Heat Storage in the Energy Transition

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CHANGER L'ÉNERGIE ENSEMBLE

About EDF/R&D

Consolidating and developing a decarbonated production mix:

- Nuclear advantage
- Development of renewable energies

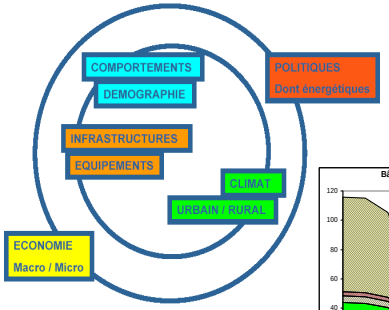
Steering the energy demand:

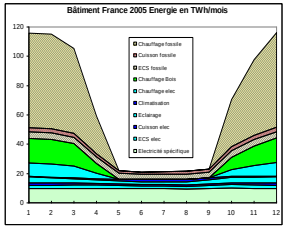
- Knowledge of the demand
- Energy Efficiency
- Smart cities

Adapting the electrical system:

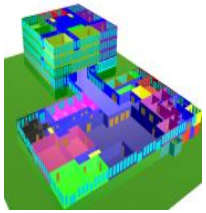
- Management of electrical facilities
- Development of transmission infrastructures

EDF / R&D - Energy in building and territories

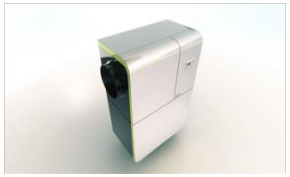


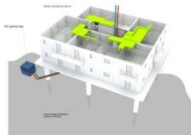


Understand and anticipate energy demand and power needs

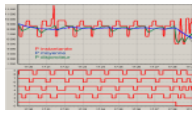


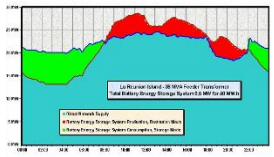
Develop tools in support of services to EDF customers





Assess and accelerate the development of low carbon technologies





Increase flexibility of energy use

Support the development of renewable technologies

Energy transition challenges

A changing energy world

Sustainability concerns (climate change)

Smart use of energies

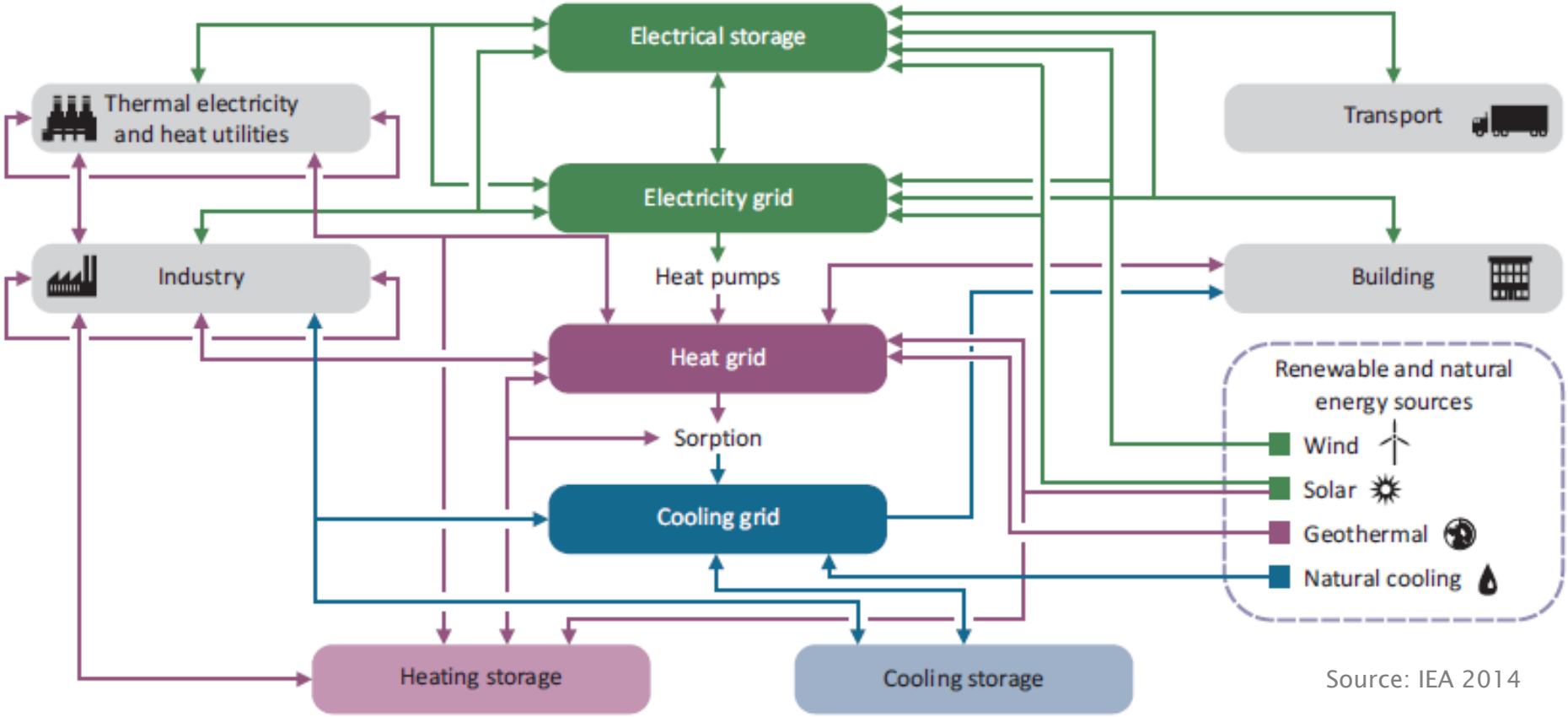
Increasing volatility (fossils fuels prices, policies)

Increasing Urbanisation (new customers with new needs)

Increased Energy needs (Emerging countries)

Flexibility provides global optimisation

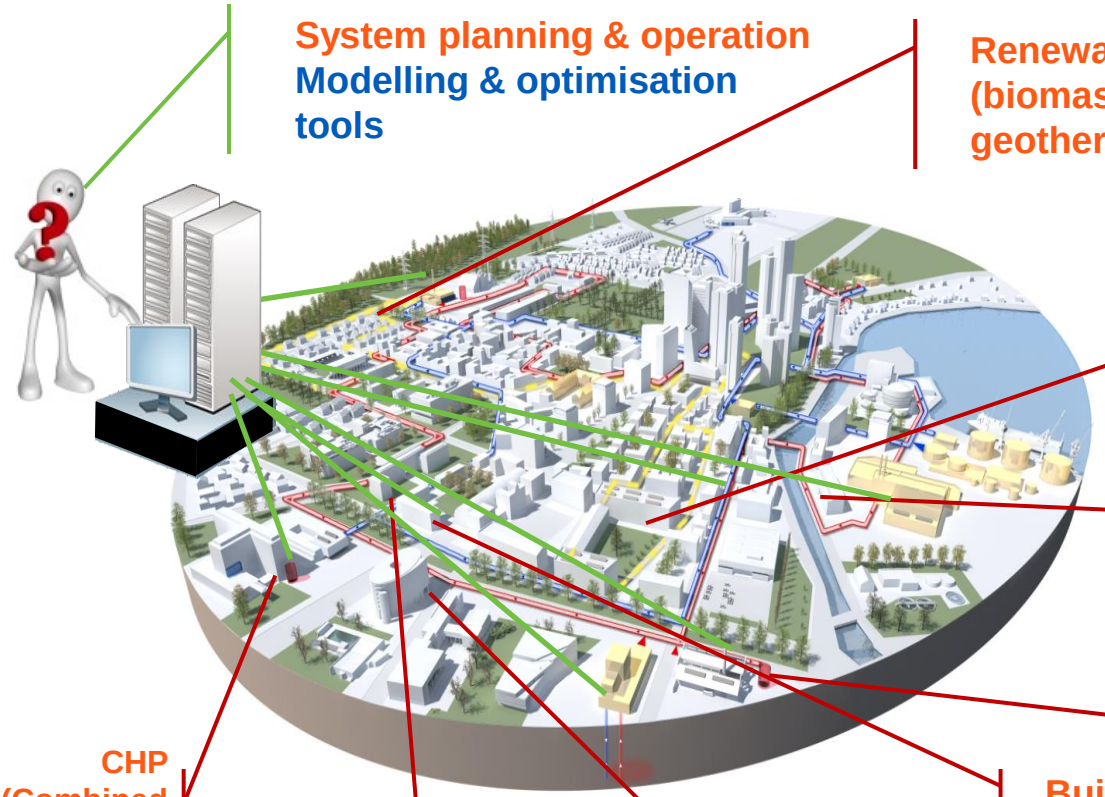
Electricity and thermal energy are an integrated energy system



Source: IEA 2014

Heat technologies and networks

Consume less, better, and with more flexibility



System planning & operation
Modelling & optimisation tools

Renewables (biomass, solar, geothermia)

Low flexibility /Must run

Low temperature networks

Very High Temperature Heat Pumps for waste heat

Must run

Heat Storage

Building isolation

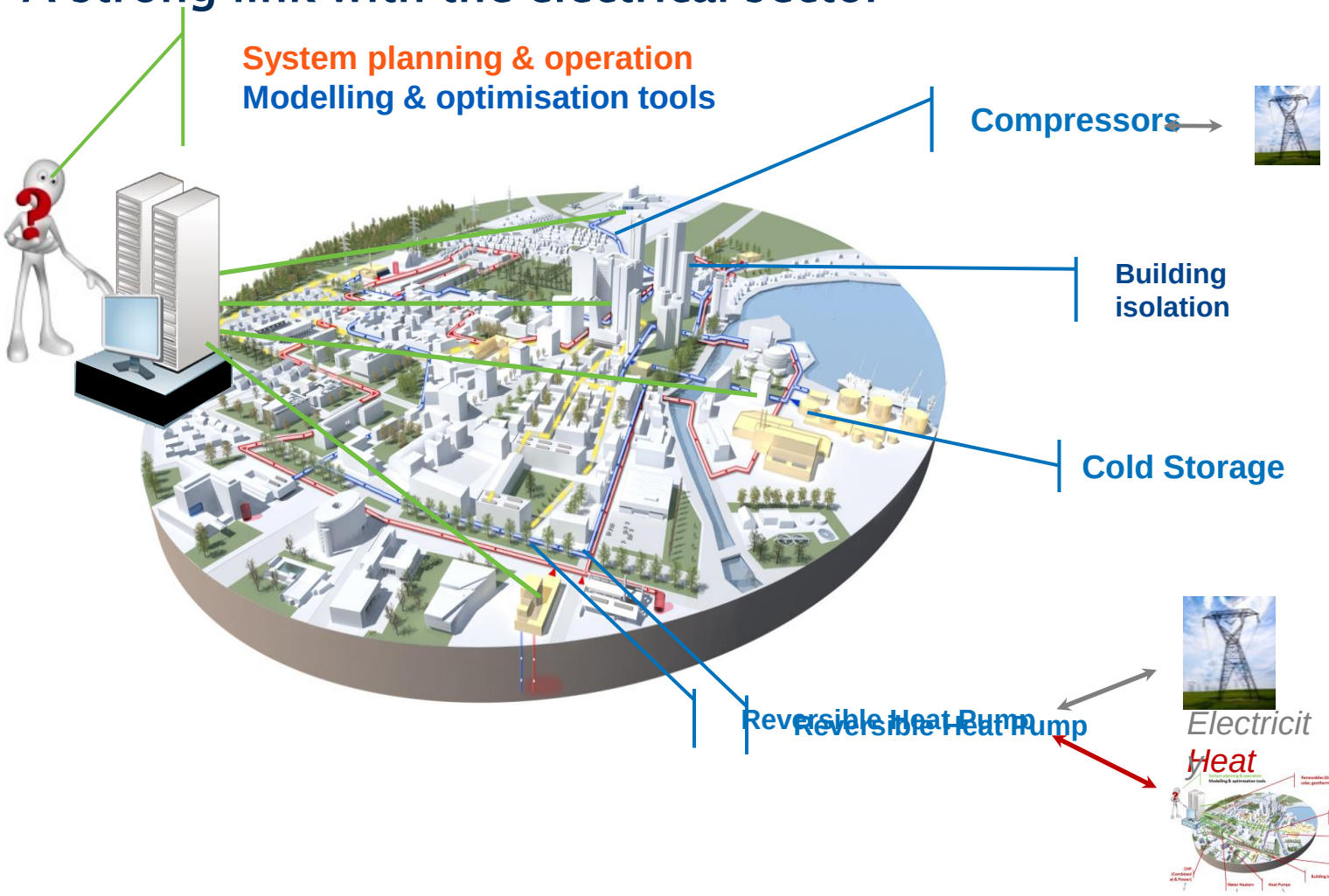
CHP (Combined Heat & Power)

Water Heaters

Heat Pumps

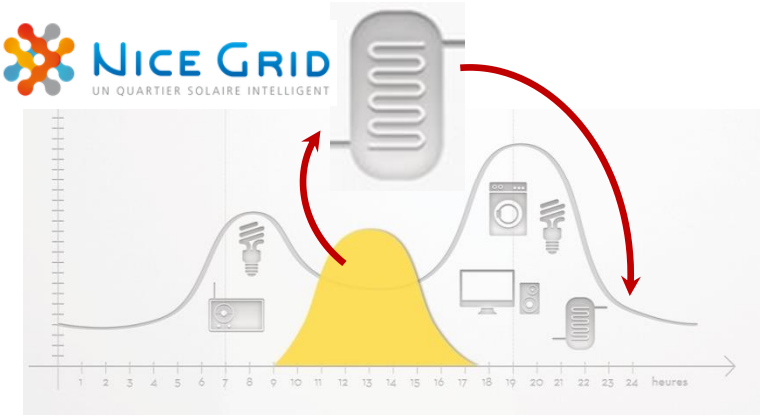
Cold technologies and networks :

A strong link with the electrical sector



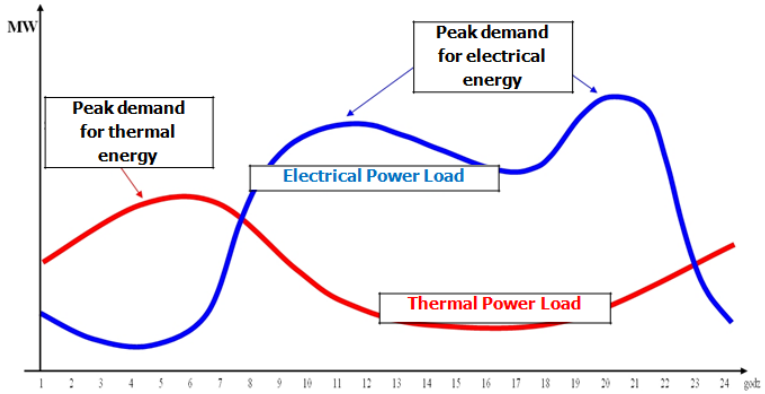
Storage to couple and optimize energies use

- **Distributed Heat storage & solar**
  - Water heater : 20 TWh of flexibility in France
  - Nice Grid : coupling solar & water heater



- **Optimisation of CHP output**
  - Produce electricity at the right time
  - Avoids part load use of CHP (yield)

- **Optimisation of a district heating network**
  - Optimisation of must run output
    - Geothermia, solar, waste heat
  - Heat grid congestions



Reference: EDF Polska SA Division No1 in Kraków, Presentation September 2013

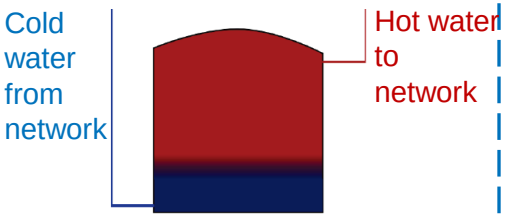
Technological challenges for heat storage

3 main technological streams

Sensible Heat

- Commercial level -50 kWh/m³
- Pilots for high temperature solar applications - 10-60 €/kWh €

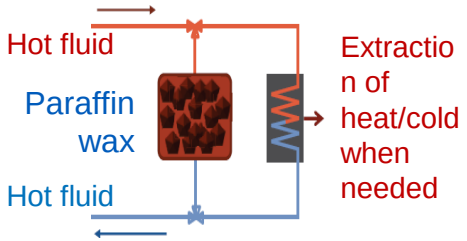
- Simple design
- Reduced OPEXes



Latent Heat

- Commercial level -100-150 kWh/m³
- Pilots for high temperature solar applications - 45-55 €/kWh €€

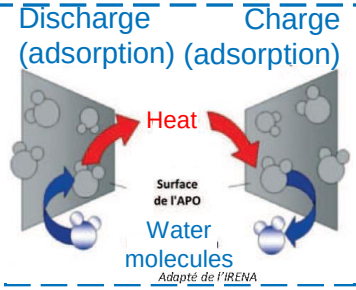
- High density
- Non toxic
- Prefered for cold applications



Chemical - sorption

- Commercial level -300-500 kWh/m³
- Pilots for high temperature solar applications - 300 €/kWh €€€

- Very high density
- Very reduced losses over long periods
- Good dynamic

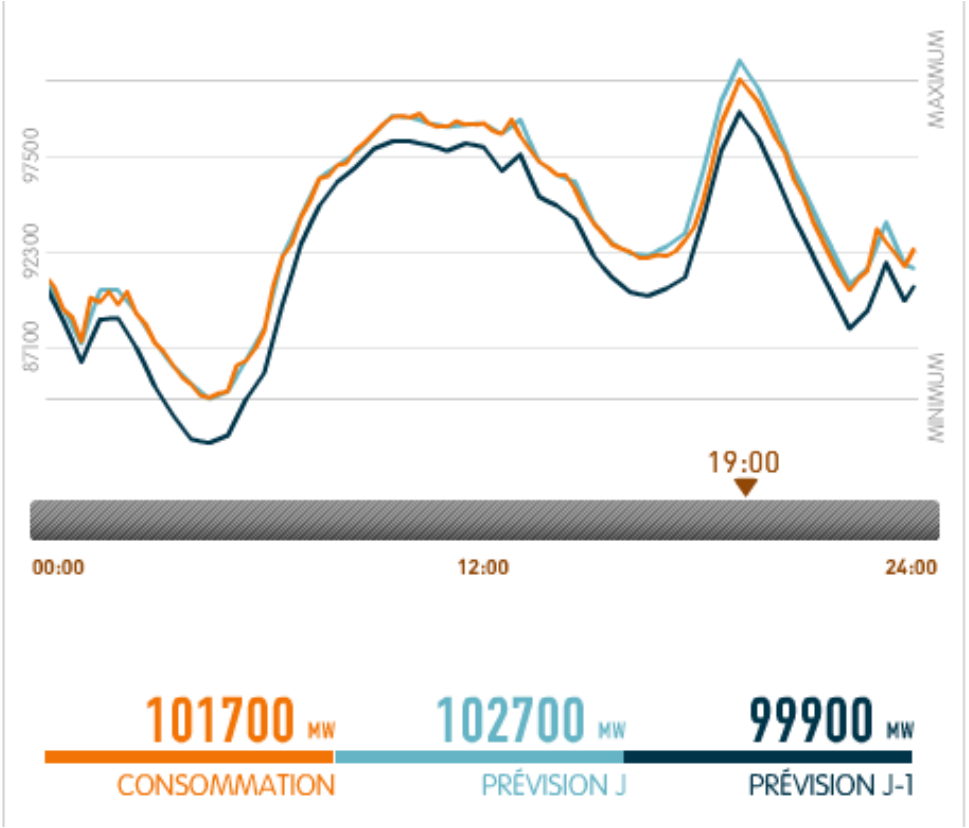


Still strong needs for RD&D

Remark : the costs mentionned concern the storage system without engineering & installation costs

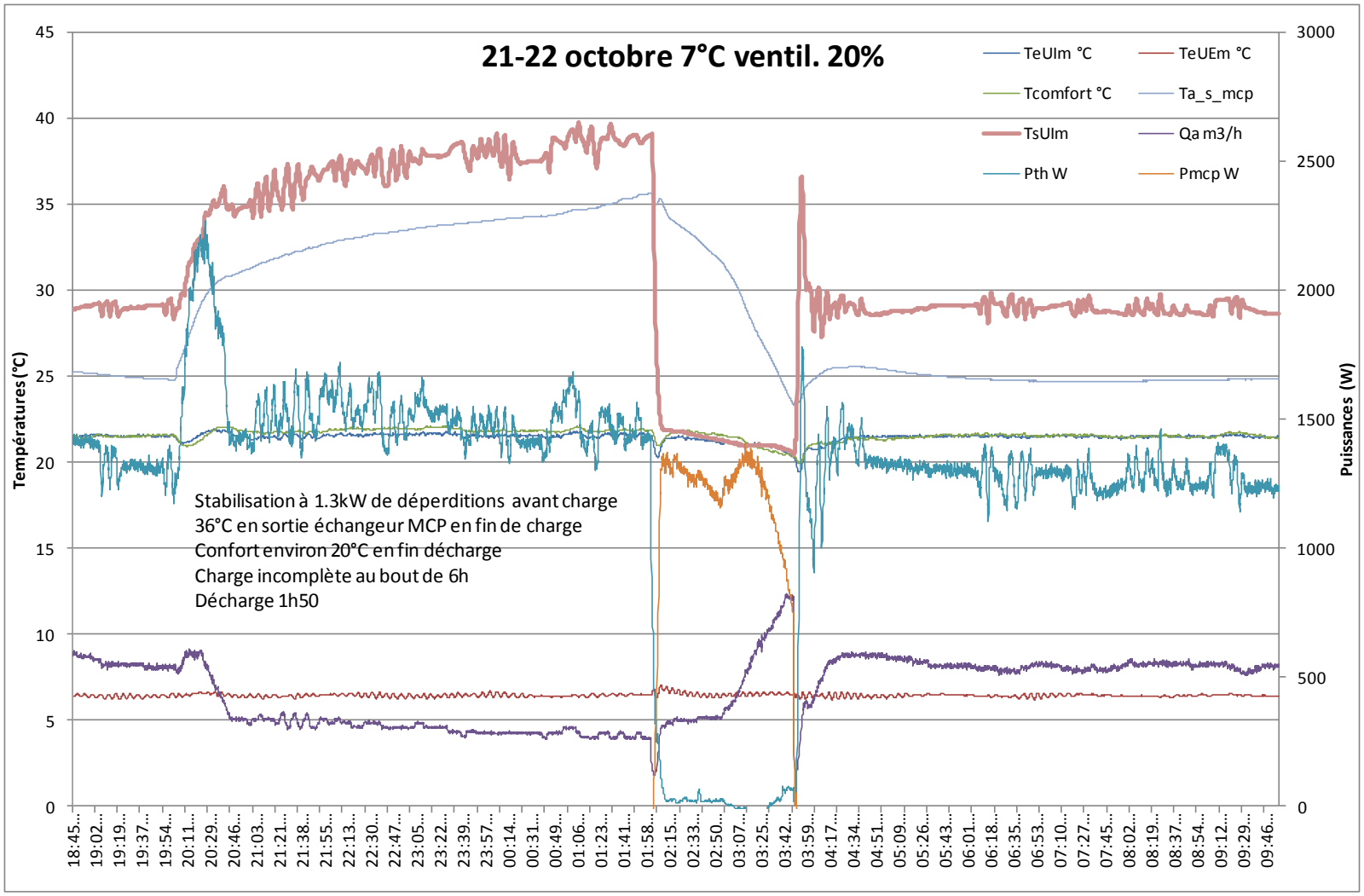
R&D including PCM : Stock-aiR2 project

- Air/air Heat Pump coupled with Phase Change Material in high energy performance building (100 m2 dwelling)
- Infra-day peak shaving : 18h00-20H00 during winter
- Energy storage period optimizing load curve and heat pump effiiency (afternoom : higher ambiant temperature)
- Energy storage and heat power requirements :
  - **4kWh**
  - **2kW**



Example of result for Text = 7°C

- **Energie storage :2.07kWh,**
- **Power : 1200W**



Thermal storage creates value at a system level




Primary ressources | Generation | Transport | Distribution | Consumption

Thermal storage