



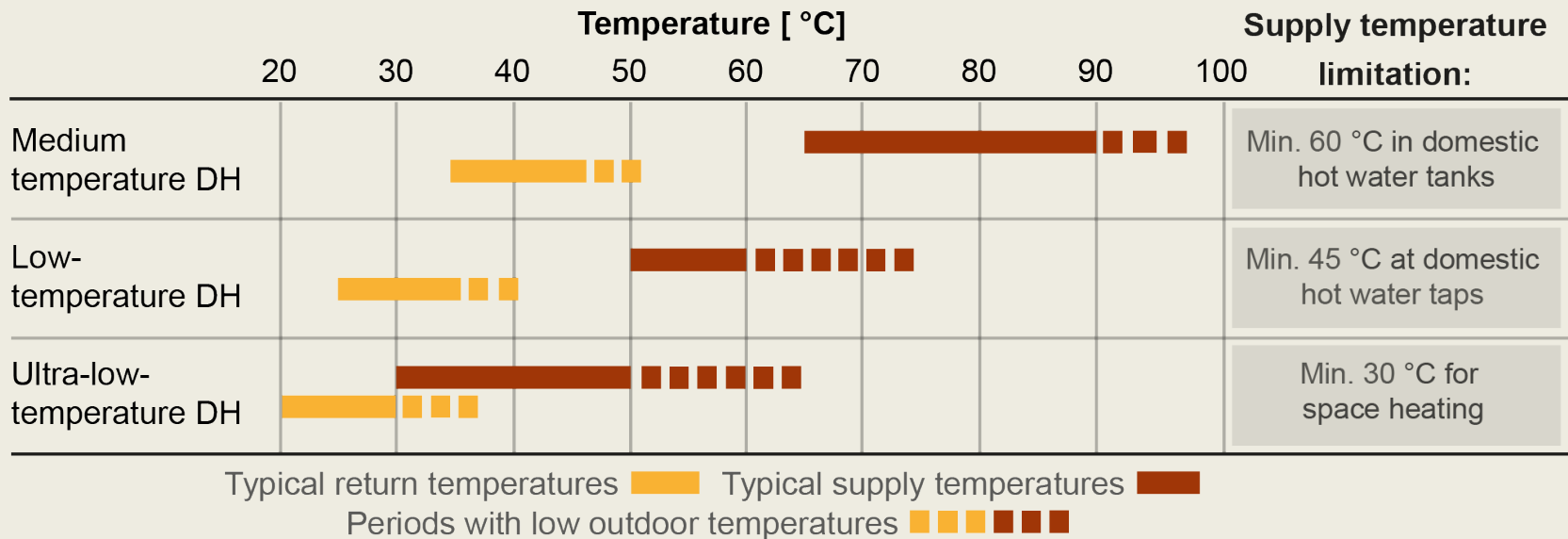
4th International Conference on Smart Energy Systems and 4th
Generation District Heating, Aalborg, 13-14 November 2018



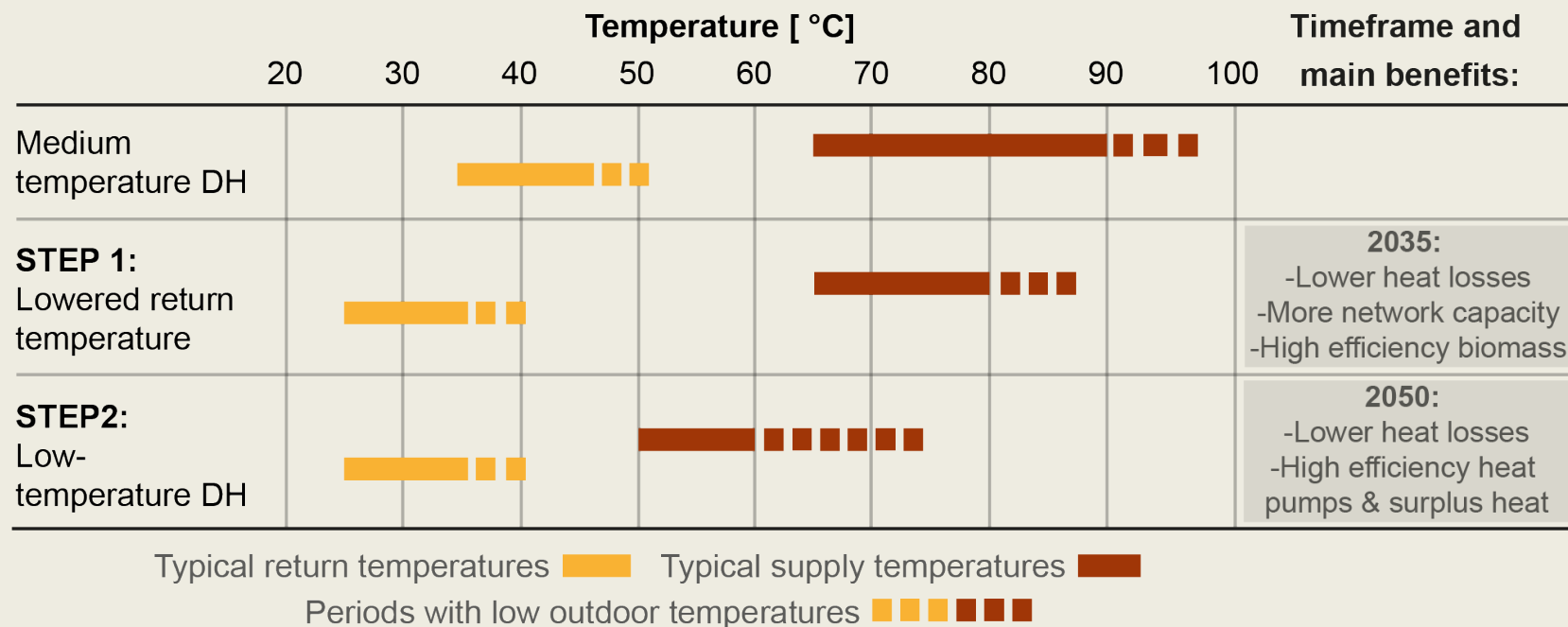
HEATING OF EXISTING BUILDINGS BY LOW-TEMPERATURE DISTRICT HEATING

- An introduction to a Ph.D.-thesis

Definition of low-temperature district heating



Two step transition



- Existing space heating systems were designed for high temperatures
- Space heating has a large effect on return temperatures

Three focus areas



Sizes of heating elements

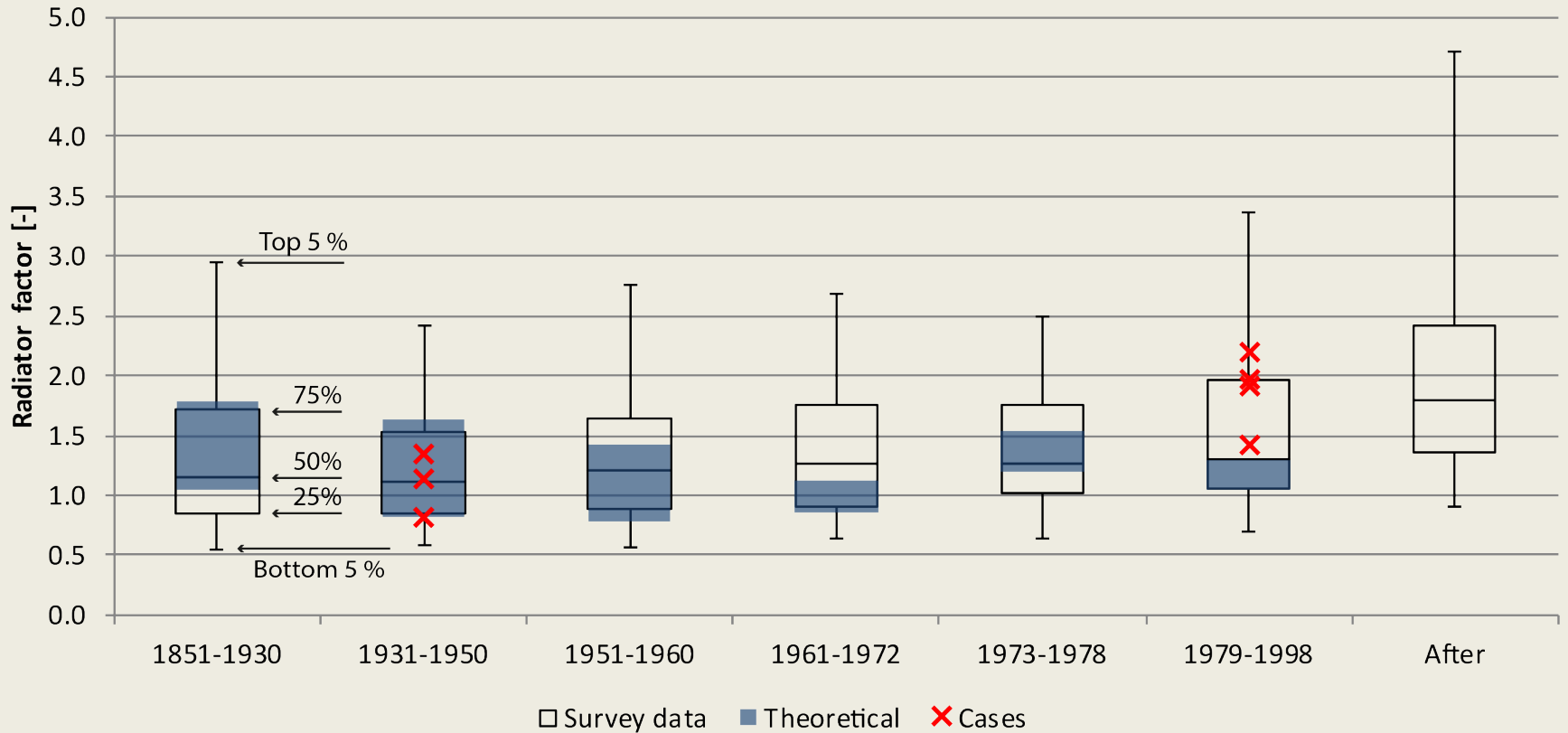


Control of heating systems

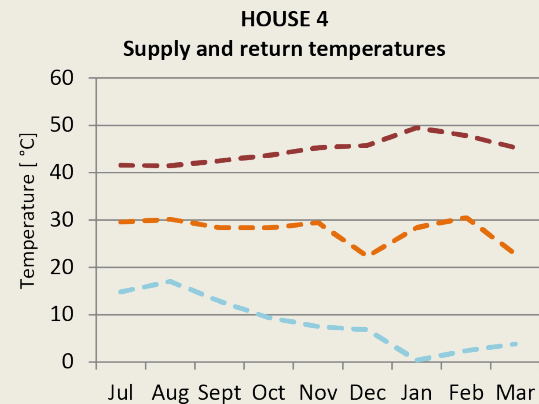
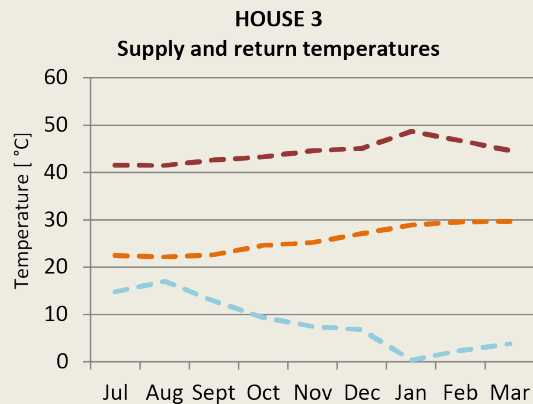
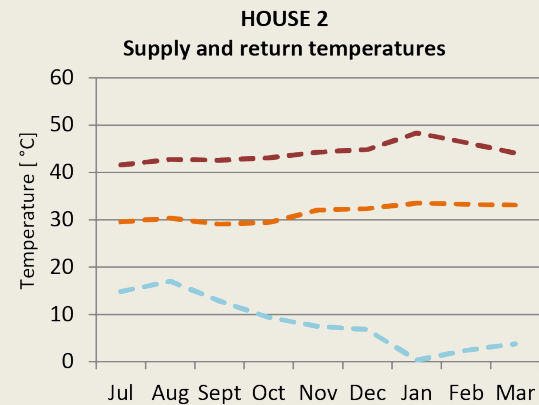
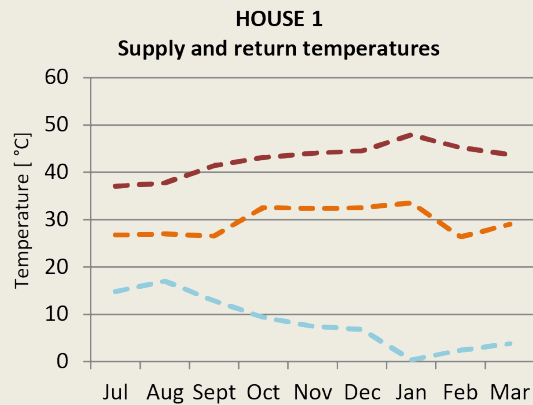


Methods for identification of errors

Radiator sizes

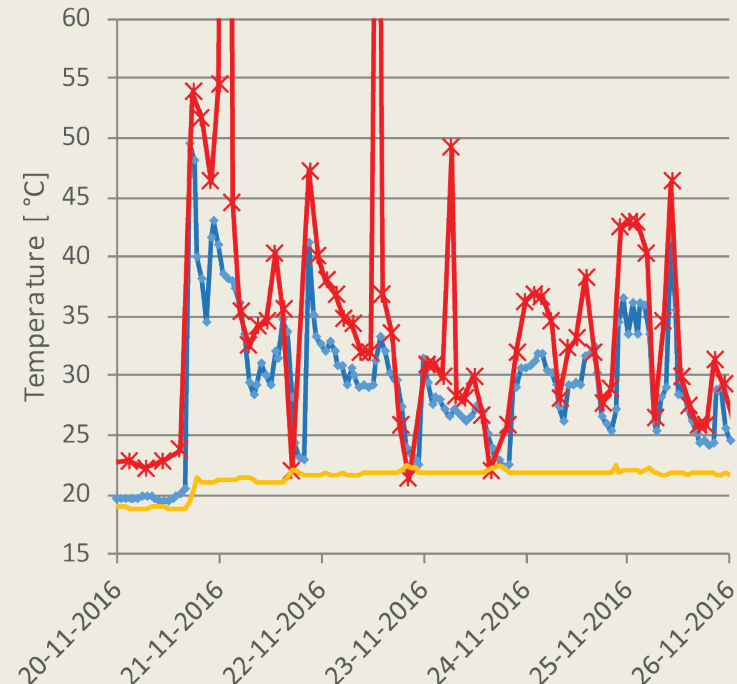
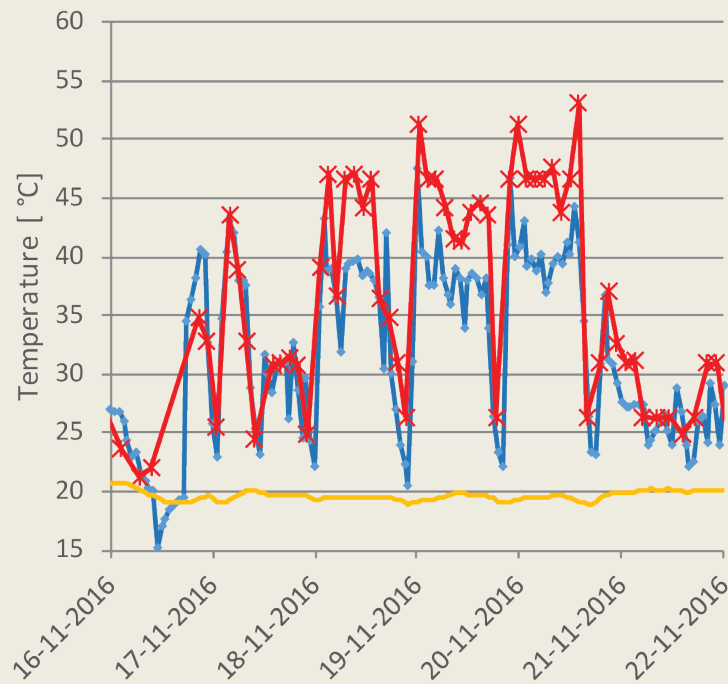


Heating system temperatures



--- Supply temperature --- Return temperature --- Outdoor temperature

Identification of heating system errors



—◆— Measured return [°C] —*— Calculated return [°C] — Indoor temperature [°C]

Main conclusions



- Heating elements are often over-dimensioned
- Temperatures can be lowered for most of the year
- Heating systems *can* be operated with low temperatures
- Poor heating system control and faults are individual and can be a barrier to obtain low return temperature
- Heat meters and heat cost allocators may provide data for identification of errors

QUESTIONS?



All figures and results are from the Ph.D. thesis "Heating of existing buildings by low-temperature district heating" and the papers included in this thesis