



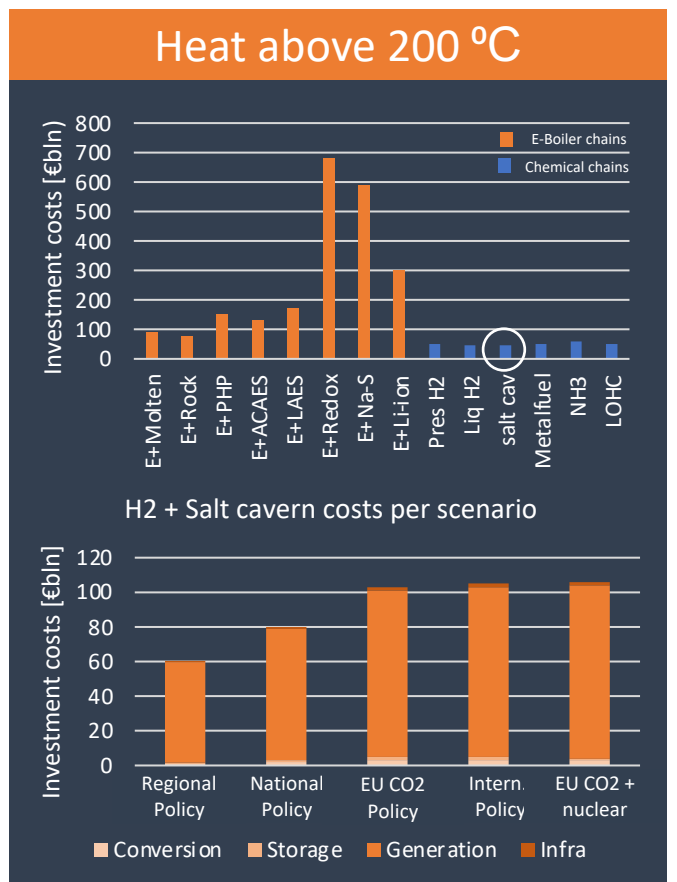
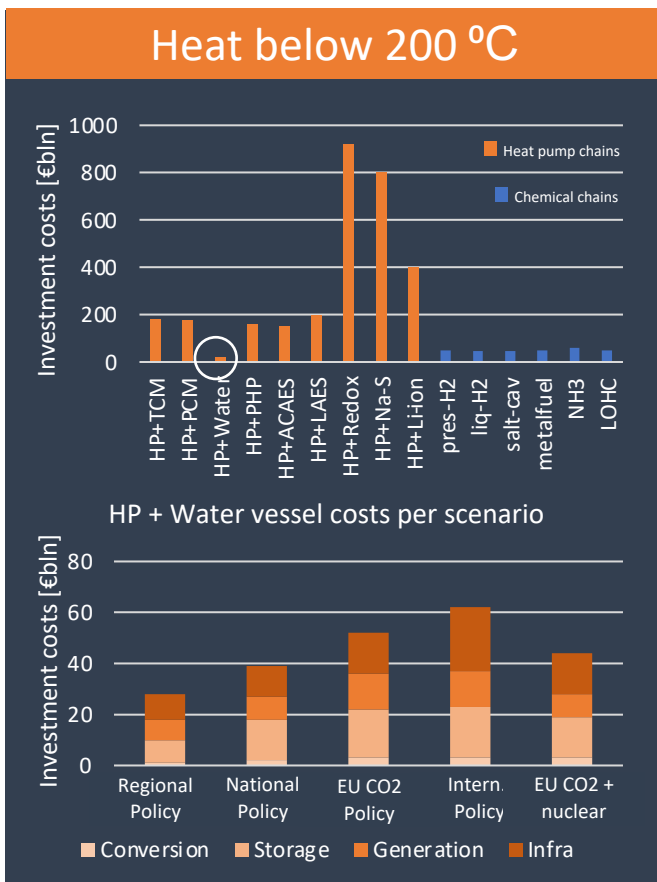
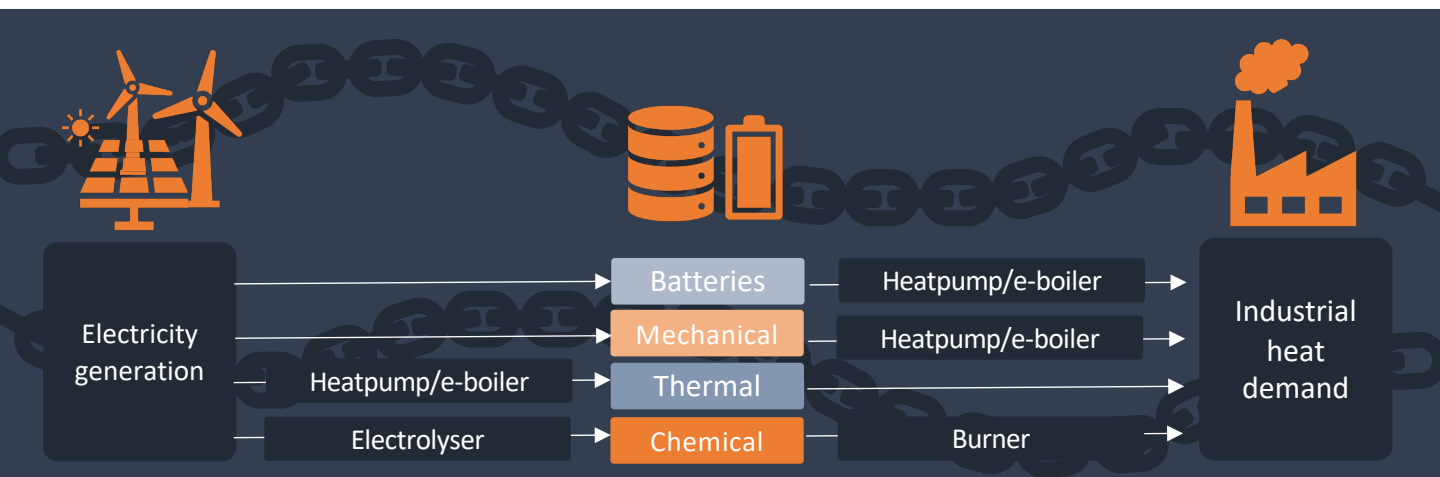
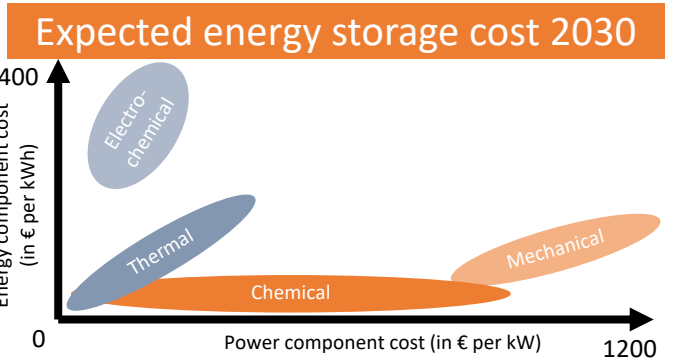
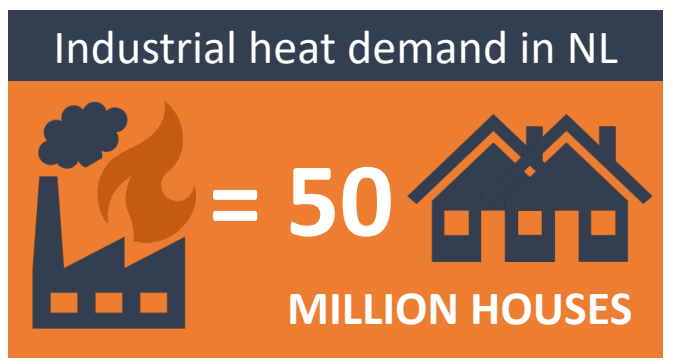


# SPOT PROJECT

## SUSTAINABLE PROCESS HEATING

In the SPOT project the costs of power-to-heat supply chains have been researched, that would be able to supply the whole Dutch industry with sustainably generated and stored heat.

<b>Electrochemical</b>  <ul style="list-style-type: none"> <li>• Redox</li> <li>• Na-S</li> <li>• Li-ion</li> </ul>	<b>Mechanical</b>  <ul style="list-style-type: none"> <li>• Pumped hydro PHP</li> <li>• Compressed air ACAES</li> <li>• Liquid air LAES</li> </ul>
<b>Thermal</b>  <ul style="list-style-type: none"> <li>• Sorption</li> <li>• Molten salt</li> <li>• Water vessel</li> <li>• Rock</li> <li>• Latent</li> </ul>	<b>Chemical</b>  <ul style="list-style-type: none"> <li>• Pressurized H2</li> <li>• Liquified H2</li> <li>• Metal fuel</li> <li>• NH3 &amp; LOHC</li> <li>• Salt cavern H2</li> </ul>



## CONCLUSIONS

- The power generation mix (ratio solar/wind/nuclear) is an important factor for the amount of energy storage required.
- Long-duration energy storage will be given a place in the chain from generation to 100% sustainable heat production.
- Energy storage costs will become a major contributor to total energy system costs.
- Energy storage in a water vessel with a heat pump is the most attractive option for heat chains below 200 degrees C.
- Energy storage in the form of hydrogen in underground salt caverns in combination with a hydrogen burner is the most attractive option for heat chains above 200 degrees C.
- CO2-free baseload generation such as nuclear energy results in lower requirements for long-duration energy storage and may result in lower overall investment costs depending on chain efficiency. Nuclear energy thus competes with seasonal energy storage, not with renewable energy generation.