4G: Lower temperature, digitalization, smarter district heating

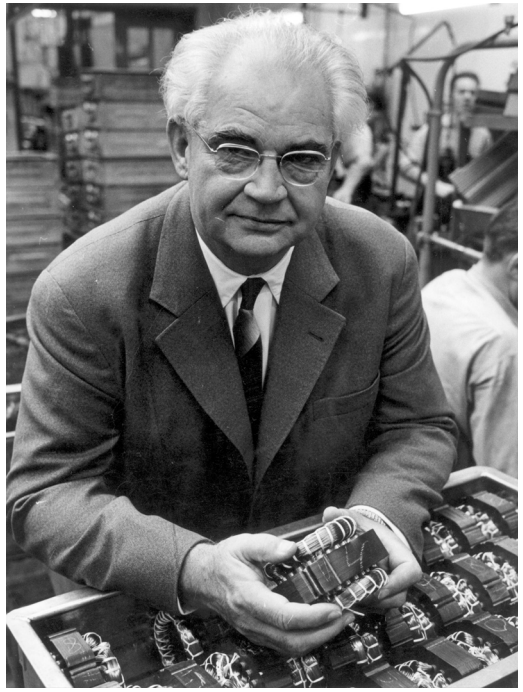
ENGINEERING TOMORROW

The latest on District Energy in Denmark, State of Green

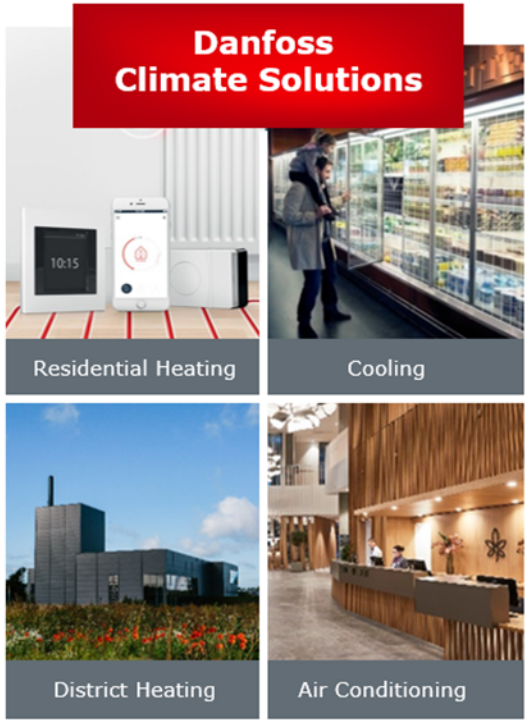
Japanese/Danish DH event June 24, 2021

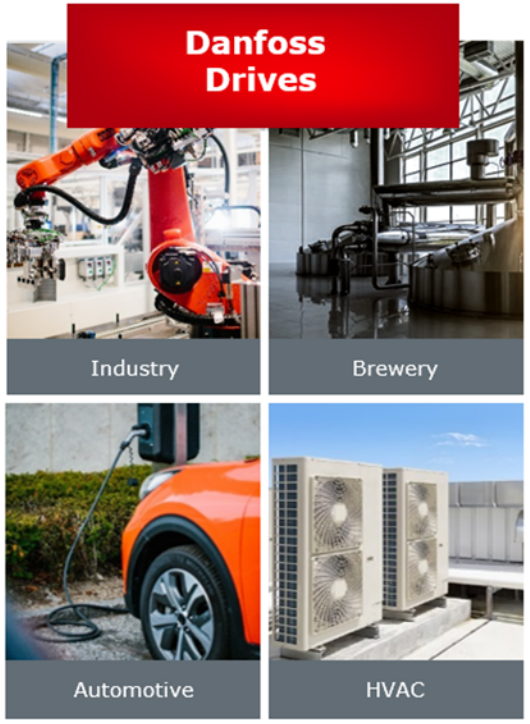
Jan Eric Thorsen, Director Danfoss DCS-DBL Application Centre

About Danfoss and the segments



Mads Clausen





My background

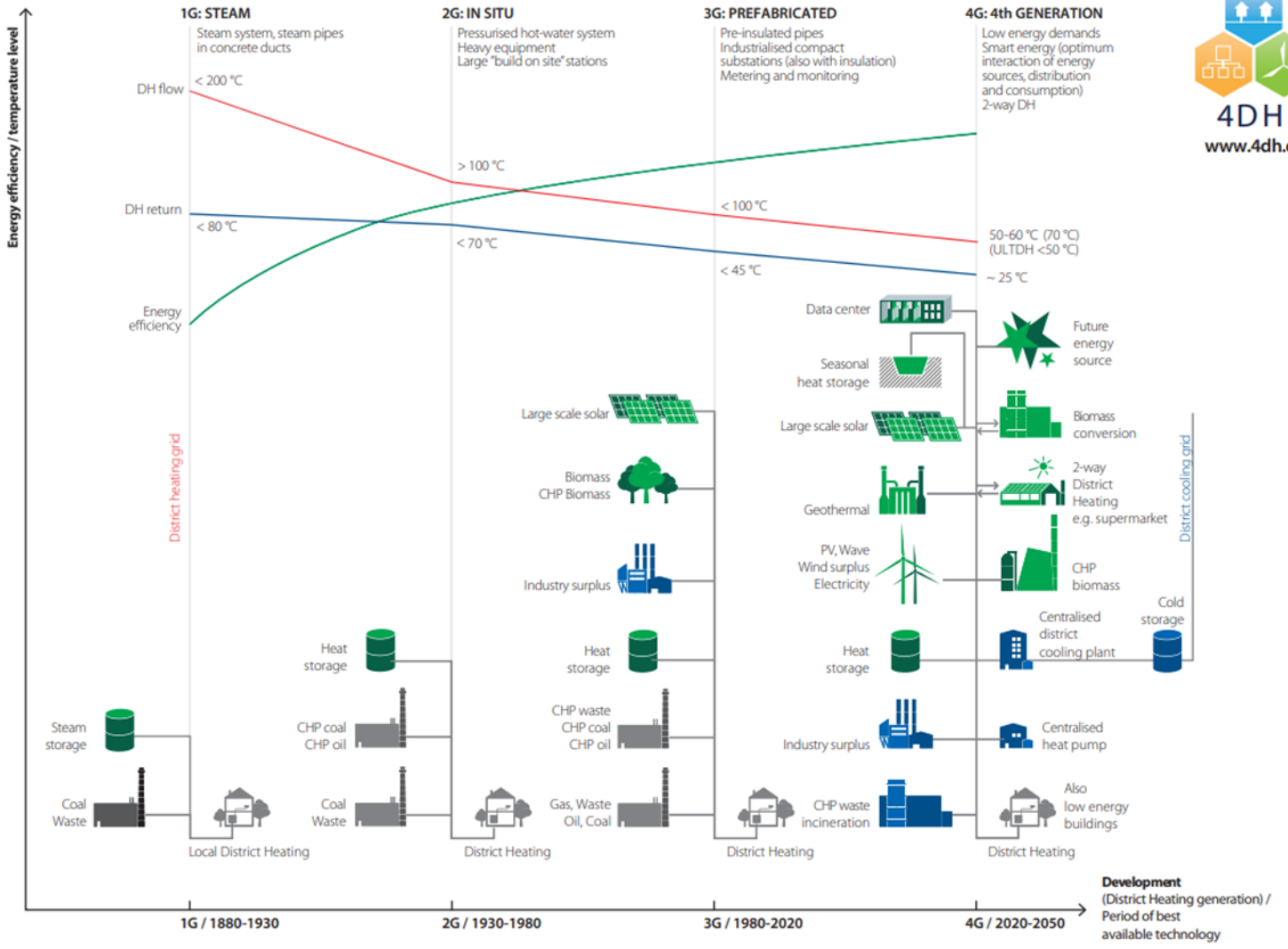
M.Sc. Jan Eric Thorsen
Director, DCS-DBL Application Centre

By Danfoss since 2000

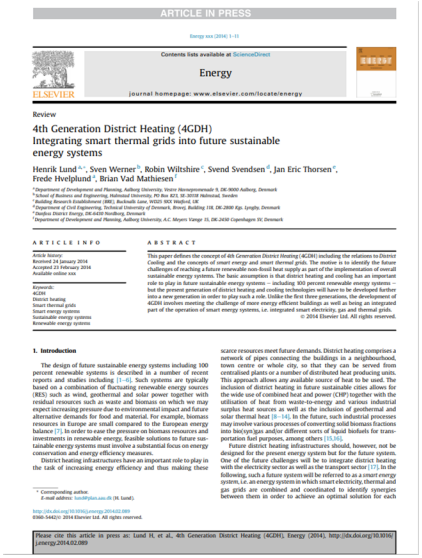
Consultant with focus on appl. knowledge

- Dynamic simulation of HVAC systems
- Lab and field test experience
- R&D within products/SW
- Conceptual development of DH/systems
- Feasibility studies on concept/systems
- Positioning Danfoss concepts/solutions
- Positioning of DH/DC in the current and future energy system

1G to 4G District Heating: The overview figure



4DH
www.4dh.dk



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Energy

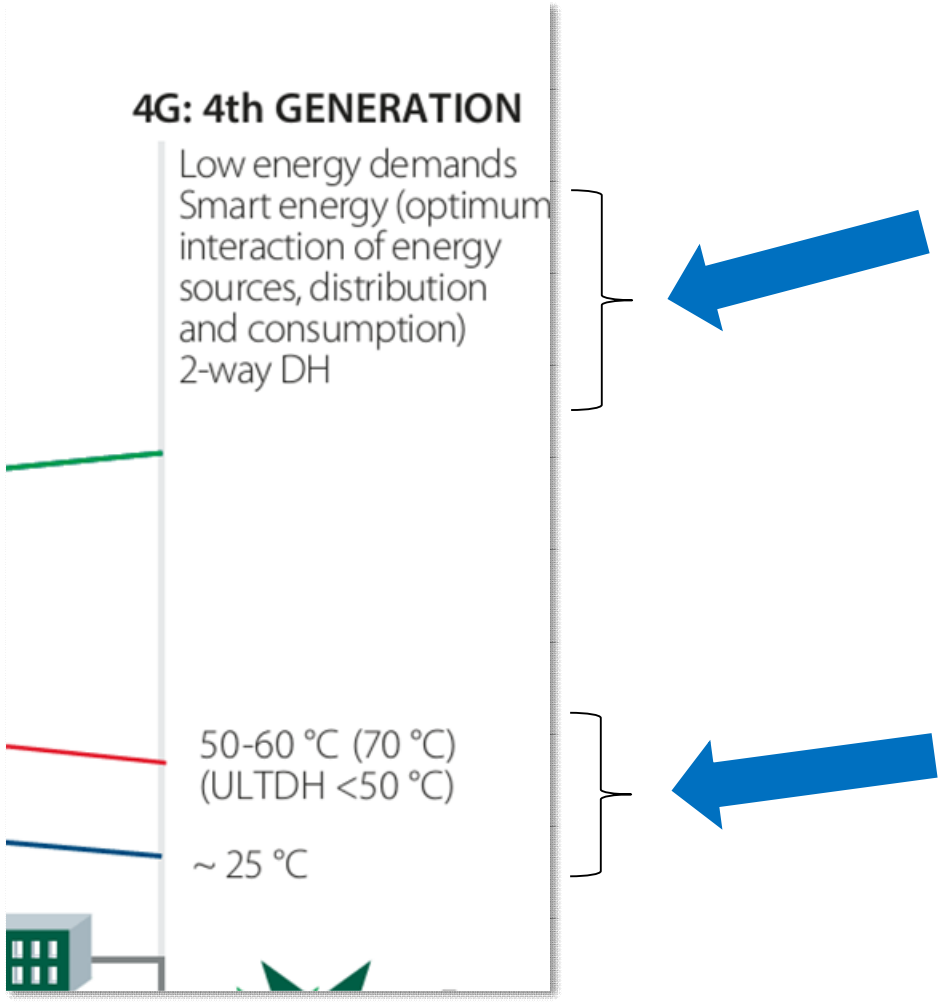
Review

4th Generation District Heating (4GDH)
Integrating smart thermal grids into future sustainable energy systems

Henrik Lund, Sven Werner, Robin Wiltshire, Svend Svendsen, Jan Eric Thorsen, Frede Hvelplund, Brian Vad Mathiesen

Link to paper

The focus of this presentation



2. Digitalization (Building level impact)

- AI based building control

3. Smart DH (System level)

- The Danfoss Nordborg Campus heat transfer station

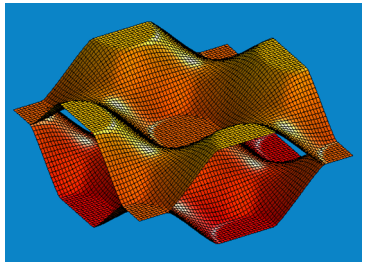
1. Lowering the temperatures (Building level impact)

- Domestic hot water system
- Heating system

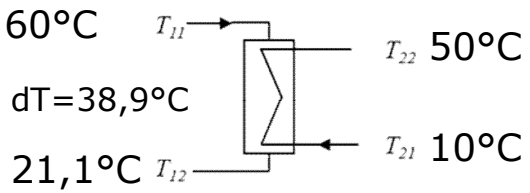
4. Final considerations on 4G DH

1 Lowering the DH temperatures (Domestic Hot Water) The impact of thermal length of heat exchangers

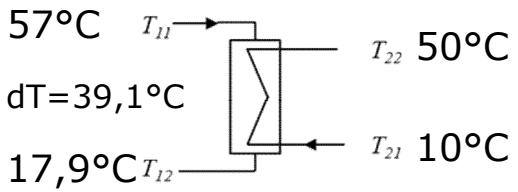
- **Domestic Hot Water (DHW)**
  - Supply temperatures for building substation is reduced !
  - BUT: DHW demands remains the same, how to handle this ?
  - Here the Heat Exchanger comes into focus !



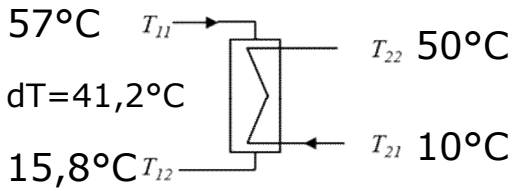
Conventional heat exchanger 40 plates

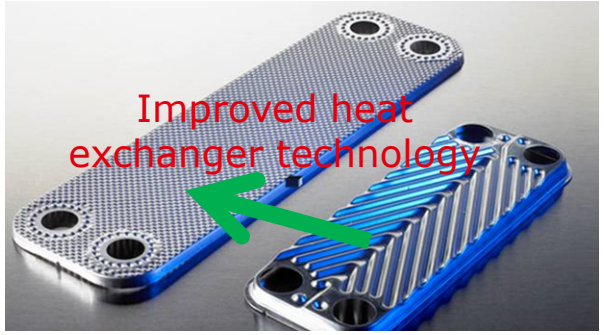


Conventional heat exchanger 60 plates



Energy efficient heat exchanger 60 plates

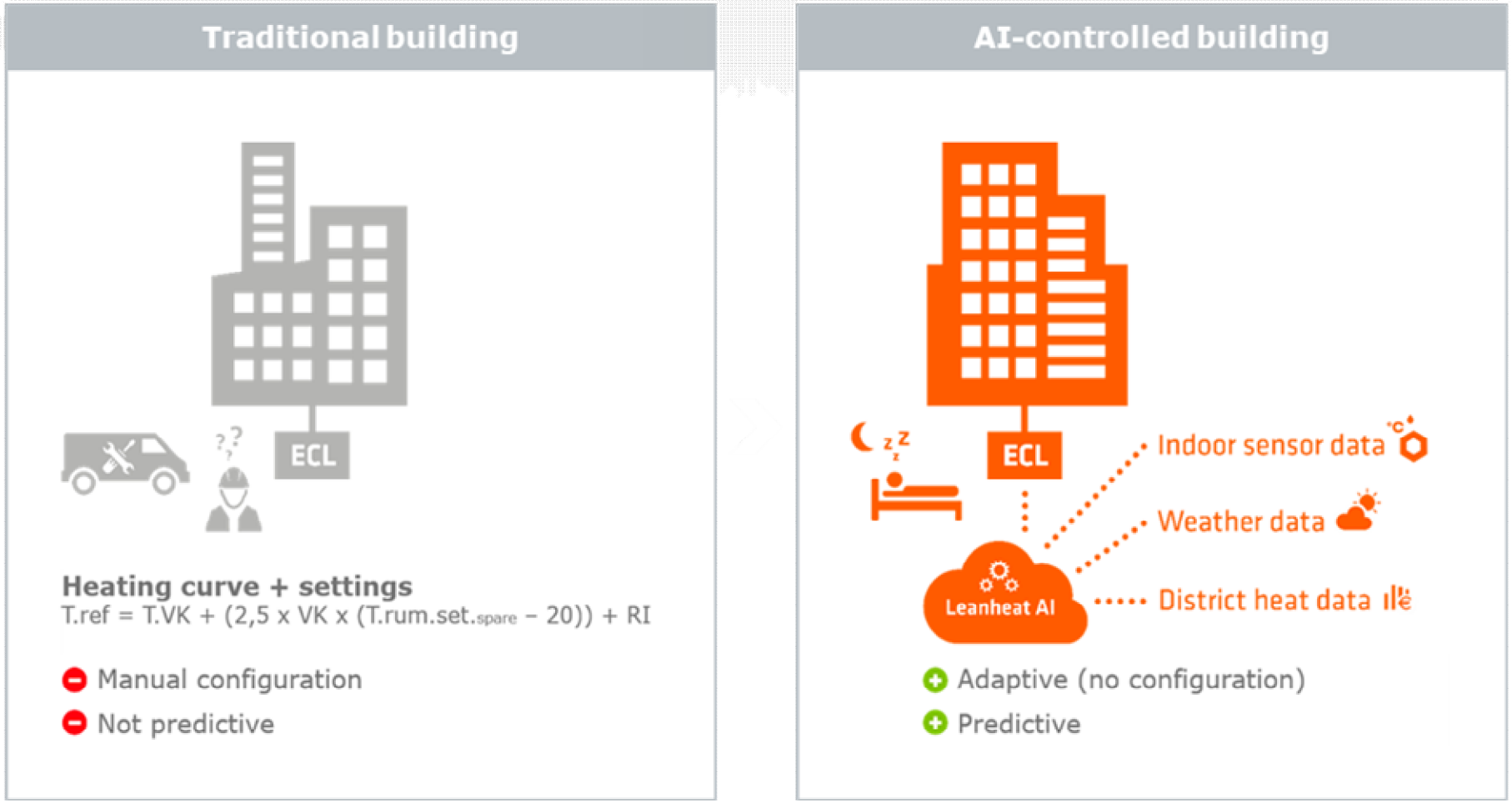




1 Lowering the DH temperatures (Heating) What to have in mind

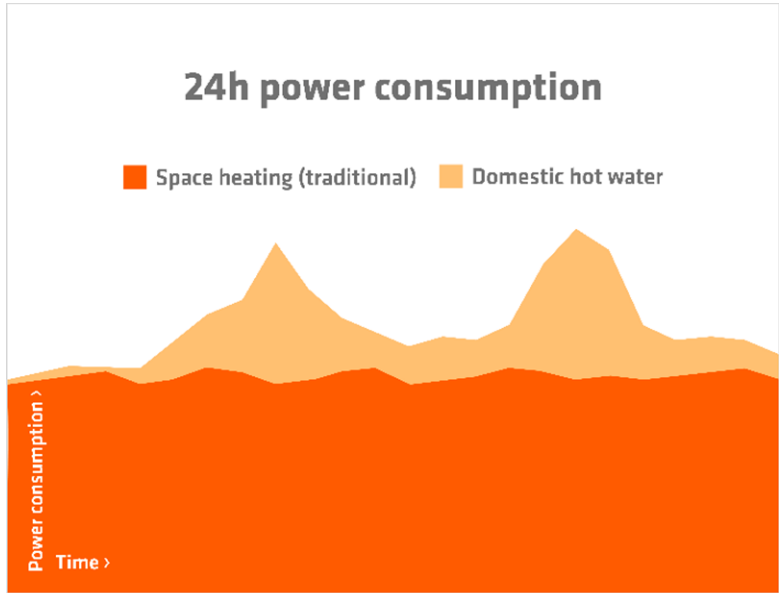
- **Space Heating**
  - Heat emitters:
    - *Radiators:* need to be dimensioned for 55°C supply, 25°C return for 20°C indoor air temperature
    - *Floor heating:* No impact as floor heating is designed for 40/25/20°C
  - Control equipment:
    - In general, there are no impact on the currently applied control equipment but high focus on smart controllers (AI), like Leanheat on substation level and SOLO on heat emitter level

2 Digitalization – AI based building control

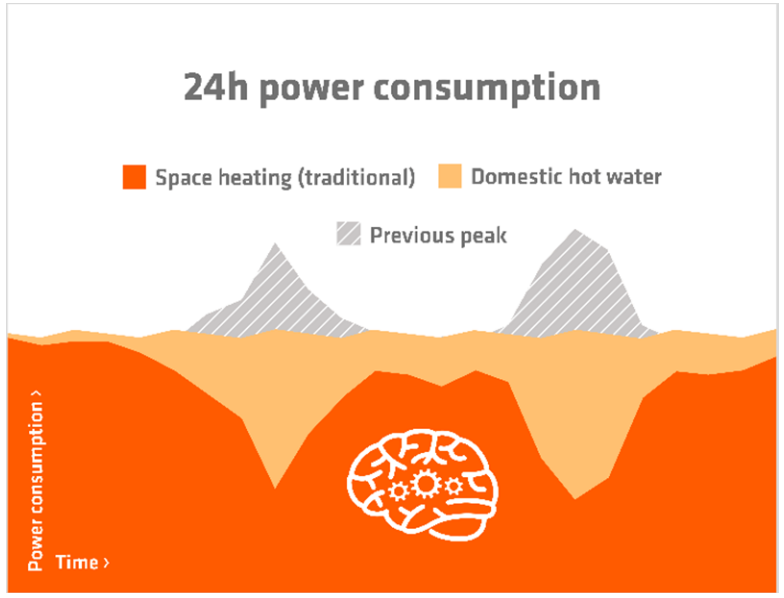


2 Digitalization – AI based building control

Traditional building automation



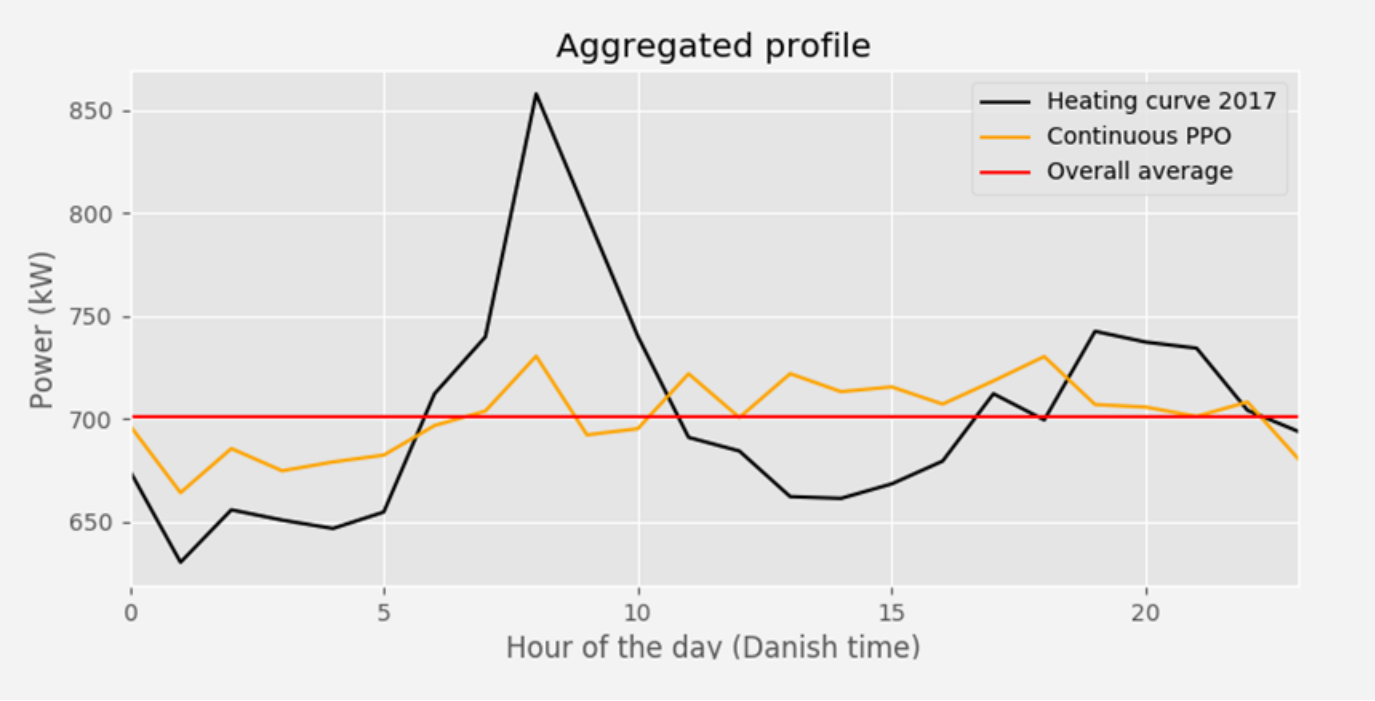
Optimized by Leanheat AI



Key Benefit

20% of reduction in peak power is 6-10% saving in energy cost and reduced CO2 emissions

2 Digitalization – AI based building control



HOFOR

Objective: Create a **totally flat** daily power profile

Scale: 10 buildings (2018-2019)

Result: **~85 % of theoretical maximum reduction**

~15% peak load reduction

3 Smart District Heating

Danfoss Campus Nordborg is connected to the local District Heating system

Sector integration by utilization of:

Heat export from Danfoss to DH system (6MW)
- Process heat, with/with out electric HP
- Data center, with heat pump
- Backup/peak load boiler for DH system (18MW)

Heat import from SONFOR (6MW)
- Based on Biomass, substituting gas boiler and gas CHP

Will be used as one of the Danfoss Campus ADC´s

Final consideration: 4G is the future of District Heating !

- District Heating / Cooling is a continuously developing technology
- 4GDH is an enabler for energy efficient utilization of local renewables and waste heat sources
- 4GDH/DC is the optimal coupling point between the future renewable based power sector and the heating & cooling sector (smart electrification)
- Existing district heating systems can transition to 4GDH, but require long term planning and active engagement between utilities and building owners
- DH utilities need to work together with the heat customers to ensure the building installations complement the 4GDH

District energy is an obvious part of the future energy system

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