



Clean energy for EU islands

## Thermal Energy Storage opportunities on Island: from distributed thermal batteries to centralized large TES for DHN and Carnot Batteries

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Clean energy for EU islands  
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# FIRST: Which of these everyday tools will help us in island energy transition?



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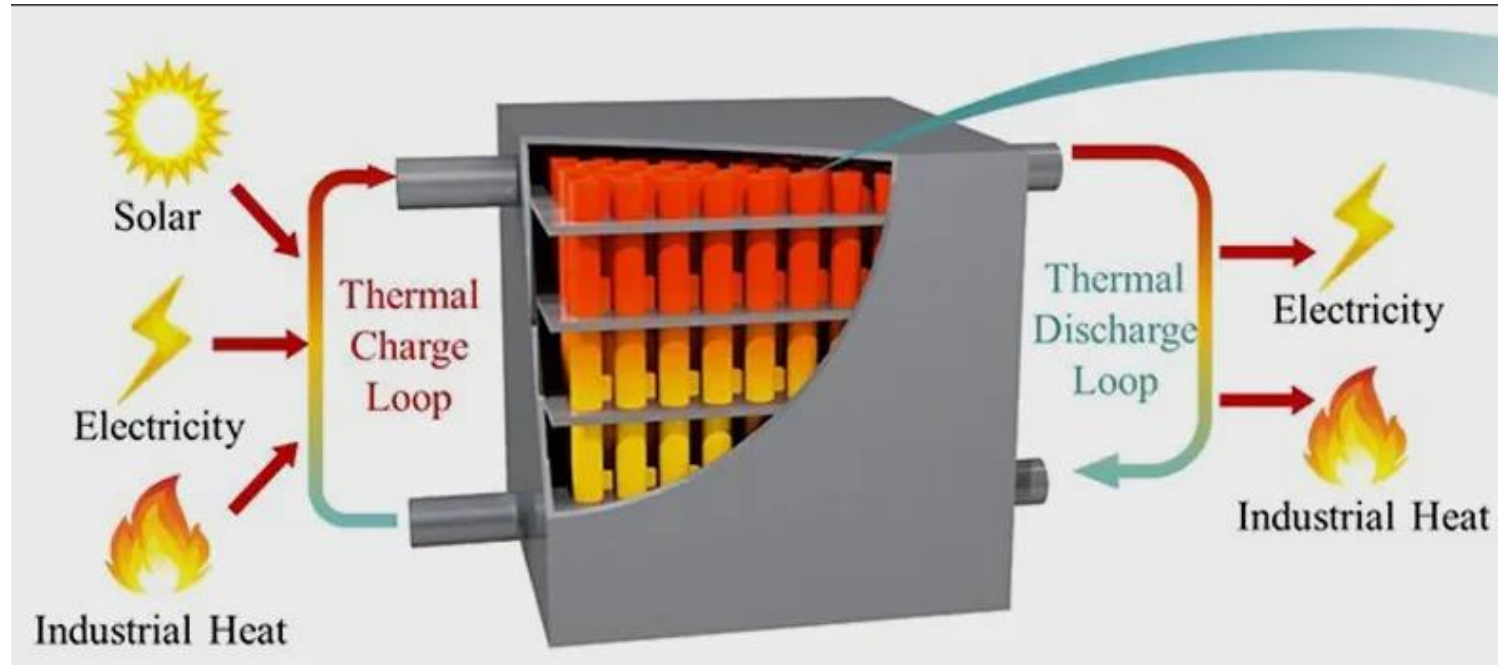
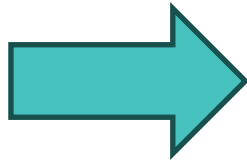


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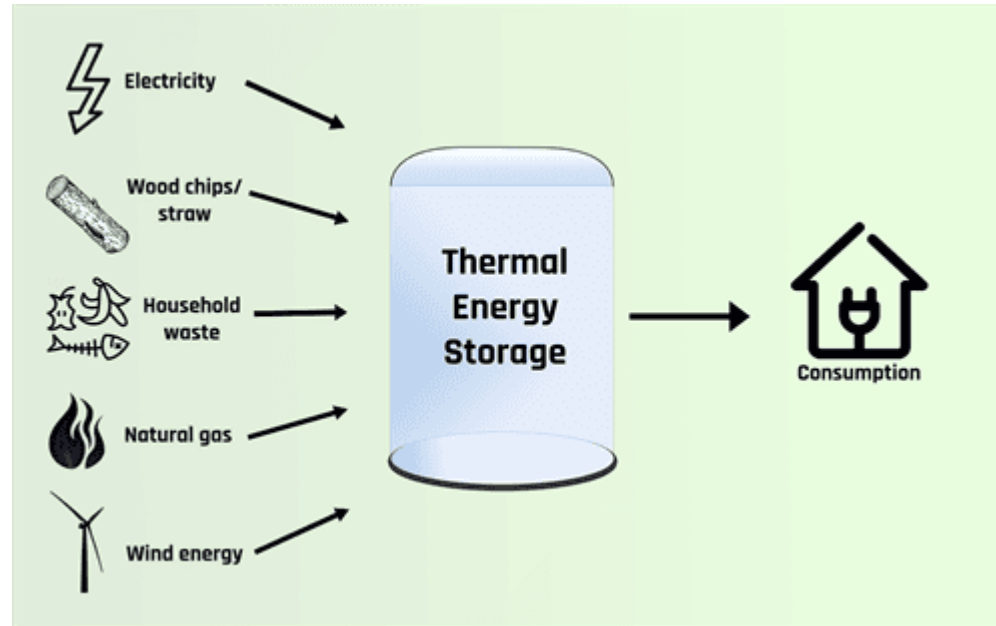


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# THERMAL ENERGY STORAGE

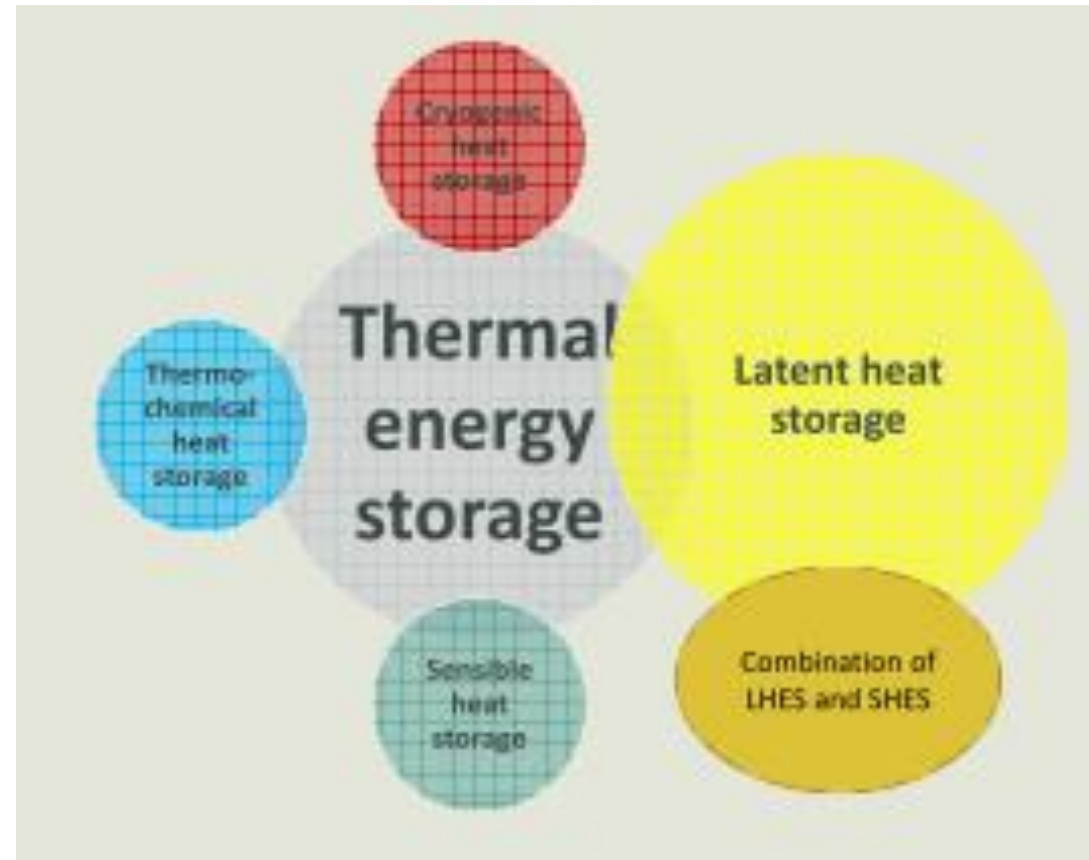


# WHY THERMAL ENERGY STORAGE?



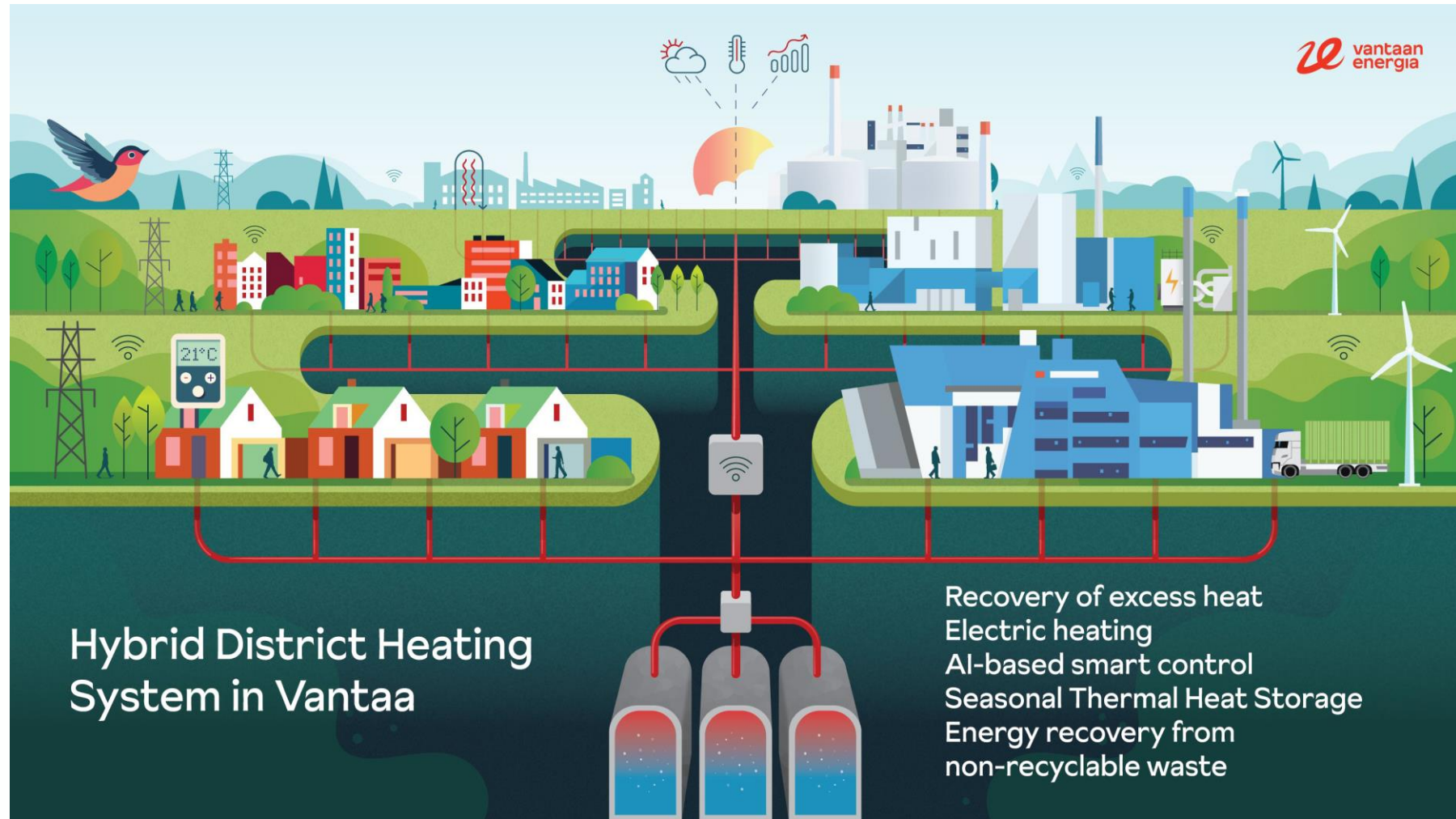
- To store Thermal RES
- Maximise the Efficiency of H&C system (particularly HPs and biomass driven ones)
- Optimize the management of H&C System (at distributed and centralized level – DHN)
- Optimize CHP units management
- To store electric RES via power-to-heat-(to-power) solutions

# HOW TO STORE THERMAL ENERGY?



- Lower CAPEX/OPEX
- Longer lifecycle
- Higher environmental sustainability

# SHORT AND LONG DURATION TES

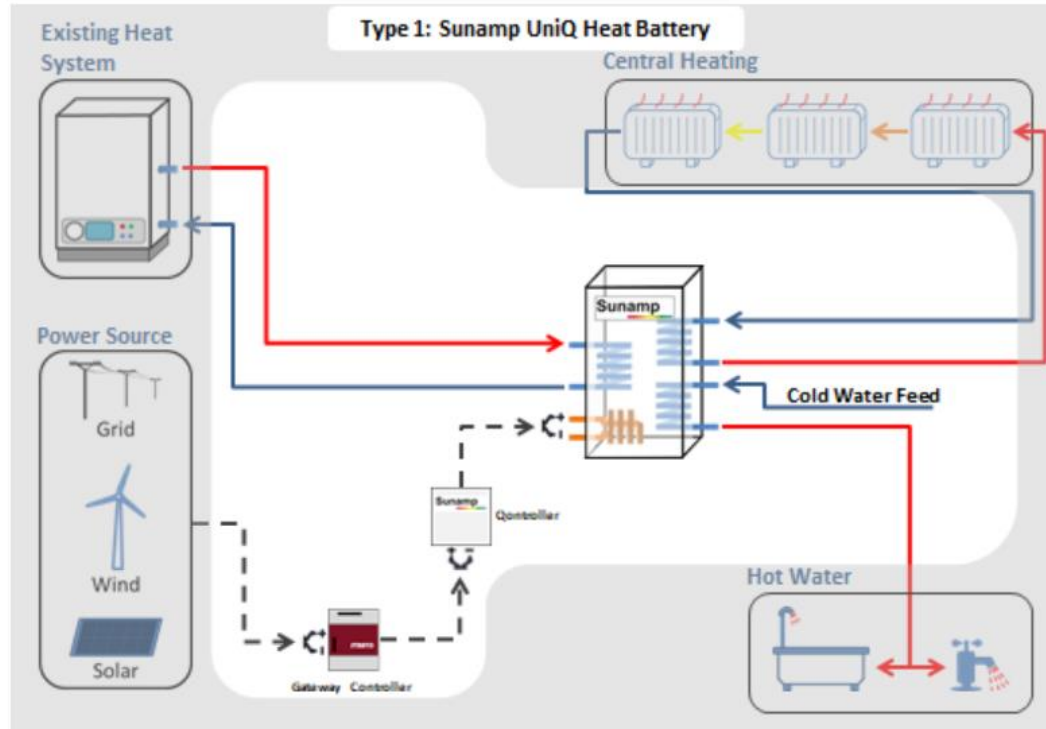




# SOME ISLAND EXPERIENCE - CENTRALIZED



# SOME ISLAND EXPERIENCE - DISTRIBUTED



**With or without electric heating system**





# THERMAL STORAGE AND LDES

## What is the issue?

To avoid catastrophic climate change, we need to rapidly build a net-zero power sector predominantly powered by renewable energy.

As the proportion of renewables grows, we are presented with 3 challenges; balancing electricity supply and demand; a change in transmission flow patterns; and a decrease in system stability.

LDES can help address these issues by increasing the flexibility of the power system.

## How do LDES technologies help?

**LDES are a host of different technologies that store and release energy** through mechanical, thermal, electrochemical, or chemical means.

Alongside LI-ion battery technology and hydrogen, LDES technologies can play a critical and distinctive role in delivering flexibility on times ranging from hours to weeks.



# LONG DURATION ENERGY STORAGE

## There are 4 kinds of novel LDES

All LDES allow energy to be stored when there is a generation surplus and released when there is a shortage.

### Thermal

Thermal energy storage systems use thermal energy to store and release electricity and heat.

E.g., heating a solid or liquid medium and then using this heat to power generators at a later date.

- Sensible heat
- Latent heat
- Thermochemical heat



### Mechanical

Mechanical LDES store potential or kinetic energy in systems for future use.

E.g., raising a weight with surplus energy and then dropping it when energy is needed.

- Novel PSH
- Gravity based
- CAES
- LAES
- Liquid CO<sub>2</sub>



### Chemical

Chemical energy storage systems store electricity through the creation of chemical bonds.

E.g., using power to create syngases, which can subsequently be used to generate power.

- Power-to-gas-to-power

### Electrochemical

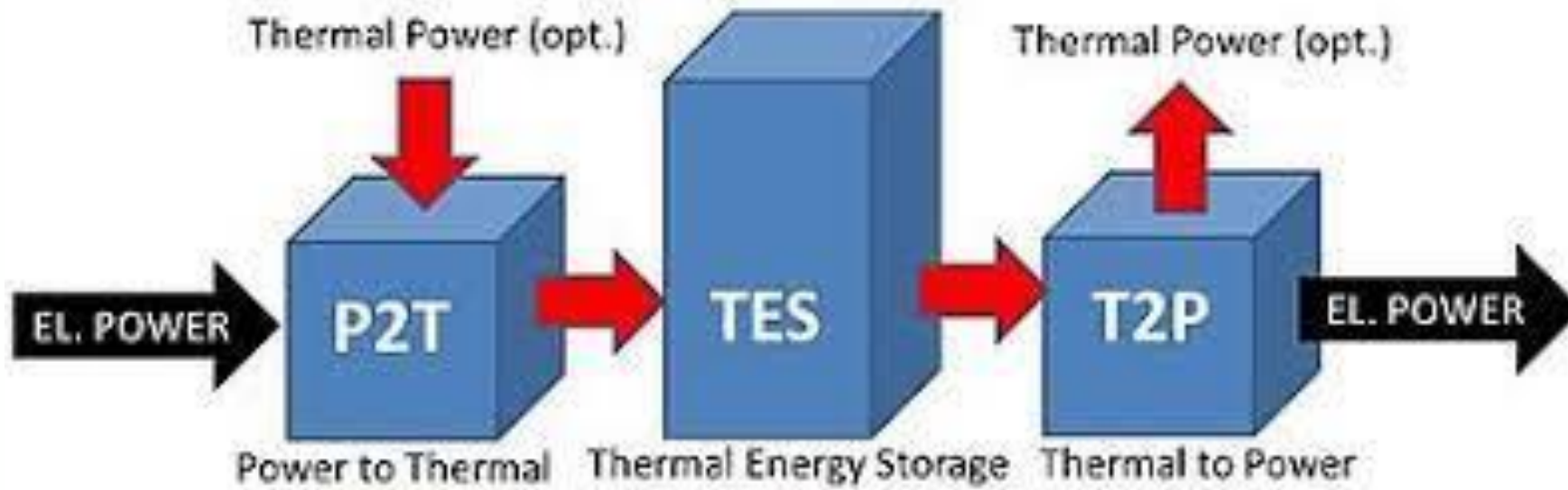
Electrochemical LDES refers to batteries of different chemistries that store energy.

E.g., air-metal batteries or electrochemical flow batteries.

- Aqueous flow batteries
- Metal anode batteries
- Hybrid flow batteries



# CARNOT BATTERIES



# SOME ISLAND EXPERIENCE

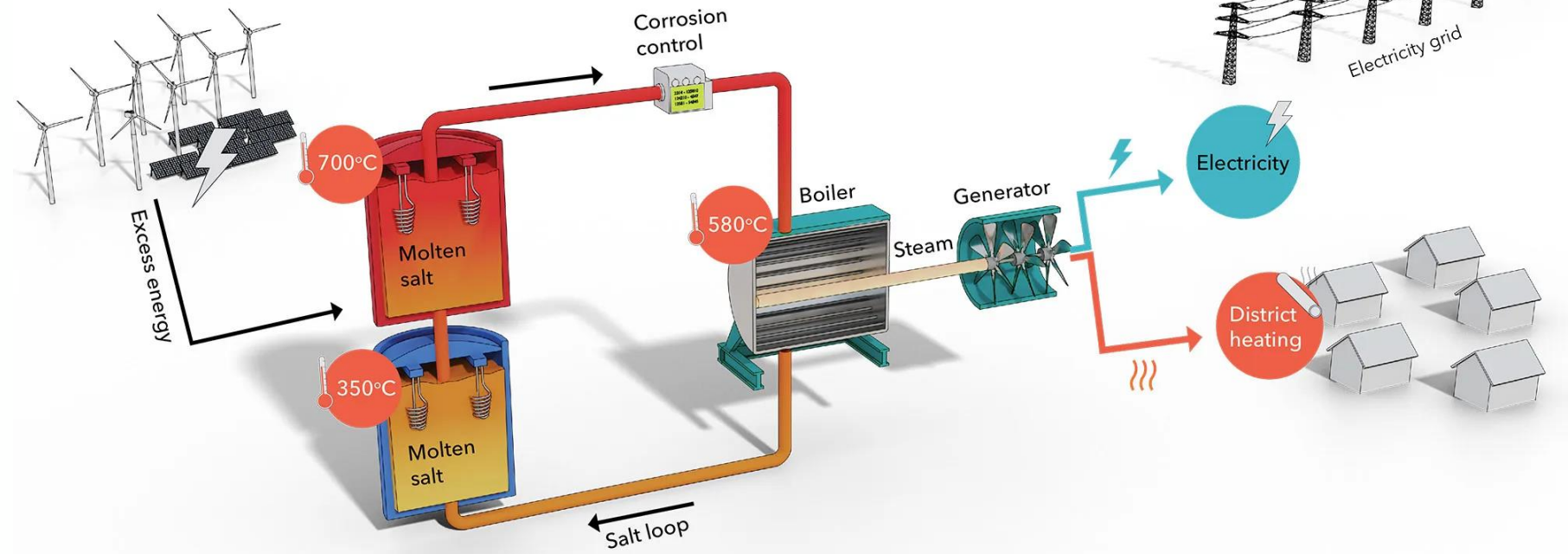




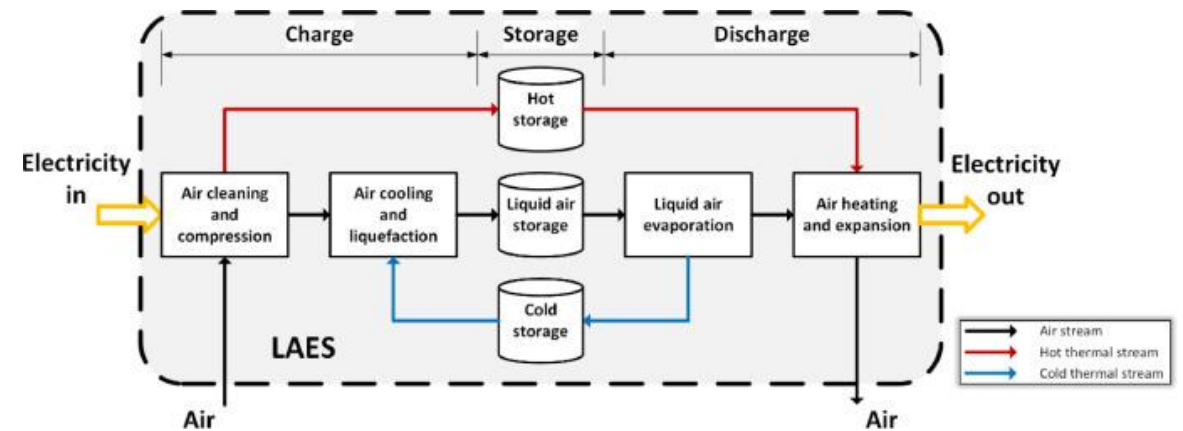
# SOME ISLAND EXPERIENCE



<https://2lipp.eu/>

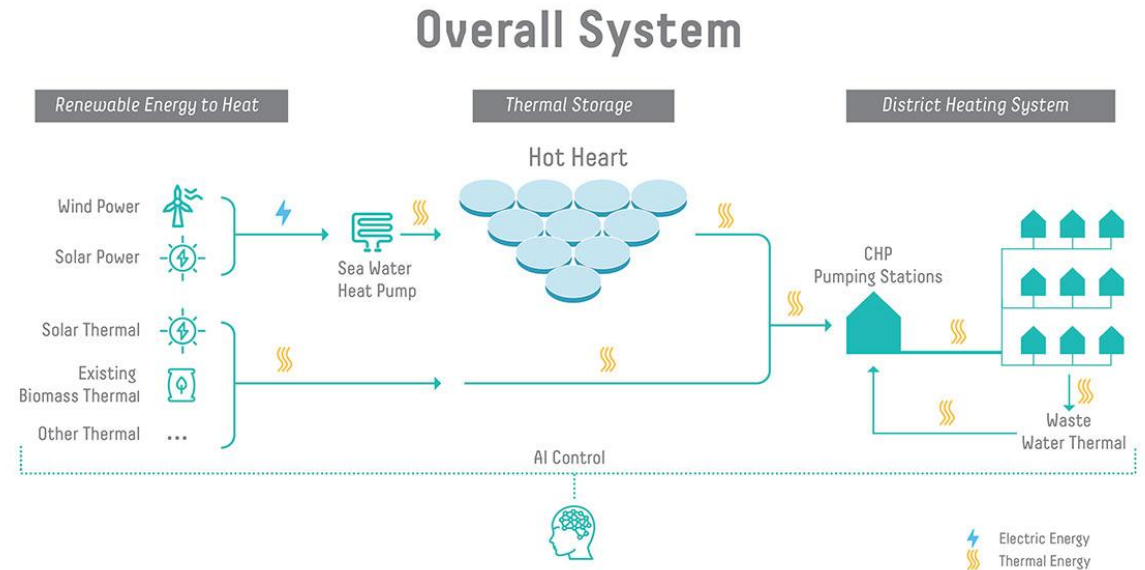


# PROJECTS IN PROGRESS....





# ...and also some STRANGE ISLANDS IDEA!



# Thank you!



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