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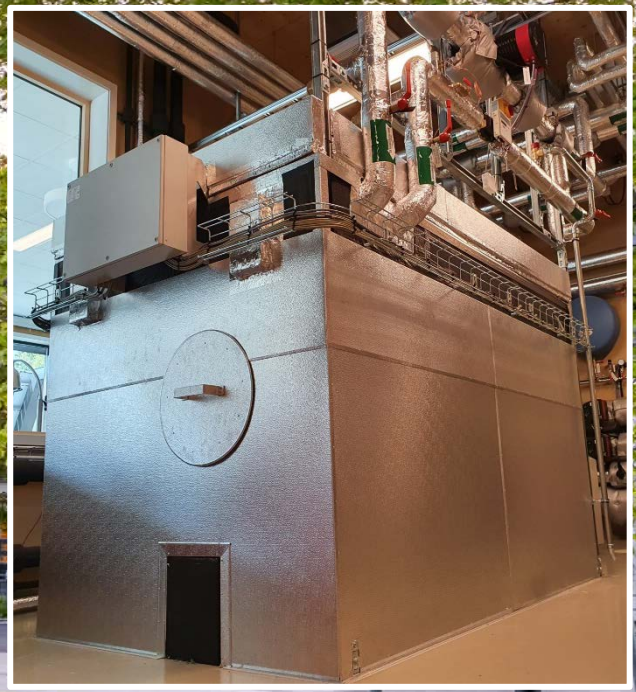
Research Centre on
ZERO EMISSION
NEIGHBOURHOODS
IN SMART CITIES

Photo: Nicola Lolli, SINTEF Community

DEMO 200-KWH HEAT STORAGE USING BIO-BASED PCM AT ZEB-LABORATORY

SINTEF TES Workshop 2021

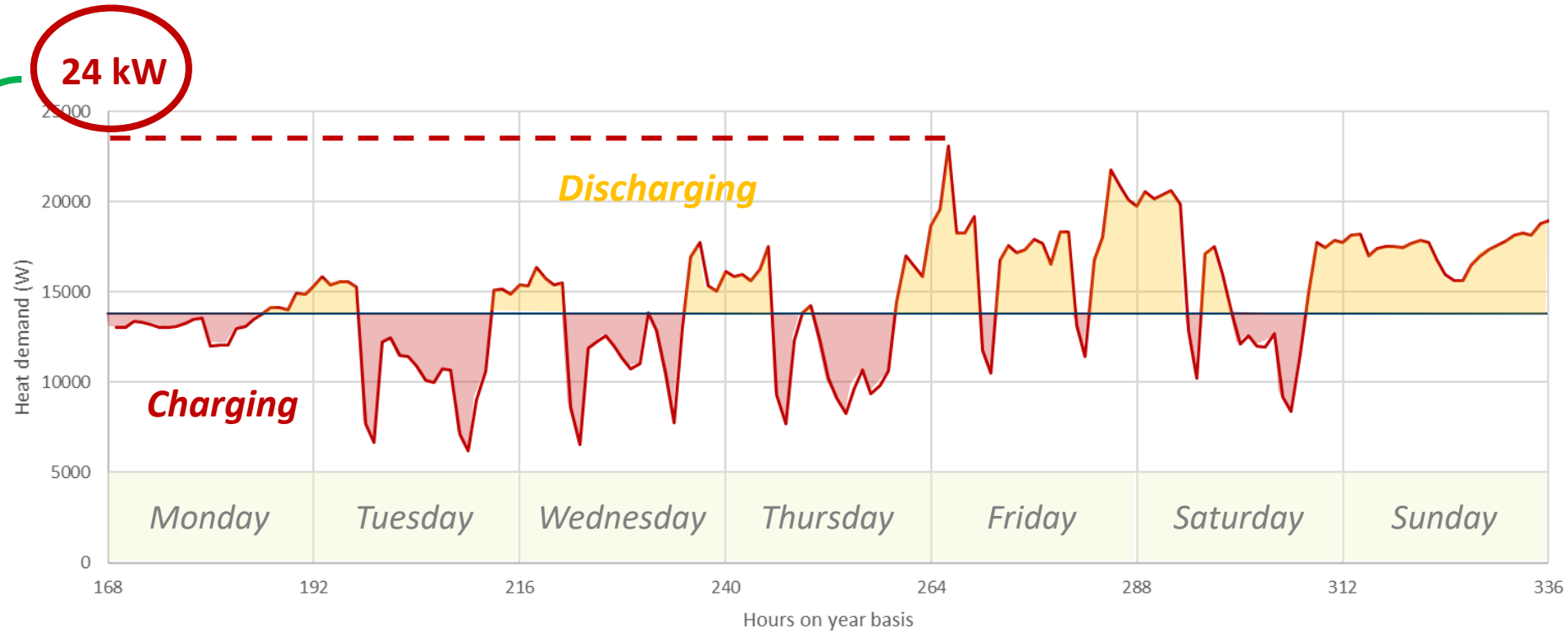
Alexis SEVAULT (SINTEF Energy Research) - 2021-11-12



Facing a quickly varying heat demand…

…and a correspondingly varying energy price

Max required output: 42% lower



-> Heat storage enables peak shaving and flexibility

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Alexis Sevault

What are PCMs?

Energy to melt **1 kg ice** = **80x** **Energy** to heat up from 1 to 2 °C **1 kg water**

Contact: Alexis Sevault

Demo PCM heat storage at ZEB-laboratory

3 ton bio-based wax PCM (melting T = 37 °C)

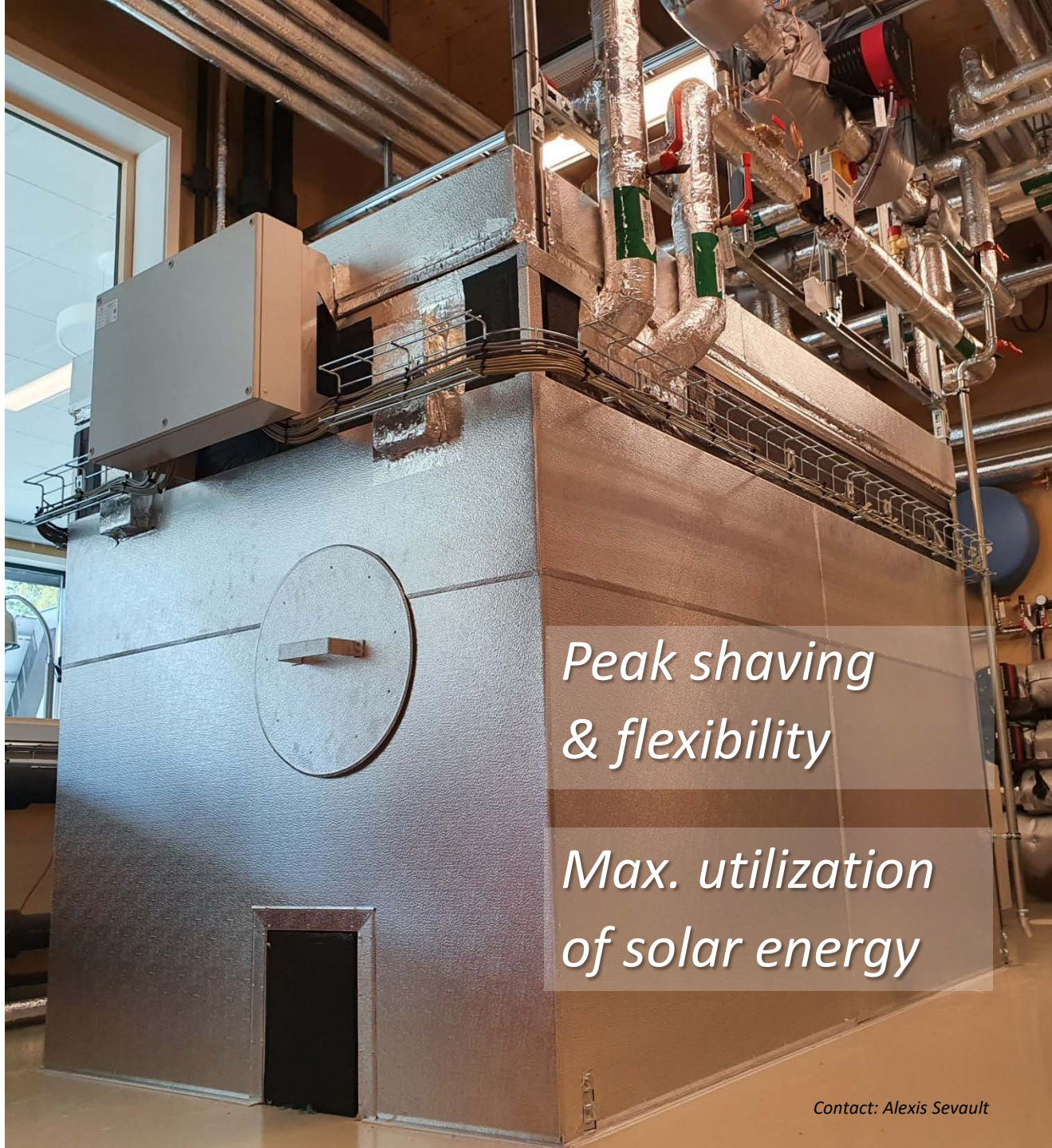
200 kWh heat storage capacity

4x more compact than a water tank

4 operation modes:

- **Charge** from heat pump or district heating
- **Discharge** to heat pump or heating system loop

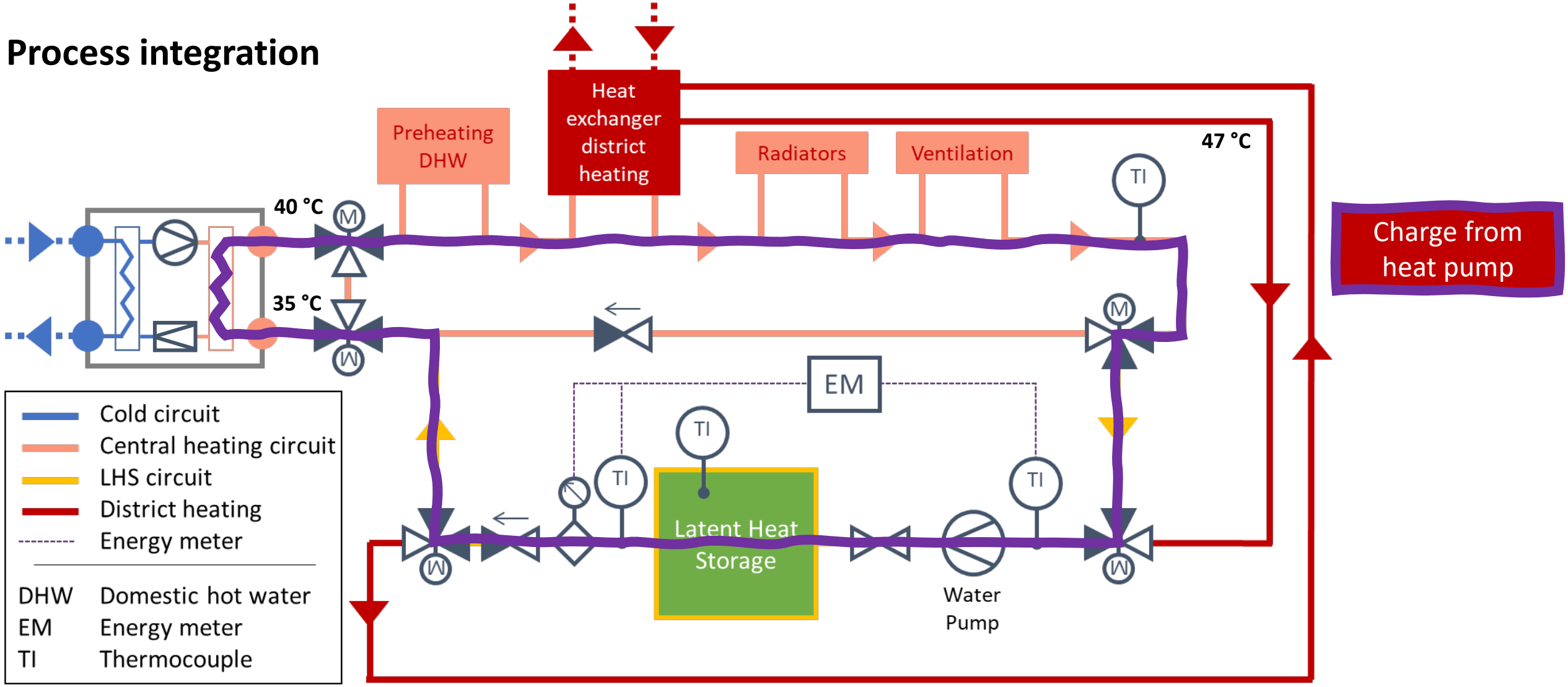
In operation since **2021** with monitoring in cloud



Contact: Alexis Sevault

ZEB Lab: Latent heat storage for peak shaving

Process integration



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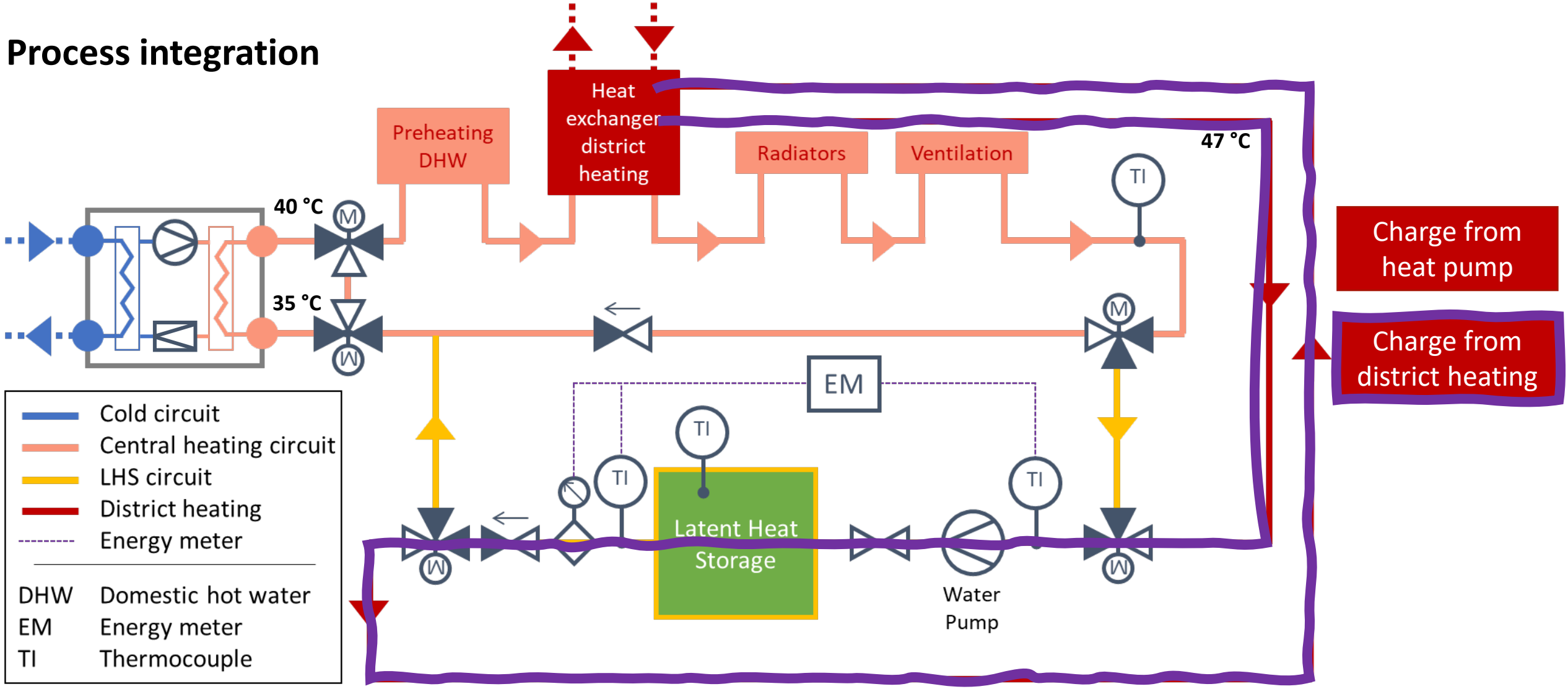
ZEB Lab: Latent heat storage for peak shaving

Process integration



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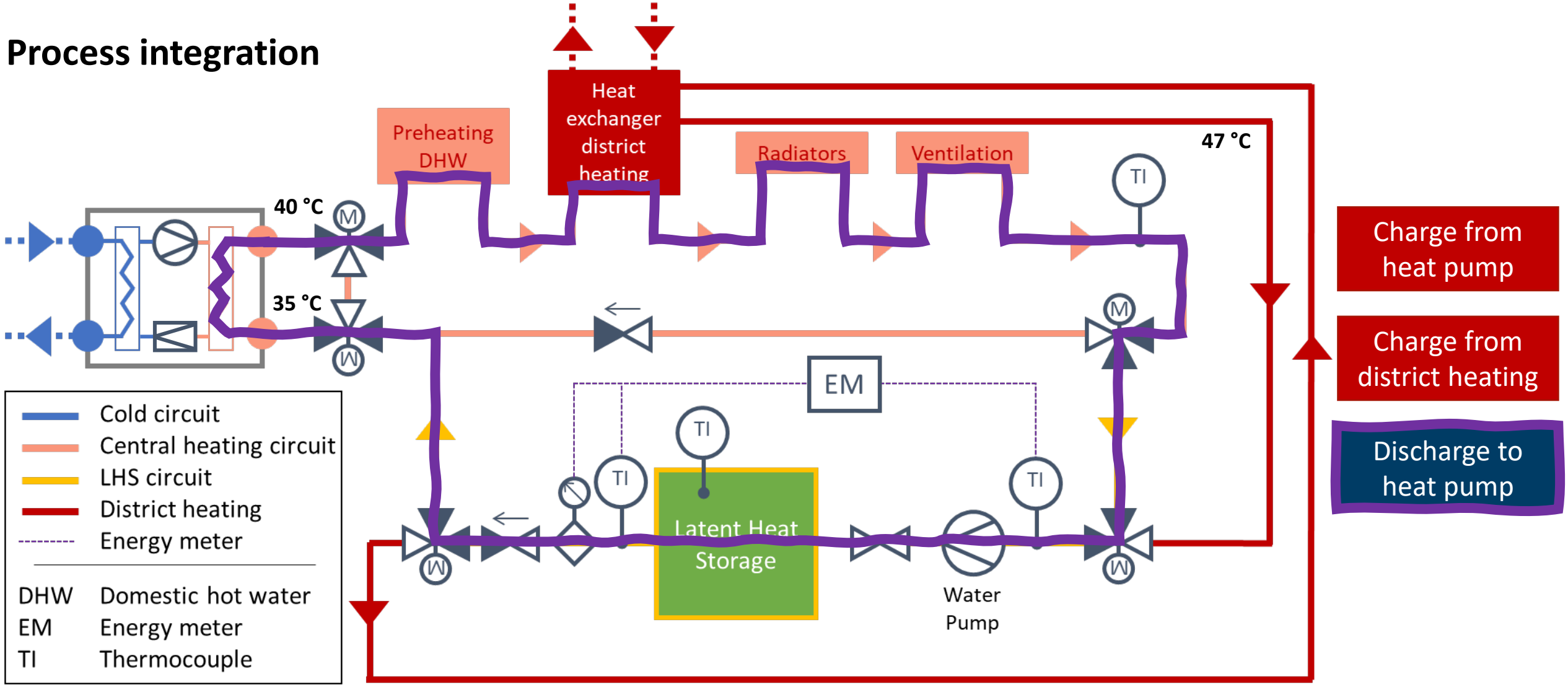
ZEB Lab: Latent heat storage for peak shaving

Process integration



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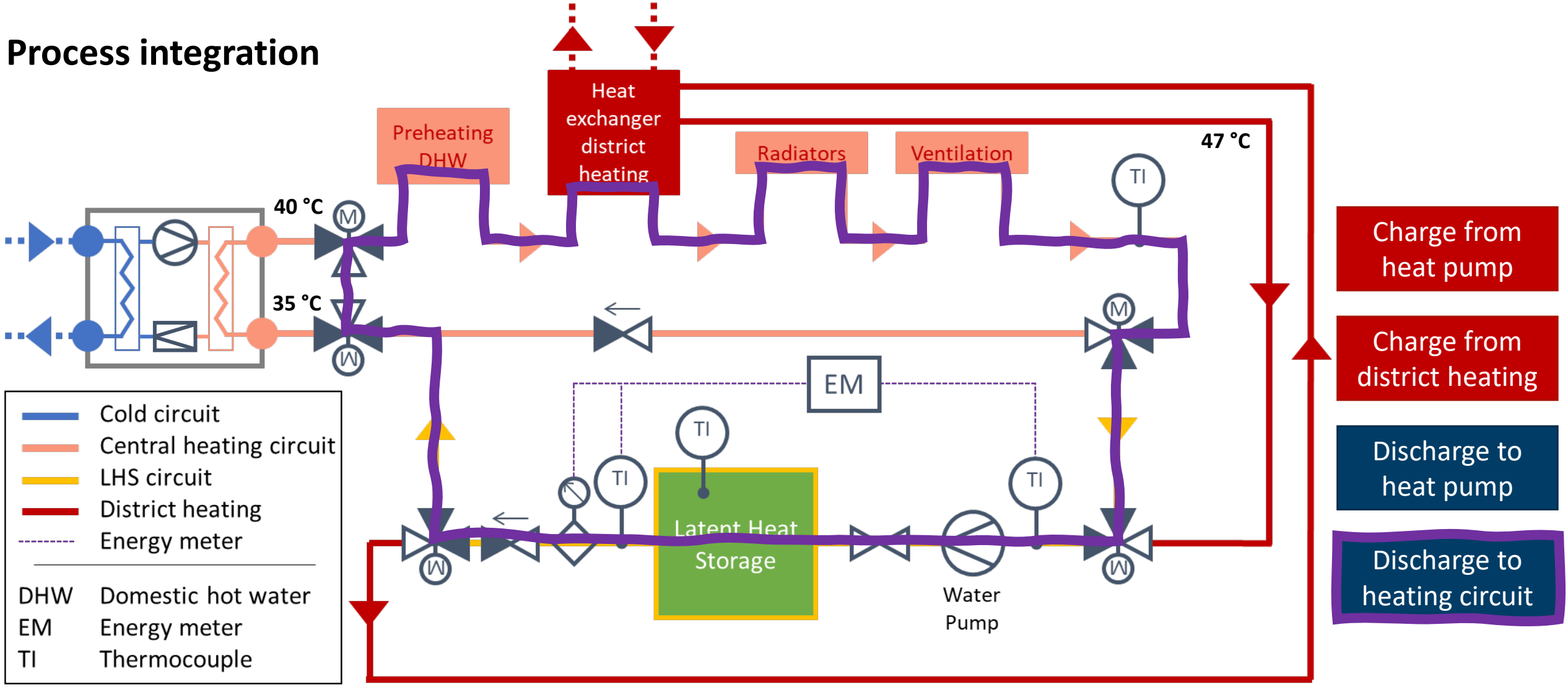
ZEB Lab: Latent heat storage for peak shaving

Process integration



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Project PRESAV

Duration: August 2021 – June 2022
Budget: 1 MNOK, financed by FME ZEN
Partners: SINTEF Energy, SINTEF Community, NTNU

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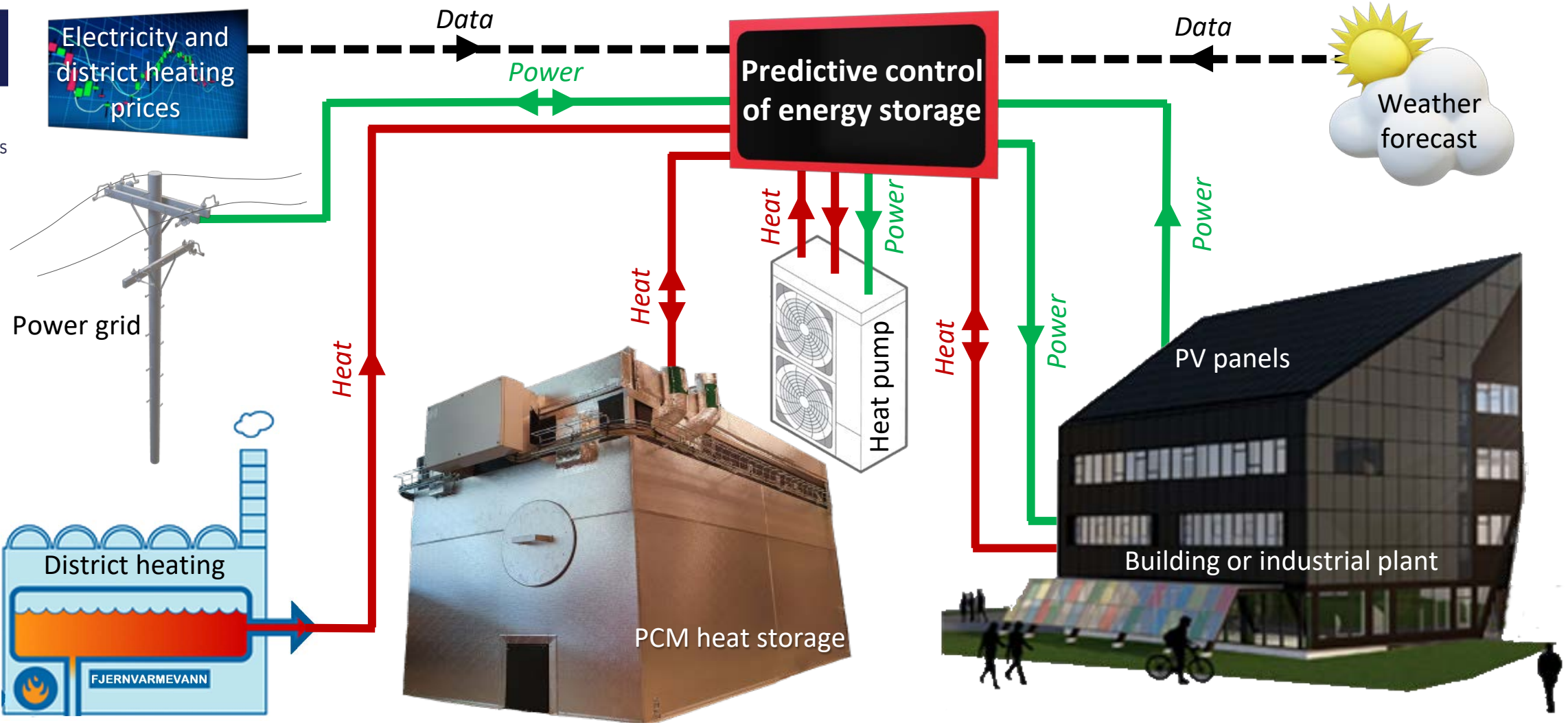

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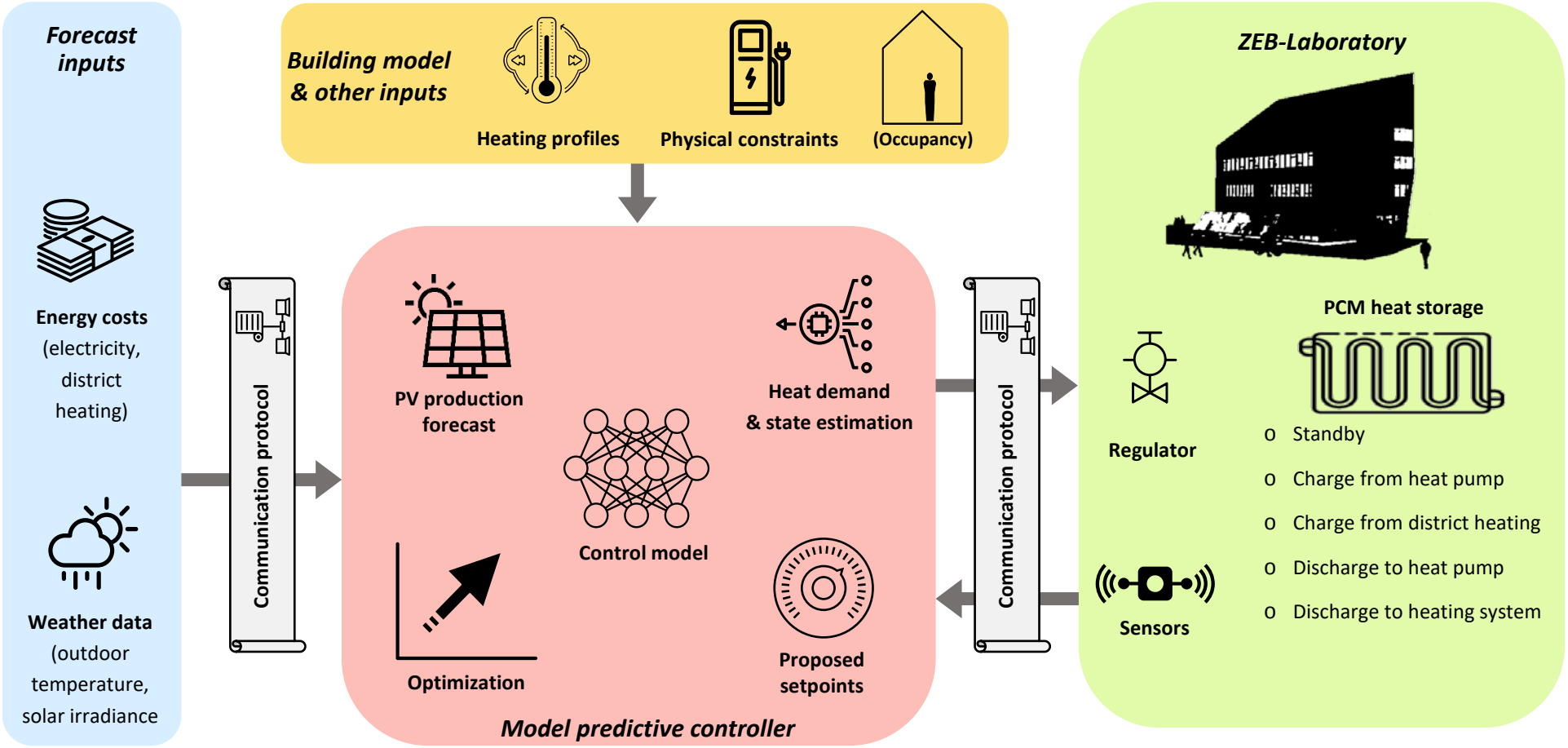
PRESAV: Model Predictive Control structure



MPC structure in project PRESAV

(adapted from SINTEF Community's project Databygg)

Contact: Alexis Sevault

PRESAV: a collaborative project

Advisers, Quality assurance and collaboration with FME ZEN:







Interface ZEB-laboratory data & cloud solution
SINTEF Community




Implementation of new predictive control strategies at ZEB-laboratory
SINTEF Community + Energy

A0. Management & dissemination
SINTEF Energy Research

A2. Implementation & testing at ZEB Lab
SINTEF Community & Energy Research

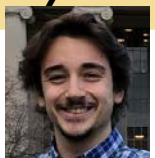
A1. Predictive control strategies
SINTEF Energy Research & Community, NTNU

A3. Data analysis & feedback to strategies
SINTEF Energy Research, NTNU

Predictive control strategies for active heat storage in buildings

Forecast for PV power production
NTNU El. Power Eng.


Core of learning Model Predictive Control
NTNU EPT / FME HighEFF



Model for building heating system
SINTEF Community

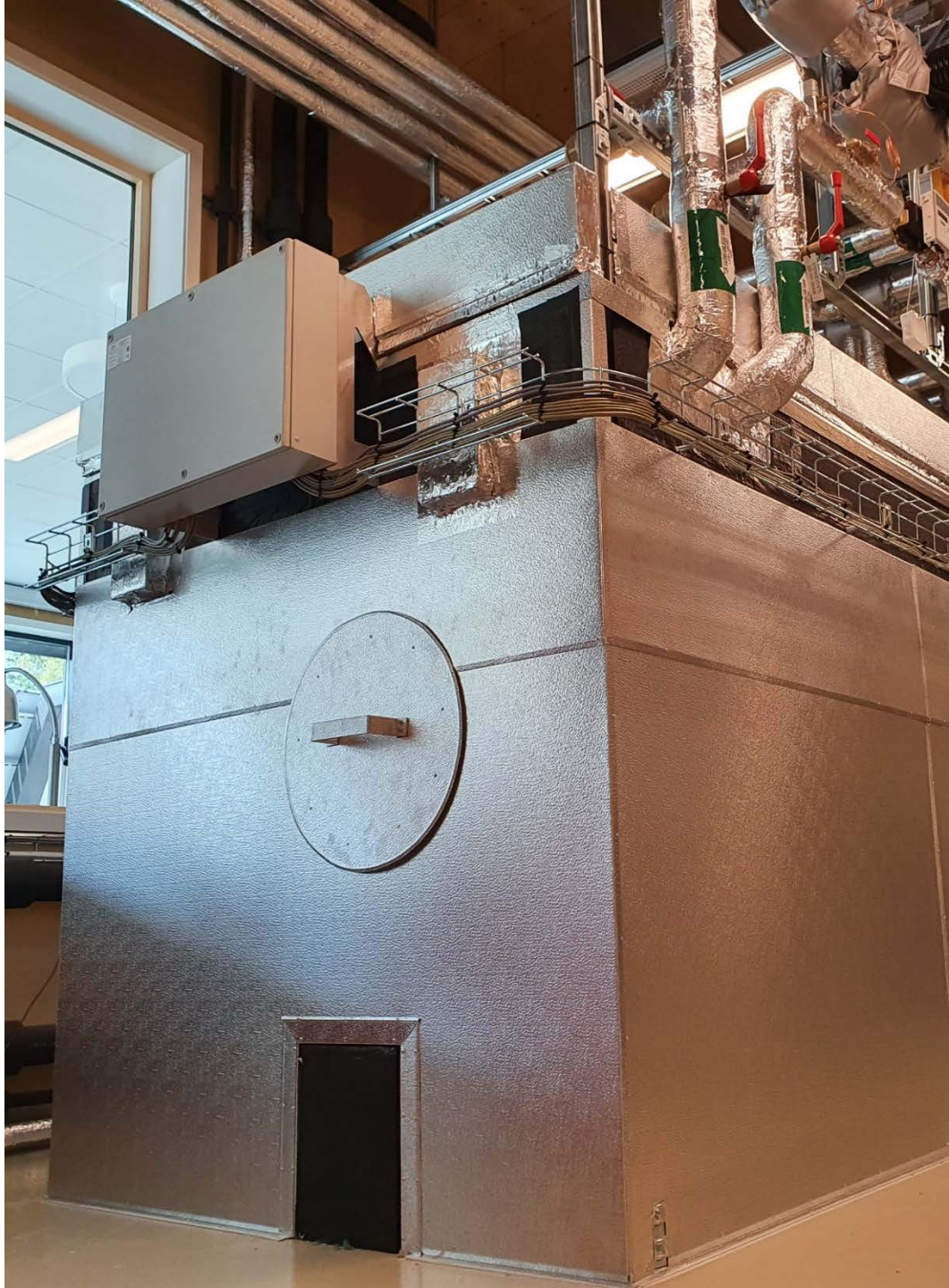
Model for PCM heat storage and interface for external data
SINTEF Energy



Contact: Alexis Sevault

Main takeaways

- Demo PCM heat storage at ZEB Lab is a **functioning MVP**
- PRESAV will **benchmark the benefits** of a well integrated TES-unit with smart control system
- PCM pillow-plate TES design & PRESAV's control strategies **can be applied in other buildings, industry processes and maritime sector**



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Technology for a better society

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Active latent heat storage using biowax in a central heating system of a ZEB living lab

Alexis SEVAULT, Erling NÆSS

https://onsite.gakkai-web.net/gl2020/pdf/1146.pdf

https://blog.sintef.com/sintefenergy/energy-efficiency/thermal-batteries-with-biowax-the-future-of-heat-storage-for-buildings/

https://blog.sintef.com/sintefenergy/energy-efficiency/phase-change-materials-pcm/

PRESAV - Predictive control for active heat storage in buildings

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https://www.sintef.no/en/projects/2021/presav-prediktive-styringsstrategier-til-aktiv-varmelagring-i-zeb-laboratoriet/