Thermal Energy Storage to enhance flexibility

Work in FME HighEFF

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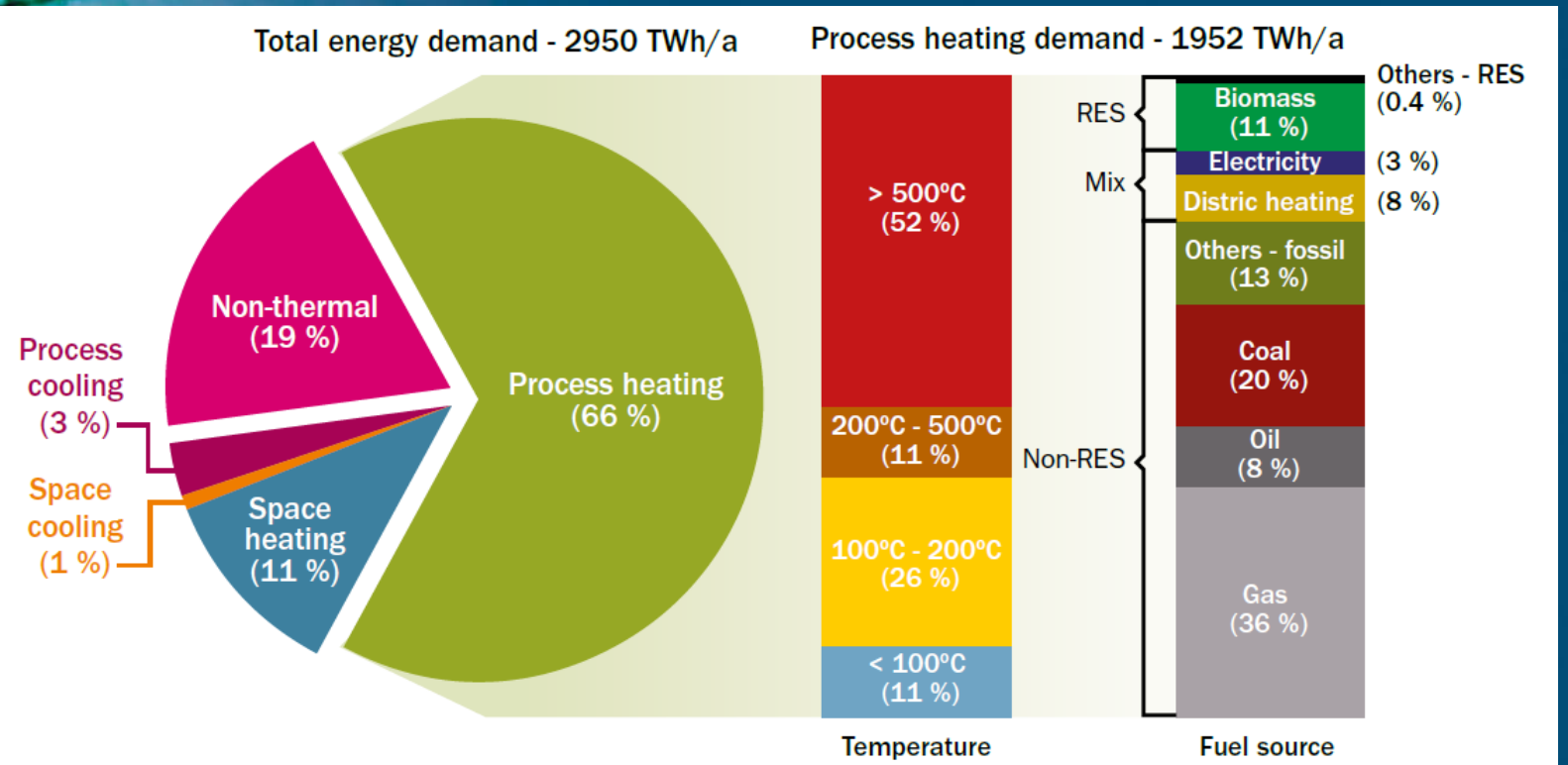
TES Workshop – 12-11-2021

Background

- The energy use in the Norwegian land-based industry: **73 TWh in 2019**
  - Energy use in households: 48 TWh
- **2/3** of industrial energy use is in the form of **thermal energy**
  - **Process heat -** Covered primarily with fossil fuels
  - **Process cooling -** Highly fluctuating demand

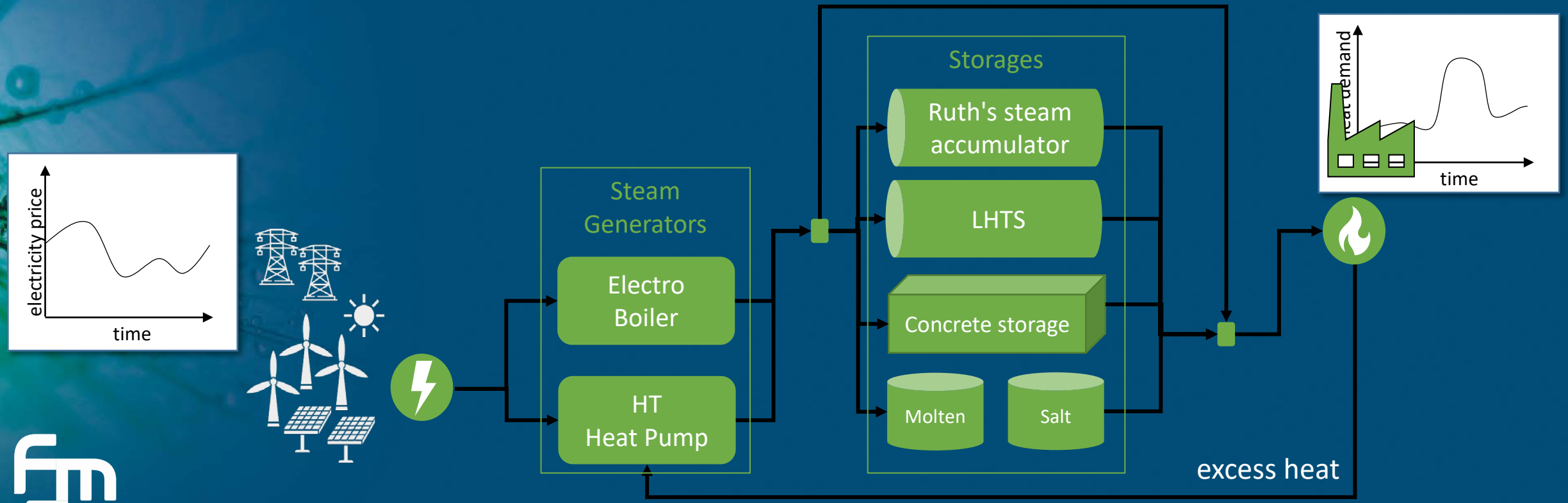


Breakdown of the final energy demand in European industry.

R. d. Boer, A. Marina, B. Zühlsdorf, C. Arpagaus, M. Bantle, V. Wilk, B. Elmegaard, J. Corberán and J. Benson, “Strengthening Industrial Heat Pump Innovation: Decarbonizing Industrial Heat,” 2020.

How do we work with flexibility in HighEFF?

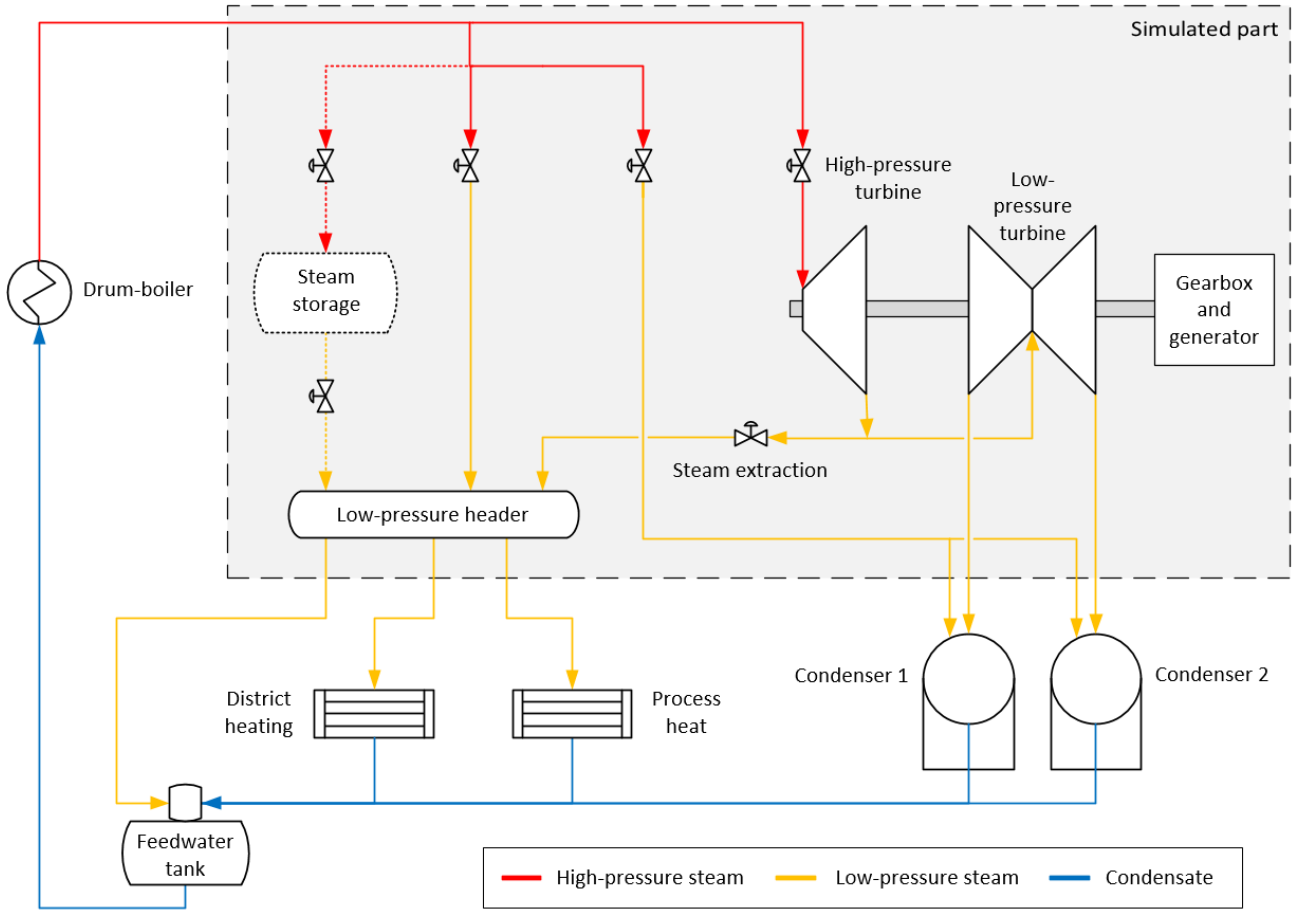
CETES: Methodology for the optimal choice of thermal storage technology for a given power-to-heat application



Beck, A., Sevault, A., Drexler-Schmid, G., Schöny, M., & Kauko, H. (2021). Optimal Selection of Thermal Energy Storage Technology for Fossil-Free Steam Production in the Processing Industry. Applied Sciences, 11(3), 1063.

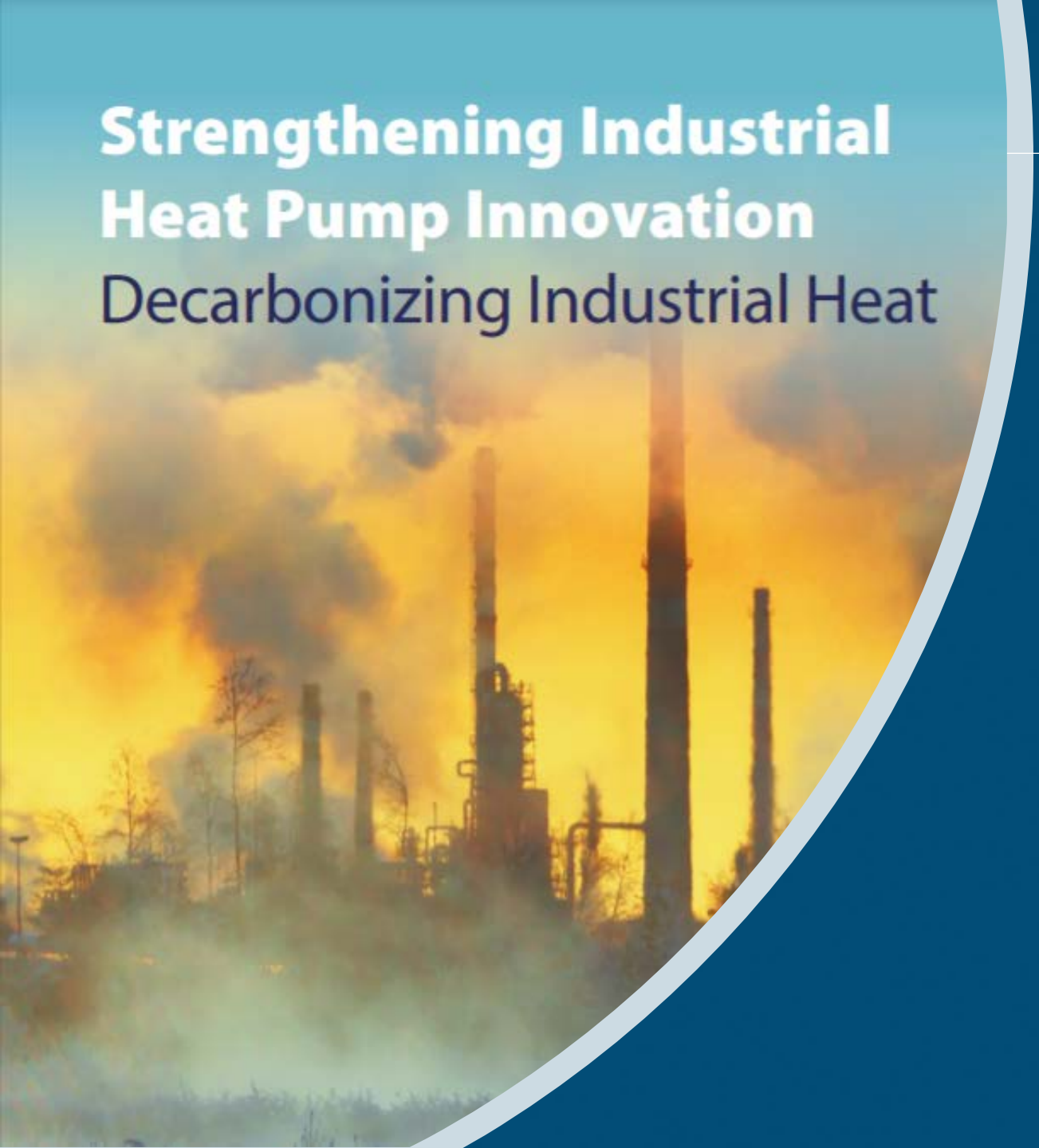
Case 1:
Elkem Thamshavn

- Silicon plant located in Orkanger, Mid-Norway
- Annual electricity use: 630 GWh
- Energy from recovery system:
  - 150 GWh electricity
  - 60 GWh heat
  - 1.5 GWh dumped to the fjord



Case 2: Nidar chocolate factory

- Current steam demand covered with a propane-fired boiler
- Desire to go fossil-free through implementation of an electric boiler – but the grid capacity is not sufficient
- Can the problem be solved by implementing a steam accumulator to smoothen the load?



Planned TES activities for 2022 in HighEFF

- Design of a high-temperature PCM TES to be tested at the SINTEF/NTNU laboratories
- Work further with the Nidar/Orkla case?
- Develop a concept for replacing fossil-based heating at poultry farms with heat pumps + TES
- Contribute in finalizing a white paper in TES

Part 2: Medium and high temperature TES

- Christopher Greiner (**EnergyNest**): *Two current projects where TES in concrete will benefit the industry*
- Christopher Kjølner (**Kyoto Group**): *Molten salt TES for the industry*
- Alexis Sevault (**SINTEF Energy Research**): *Demo 200-kWh heat storage using bio-based PCM in ZEB Lab*
- Eivind Selvig (Civitas/Statsbygg) & Frode Holthe (Rambøll): EnergiHUB – Energy concept for the giant project NTNU Campussamling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Thank you for your attention.