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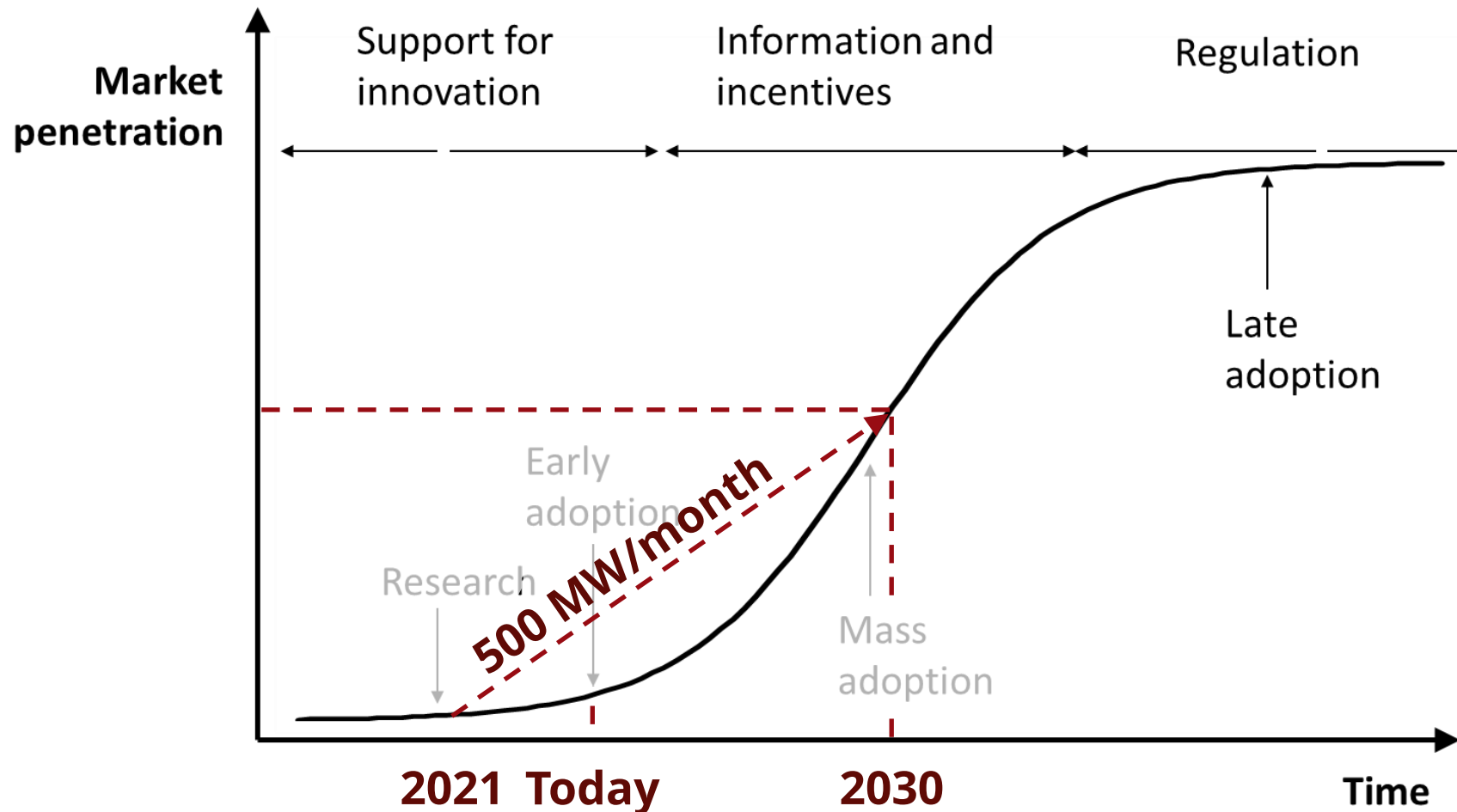


Strategien zur Dekarbonisierung von industrieller Prozesswärme

03.04.2024

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Innovation Director**

From Early Adoption to Mass Adoption



The Road Towards Implementation



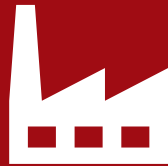
Technology Awareness

- Commitment to sustainability and decarbonization
- Potentials, limitations and characteristics of the technology
- How to exploit the potentials?
- Variety of stakeholders involved



Technology Development

- Component and system development
- Testing and demonstration
- Variety of technologies
- Collaborative effort



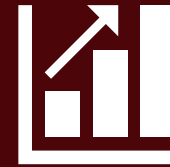
End-user adoption

- Technology adoption life cycle
- Retrofitting of industries for HP-based heat supply
- Decarbonization strategies



Boundary conditions

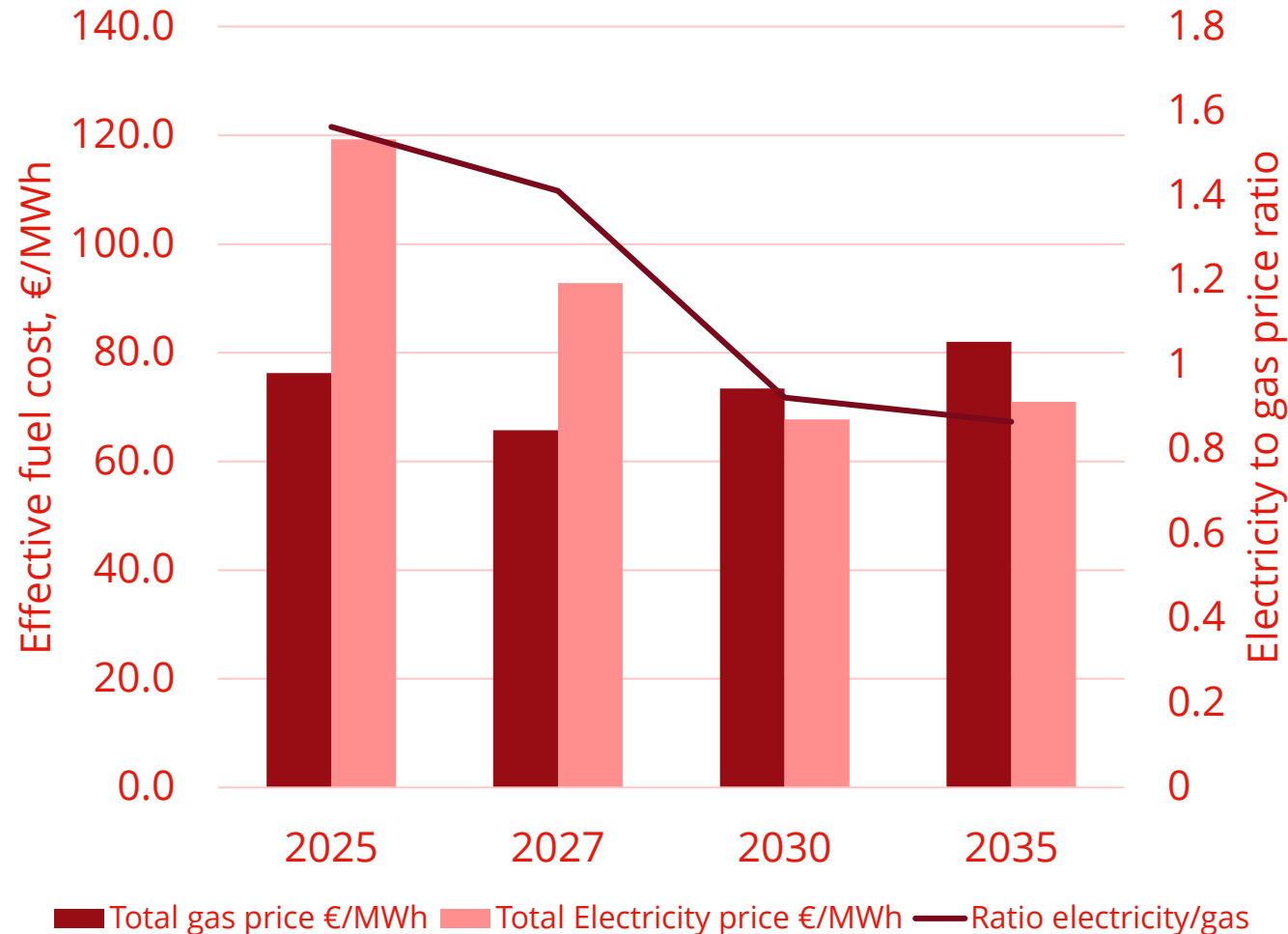
- Cost for fuels and GHG
- Regulatory frameworks
- Subsidies & incentives
- Market developments



Market deployment

- Technology implementation within commercial projects
- Learning curve for operators and suppliers
- Supply chain covering considerable volumes
- Business models

Development of fuel prices



- Data from the Danish Energy Agency - climate status and outlook 2023
- Transportation cost for electricity varies depending on contracts and area's - average assumed
- Taxes for electricity are limited to EU-minimum

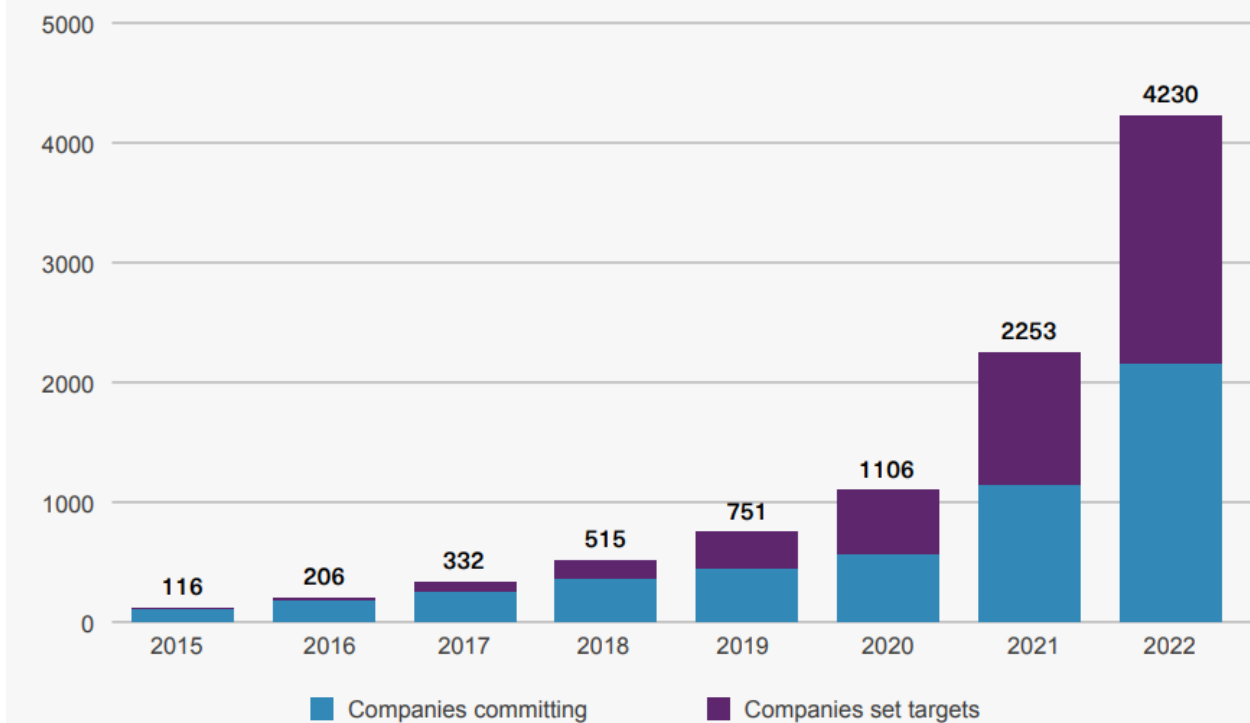


SCIENCE
BASED
TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

Decarbonization is gaining traction

Annual cumulative number of companies with approved targets and commitments, 2015–2022^{10 11}



4408

with science-
based targets

7253

companies taking action

2796

net-zero
commitments

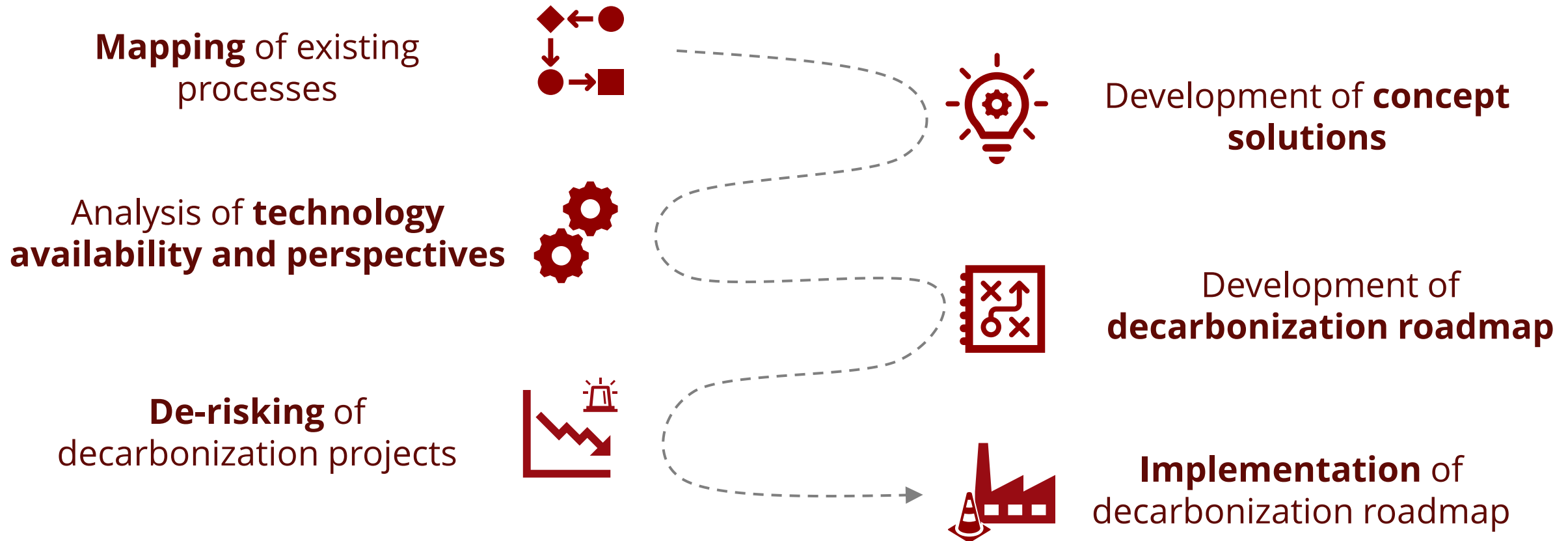
<https://sciencebasedtargets.org/> [accessed: 21.01.2024]

HEINEKEN selects Siemens for multi-phase decarbonisation program at breweries and malt houses



- HEINEKEN's global Net Zero Production roadmap aims to reach **net zero in Scope 1 and 2 by 2030**
- Approximately **70 %** of energy use was linked to the generation of **heating and cooling** necessary for the brewing process.
- ... implement a system to electrify the production of heat and cooling using **heat pumps powered by renewable energy**, reducing reliance on steam generated by fossil fuels.
- By optimizing and monitoring these cooling and heating, Siemens estimates **energy savings of between 15-20 %** at each site, and an average **CO₂ reduction of 50 %** at each site.
- **15 HEINEKEN beer and malt production sites**, spanning facilities across **Asia-Pacific, the Americas and Europe**
- **→ Next step: HTHPs for steam generation?**

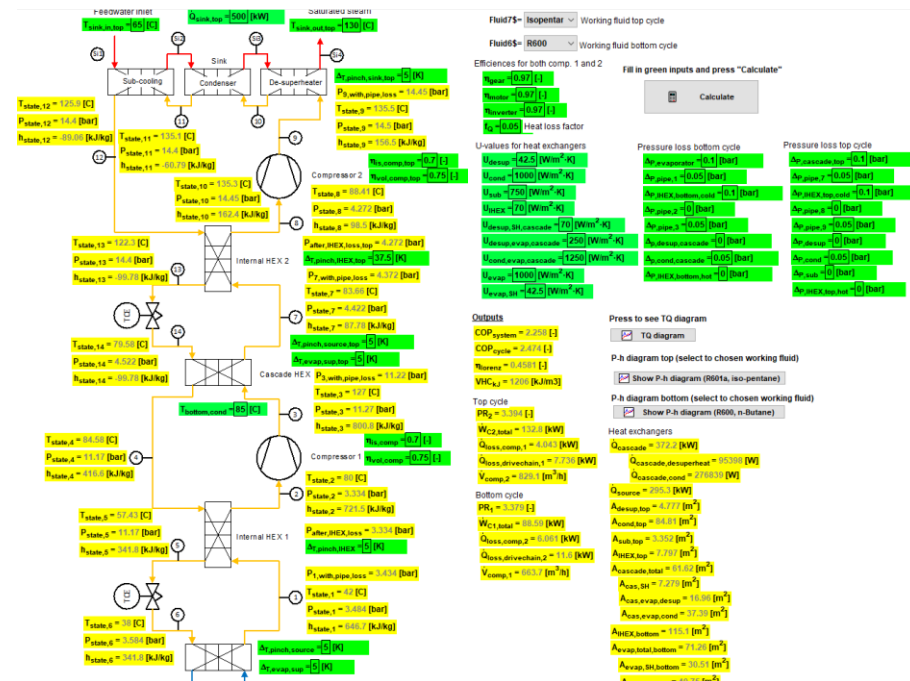
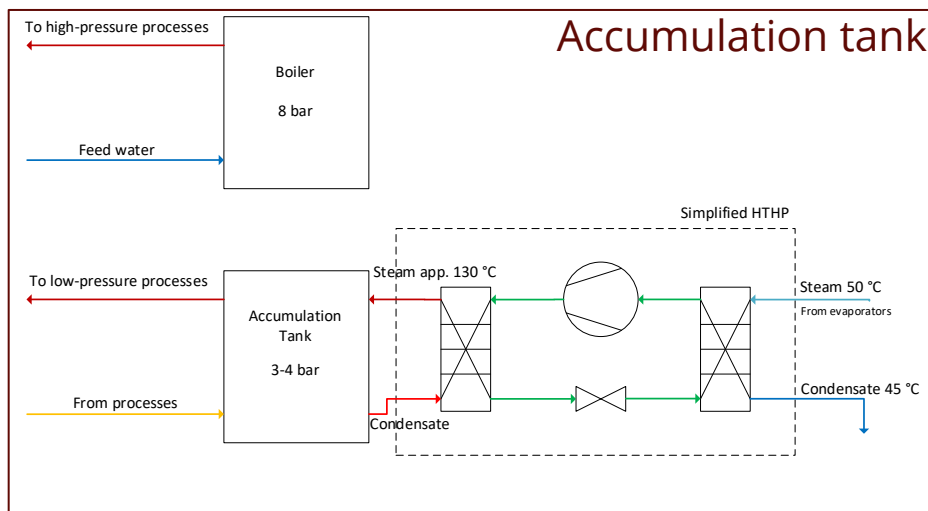
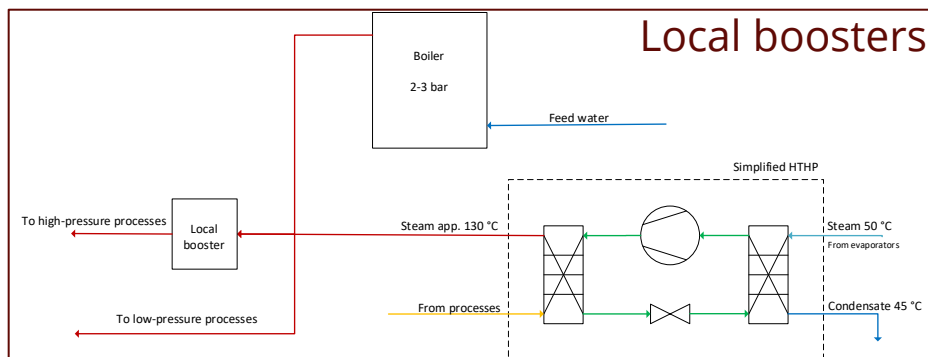
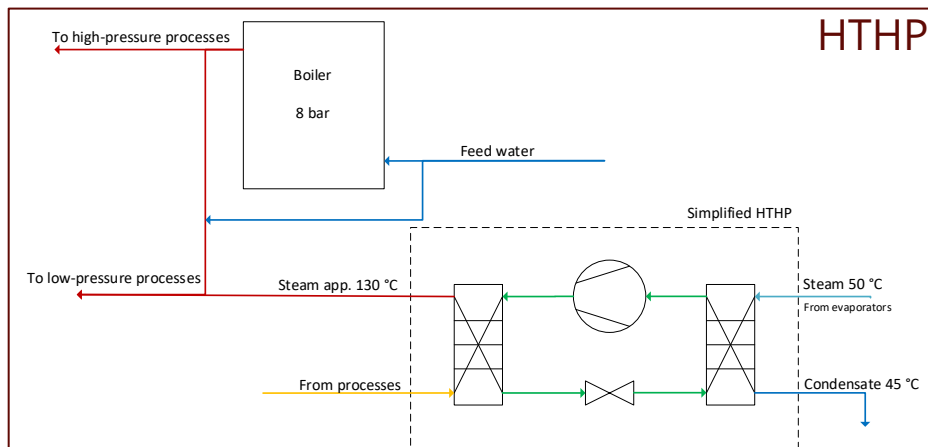
Development of Decarbonization Strategies



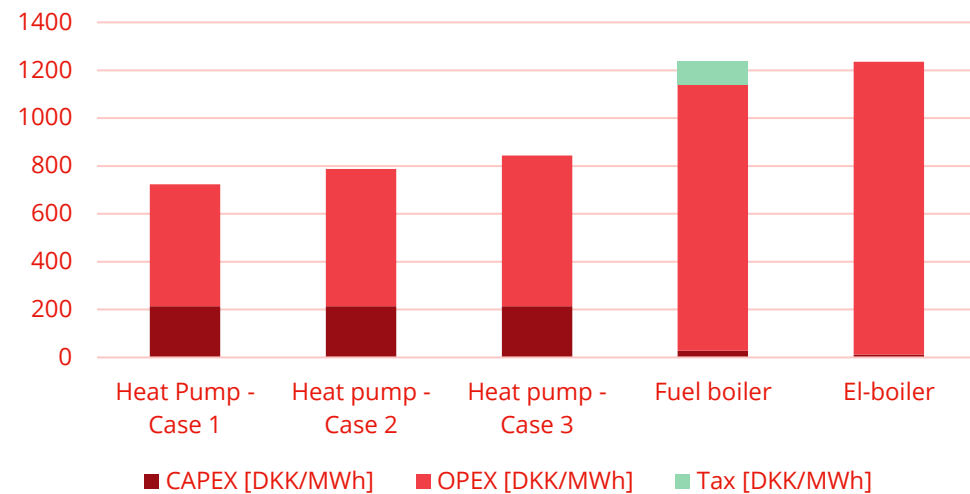
Case Study – VARDIN

- Fish treatment plant in the Faroe Islands
- New production facilities
- Optimize process parameters
- Avoid oil consumption and ensure grid stability





Comparison of LCoH in Case 1-3



Technology lock-in

Wrong investments = Slower decarbonization



Process equipment designed for high pressures



Waste-heat recovery with too large temperature differences



Waste heat recovery from combustion processes



Waste heat supply for external purpose



Investments in process equipment not optimized for new energy supply



Investments in energy utility based on wrong or short-sighted assumptions

Different level of integration

Process level

Integration directly in processes, e.g.:
MVR

Unit level

Integration around one or more processes, e.g.:
Drying equipment

Utility level

Replacing utility with or without integration, e.g.:
Drop-in boiler replacement

Sector level

Heat supply by external party, e.g.:
District Heating

Highest efficiencies

Process modifications
required

Strong dependency on
process demands

Low required PBT

Various application requirements

Heat recovery

Buffering and load
balancing

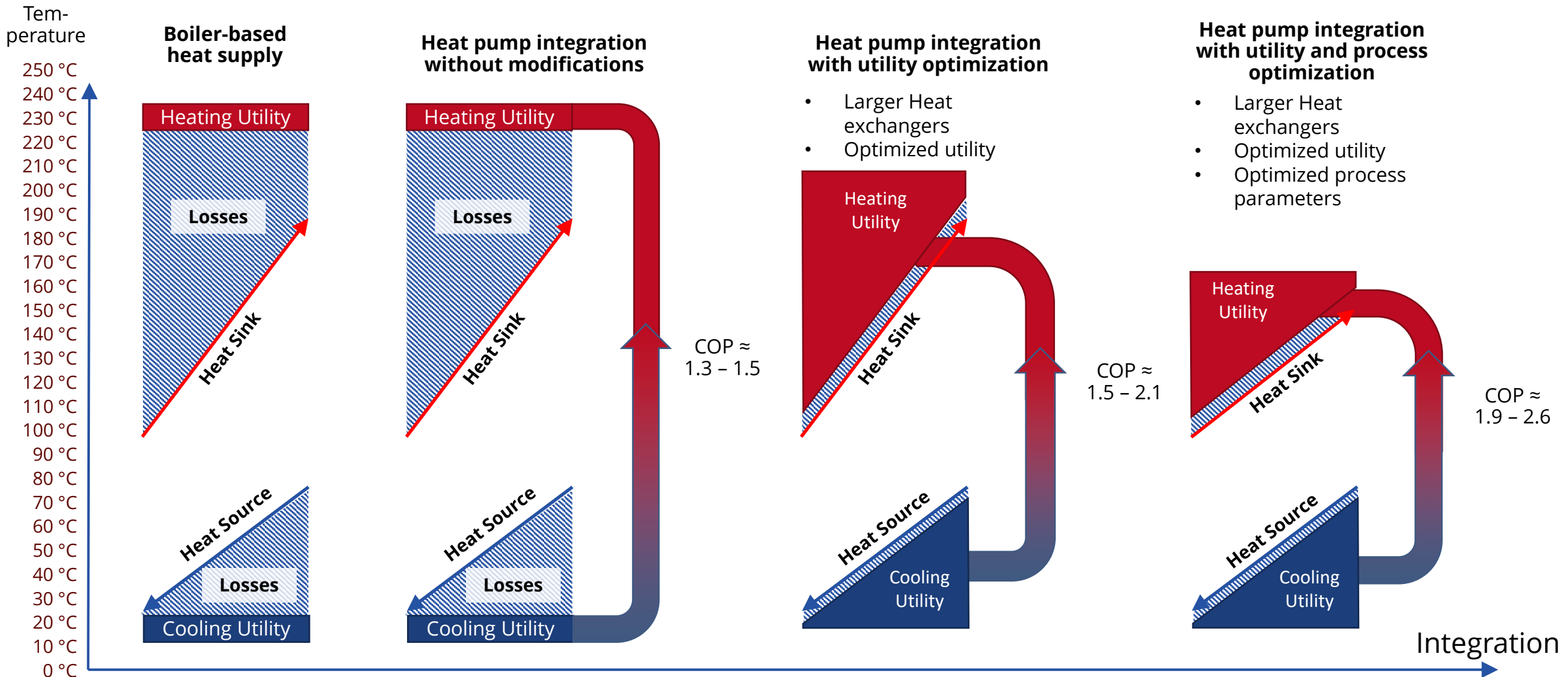
Larger capacities

Economy of scale

Longer (economic)
planning horizons

Limited process
modifications required

Temperature demands & level of integration

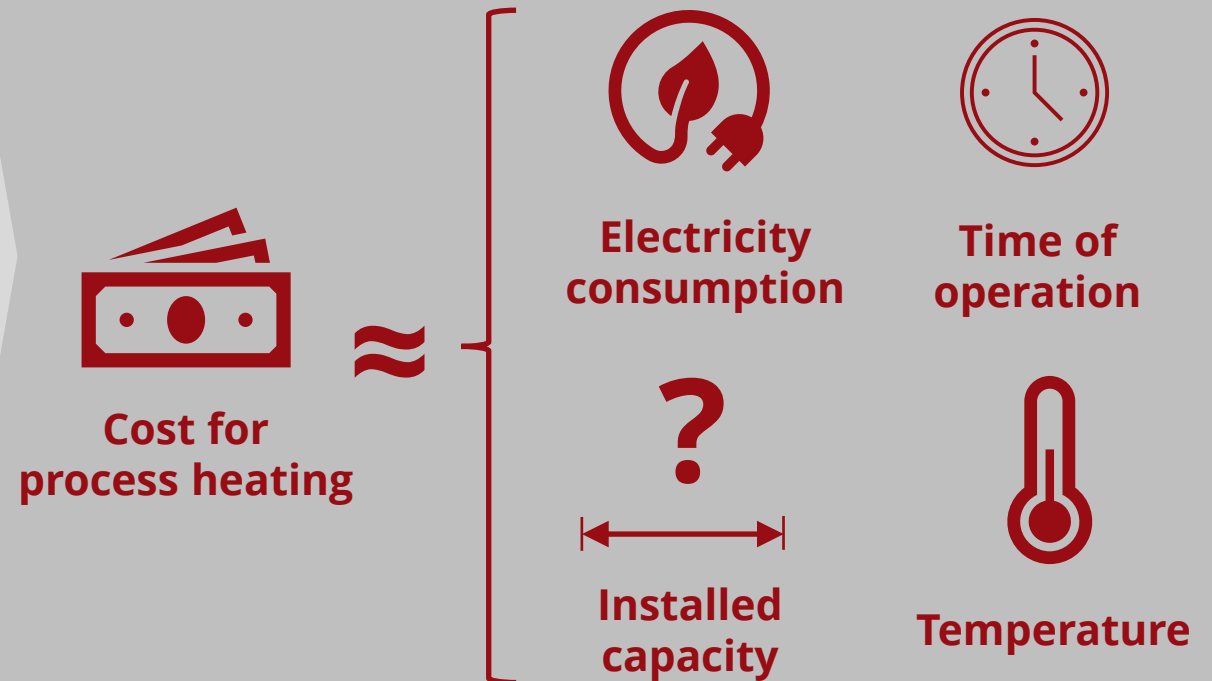


Converting to HPs requires Shift of Mindset

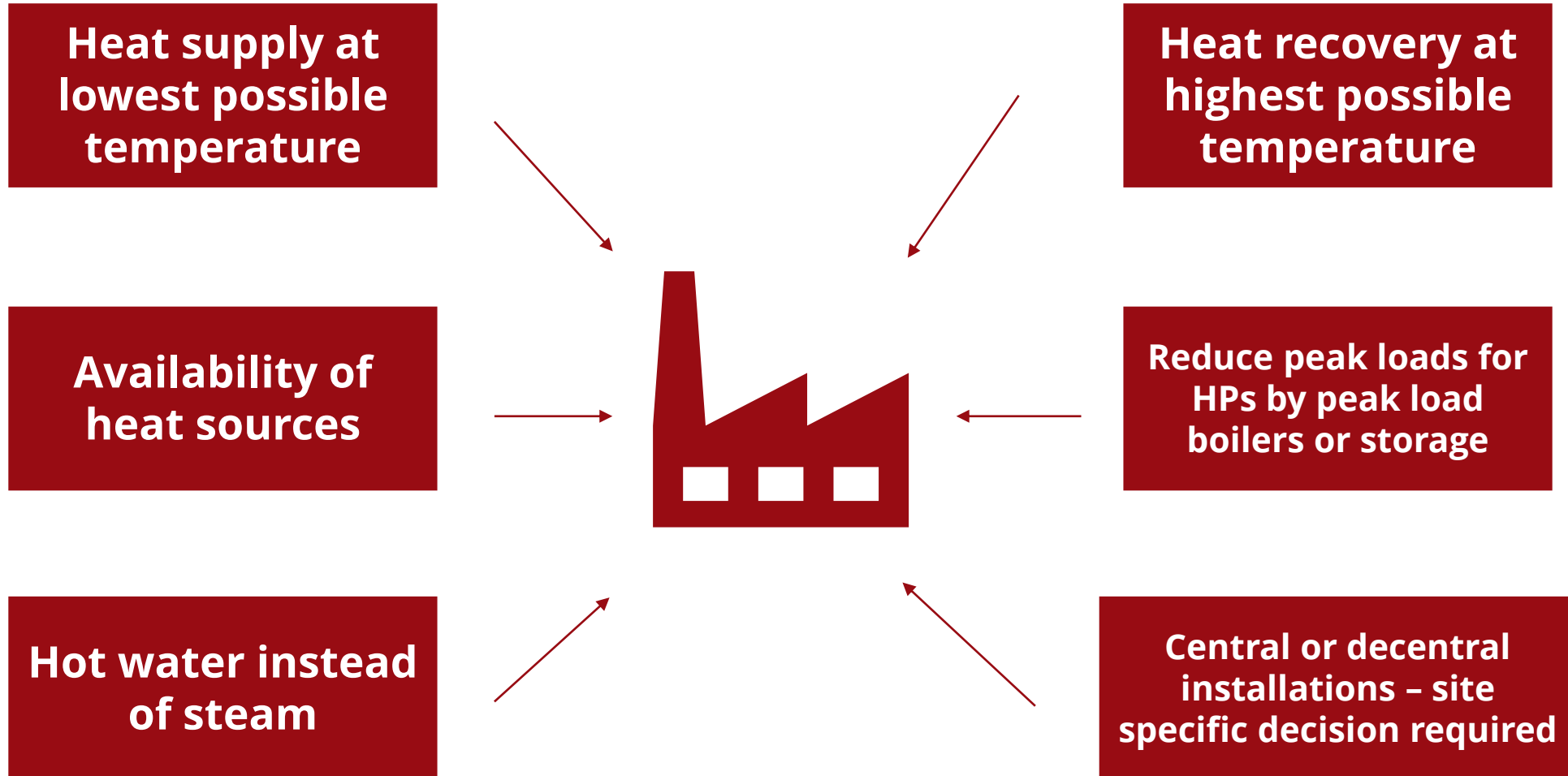
Fossil-fuel based process heating



Heat pump-based process heating



Paradigmes



Annex 58 – Task 3

How to define a decarbonization goal?

How to describe the current status?

How to develop and evaluate concept solutions for decarbonized systems?

How to derive the decarbonization path?



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Thank you for your attention!

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