

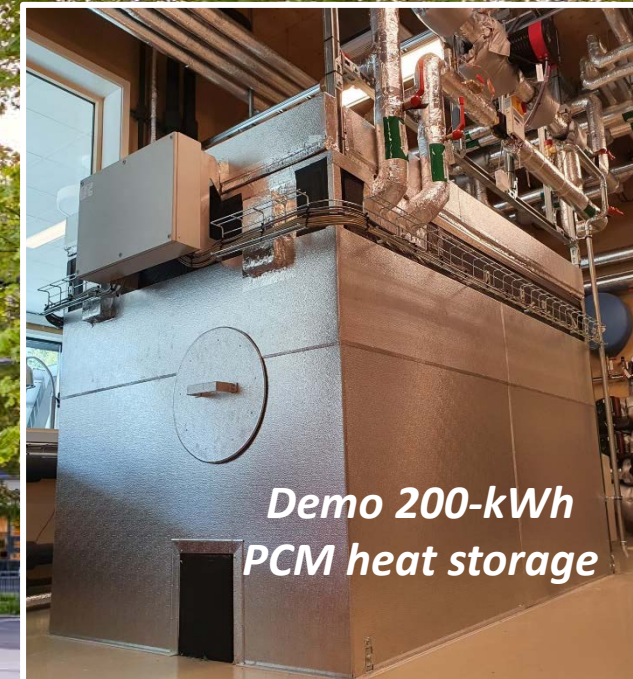


PCM HEAT STORAGE AT ZEB LABORATORY

General presentation

2022-01-25

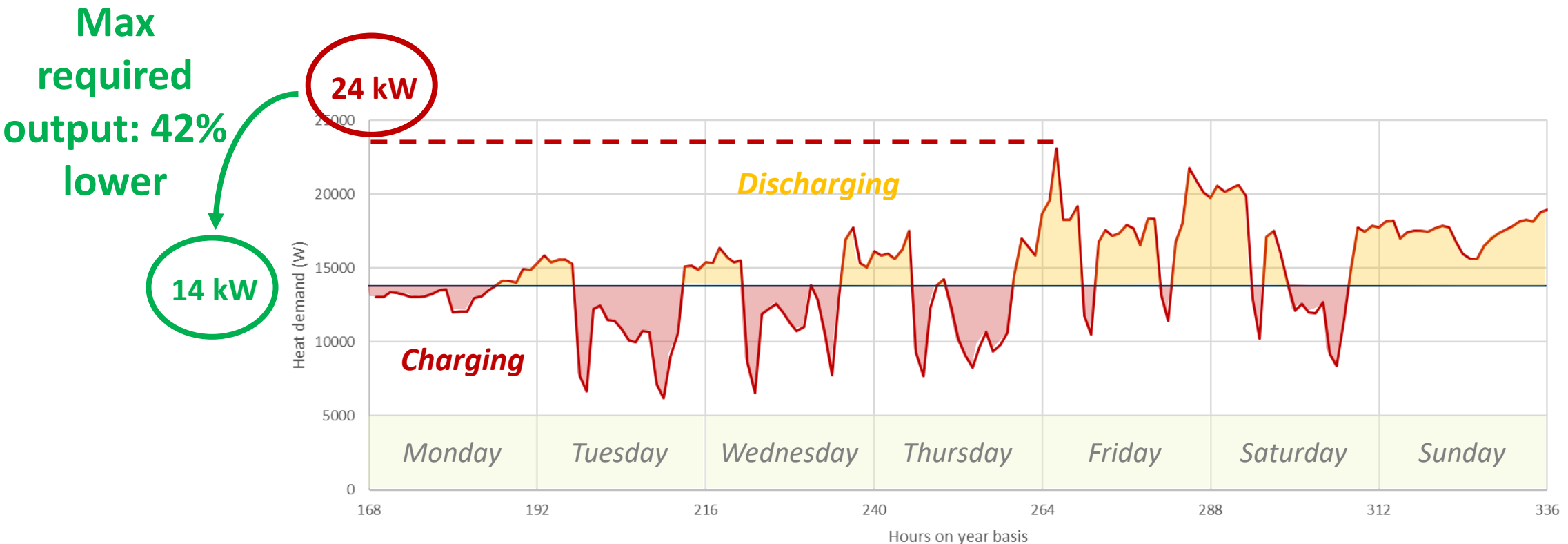
Technology for a better society



*Demo 200-kWh
PCM heat storage*

Facing a quickly varying heat demand...

...and a correspondingly varying energy price



-> Heat storage enables peak shaving and flexibility

Hva er PCMs?



Energi
for å smelte
1 kg is

= 80x

Energi
for å oppvarme med 1 °C
1 kg vann



Demo PCM heat storage at ZEB-laboratory

3 ton bio-based wax PCM (melting $T = 37\text{ °C}$)

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

Technology for a better society

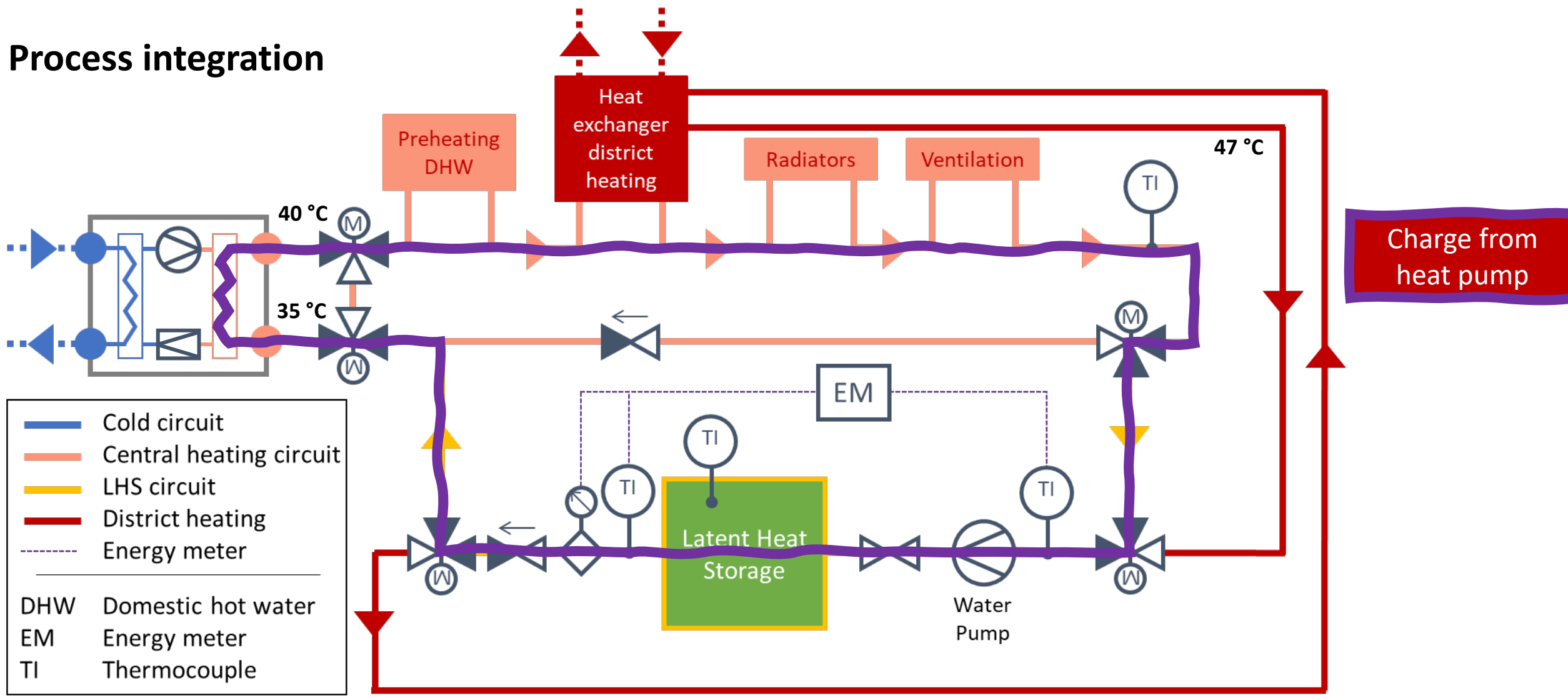


*Peak shaving
& flexibility*

*Max. utilization
of solar energy*

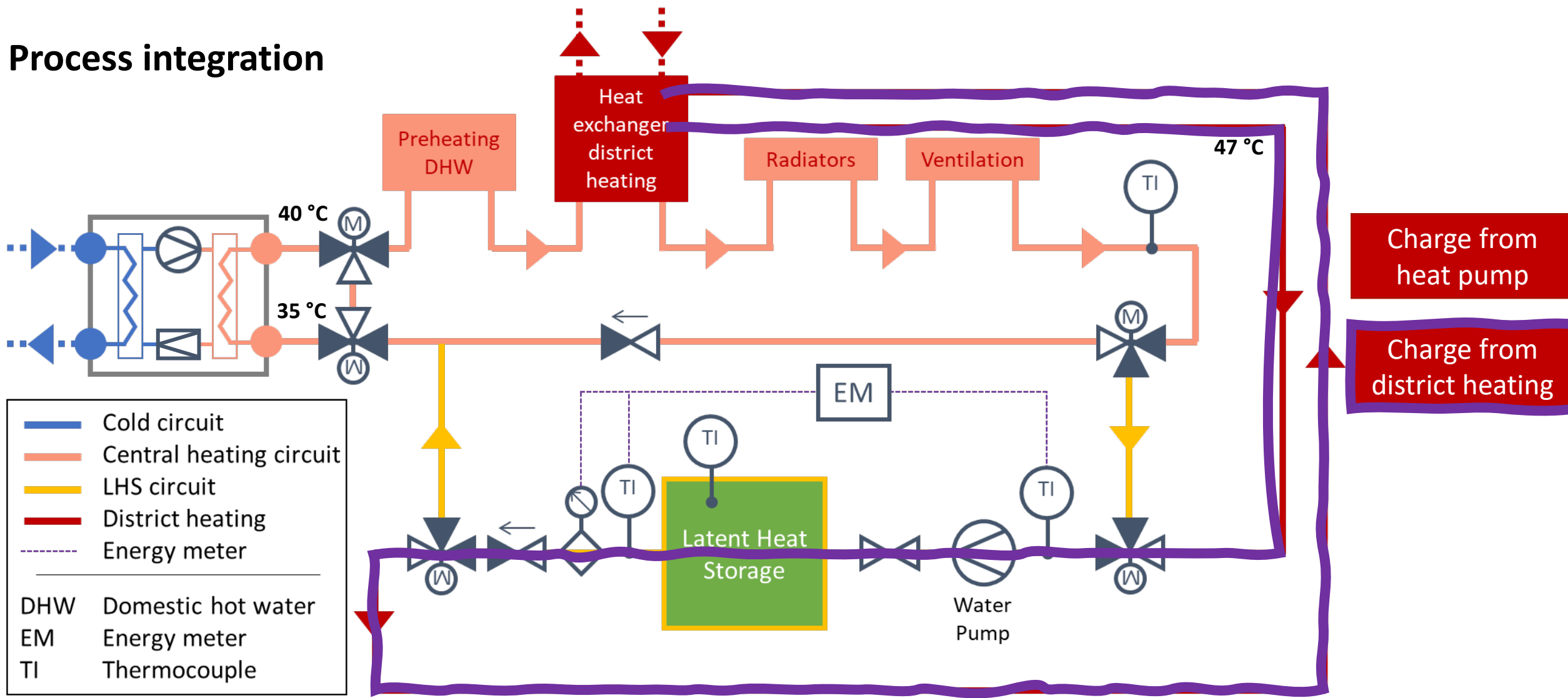
ZEB Lab: Latent heat storage for peak shaving

Process integration



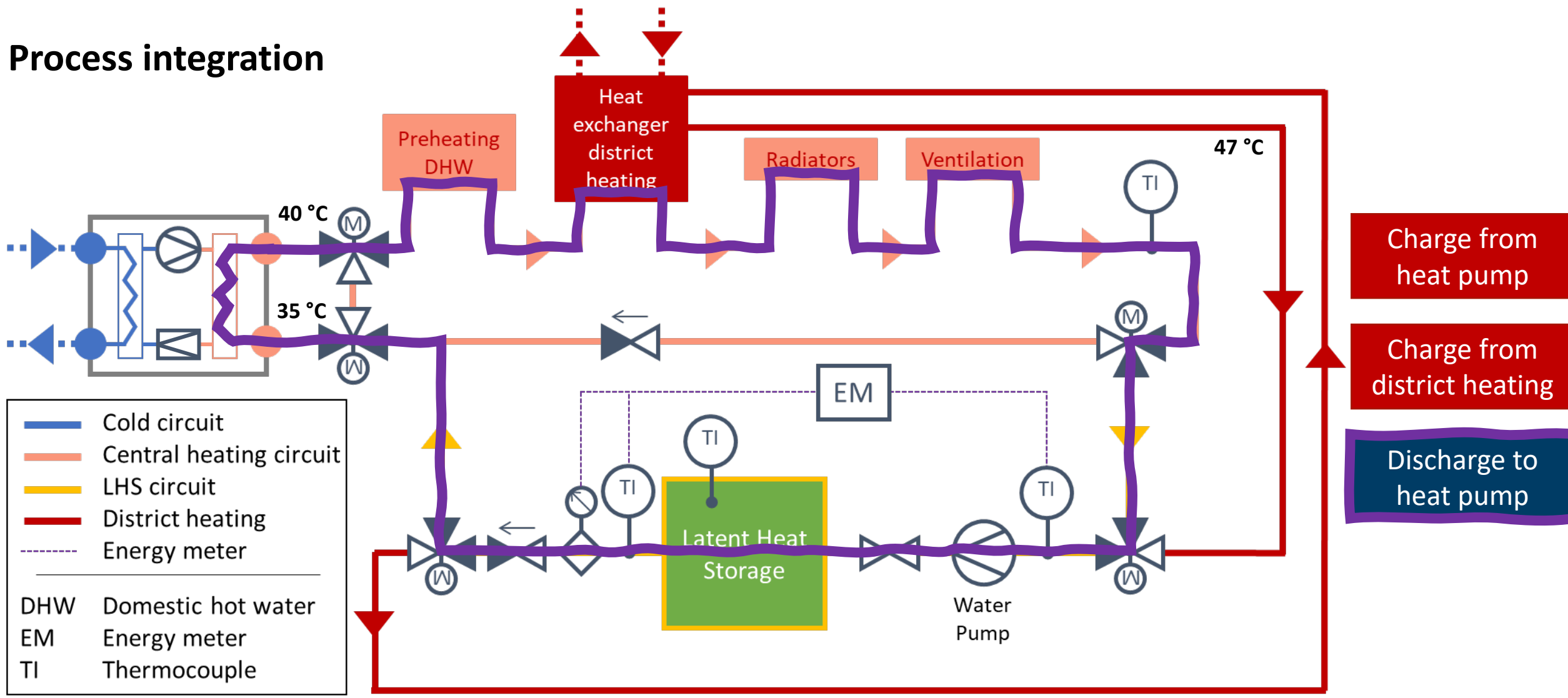
ZEB Lab: Latent heat storage for peak shaving

Process integration



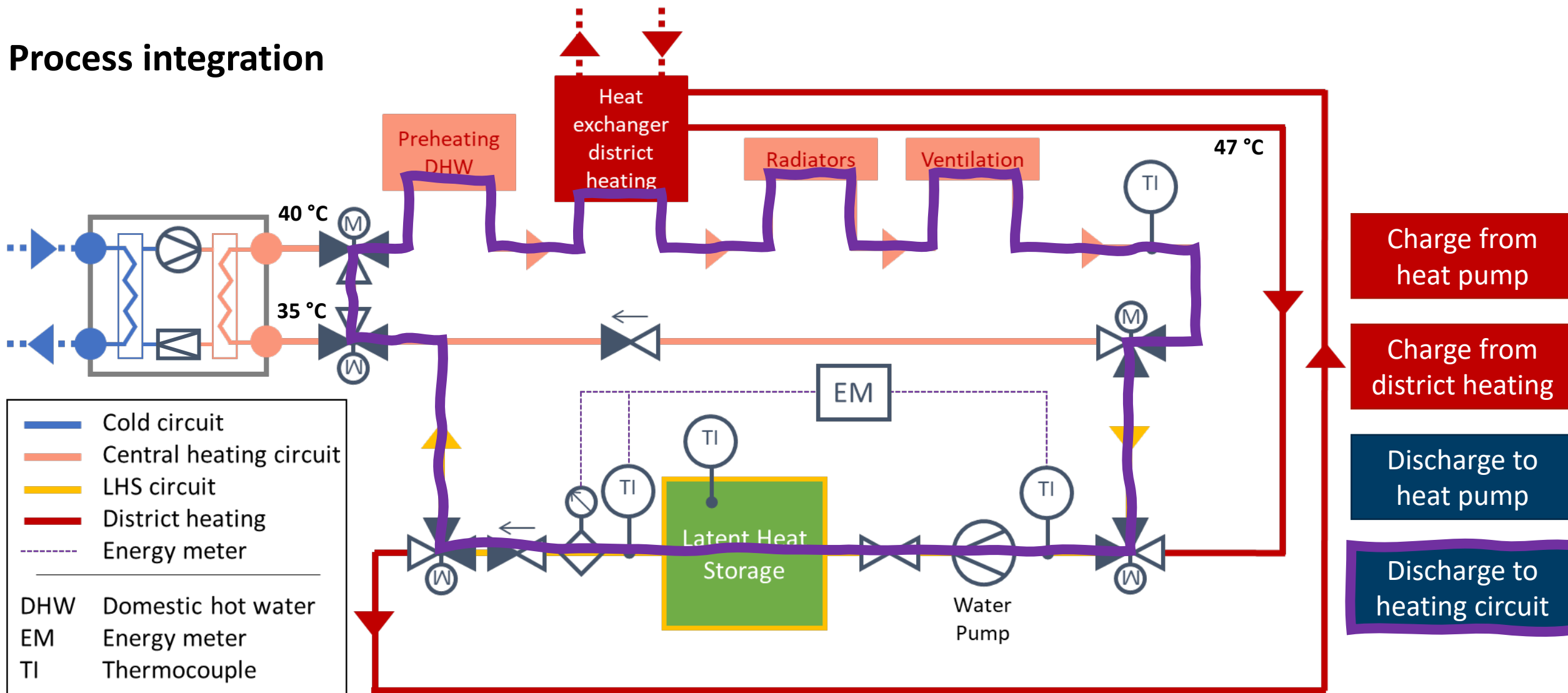
ZEB Lab: Latent heat storage for peak shaving

Process integration



ZEB Lab: Latent heat storage for peak shaving

Process integration



Z

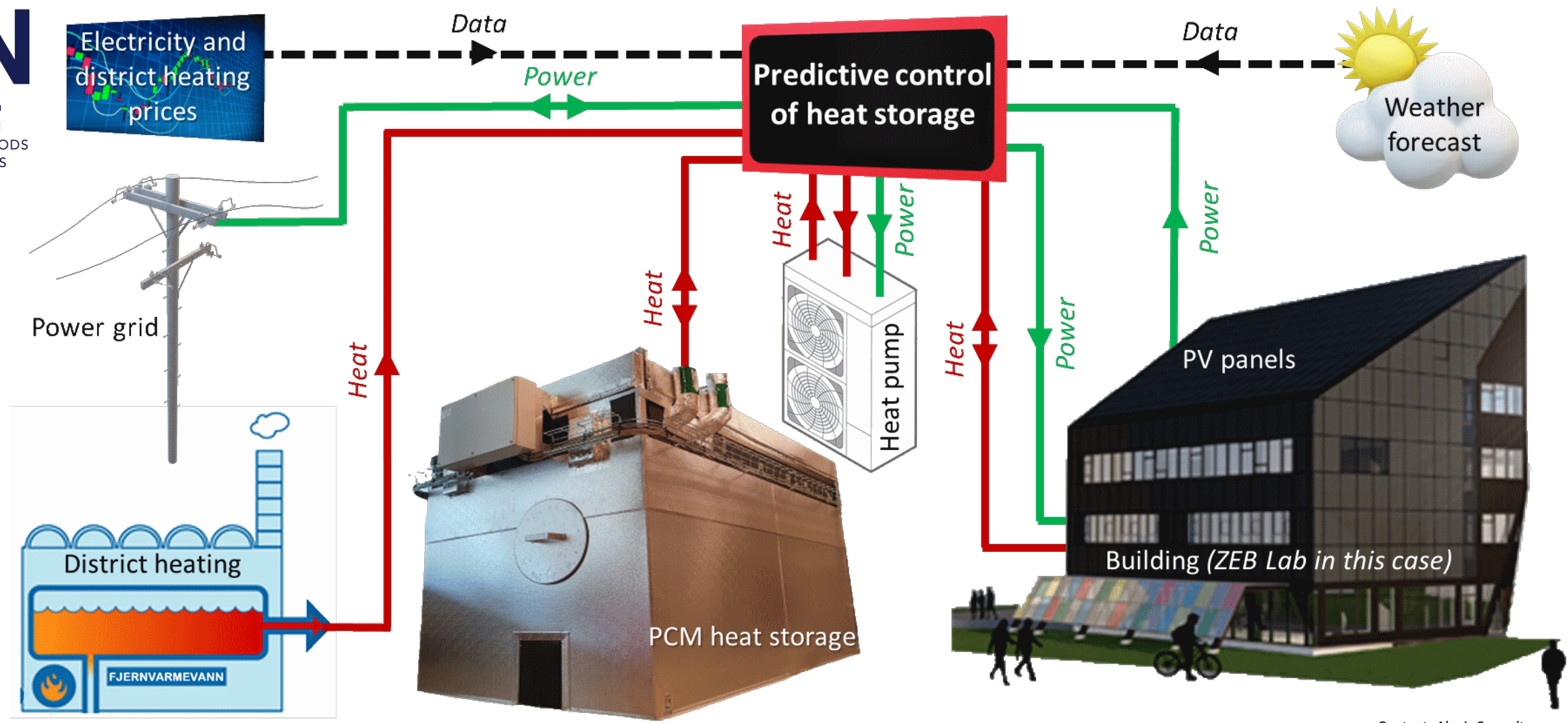
ZEN

Research Centre on
ZERO EMISSION
NEIGHBOURHOODS
IN SMART CITIES



Project PRESAV

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



PRESAV - Predictive control strategies for active heat storage in buildings

Main objective:

PRESAV will develop various **predictive control strategies for active heat storage** accounting for electricity price, district heating price, weather forecast (especially solar irradiance and outdoor temperature) and local heat demand in buildings with installed photovoltaic systems and active heat storage.

The control strategies will be **tested in the ZEB laboratory**, which has both a PCM heat storage unit and a solar PV system in addition to a customizable energy management system. The best control strategy will be used in the future.

Budget: 1 MNOK

Project duration: August 2021 – June 2022





SINTEF

PRESAV: Alle har et viktig bidrag

Grensesnitt ZEB-lab.
data og cloud løsning
SINTEF Community



Implementering av nye prediktive
styringsstrategier til ZEB-laboratoriet
SINTEF Community + Energi

Rådgiving, KS og forankring
i FME ZEN:



A0. Management &
dissemination
**SINTEF Energy
Research**

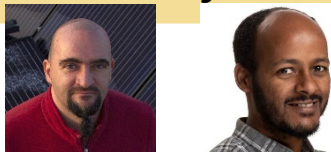
A2. Implementation & testing at ZEB Lab
SINTEF Community & Energy Research

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 til PV
produksjon
NTNU Elkraftteknikk



Core of learning
Model Predictive Control
NTNU EPT / FME HighEFF



Modell bygning
varmesystem
SINTEF Community



Modell PCM varmelager og
behandling eksterne data
SINTEF Energi



Technology for a better society

PRESAV: Dissemination and beyond

Contribute actively to ZEB-standard through max. utilization of locally produced solar energy

Even more **attractiveness for ZEB-Laboratory**

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

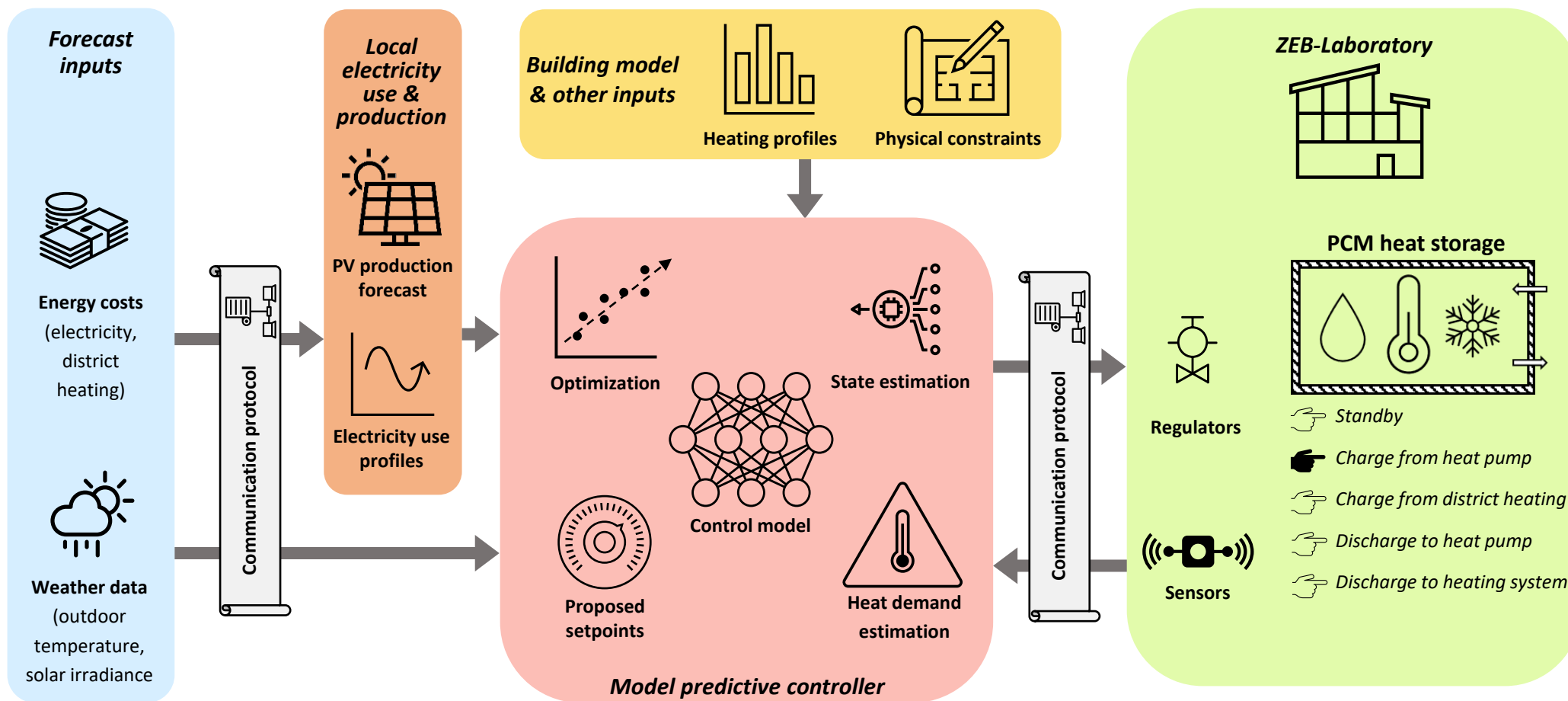
Predictive control strategies for active heat storage in buildings

2-4 common peer-reviewed publications planned

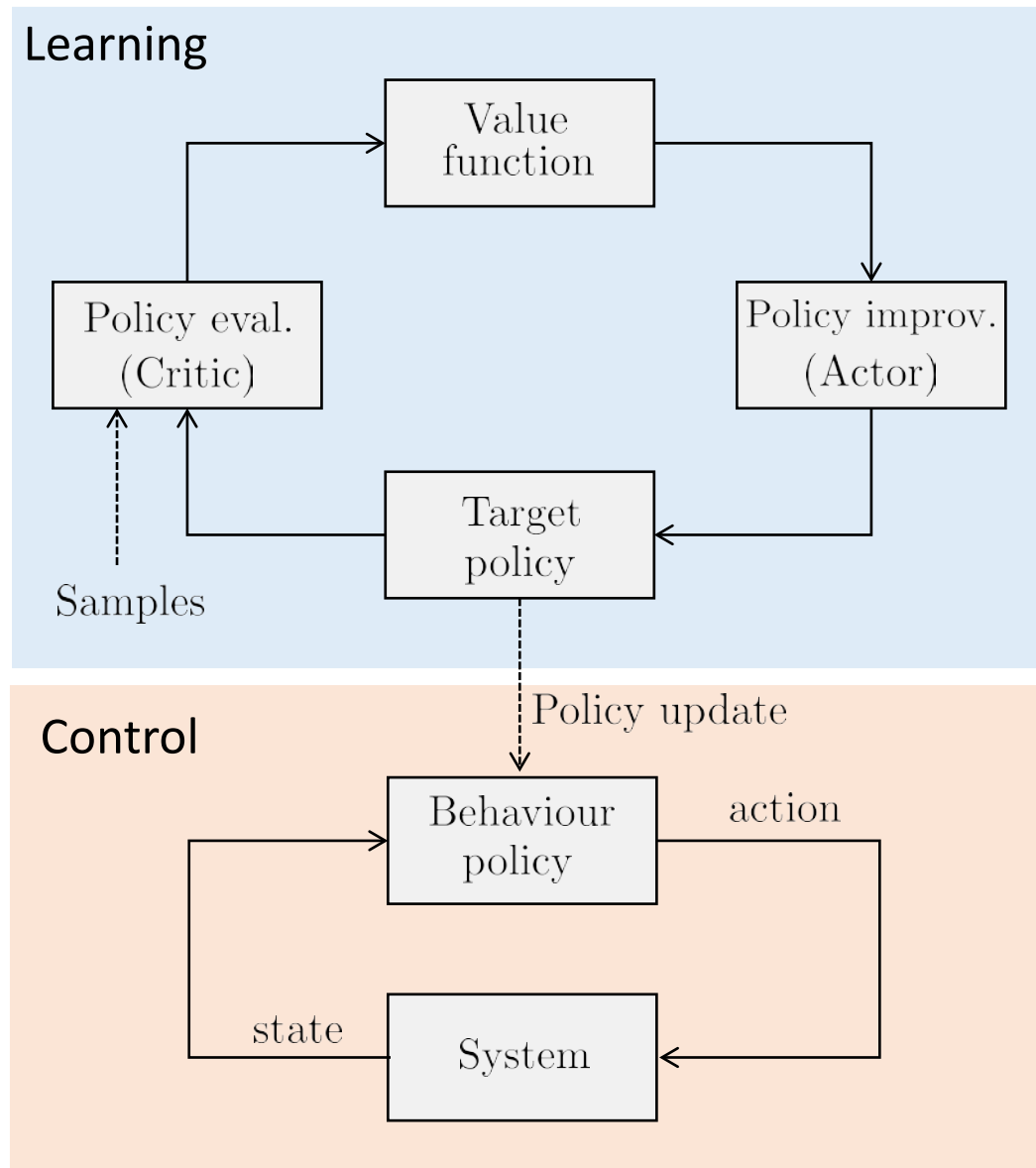
Common proposal in progress in Horizon EU call "*Demonstrating integrated technology solutions for buildings with performance guarantees*" (DL: 25th Jan 2022)

Already several **presentations of PRESAV in external meetings** (ZEN Partner meeting, SINTEF KL-meeting, Workshop Smart Energy Alliance (FR), Tr. Fylkeskommune)

PRESAV - MPC structure



MPC-based Reinforcement Learning





Teknologi for et bedre samfunn

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[@alexisSevault](https://twitter.com/alexisSevault)



PAPER ID: 1146
DOI: 10.18462/iir.gl.2020.1146
Active latent heat storage using biowax in a central heating system of a ZEB living lab
Alexis SEVAULT, Erling NÆSS
<https://onsite.qakkai-web.net/gl2020/pdf/1146.pdf>

#SINTEFblog

Thermal batteries with biowax: The future of heat storage for buildings

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

What are Phase Change Materials? (Will they be the next big thing in Norway?)

BY ALEXIS SEVAULT
AUGUST 8, 2018

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

PRESAV - Predictive control for active heat storage in buildings



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