

CELSIUS Talk: Optimising district heating systems at the building level

2016.10.19

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This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 314441.



Radiator temperatures in existing buildings supplied by district heating



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- Background and purpose with study
- Data collection
- Results radiator temperatures
- Results factors affecting the temperatures
- Conclusion

Situation Today

- 3rd generation
- 90-75°C Supply / 40-50°C Return
- Customer temperature demand:
20°C space heating / 50-60°C DHW

Future Expectations

- Decrease of building heat demand
- New heat sources to be integrated
- Improve environmental performance



Low temperature district heating (LTDH)

50-55°C Supply
20-30°C Return

Radiators in Buildings

- Design before 1980: typ. 80°C supply
- Design after 1982: max 60°C supply
- Control, monitoring and balancing of radiator systems important

Previous Work

- Focus on temperatures on the district heating side
- Lack of documentation of temperatures on secondary side



What are the temperatures of radiator systems in existing buildings?

The Actors Involved in This Project



District Heating Provider



Research Institution



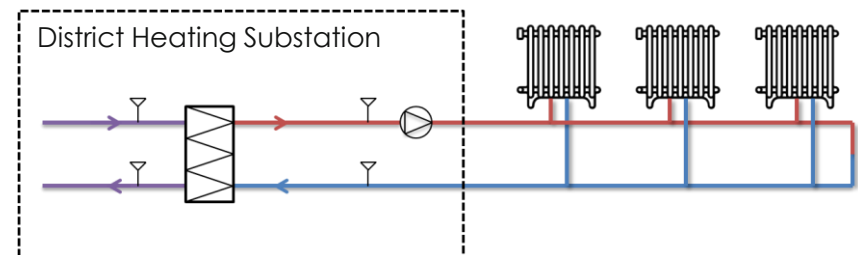
Public Housing Company



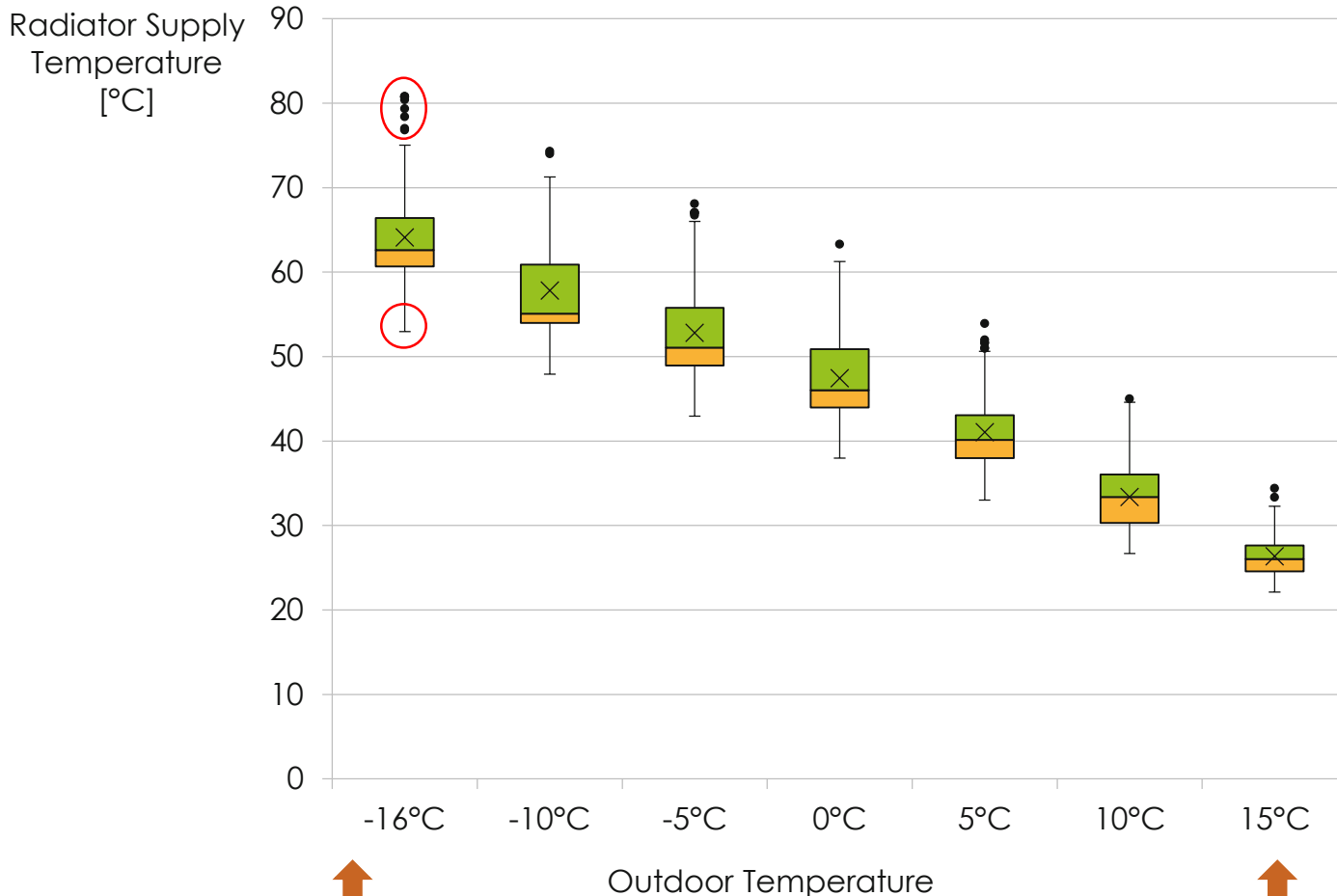
- Major DH customer
- 330 Substations
- 26 900 Apartments
- Hourly data measurements available from SCADA system

Temperature data from:

- 5 different geographical areas within Gothenburg district heating system
- Multi-family buildings only
- February 1st 2015 to January 31st 2016
- 109 radiator systems in total
- Recorded automatically in the substation of each radiator system
 - Each radiator system serves approx. 100 apartments



Radiator Supply Temperatures



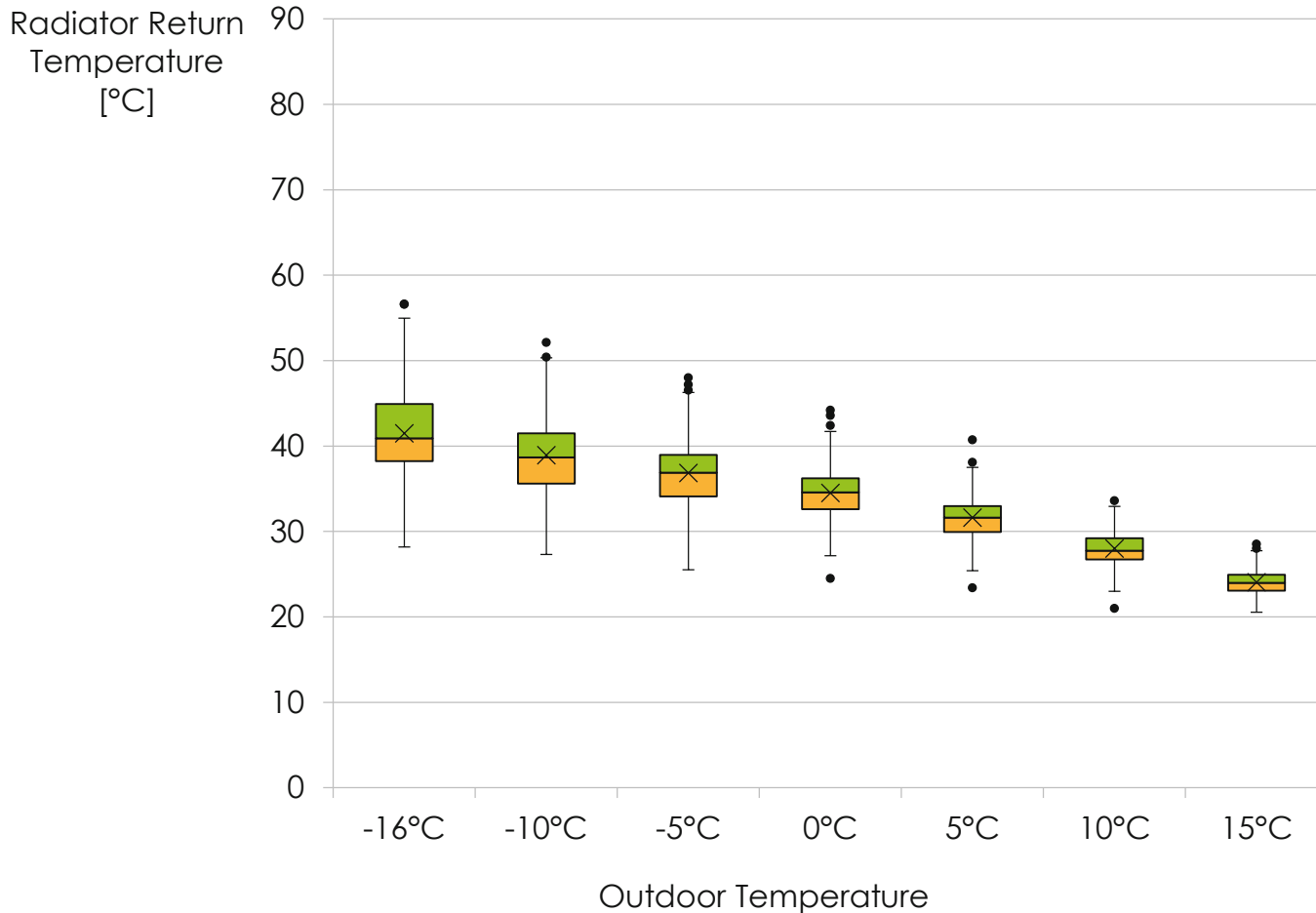
For DOT = -16°C

- Avg: 64°C
Max: 81°C
Min: 53°C
- Outliers (circled) almost 4°C higher than control curve set points
- 9 radiator systems (8%) have supply temperatures of 55°C or less

Design Outdoor Temperature (DOT)

Building Balance Temperature

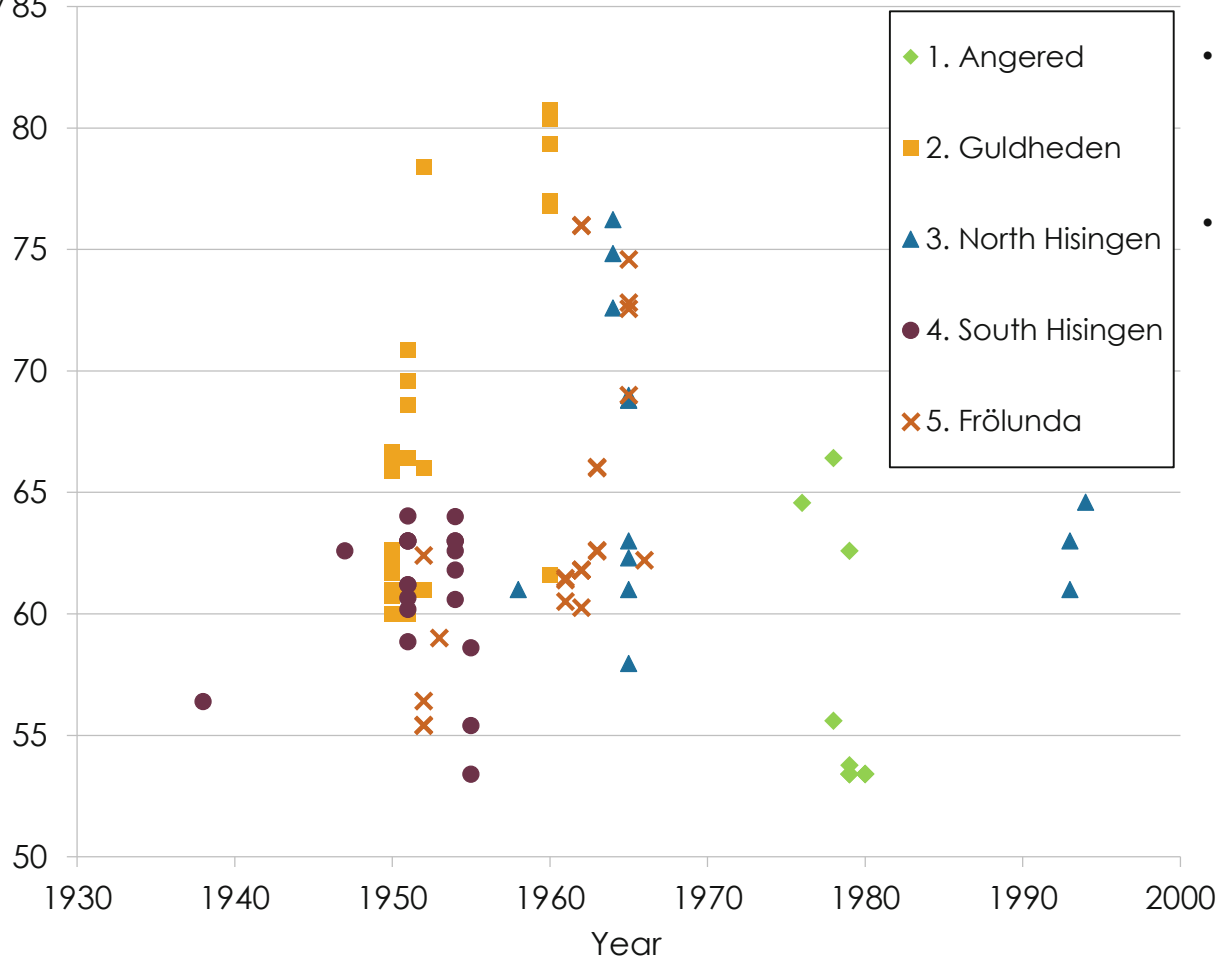
Radiator Return Temperatures



For DOT = -16°C

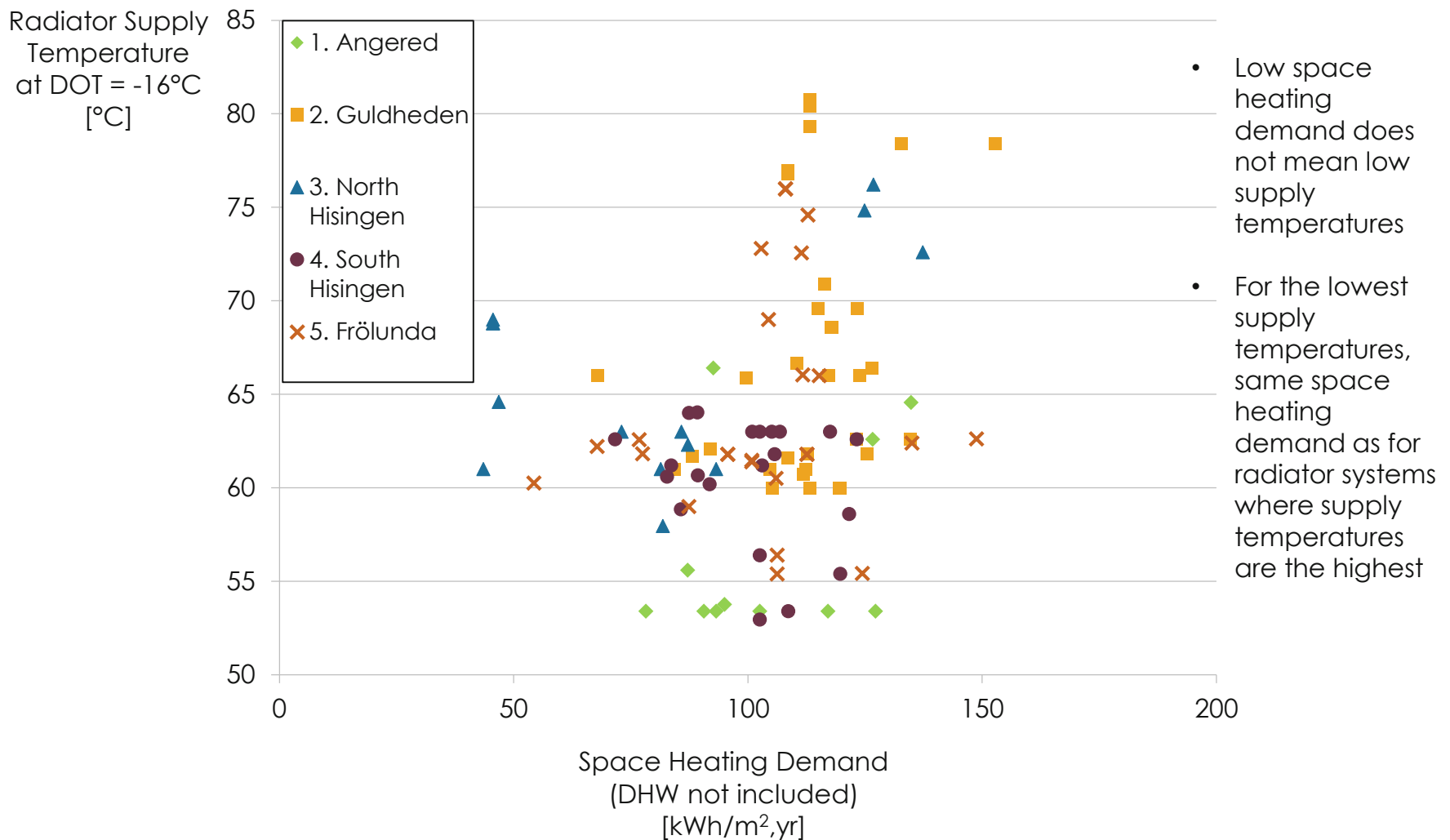
- Avg: 42°C
Max: 57°C
Min: 28°C
- Minimum value for each outdoor temperature belongs to same radiator system

Radiator Supply 85
Temperature
at DOT = -16°C
[°C]



- Any renovation done to buildings not accounted for
- Majority of buildings constructed between 1950 and 1965, also have the highest supply temperatures

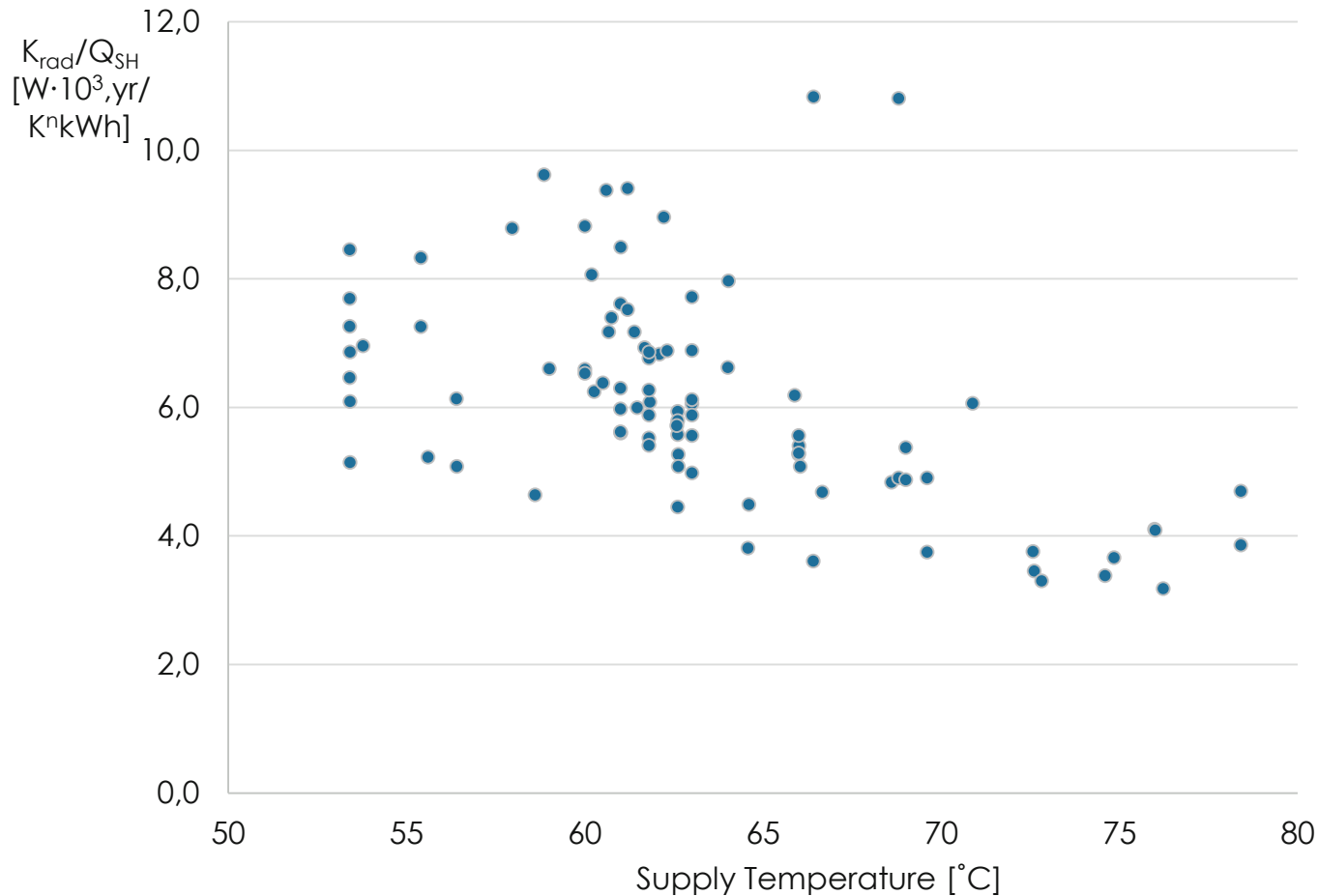
Building Specific Heating Demand



Radiator Size and Space Heating Demand



Relation between Radiator Size and Yearly Specific Heating Demand vs. Radiator Supply Temperature



- Radiator systems with the higher supply temperatures had a low heat transfer area to heating demand ratio
- Majority of radiator systems need heat transfer area to be increased or building heating demand to be lowered, or maybe a combination of both

Radiator Temperatures

- 64/42°C for DOT = -16°C
- Large range of values

4th Generation District Heating

- 8% of radiator systems with supply temperatures less than 55°C for DOT
- Renovation needed and heat transfer surfaces to be increased

Potential actions today

- Reduce temperatures to some extent
- Reduce temperatures during parts of the year

Thank you!
Questions?