Low temperature heating for existing dwellings

TU Delft

The LT ready project

TU Delft BK Bouwkunde

PORTAAL

e.d.b.a

SPAARgas

bo-ex

mitros

HUIZEN DOKTER

duurzaam garenkokerskwartier
Buurtcoöperatie, winst in de wijk

Content

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2. Why this LT-ready project
3. What we did in the LT-ready project
4. Some results of the LT-ready project
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The aim of the LT ready project

Determine the “LT-readiness” of existing dwellings and if the dwelling is not LT-ready which measures are needed to make a dwelling ready for low temperature heating*

* Low temperature heating is in this project defined as 55 °C

Why LT-ready?

- Energy saving

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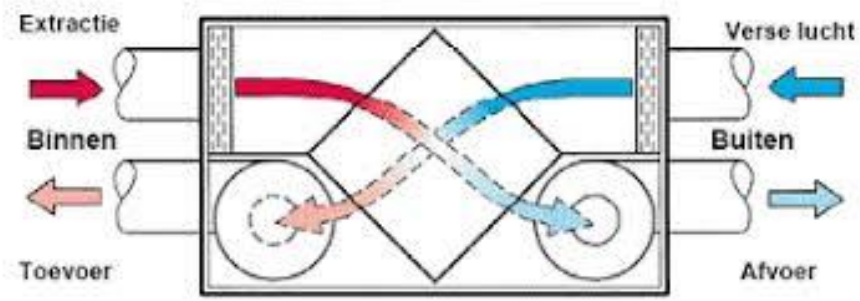
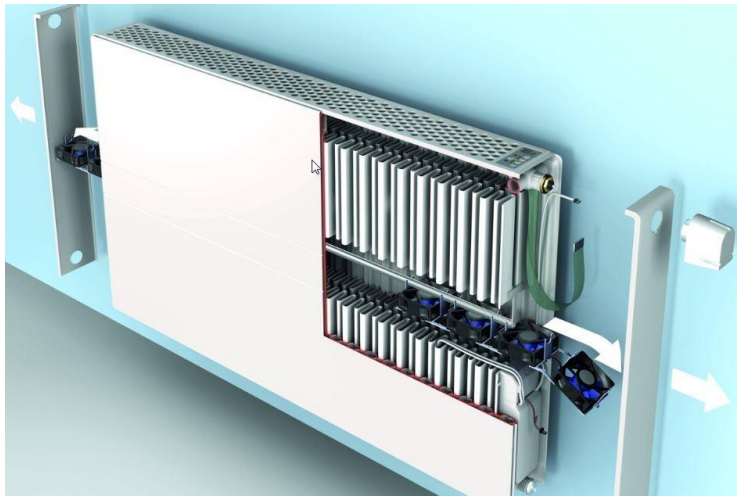
- Energy saving

More important:

- Potential to switch from fossil fuel to renewable energy sources

Why this research?





Why this research?

Research context

Haarlem – Garenkokerskwartier & Ramplaankwartier – private homeowners

Utrecht & Amersfoort – Social housing

The LT-ready research

- Which renovation measures are already taken and why?
- Analysis of (innovative) renovation materials and techniques
- Pilot homes
- Measurements in homes with supply temperature 55 °C
- Analysis LT-readiness of homes
- LT-ready tool

Results – renovation and energy saving measures private homeowners, Haarlem

1. The most common renovation measure is the replacement of single glass into high efficiency double glazing
2. Roof insulation from the inside in many homes
3. 60% of respondents is planning to apply floor insulation
4. A large part of the residents also indicate that they would like to insulate the facade, but that is a long term plan because they do not know how to approach this.
5. Most participants set the thermostat to 20°C during the day and apply a night reduction of 4°C during the night
6. The upper floors of the homes are often not or only moderately heated

Results – which renovation measures, why and how people use their house

People mentioned that they want to renovate to:

1. reduce energy demand
2. Increase comfort
3. To switch from gas as a heating source to a non-fossil fuel energy source

Reasons why they didn't execute the renovation measures yet:

1. Not sure which measures are needed
2. Afraid for moisture problems
3. Lack of budget
4. Lack of time

Analysis (innovative) renovation materials and techniques

1. **Insulation value and energetic performance;**
2. **Costs and costs to be expected in the (near) future;**
3. **Potential of the material / product for integration into a circular raw materials cycle;**
4. **Practical handling during application / execution;**
5. **Architectural quality;**
6. **Comfort and health.**

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WP3 - stand der techniek en innovaties per categorie

Pilot dwellings*

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** To protect the privacy of the people in the research these pictures are not the exact pilot dwellings we measured but they reflect the type of dwellings*

Measures Pilot dwellings

- Balanced ventilation system with heat recovery
- Demand-driven ventilation system (CO2)
- Improvement air tightness
- Cavity insulation
- Façade insulation
- Replacement of window(frames)
- Roof insulation (inside)
- Floor insulation
- Replacement of front door
- Decentral ventilation system with heat recovery
- Radiator booster

TRHC sensor
USB Antenna (X1)

ELP Sensor
USB Antenna (X1)

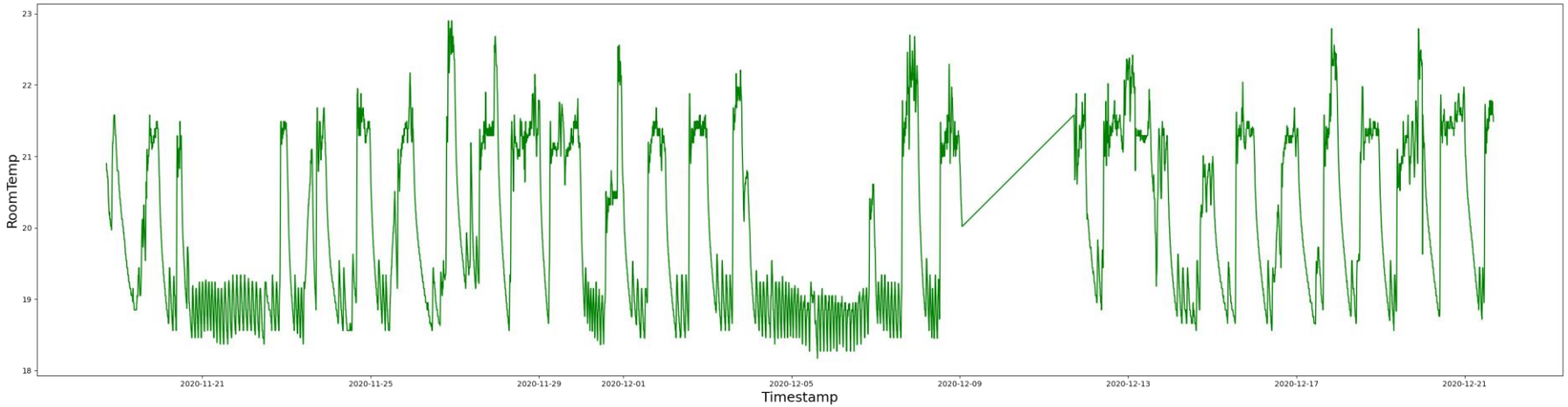
ensor
Meter (X1)

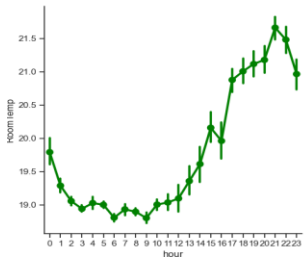
Mini PC

C

Measurements in dwellings with a supply temperature of 55 °C

Temperature





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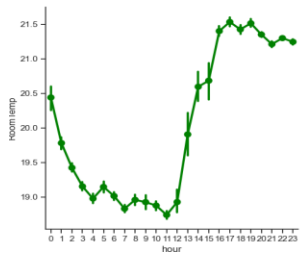

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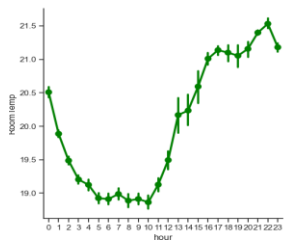

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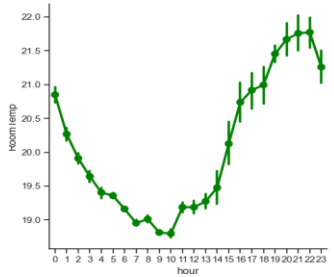

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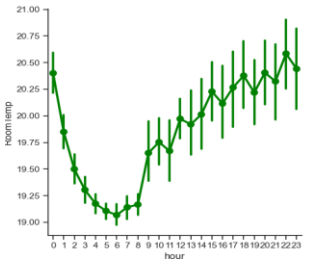
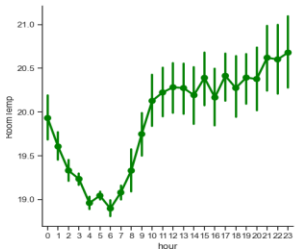


Friday



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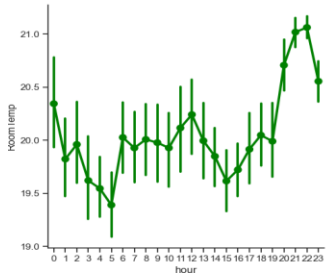

Sunday

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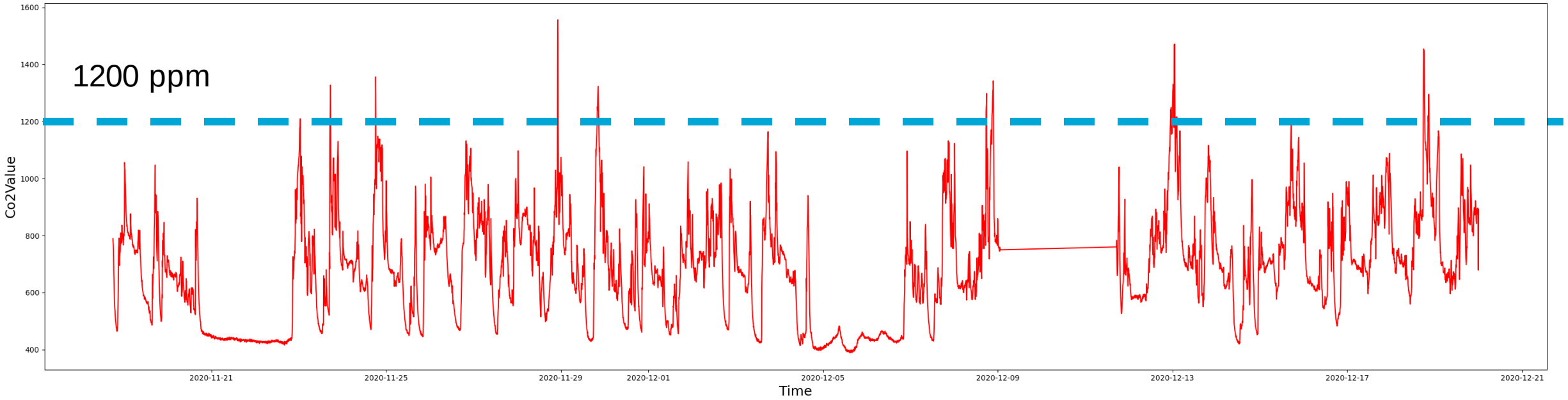
Measurements in dwellings with a supply temperature of 55 °C

CO_2



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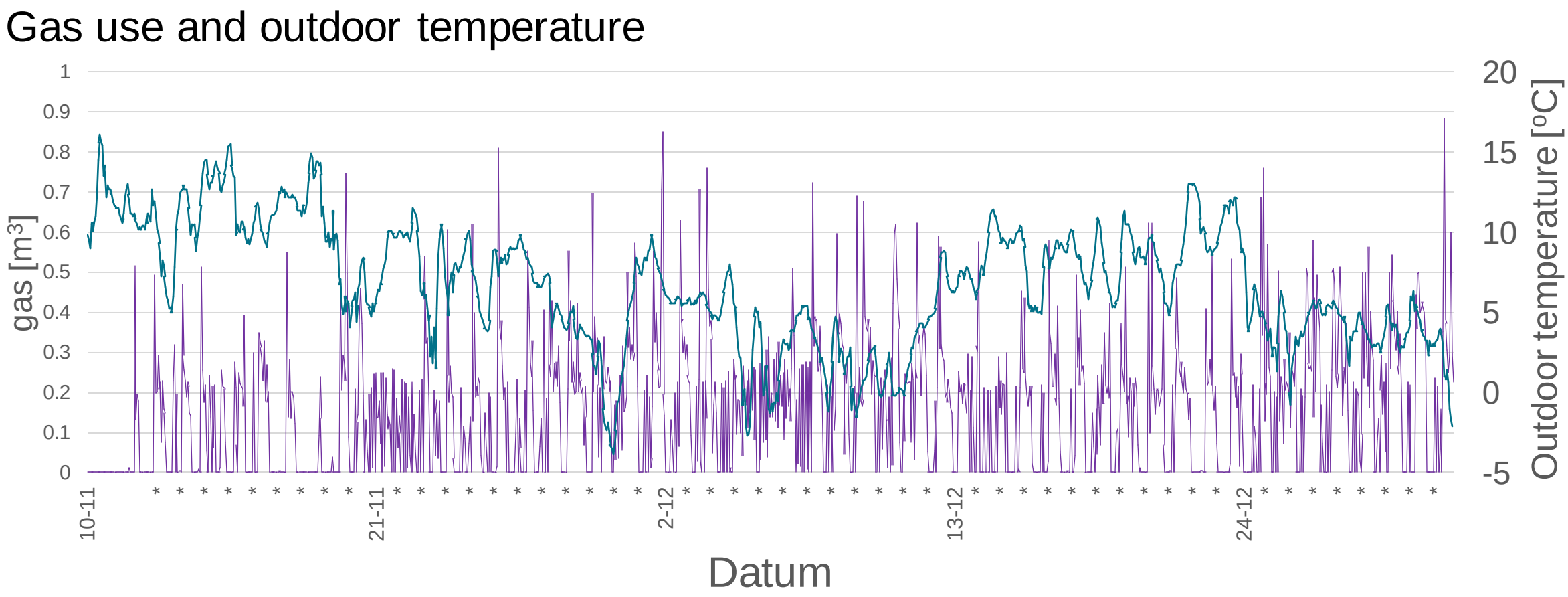

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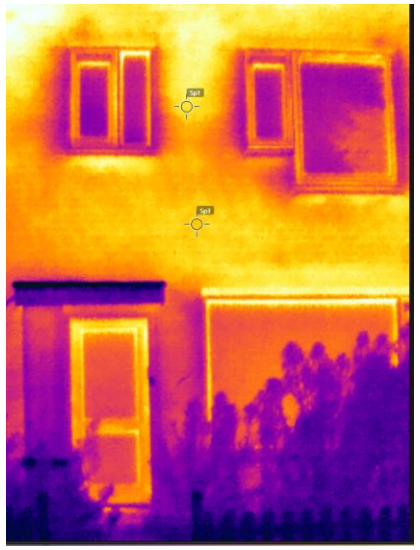
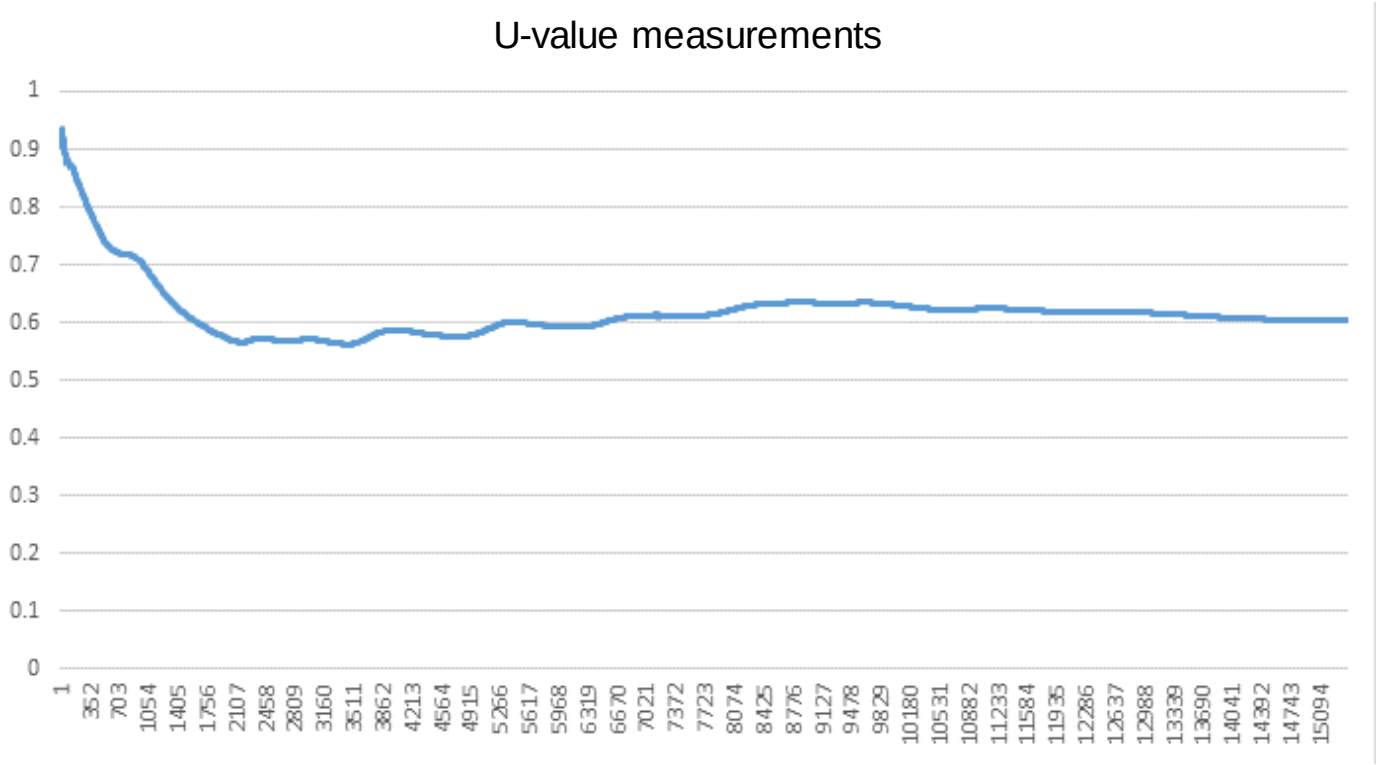


U-value measurements



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Measurements in dwellings with a supply temperature of 55 °C

During the measurement period the desired temperatures are always achieved and the occupants felt comfortable

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Measurements in dwellings with a supply temperature of 55 °C

During the measurement period the desired temperatures are always achieved and the occupants felt comfortable

However we can not conclude that the dwelling is LT ready because the outdoor temperatures were relatively high during the measurement period

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Plan B: Analyse LT-readiness dwellings – Dyanamic building energy simulation models (TRNSYS)

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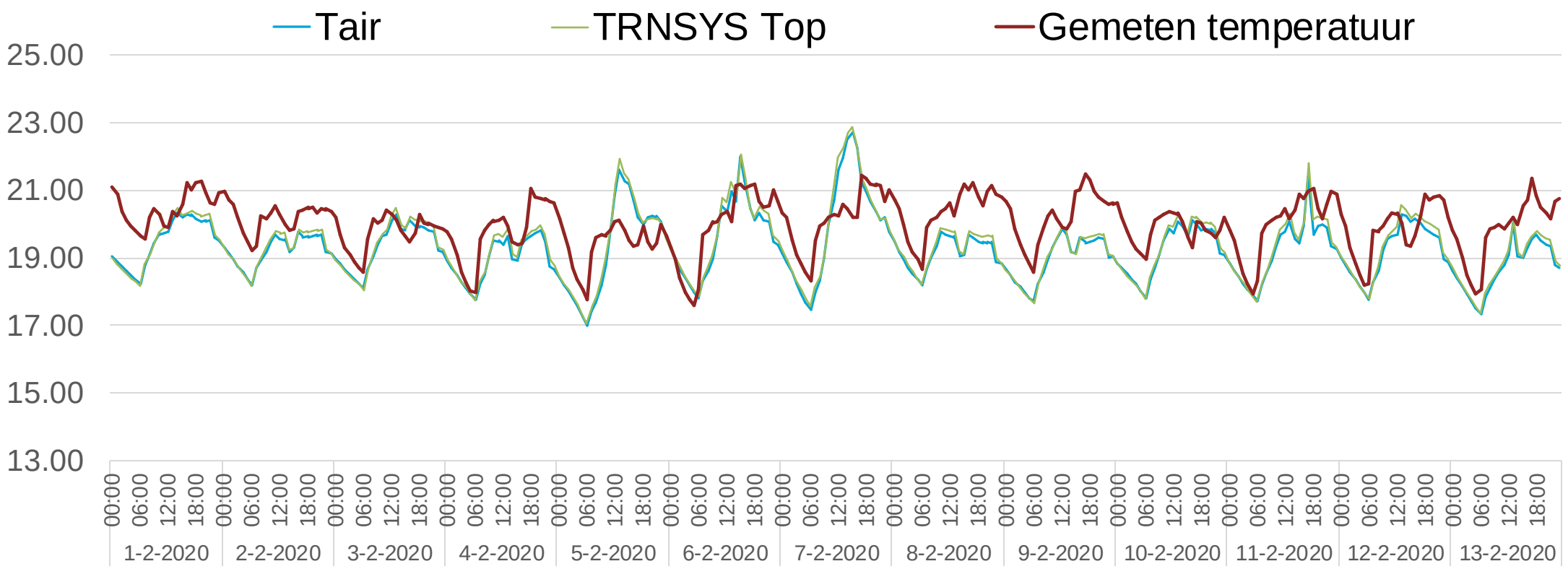
Definition LT-ready

- 'LT-ready' in this project means that the house can be heated with a low temperature, a maximum of 55 °C by using the current heat emitter systems such as radiators or underfloor heating.

- Renovating a house to level: 'LT ready' means that after renovation the house can switch from high temperature to low temperature (max 55 °C) heating while maintaining the current heat emitting system and maintaining similar indoor temperature level as achieved in the situation of high temperature heating .

Dynamic building energy simulation - Calibration



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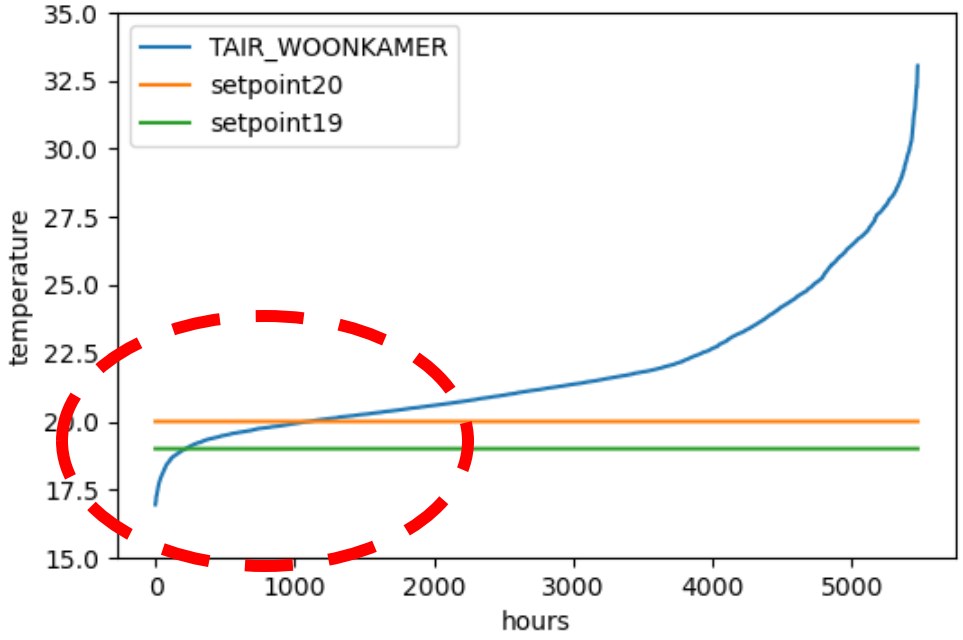
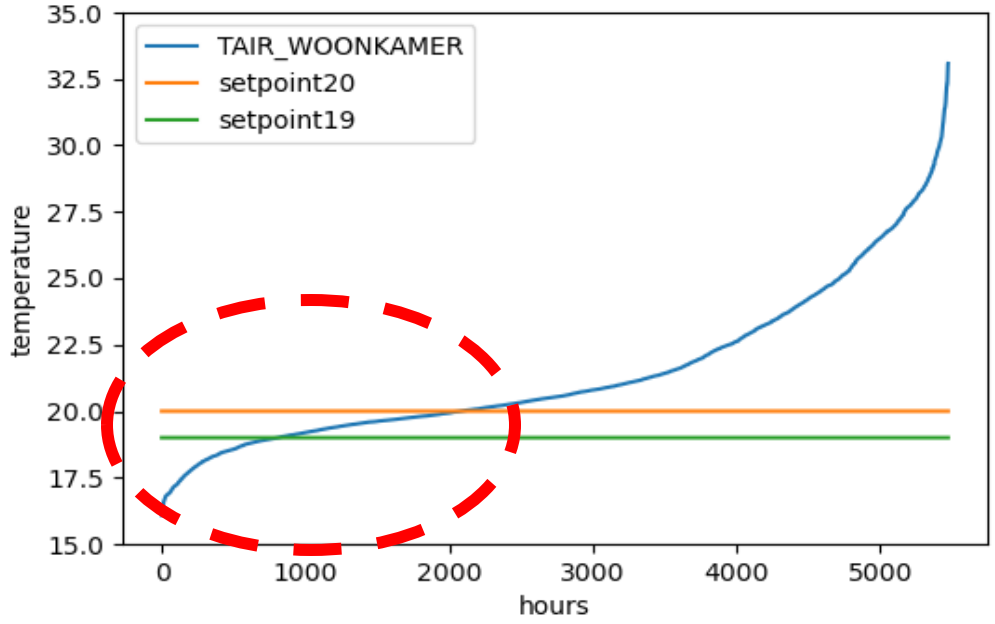
Analyse LT-readiness of dwellings – high versus low temperature heating

High temperature heating



Low temperature heating



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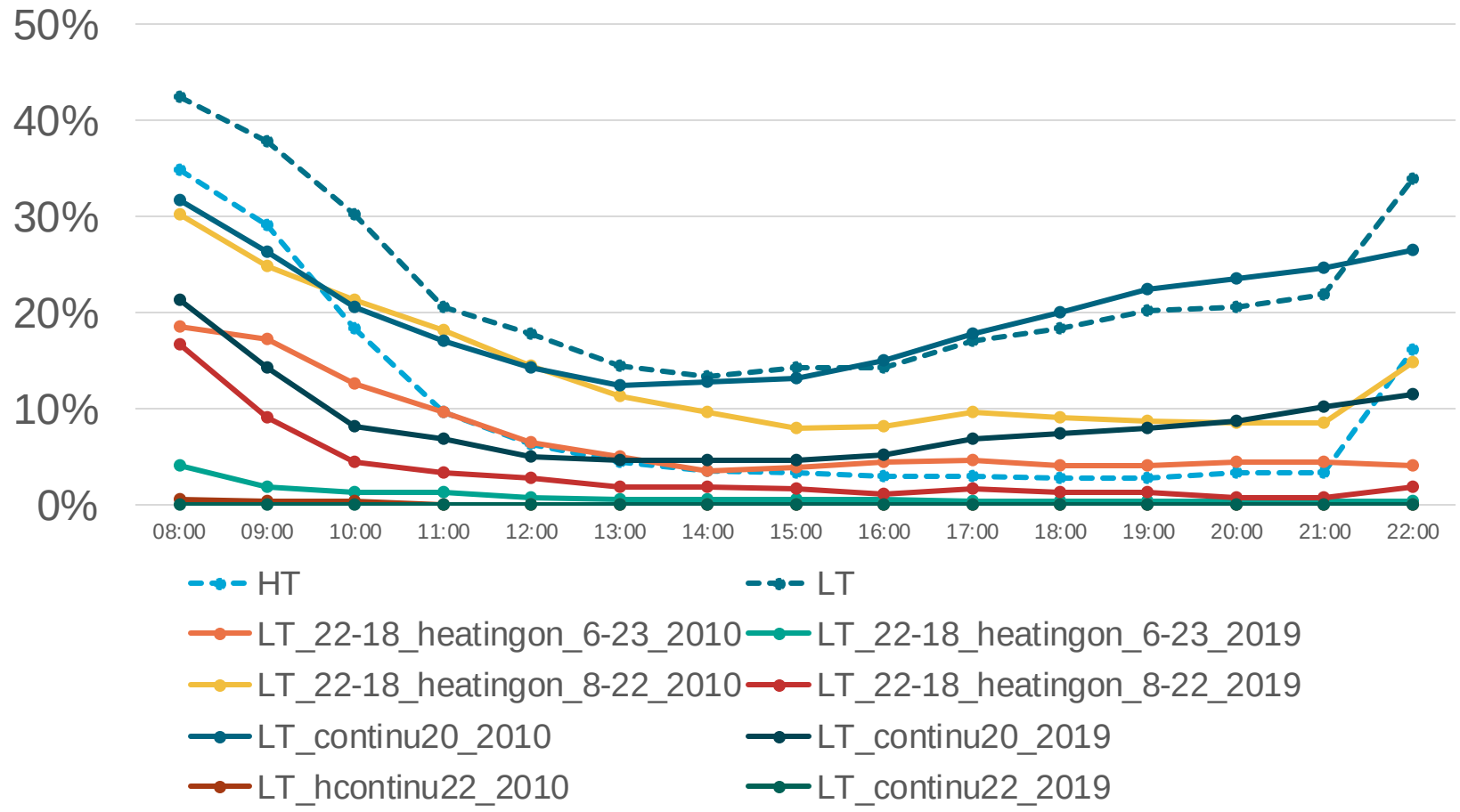
Analyse LT-readiness of dwellings – different user profiles and climate years



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Comfort

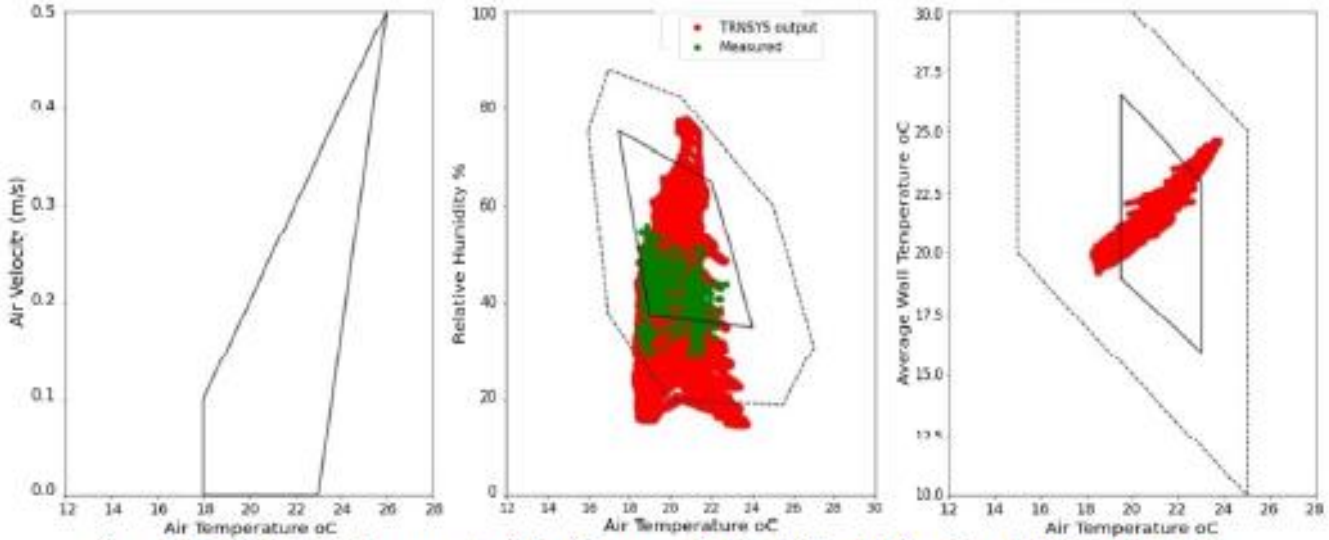
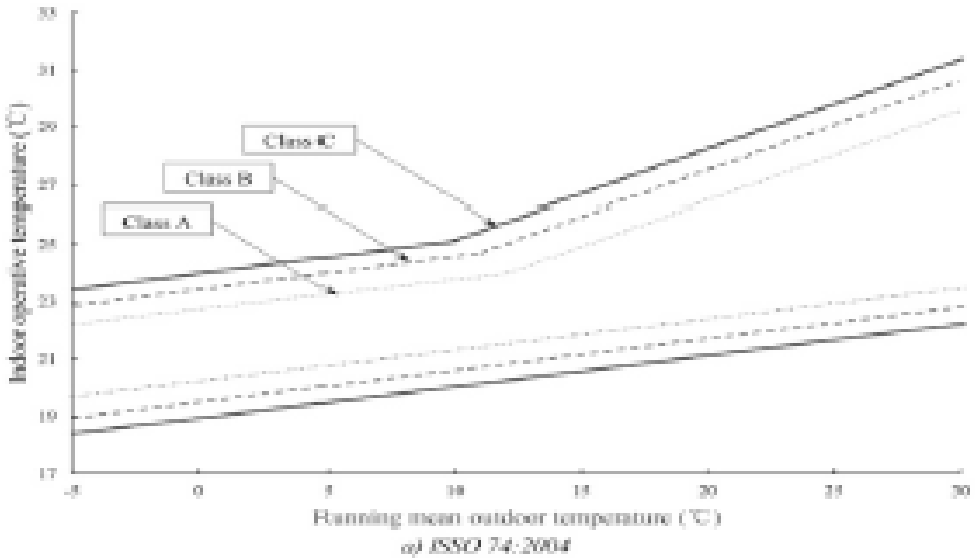
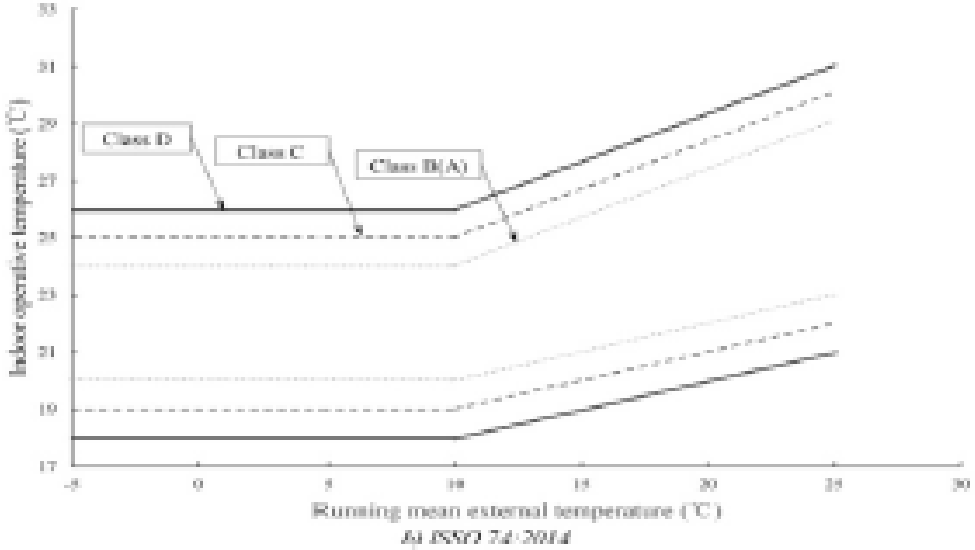


Figure 5.65: Individual comfort parameters in the living room with LT underfloor heating with updated façade properties





By: Victor Ghering

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Which aspects have influence on the ‘LT-readiness’ of a dwelling?

- Heat loss of a dwelling (e.g. insulation façade, floor, roof, type of glass, window frames, air tightness, ventilation)
- Technical aspects of the building
- Installed heating capacity of a dwelling (is there extra capacity?)
- Flow capacity of heating pipes
- Heating time of the dwelling (thermal capacity)
- Desired indoor temperatures
- Desired night temperatures
- Preferences of the occupants and building owners

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Impossible to conduct dynamic simulations for every dwelling

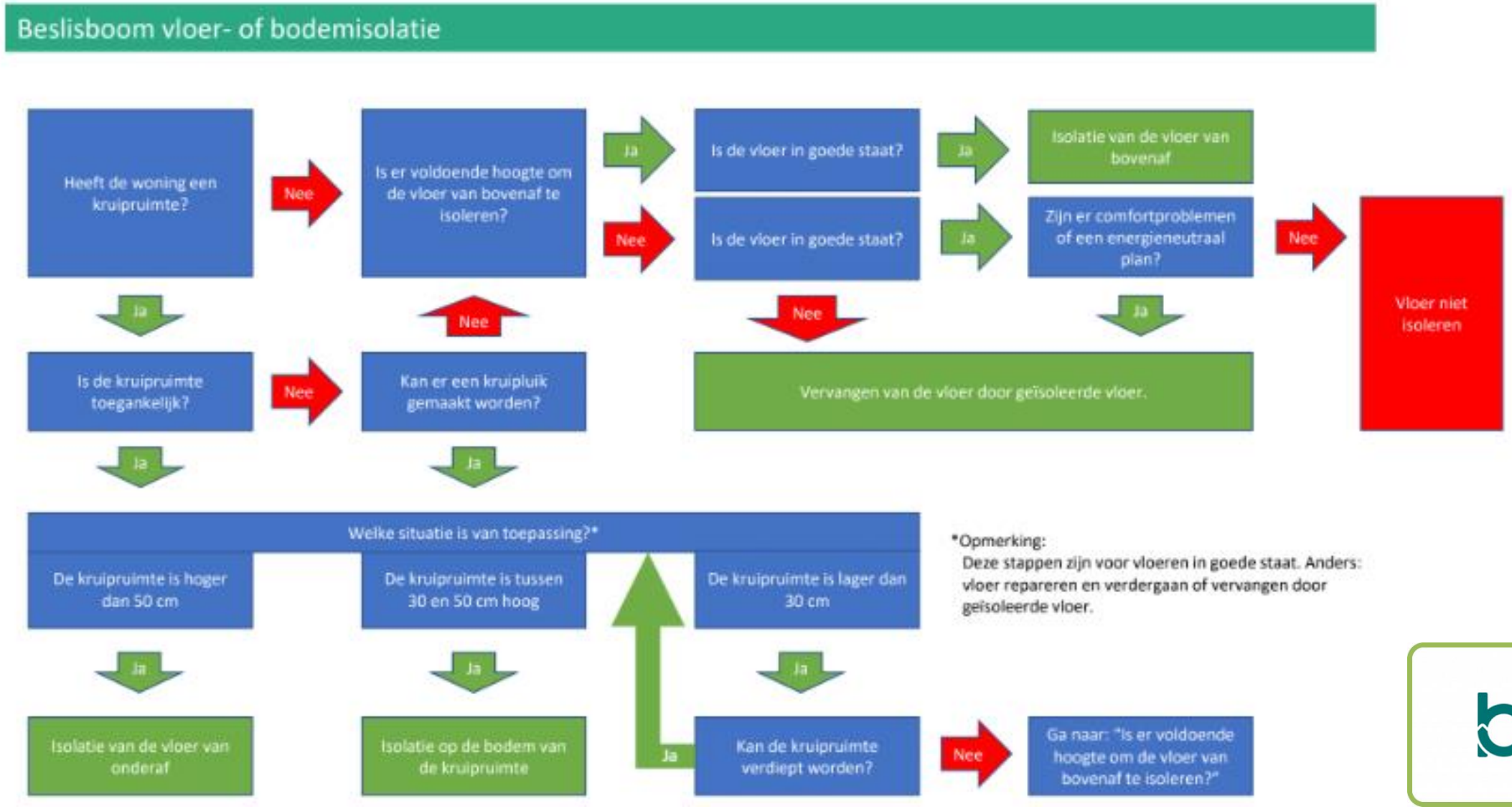
Detailed input is required which is difficult/time consuming to obtain, if standard assumptions are used there is no added value to dynamic simulations

Alternative:

ISSO 51

- Relatively simple calculation
- Most of the time the predictions are a bit stricter than the dynamic simulation results (depends a bit on the building and the assumptions)

Technical aspect – decision trees



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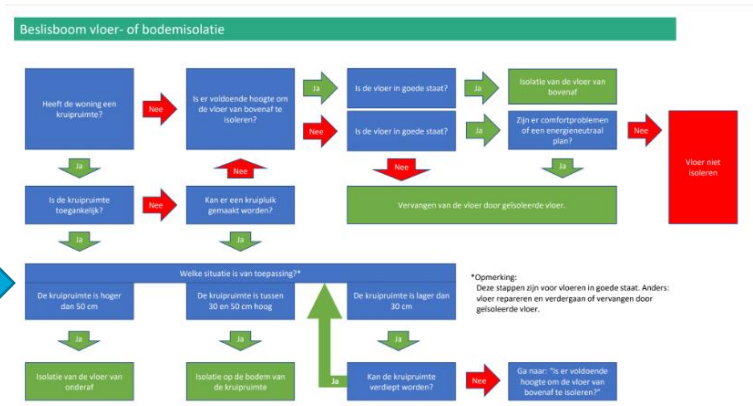
LT-ready tool

- Overview of new and existing renovation techniques including environmental impact & circularity
- ISSO 51 per room
- Decision trees: what is technical possible
- Comfort advise



Decision trees

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Lessons learned LT-ready

- Definition is important
- It is important to not only look at capacity of the heating system but also at comfort
- Important to take the wishes of the occupants into account, this also influences which measure is the ‘best’ measure
- The installed over capacity of the system and the flow capacity of the pipes play an important role
- ISSO 51 is an acceptable alternative for dynamic calculations to indicate the LT readiness of a dwelling
- It is important to analyse the current comfort level
- It is important to look at individual rooms/zones
- More experience from practice is needed

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With Thanks to:

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Regina Bokel

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Paula van den Brom

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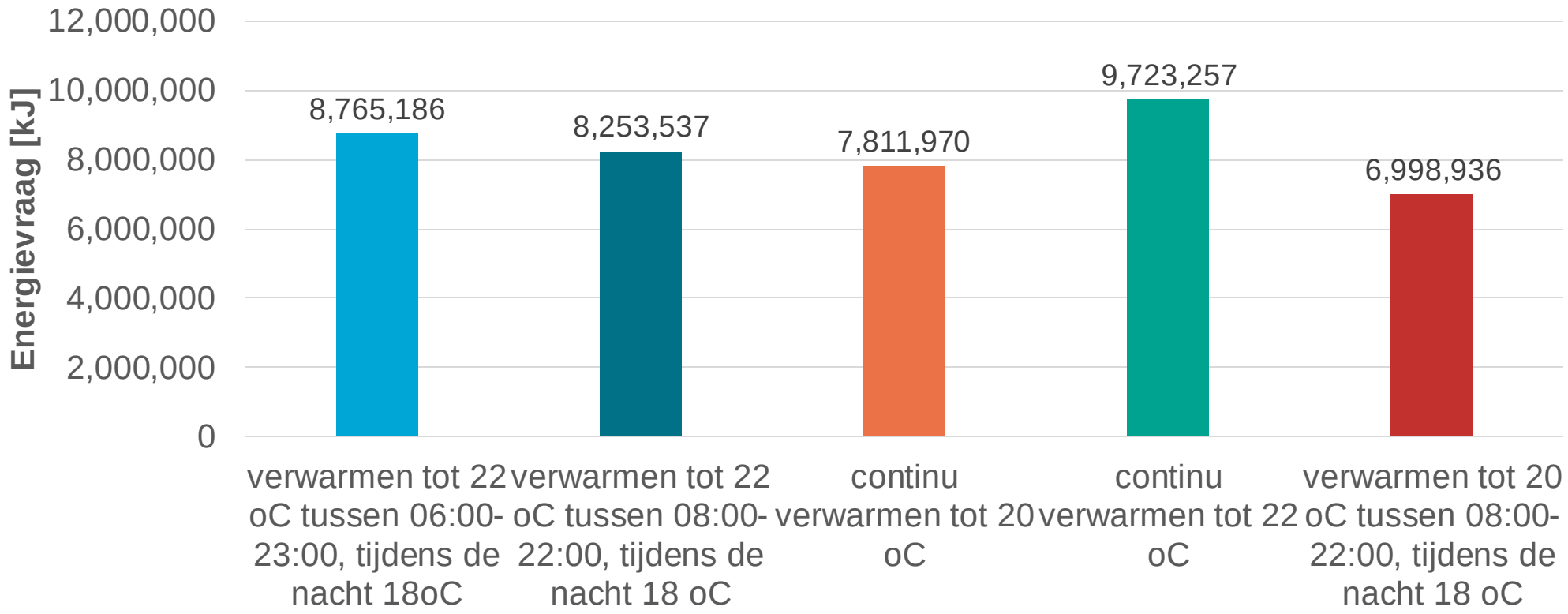
Analyse LT-readiness of dwellings – different user profiles and climate years



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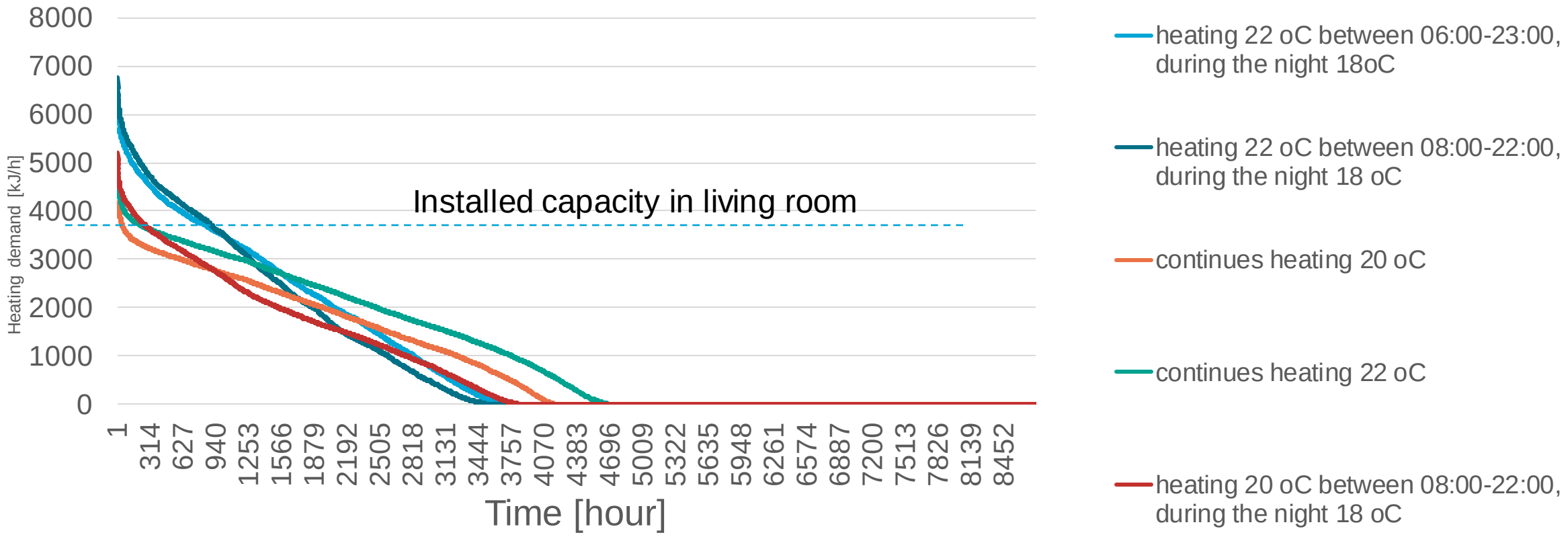

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