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Ultra-Low Temperature District Heating With 35 °C Supply Temperature

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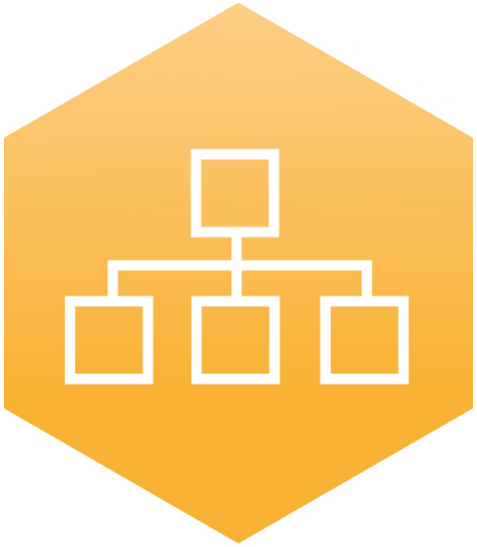

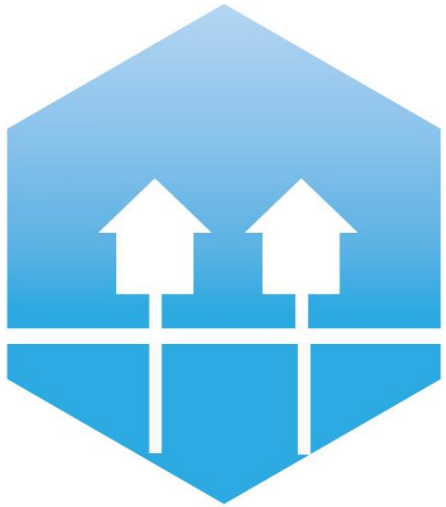

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Question

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What is Ultra Low Temperature District Heating?

We define it as district heating with supply temperatures <u>below</u> 45 °C

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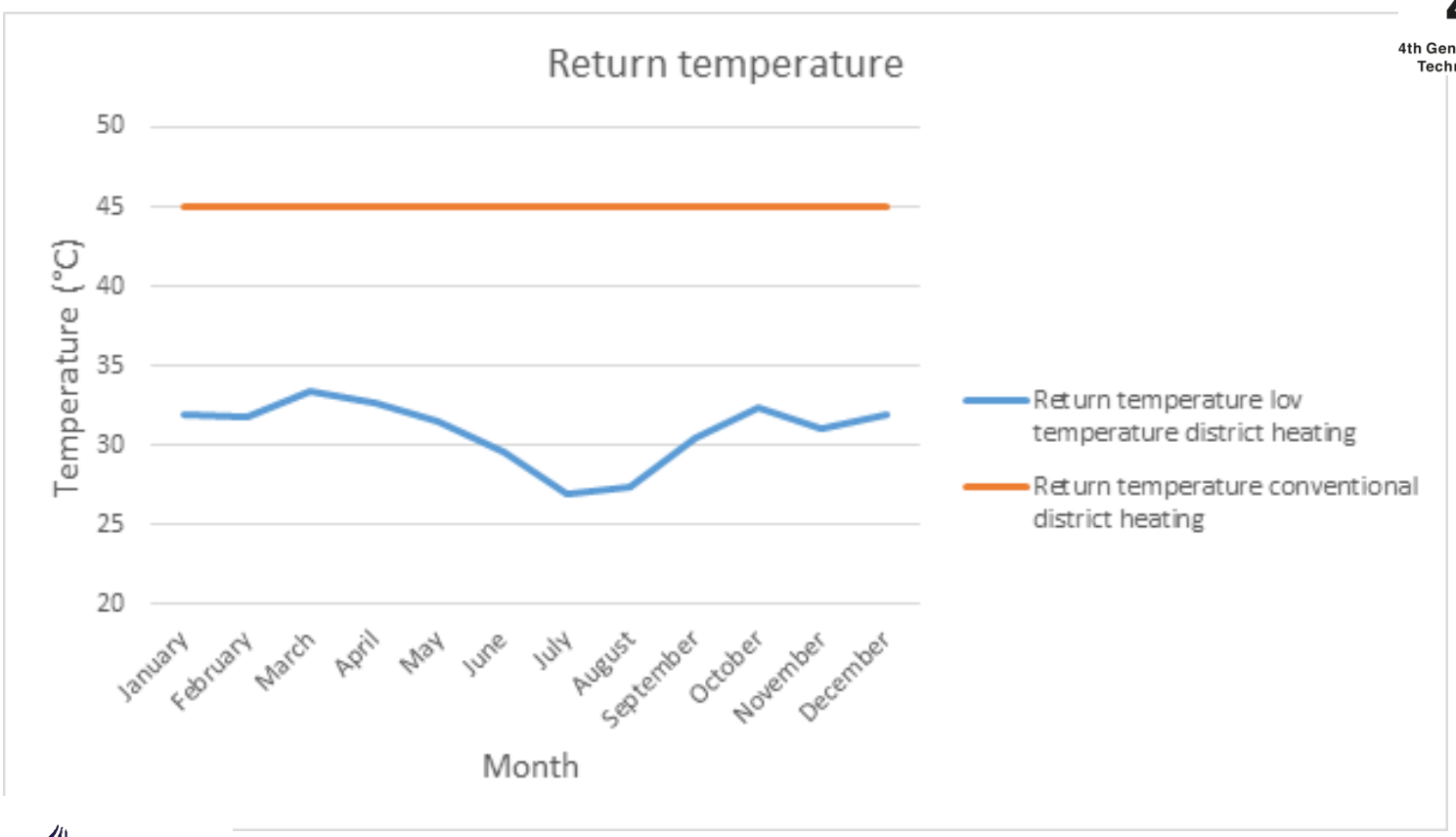
A brief history I

- Started with a project funded by the Danish Energy Technology Development and Demonstration Programme (EUDP) in 2011
  - Grontmij, The Technical University of Denmark, Danfoss and I/S Norfors (waste incineration facility)
  - Design, development and test of new district heating unit with integrated heat pump booster for domestic hot water preparation
- Test of developed unit in 4 buildings in Birkerød, Northern Seeland
  - Indirect system
  - Some challenges, but satisfied costumers
  - Still in operation

A brief history II



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How does it work?

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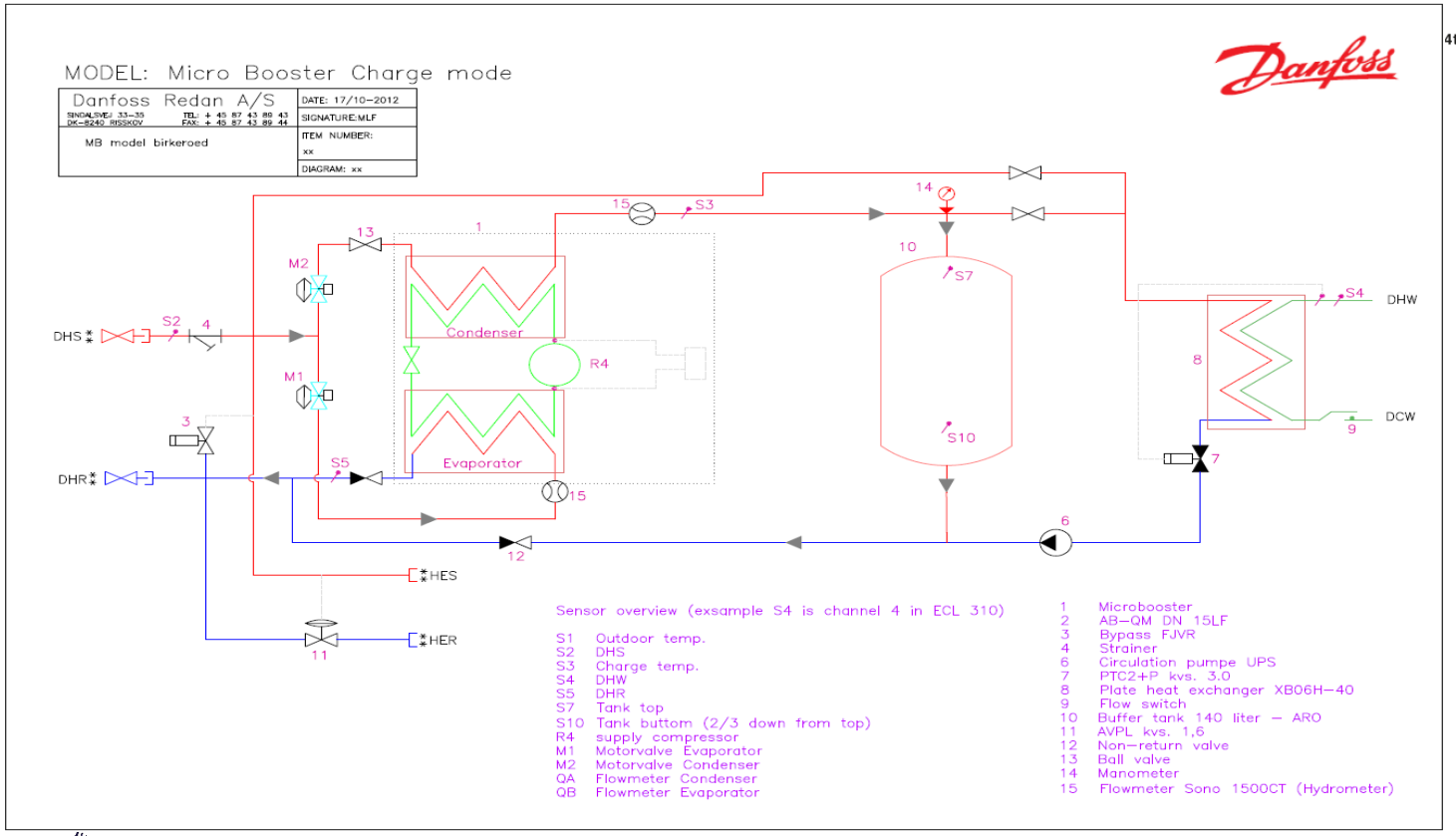
Space heating

- Directly from DH supply
  - Existing return line with possibility to adjust supply temperature
  - Low temperature DH supply

Domestic hot water

- Initial heating by district heating
- Temperature boost by booster unit (heat pump)
- Storage tank on substations primary side
- Instantaneous DHW preparation via heat exchanger

How does it work?



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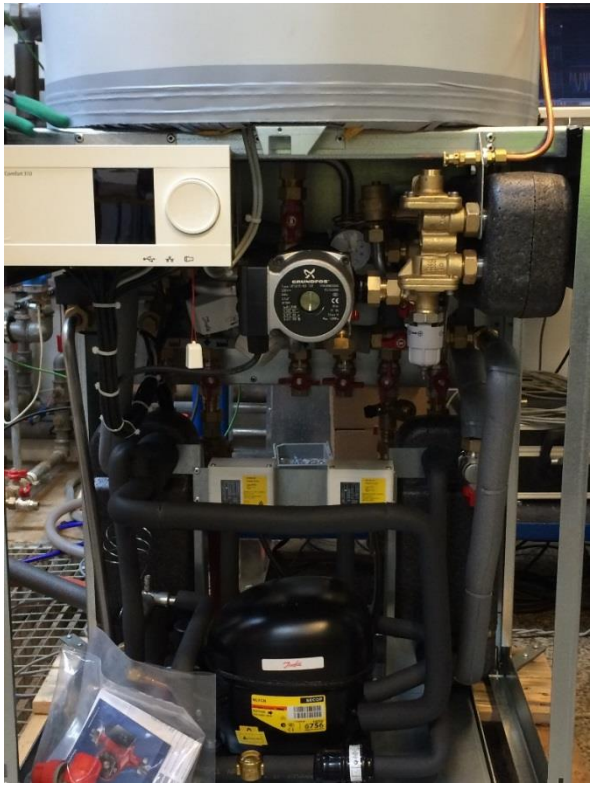
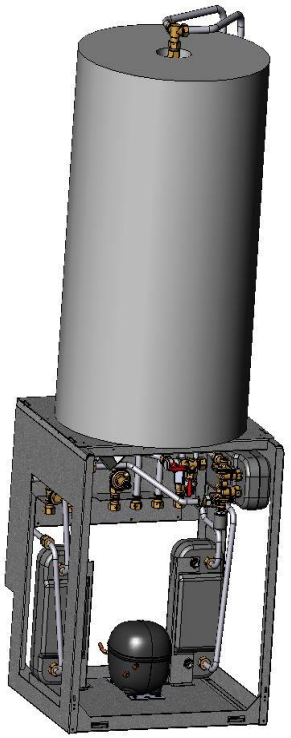
Specifications of ULTDH unit

- General
  - Supply temperature – max. 100 °C, min. 30 °C.
  - Max. PN 10 on primary side
- Hot water tank
  - 160 L hot water tank (primary side)
  - 50-55 °C set point
  - Charge with 70 - 150 L/hr
- Heat pump
  - Max electricity consumption:
    250 W (230V / 1A)
  - COP = 4,2 - 5
  - Refrigerant = R600a (< 1kg)



Design



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Current demonstration project I

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- Part of a package of demo projects for the Danish Energy Agency
- 2nd generation microbooster units/ULTDH units
- Test site: Geding outside Aarhus in Jutland
  - 25 village houses
  - Separate district heating network
  - Heat demand approx. 450 MWh/yr
- Project partners

ENERGI STYRELSEN
Grontmij
AFFALDVARME AARHUS Teknik og Miljø Aarhus Kommune
Danfoss

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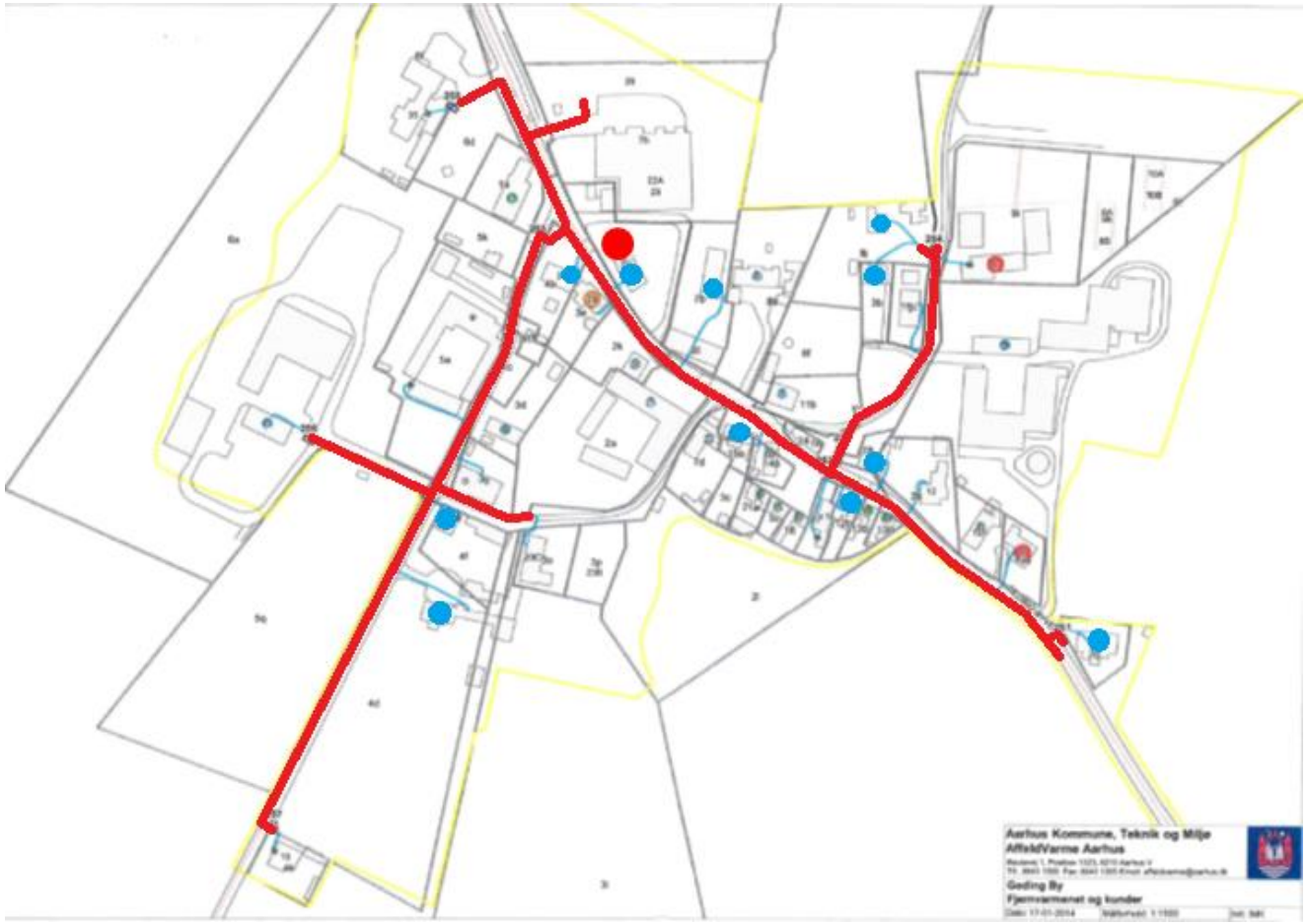
Current demonstration project II

- Main objective is to test ULTDH in a larger scale
- Extensive measurement programme with the purpose of:
  - Document technical capability of concept
  - Investigate economical feasibility
  - Uncover in which contexts the concept is particularly suitable
  - Demonstrate the concepts suitability and benefits in relation to other RE-technologies

Network overview



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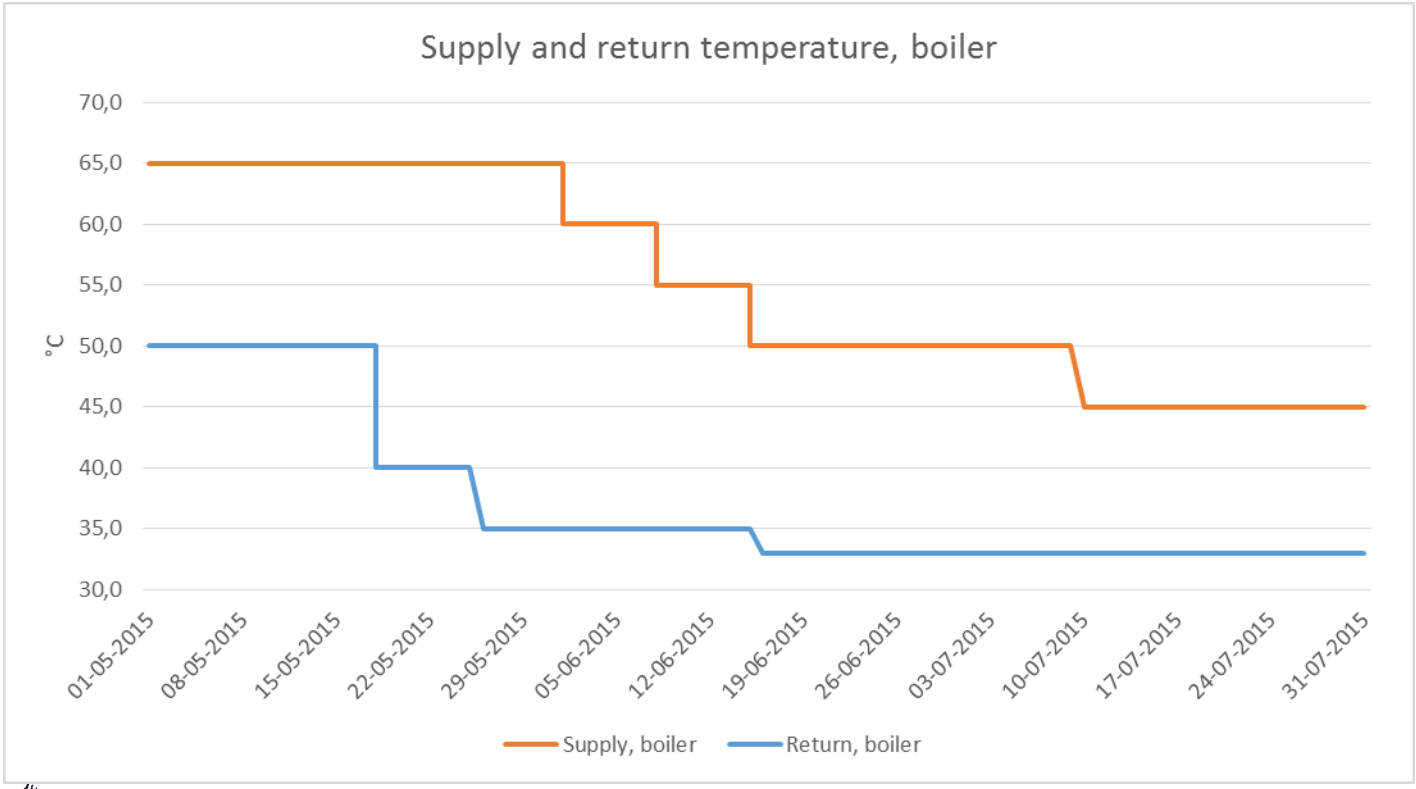
Preliminary results I



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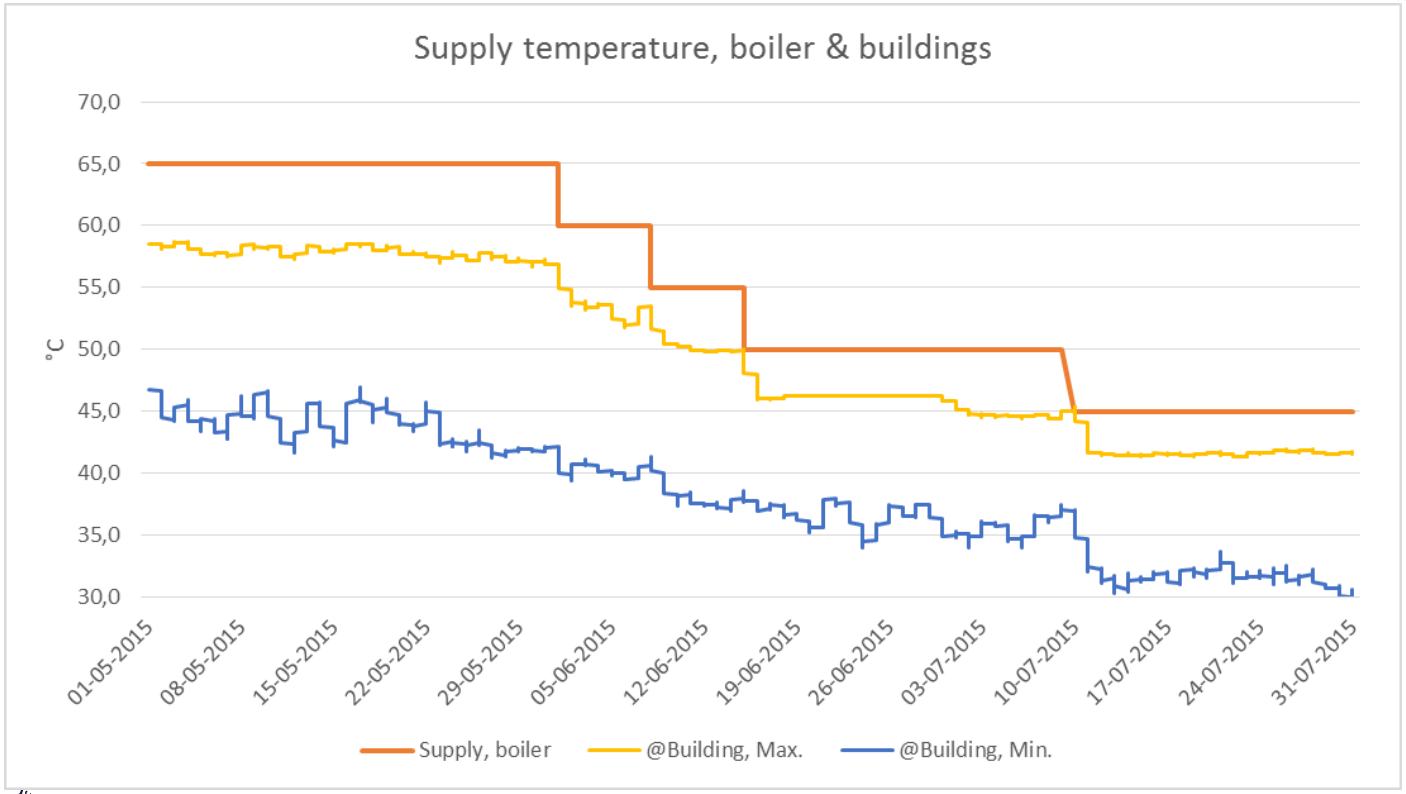
Preliminary results II



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Preliminary results III

- Some technical challenges
- Few complains
- Same level of comfort
- Supply temperature between 30 – 35 °C at buildings sufficient in summer months (for new buildings all year around)
- Heat loss expected reduced by 30 – 40 %*
- Allows very efficient use of low temperature and RE sources for future heat supply

*To be verified

Future work I

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New Danish Energy Technology Development and Demonstration Programme (EUDP).

- Purpose
  - To develop, demonstrate and promote an energy efficient concept with a domestic hot water (DHW) solution with a storage tank for apartment buildings, according to with DHW is partially heated by means of a heat pump, enabling district heating supply temperatures as low as 35°C
- In collaboration with I/S Norfors and Hørsholm General Housing Association.
- Test site is the Nursing Homes Apartment complex “Louiselund”
- Funded with €110.000
- Carried out from July 2015 to June 2017.

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Future work II

- Demonstration of concept in new DH networks
- Demonstration of concept in new urban areas e.g. low energy buildings
- Lowering of distribution network costs e.g. DH network in PEX pipes

Thank you for your attention

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