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TECHNOLOGIES

Reducing supply temperature in existing buildings with advanced heating curve control technology

Outline

1- Introduction and context

2- PreHEAT: An advanced heating curve controller

3- Cases on Danish residential buildings

4- Conclusions

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Neogrid Technologies

Founded in 2009 in Aalborg, today 8 people

Focus areas:

- ✓ Visualisation and monitoring technology for building heating
- ✓ Data collection from ‘smart’ meters and IoT sensors
- ✓ Energy-efficient and energy-flexible controllers
- ✓ Smart-grid controllers for heat-pumps and aggregator solution
- ✓ Custom-made solutions for demonstration projects in the energy sector

Collaboration-oriented

Experienced in research and demonstration (14 projects until now)

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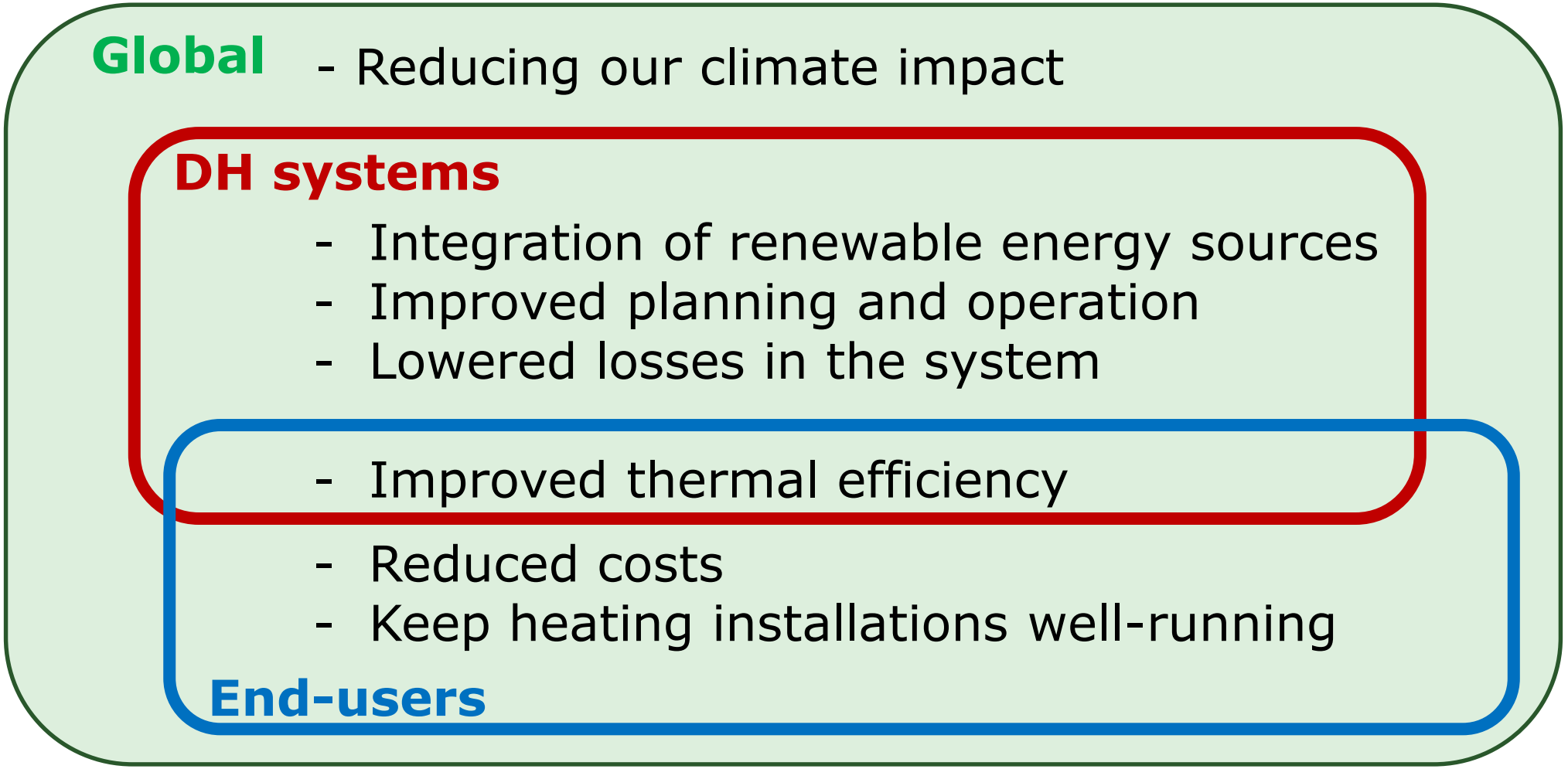
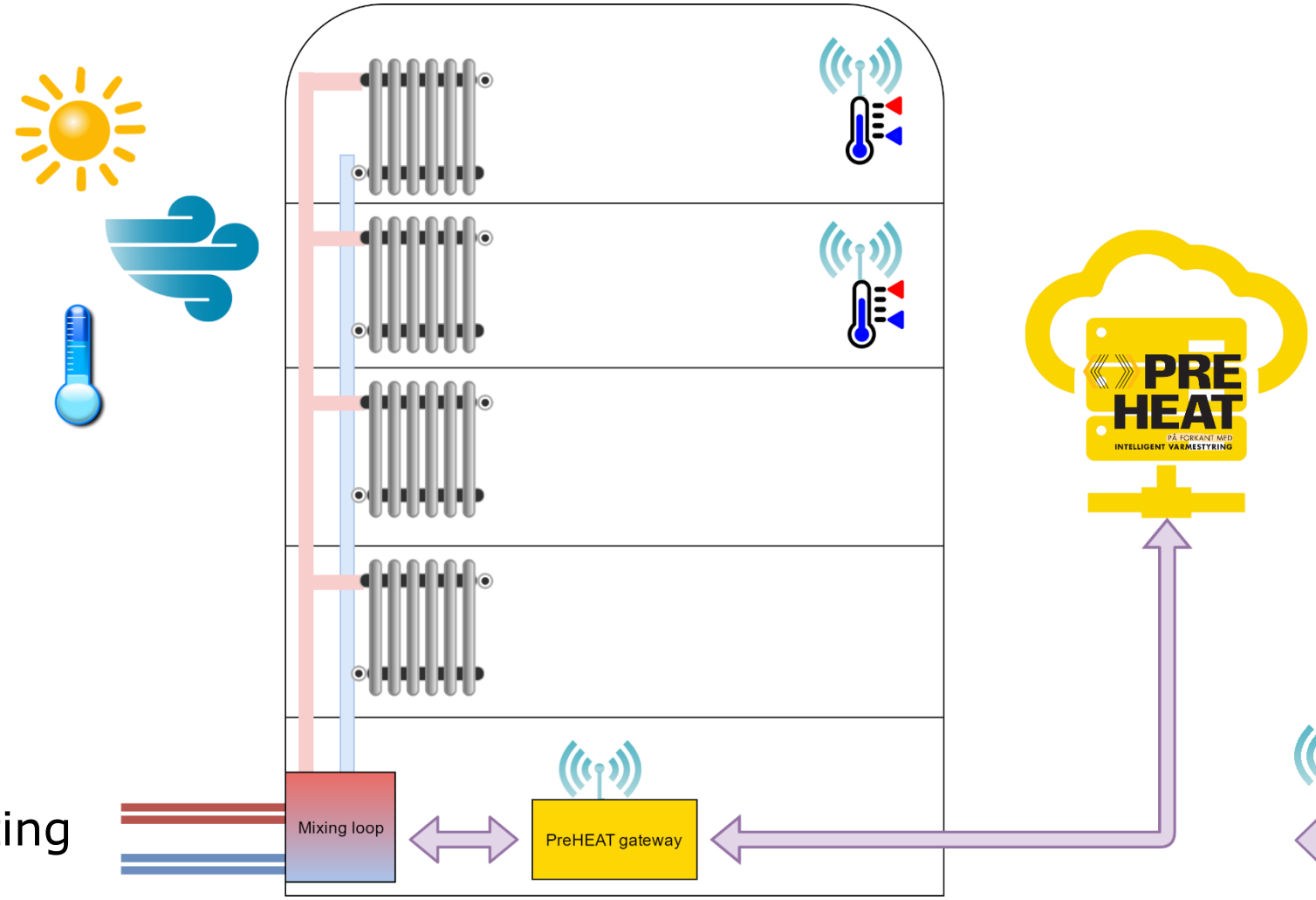
The DH agenda combines diverse targets



PreHEAT is a cloud-based controller for the mixing loop at whole building level



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PreHEAT is data-driven and forecast-based

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- Optimises according to models built on historical data from the building

- Predicts the upcoming heating demand of the building
  - Uses weather forecasts
  - Extends standard heat curve controller by using sun, wind, and time
  - Accounts for indoor temperatures in critical zones

- Dynamically minimises the supply temperature
  - ✓ While ensuring comfort in critical zones of the building
  - ✓ Reducing thermal losses throughout the building

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PreHEAT provides extra services

- Condition monitoring (regular reporting)
  - Energy usage
  - Indoor climate
  - State of the installation

- Fault-detection (building owner is contacted)
  - Abnormally high consumption
  - Bad cooling in heat exchangers
  - Defect valves and other components in technical rooms

- Can deliver demand forecasts (at building and aggregate level) to DH operators

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PreHEAT operates 24/7 in several buildings

- Deployment started in 2016

- The current PreHEAT fleet (located across Denmark) consists of:
  - 52 apartment blocks (all energy class C or older)
  - 15 single family houses
  - 1 school

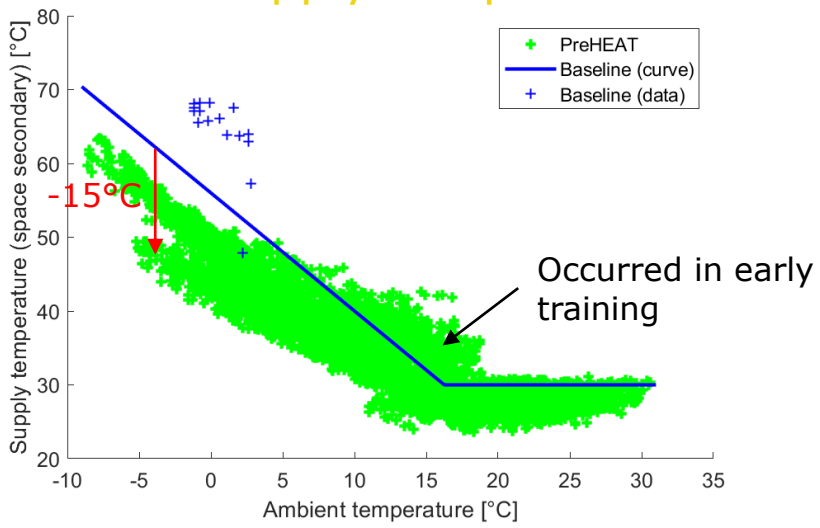
- Operating environment characteristics – example from Aalborg:

Aalborg DH context		
Heat price	1.92 (~45,9)	€/**m³** (€/MWh @ 36°C cooling)
Emission intensity	84 (marginal 130)	gCO2eq/kWh

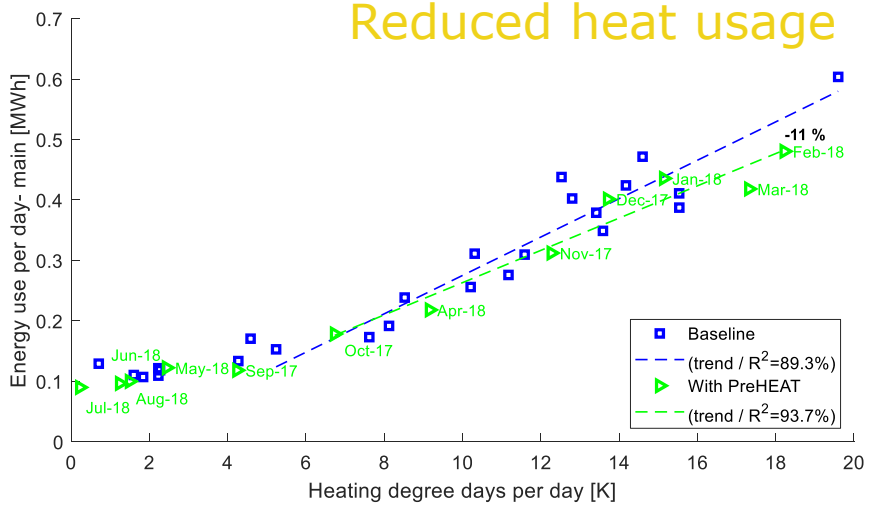
PreHEAT has improved energy efficiency and cooling

Example: M16 in Aalborg	
Construction	1964 (renovated)
Heated area	1 132 m²
Energy class	C
Total heat usage	90 MWh/yr. (80 kWh/m²/yr.)

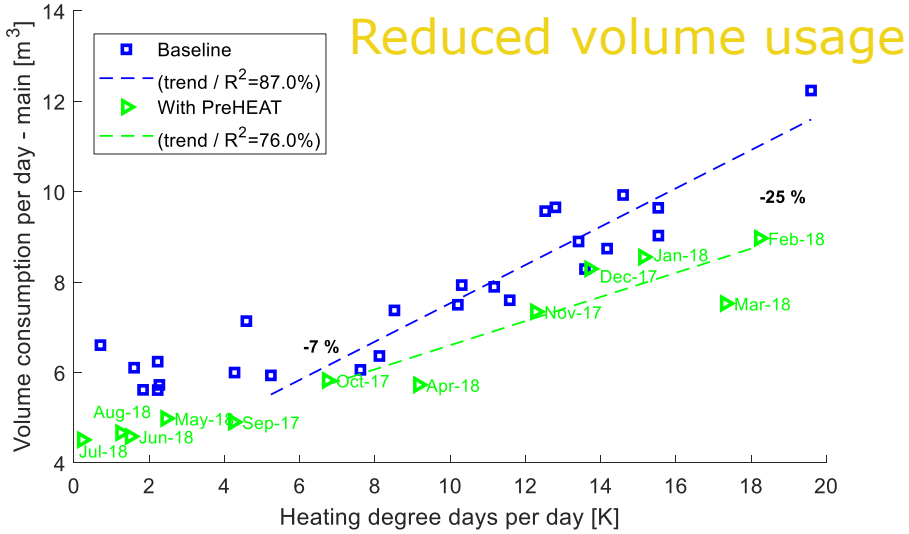
Reduced supply temperature



Reduced heat usage



Reduced volume usage



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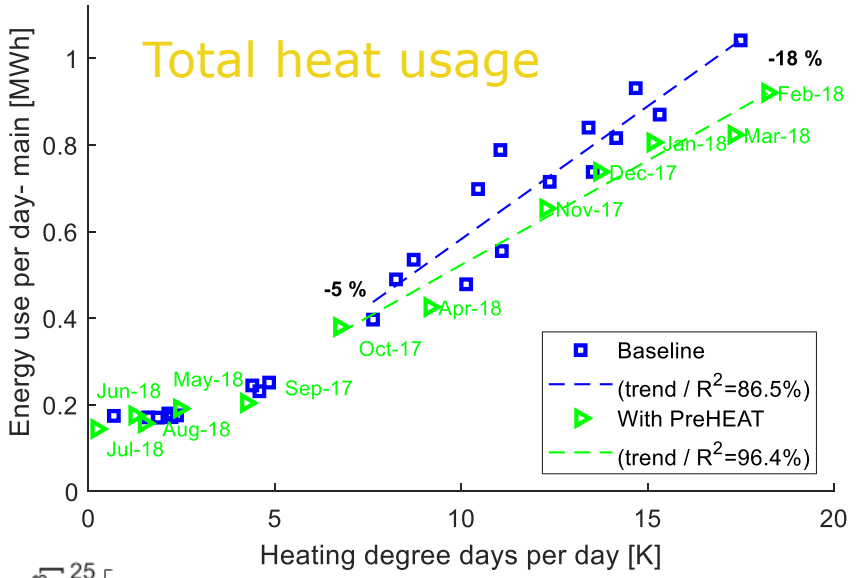
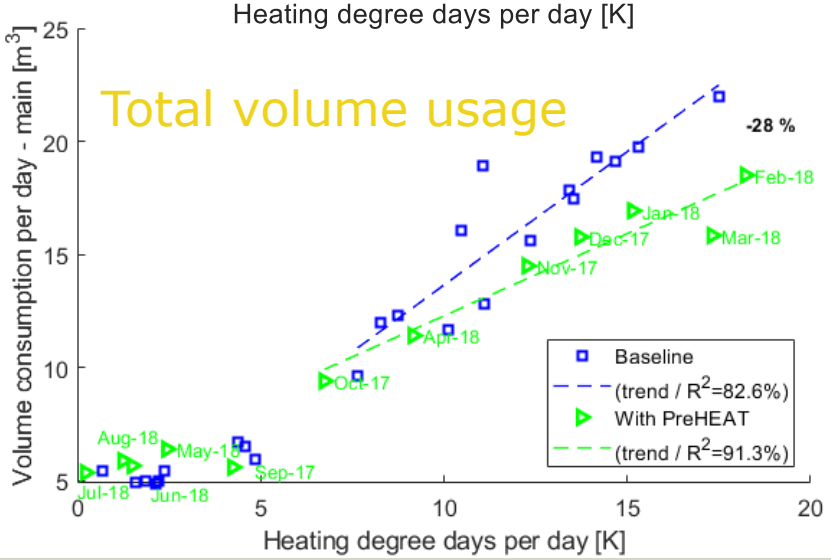
Performance varies among buildings

Example: R4 in Aalborg	
Construction	1958 (renovated)
Heated area	2 387 m^2
Energy class	B
Total heat usage	169 MWh/yr. (71 kWh/m^2/yr.)





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Take home messages (1/2)

- Heating curves controllers have high margins resulting in unnecessary heat losses

- Advanced controllers can significantly reduce these margins,
  - ✓ without harming thermal comfort,
  - ✓ improving energy efficiency
  - ✓ increasing the cooling of the DH water

- Precise quantification of energy savings is difficult for such retrofits, as model uncertainties can be in close range to savings

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Take home messages (2/2)

- Heating installations are often insufficiently monitored (e.g. manually and irregularly)
- A new 3rd party looking at the heating operation challenges the pre-existing status-quo, uncovering shortcomings and inefficiencies
- Tenant may need to be educated about correct use of thermostats and heaters
- Neogrid is enthusiastic about collaboration, and contribution to research projects

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