermal energy without changing their temperature. During the crystallisation at a consistent temperature level the materials release this latent stored energy. This capacity of the material can be used to store thermal energy when it is available in excess or to store naturally occurring sources of energy.

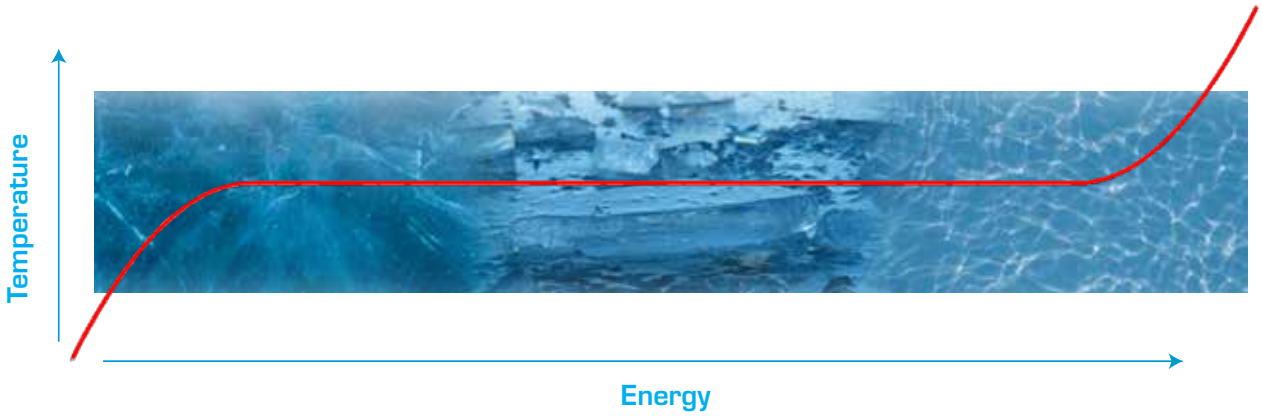

Image 1: Stages of PCM

BENEFITS OF THERMAL STORAGE BY PCM

The obvious benefit of using thermal storage in marine HVAC systems is to reduce energy consumption on board a ship. This is achieved by using what is normally considered waste energy at a time where heating or cooling would otherwise be produced using electricity or fossil fuel. The advantage of using PCM in the thermal storage is that it is possible to store larger amounts of energy at the same volume, and that the energy can be released at the preferred temperature. A tank filled with PCM can hold 3-4 times the energy of water within the same temperature span.

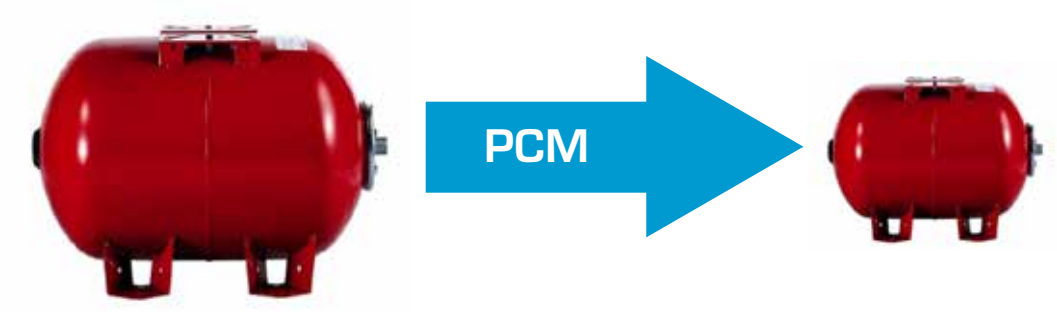

Image 2: Smaller tank is needed

CAPACITY EQUALIZATION

Many processes that involve thermal energy on board a modern ship have a strongly variable load during the day. Perhaps the best example: heating and cooling for the accommodation. At night, the cooling demand will always be considerably lower than at daytime.

Chillers are normally sized to cover this high load. By using thermal storage and PCM, the chillers can be sized to a much lower capacity. By running these chillers at full speed and high efficiency at night, the thermal storage can be loaded. At daytime, the thermal storage can be drained for energy and supplement the capacity of the chillers.

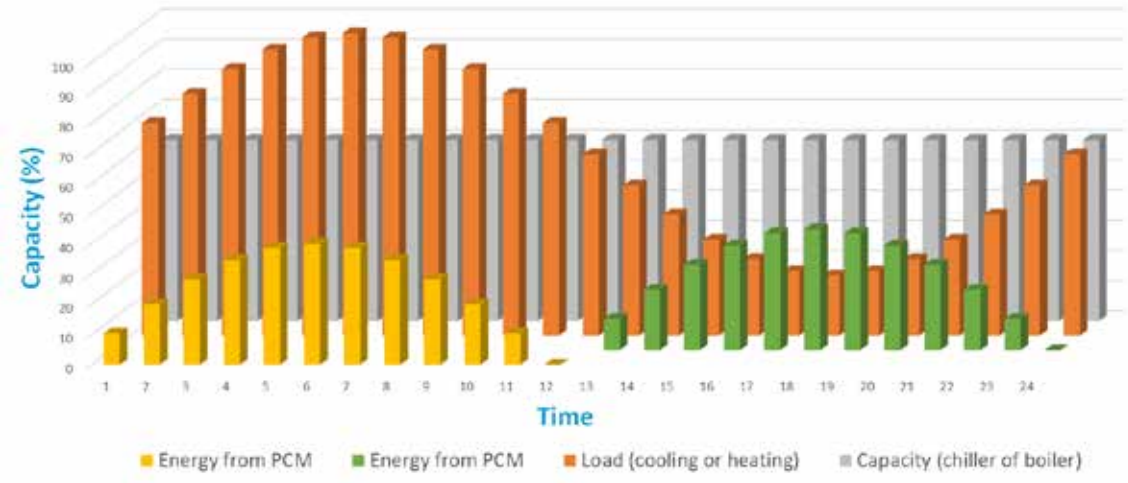

Image 3: Thermal storage diagram

EXAMPLE PROJECT

For Fjord1's two new building electrical car ferries MF Tustna and MF Grip – in operation from late 2019 – Teknotherm has implemented a heat storage tank with PCM to cover a certain amount of all night heating for the accommodation for a total year.

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Heinen & Hopman encourages a more sustainable world. By providing eco-friendly solutions and services we offer our clients the option of reducing energy consumption and thus CO2 emissions.

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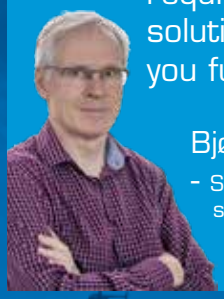

"Do you require more information about our Phase Change Materials or do you require other custom-made solutions? I am keen to help you further!"

Bjørn Martin Holo
- Senior Technical Advisor
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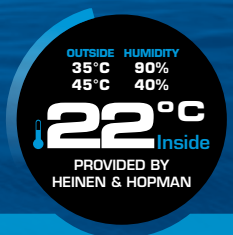

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