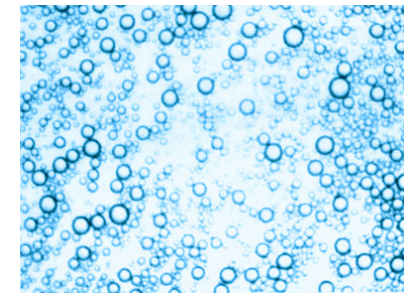


Cryosol

Ready to use cold storage fluid



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Kaplan Energy SAS

KAPLAN ENERGY SAS

Date: company specialised in Phase change material since 2009,

Activity: KAPLAN ENERGY, one of the main Bio-Based PCM engineering, consulting, design and development company,

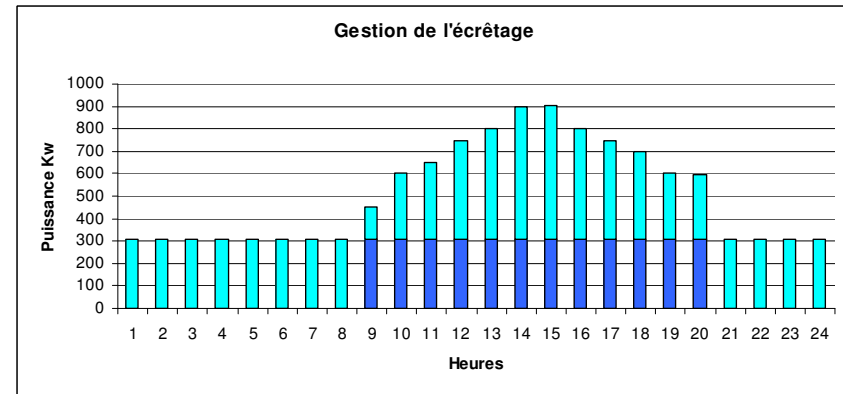
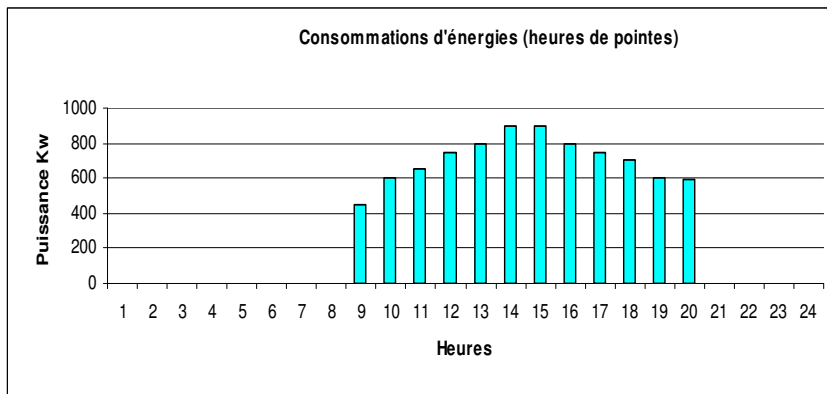
Industrial sectors: Heating and air-conditioning systems, building products, temperature-controlled transport of sensitive goods, medical products, electronic applications, textile applications, automotive, aerospace, food, ...



**KAPLAN ENERGY R&D on ARKEMA
Pierre Bénite (69) - FRANCE**

Why save cold energy ?

- Management of the useful cold

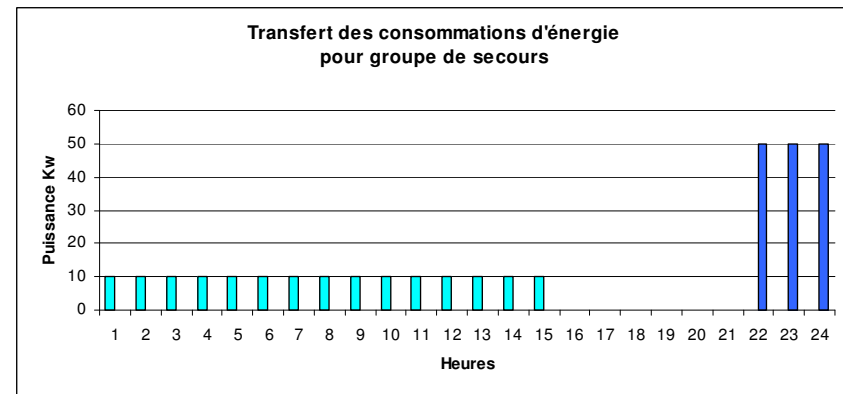
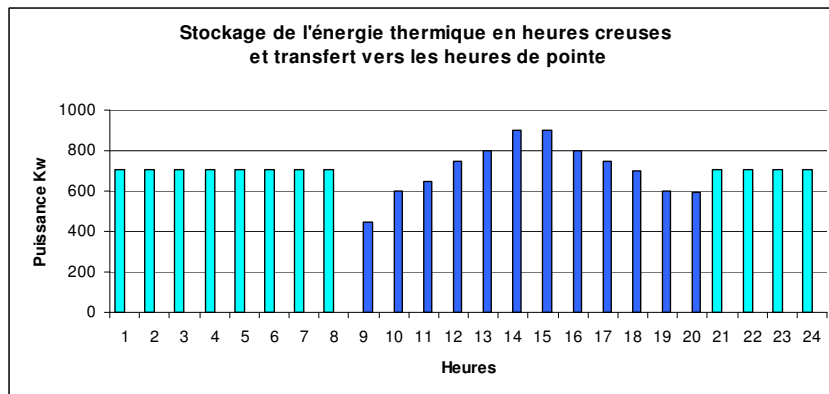


- ⇒ Management of cold emergency,
- ⇒ Reduction of the electric consumption during rush hours,
- ⇒ Reduction of the size of the systems (latent heat reduction of the sections of pipes).



Why save cold energy ?

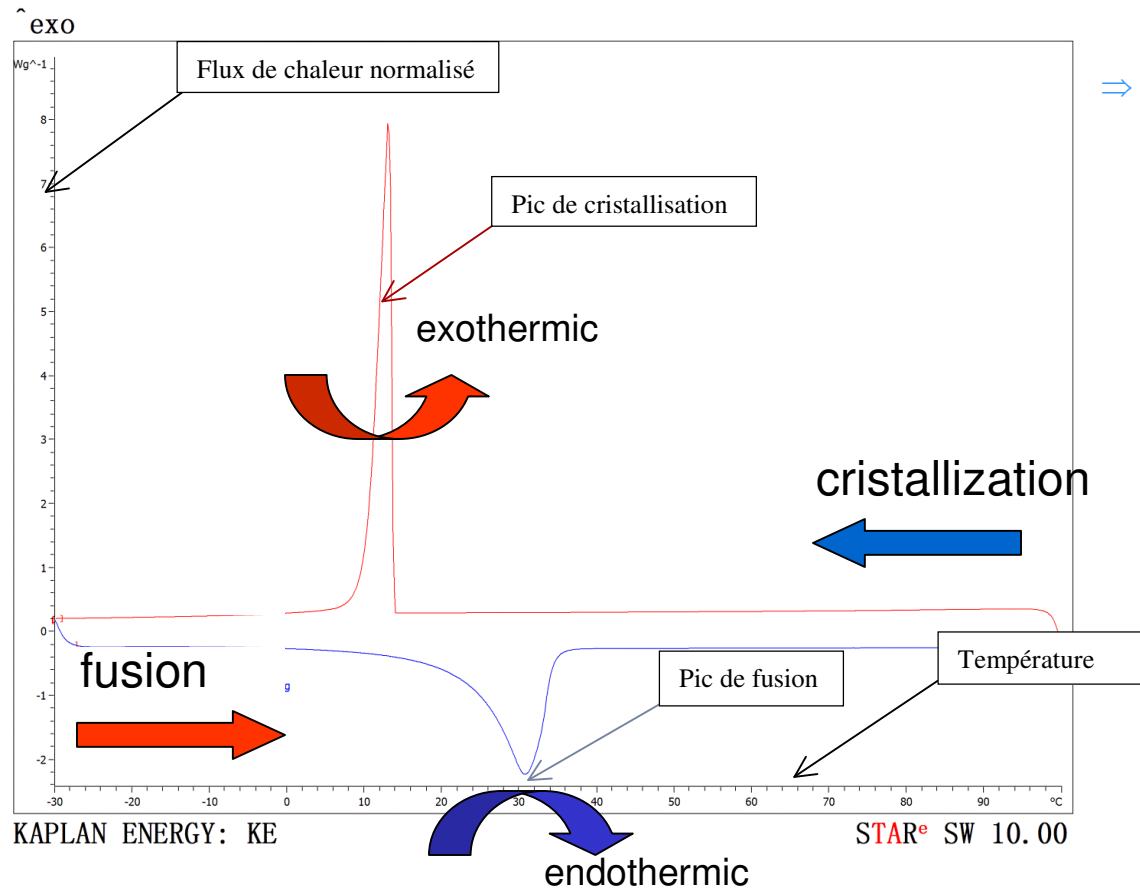
- Management of the useful cold



- ⇒ Move of peak hours towards off-peak hours,
- ⇒ More interesting COP of the Heat Pump in night than daytime (more 30 % of efficiency),
- ⇒ Extension of the half life Heat Pump (longer cycle),
- ⇒ Reduction of the electric power,



Latent Heat of PCM



⇒ What is Latent Heat of PCM?



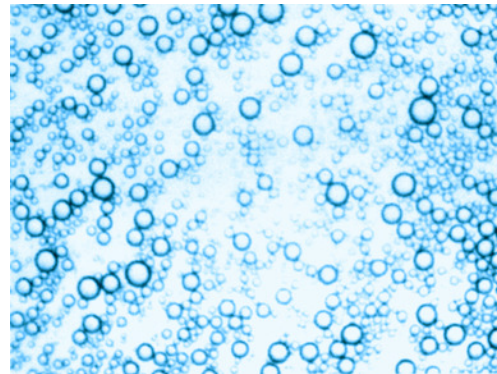
Cryosol[®] a cold slurry solution

⇒ What is Ready to use Cryosol[®] solution?

- Cryosol[®] is a ready to use cold storage fluid based on PCM in water carrier fluid.
- Cryosol[®] can store and transfer amount of thermal energy by using both the sensible heat capacity of the carrier fluid and PCM as well as the latent heat capacity of the PCM.

Cryosol[®] is an attractive alternative solution ready to use for cold supply networks, cold storage system and building cooling applications.

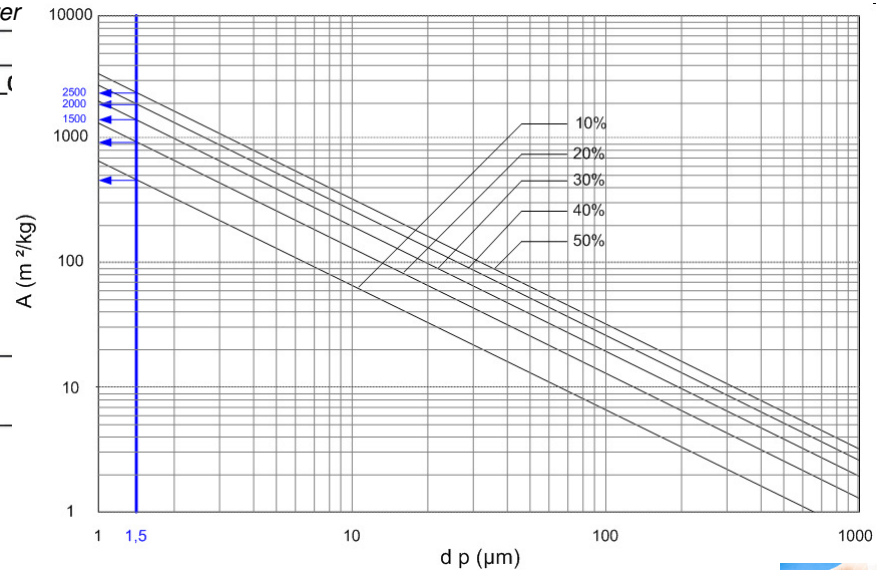
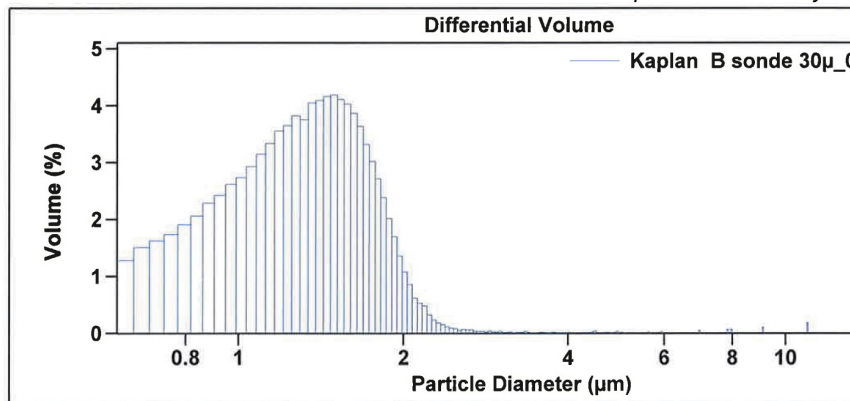
⇒ **pumpable fluid innovation**



Cryosol[®] a large surface area of PCM

⇒ Ready to use Cryosol[®] with very high exchange surface.

CRYOSOL[®] with Beckman Coulter particle size analyzer



⇒ Cryosol particle size = 1,5 µm

⇒ Cryosol with large surface area of PCM in water emulsion

ei: until 2500 m²/kg for 50% of PCM in water



Cryosol[®] a large surface area of PCM

⇒ Large surface exchange to stock the power



1Kg of Cryosol*

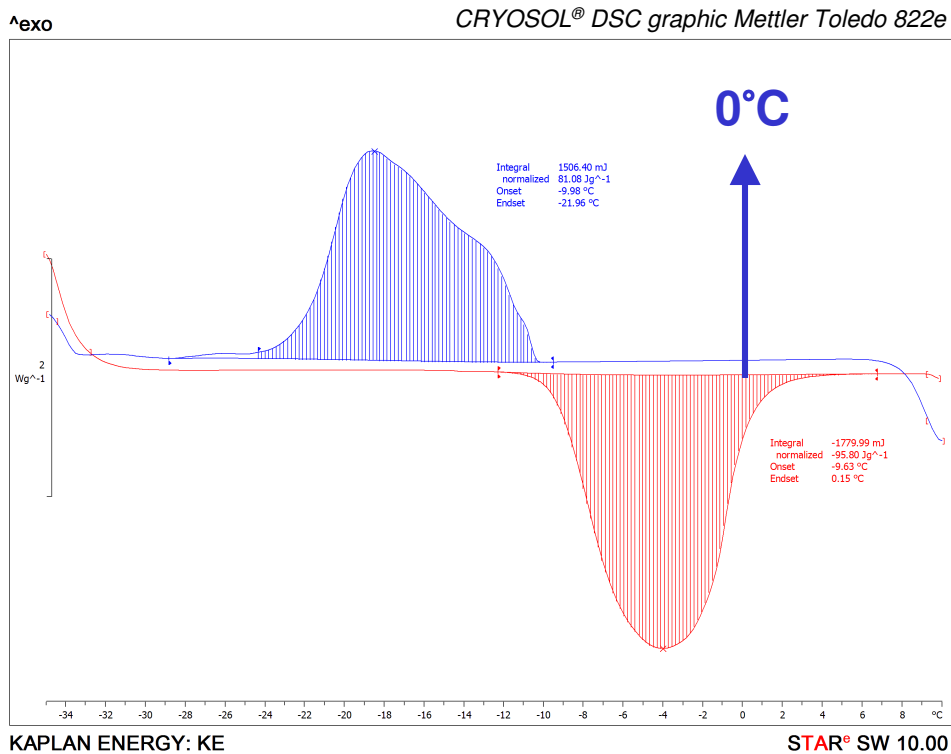


*with 30% of PCM in water emulsion

Surface 1830m²



Cryosol® a high storage fluid



⇒ **Density of useful cold energy**

- Cryosol® is a Phase Change refrigerant slurry with high storage capacity.

ei: - Cold water between 0°C and -6°C has a useful energy density of 25 KJ/Kg

- Cryosol between 0°C and -6°C has a useful energy density of 250 KJ/Kg



Cryosol® a high storage fluid

- ⇒ High energy density = high storage fluid
- ⇒ Decrease of the volumes of storage " of the cold ", ...



1Kg of Cryosol*

10Kg of water with glycol**

**with 50% of PCM in water emulsion*

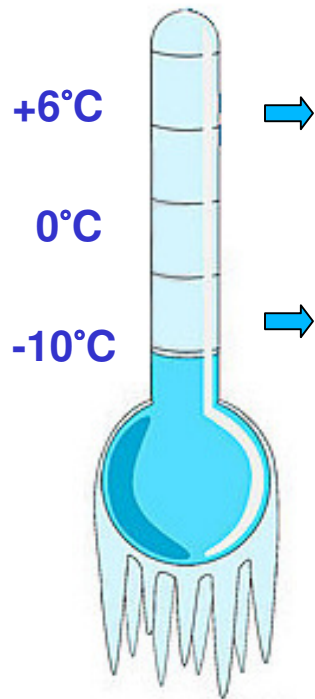
***with 25% of glycol*



Cryosol[®] for Cooling and Cold Supply Networks

⇒ No need to add antifreeze in the system

⇒ Ready to use cold storage fluid



Air conditioning,
Data center, ...

Food industry

**Cold
storage**

**Cold
release**

**Anti-
freeze**

0°C ; +6°C

+6°C ; +12°C

Included

-20°C ; -10°C

-10°C ; 0°C

Included

Various fields of applications: - air conditioning technology,
transport, cooling networks,
supermarkets, food industry, ...

- cooling



Strategy

- BUSINESS MODEL

=> **PRIVATE LABEL** (*Manufactured for others companies*)

=> **CONSULTING SERVICES & CDS** (*Custom Design Service*)



The main qualities of our PCM Consulting Services are:

- *Feasibility, researches of previous art and Studies*
- *Concept Development*
- *Rapid Prototyping*
- *Test and Validation*
- *Industrial Design*



R&D Partners





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