Transforming our Approach to Waste Heat

Thermal systems of the future

Ammonia-Salt Resorption for Thermal Transformations

23rd January 2020

ENERGY RESEARCH ACCELERATOR

EPSRC
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Overview

- The Problem or Opportunity?
- Why do we have waste heat?
- Resorption technology
- My research project

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Government reports identify 48TWh/yr of waste heat sources from industry

Equivalent to a 1/6th of industrial energy use

Element Energy (2014) Imperial College London for DECC

- 78% more than total energy generated by offshore wind in 2017[1]

- Equating to around 10 MtCO2, which is similar to driving **25 billion miles** in an average car

[1] BEIS (2019) Digest of UK Energy Statistics (DUKES): renewable sources of energy- Chapter 6

Why are we losing so much?

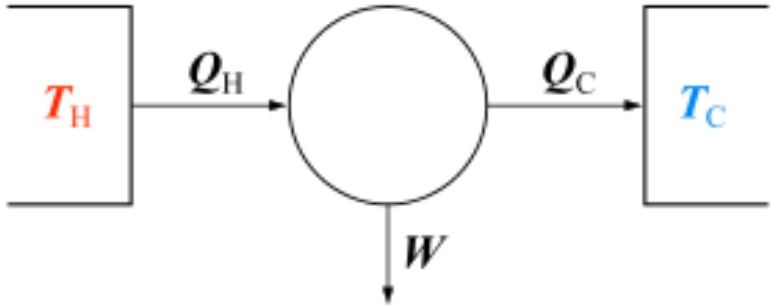
Heat is Work is Energy is Heat is Work

Energy most often required as: Heating, Ventilation, Air conditioning, mechanical and electric power

Often produced by a heat engine using

High Temperature Heat

Second Law of Thermodynamics and **Carnot**



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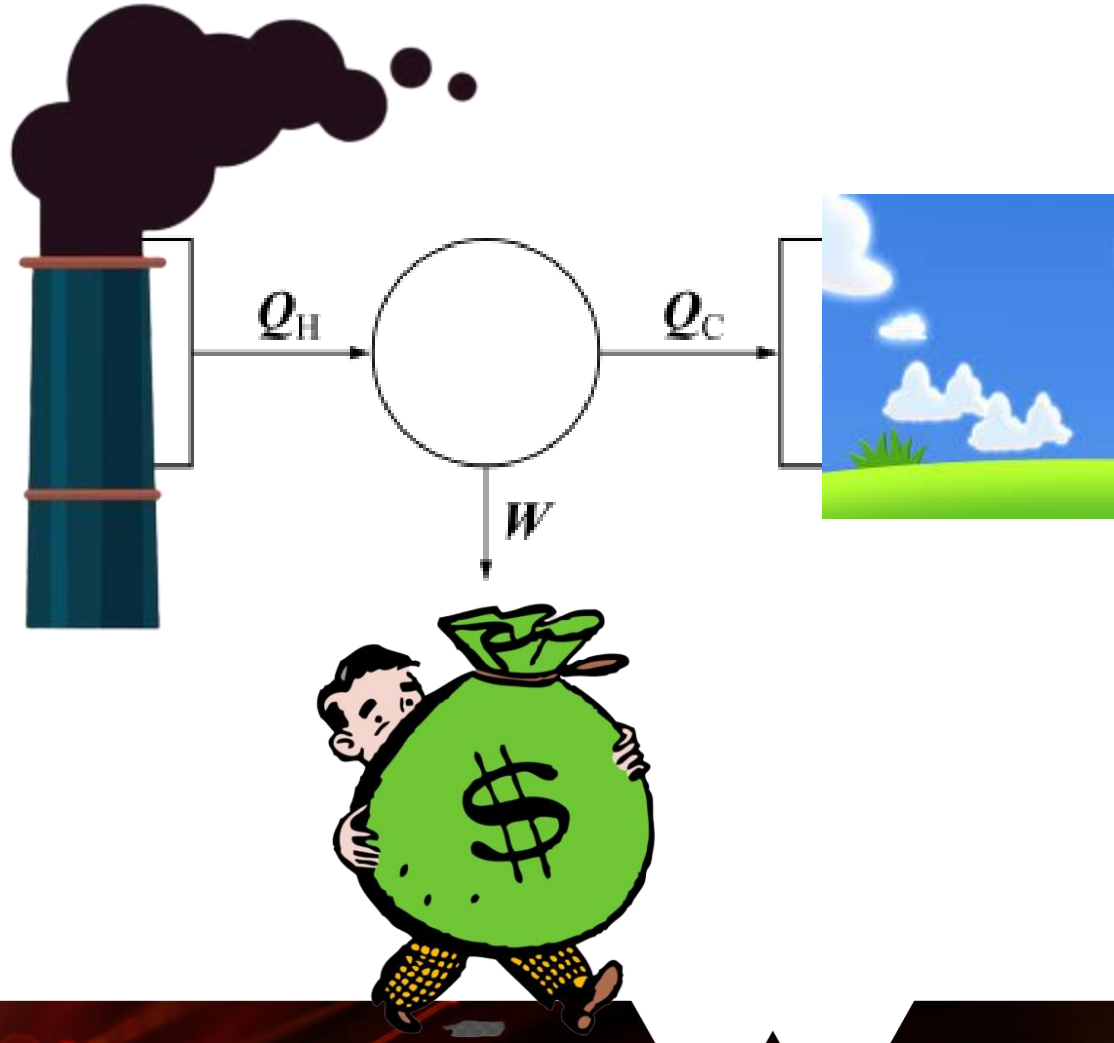
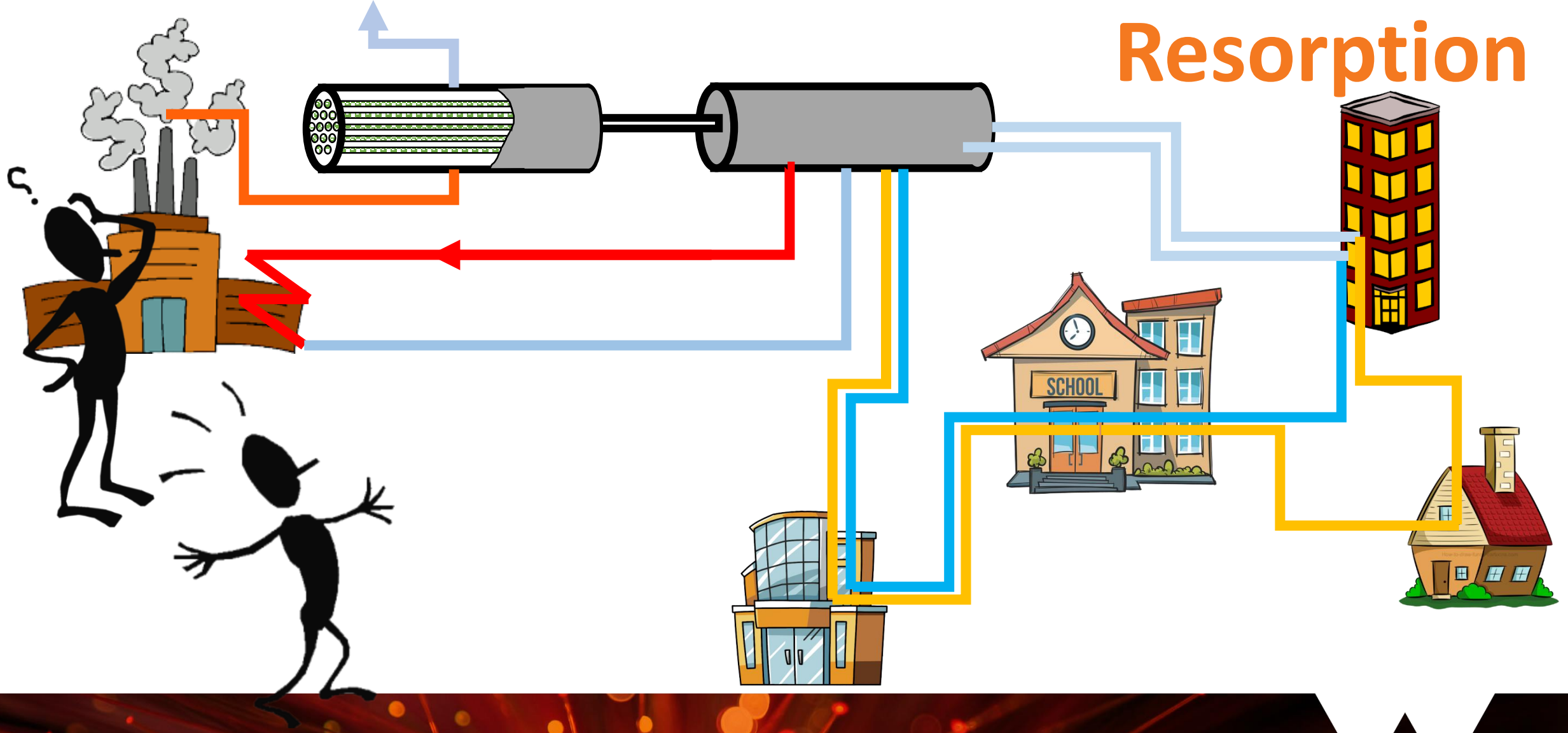
The Universe's tax on heat exchange

Do we want to pay more tax?

What has the universe ever done for us?

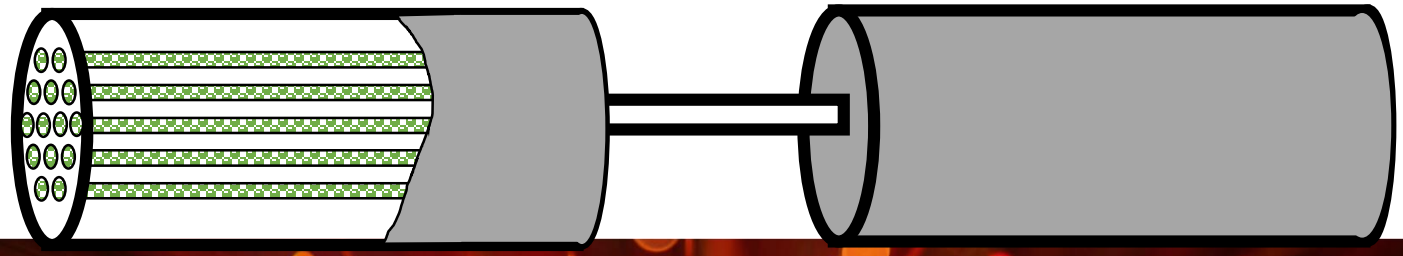


Resorption

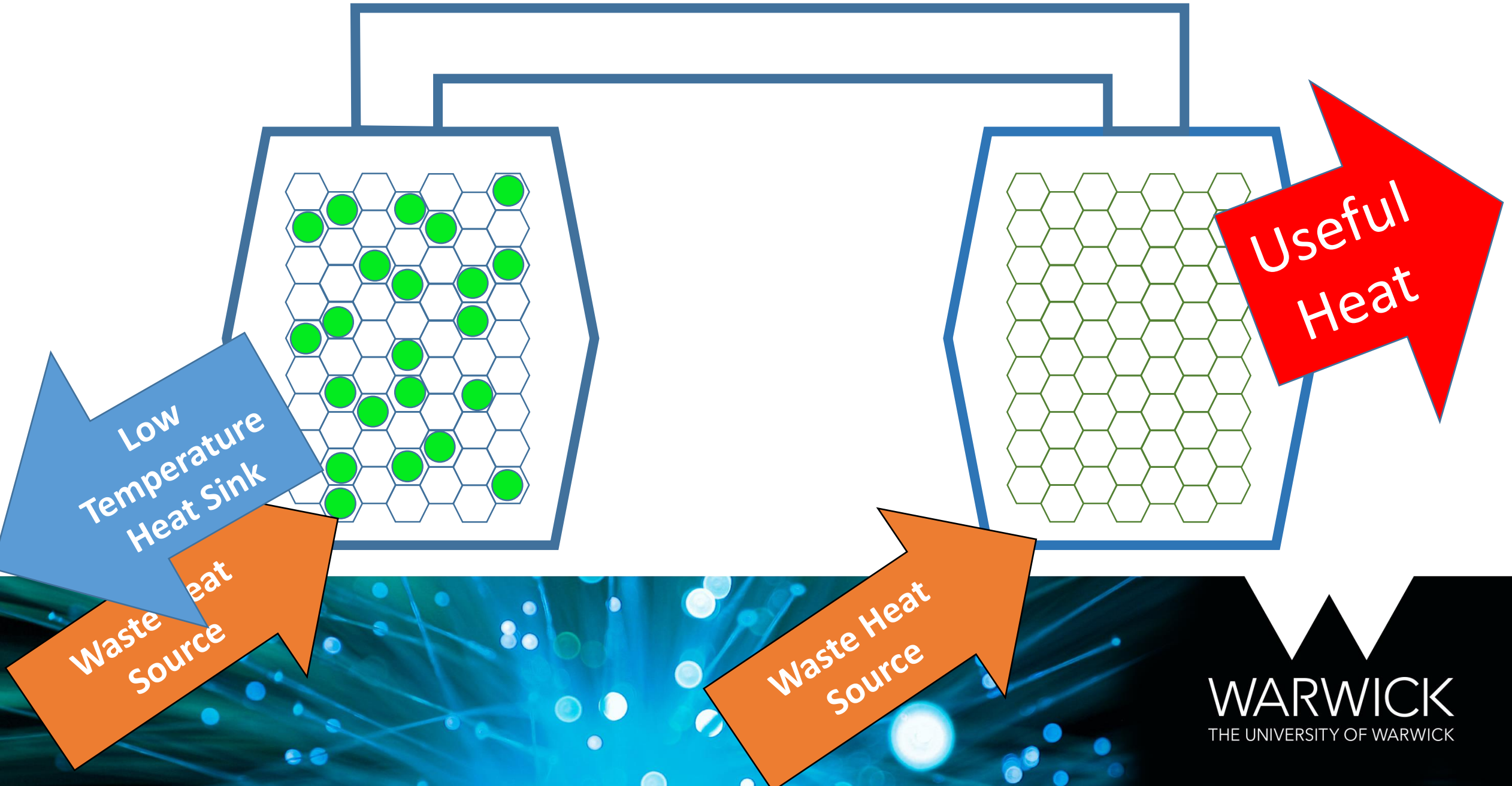


Resorption &Thermal Transformers

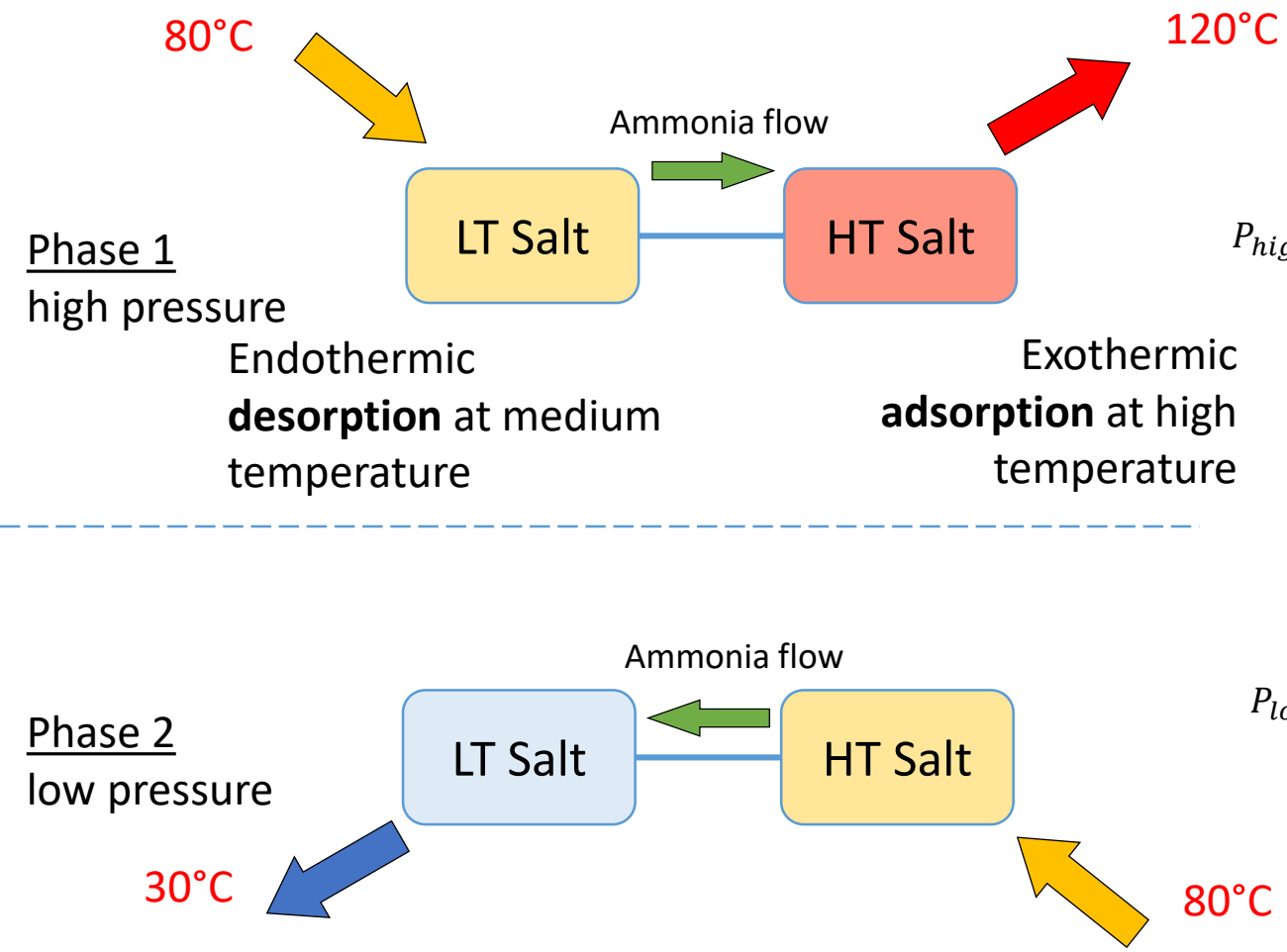
- Simple concept and design, no pump, no evaporator or condenser
- Components can be cheap to manufacture
- Recovers waste heat by upgrading to useful temperature
- Or Better integration of heat in district heating
- Or provisions for refrigeration for district cooling
- Use of solid salts enables an endless list of possible operations and alternative applications

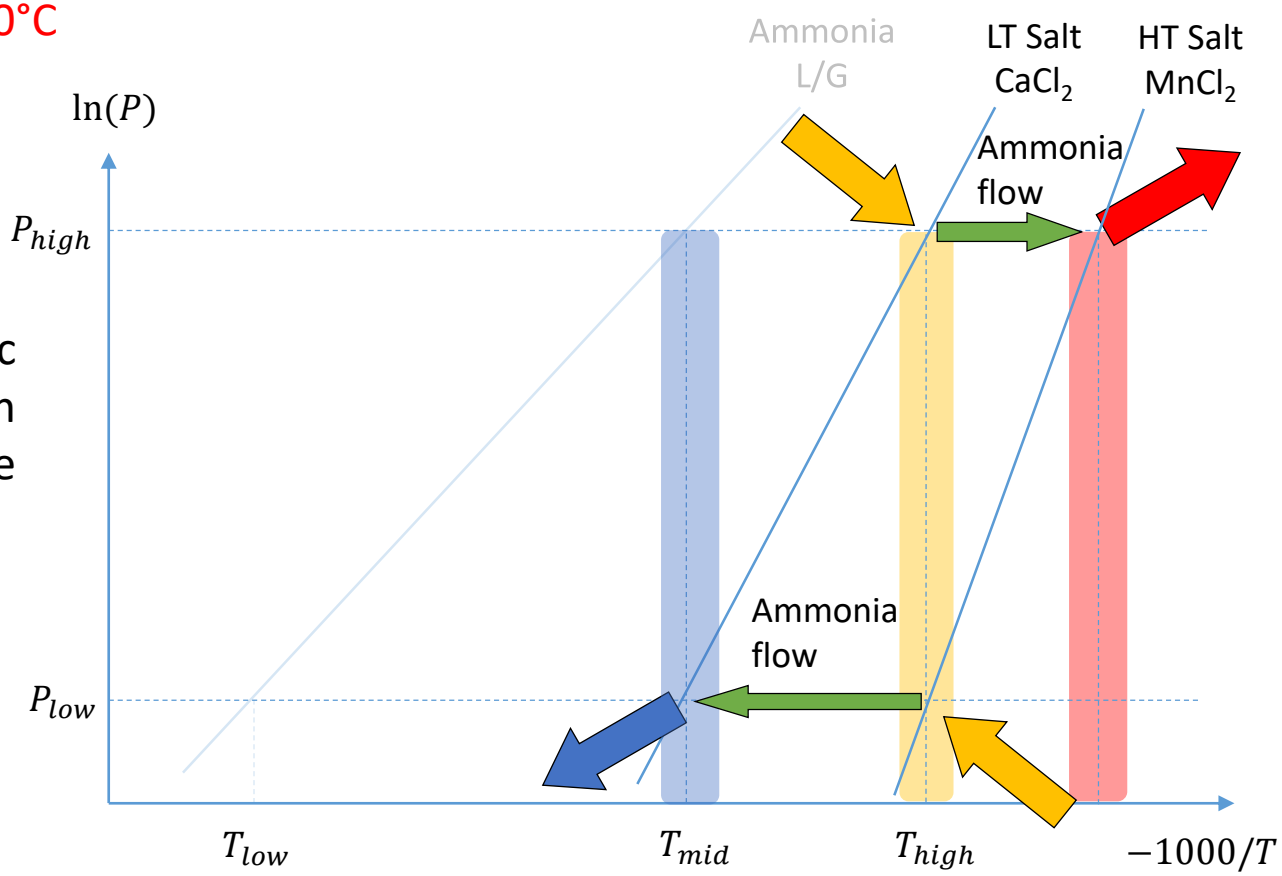


Resorption Transformer

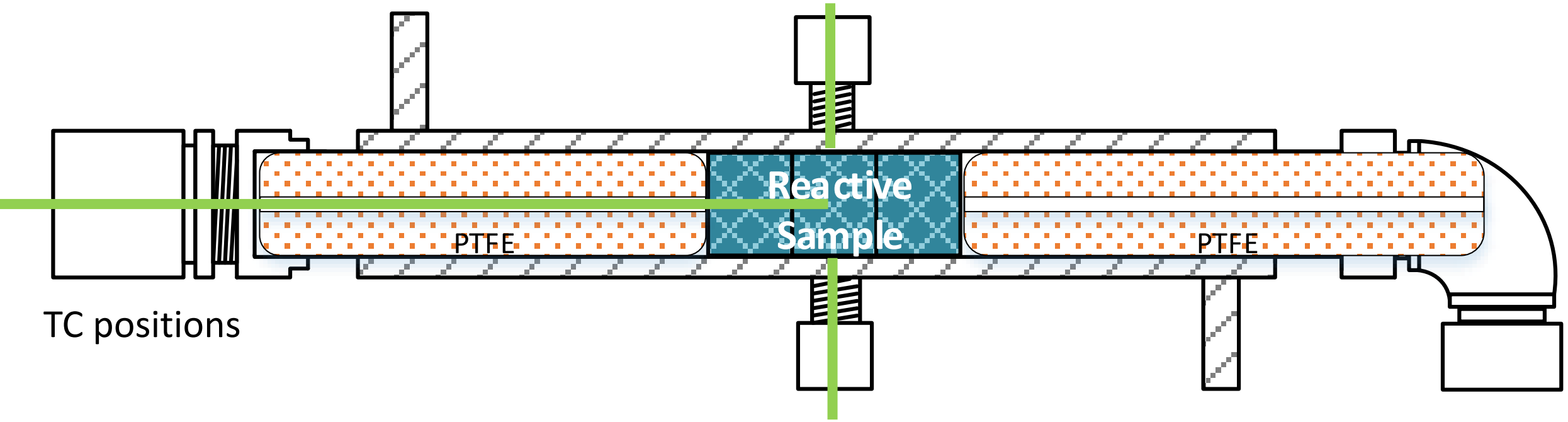


2-Salt resorption cycle thermal transformer

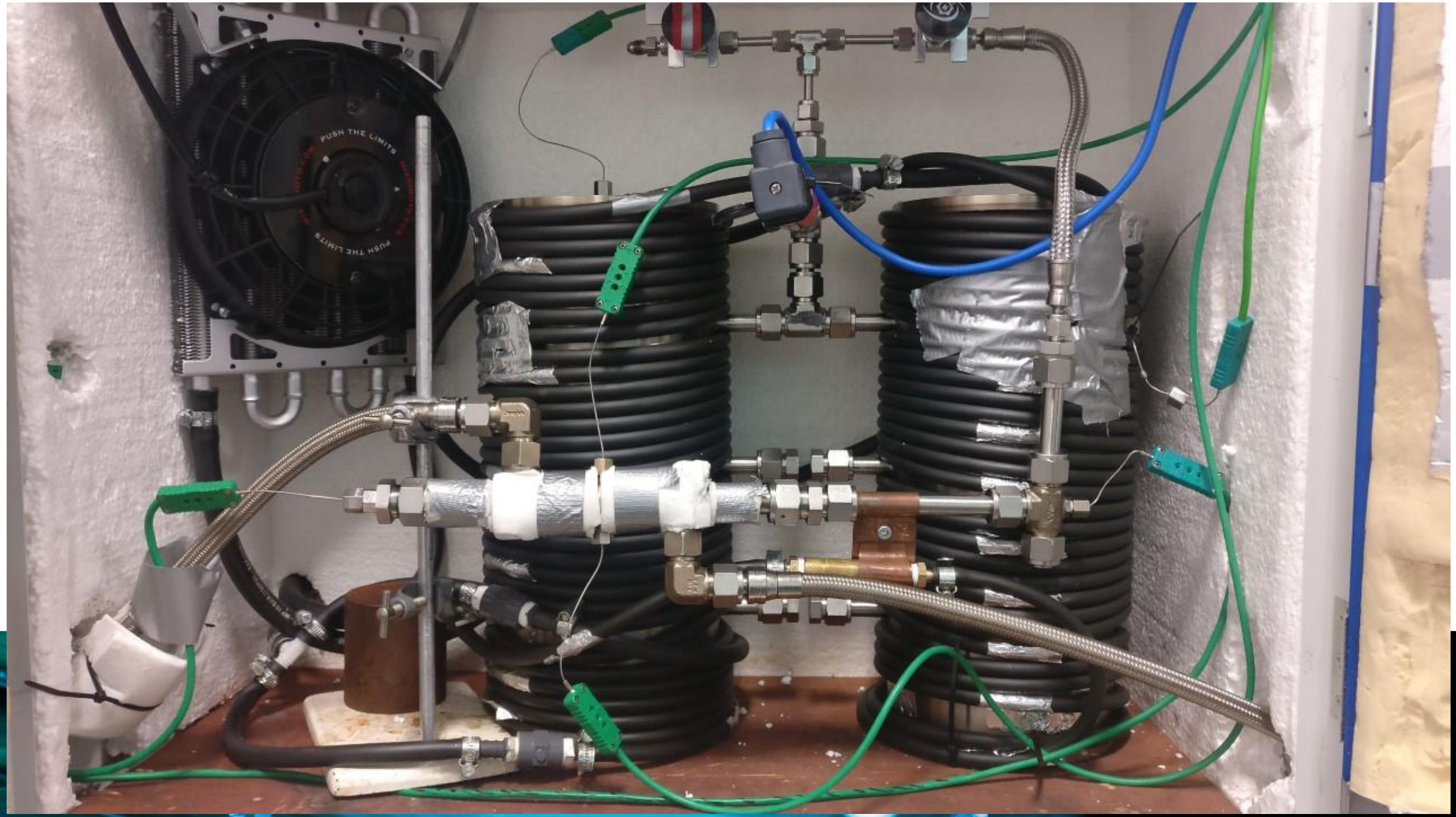




Material Testing



½ inch pipe centre	1 inch pipe jacket	PTFE to fill heated volume	O-ring Swagelok face seal fitting


PUSH THE LIMITS

To Conclude

- Waste Heat must be reduced
- Fiscal incentives
- District heating and heat recovery
- Sorption and Resorption
- Further integration better returns

Thank you for listening

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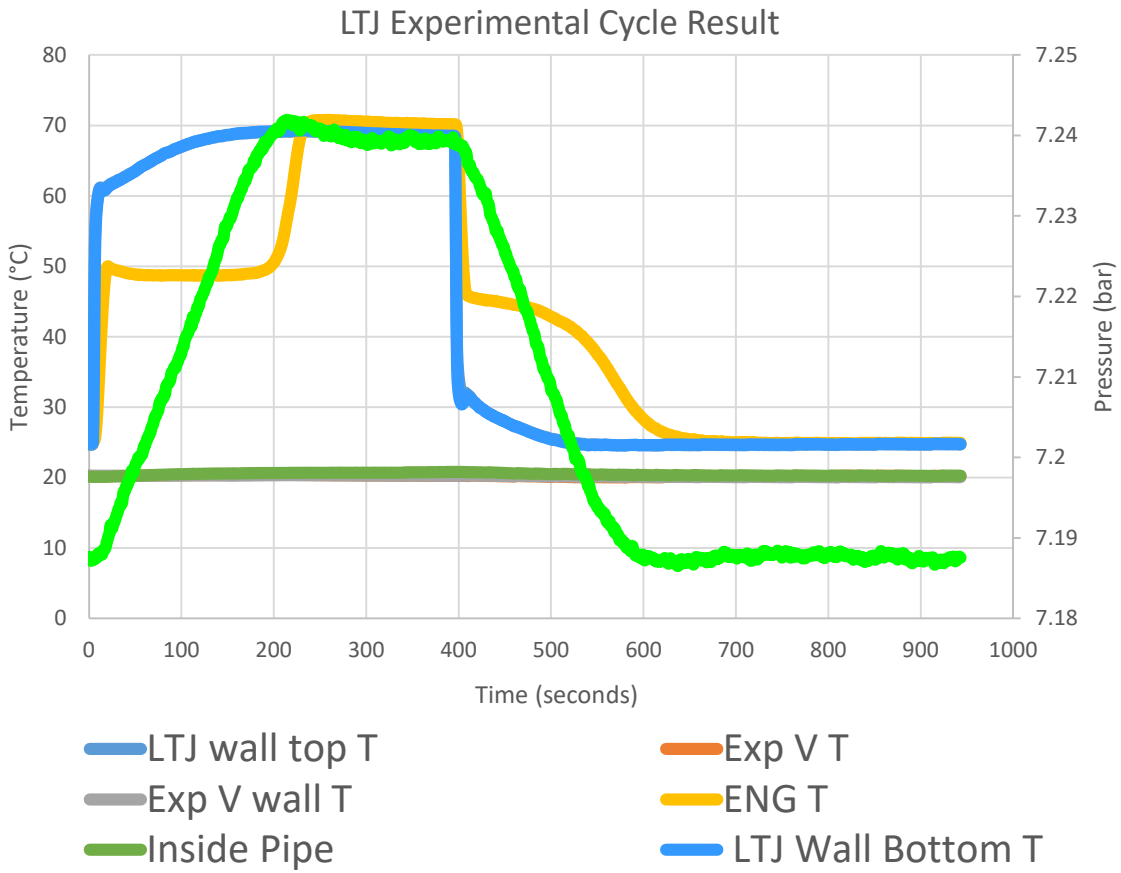
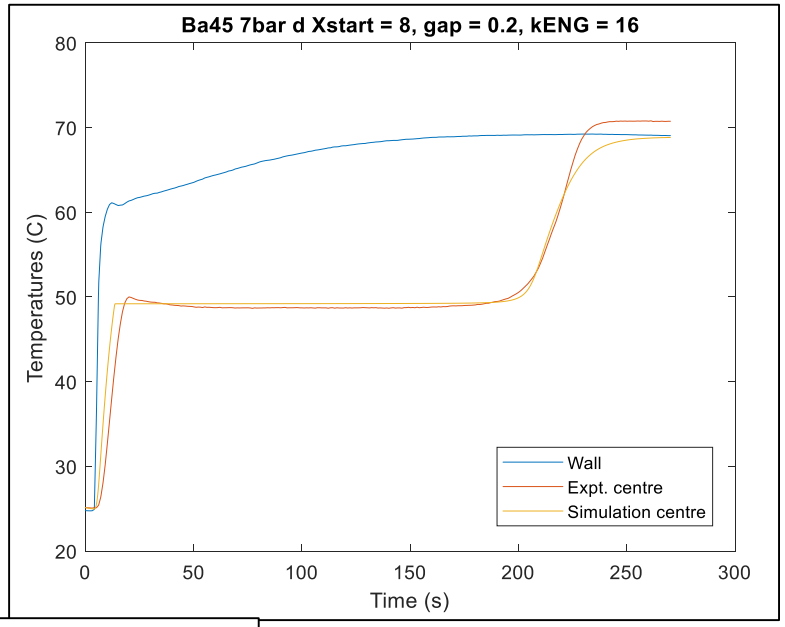
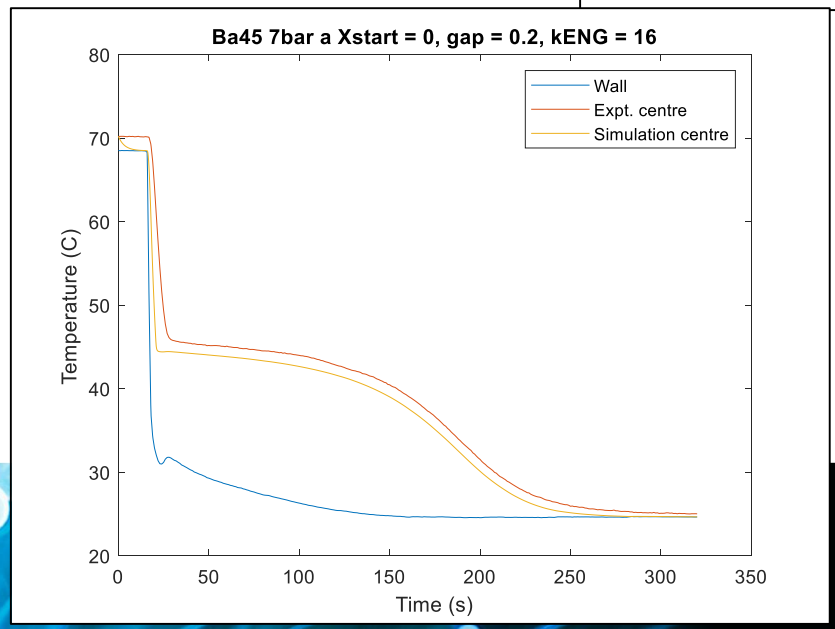
Results, full LTJ cycle







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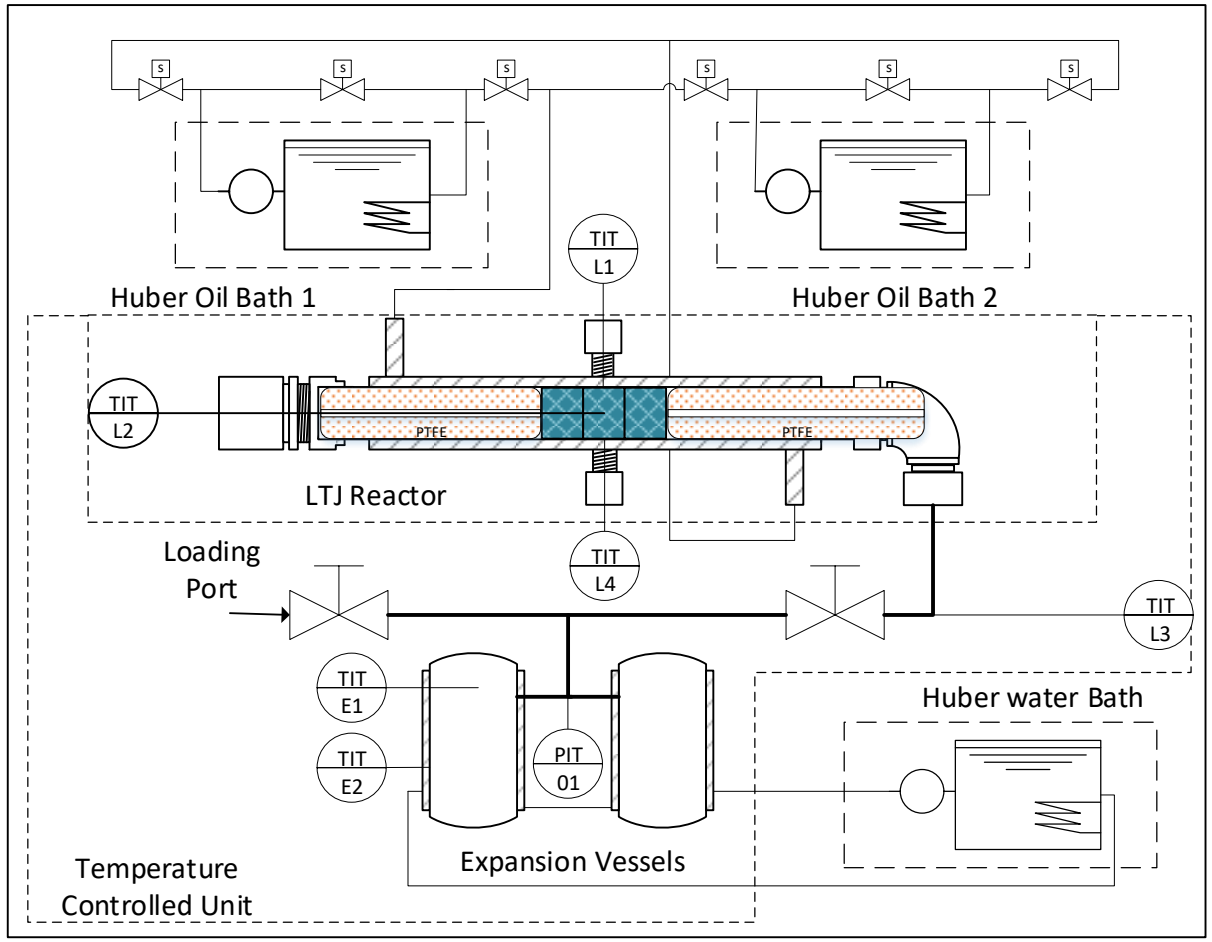
Objectives



- Test different salts in a conductive material
- Model and build a resorption transformer
- Produce a Coefficient of Performance of 0.4
- Highlight the efficacy of the technology/write thesis