



Low temperature heating for existing dwellings

The LT ready project



Content

1. The aim of the LT-ready project
2. Why this LT-ready project
3. What we did in the LT-ready project
4. Some results of the LT-ready project
5. Lessons learned and recommendations

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

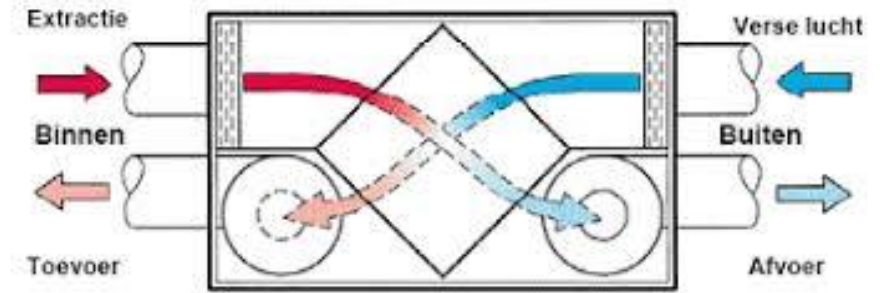
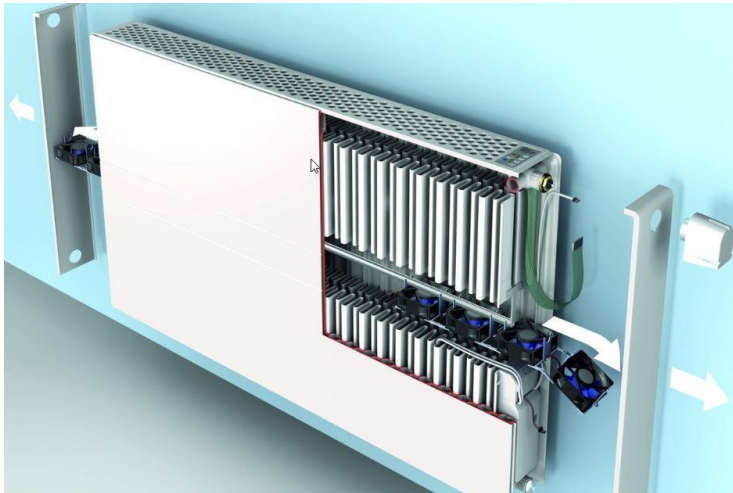
Why LT-ready?

- 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.



WP3 - stand der techniek en innovaties per categorie

1	Inleiding.....		
2	Methoden.....		
2.1	Inventarisatie.....		
2.2	Key Performance Indicators.....		
2.2.1	Isolatiewaarde en energetische prestatie.....		
2.2.2	Kosten en in de (nabije) toekomst te verwachten kosten.....		
2.2.3	Potentie van het product voor circulariteit.....		
2.2.4	Praktische hanteerbaarheid bij aanbrengen en uitvoering.....		
2.2.5	Architectonische kwaliteit.....		
2.3	Categorisering.....		
3	Isolatiematerialen en basisproduct.....		
3.1	Steenwol.....		
3.2	Glaswol.....		
3.3	Houtvezel.....		
3.4	Vlas & Hennep.....		
3.5	Schapenwol.....		
3.6	Cellulose.....		
3.7	Zeewier.....		
3.8	Mycelium.....		
3.9	Kurkisolatie.....		
3.10	Katoenisolatie.....		
3.11	Geextrudeerd/geexpandeed polystyrene.....		
3.12	Polyurethaan- en polyisocyanuraatsch.....		
3.13	Resolschuim.....		
3.14	Vacuumpanelen/Vacuumplossingen.....		
3.15	Aerogels.....		
3.16	Calcium silicaat.....		
3.17	Perlite.....		
3.18	Vermiculite.....		
3.19	Folies.....		
4	Toepassingen steenwol.....		
4.1	Rockwool RockSono voorzetwand.....		
4.1.1	Isolatiewaarde en energetische prestatie.....		
4.1.2	Kosten en in de (nabije) toekomst te verwachten kosten.....		
4.1.3	Potentie van het materiaal / product voor grondstoffencyclus.....		
4.1.4	Praktische hanteerbaarheid bij aanbrengen en uitvoering.....		
4.1.5	Architectonische kwaliteit.....		
4.2	Rockwool inblaaswol spouw.....		
4.2.1	Isolatiewaarde en energetische prestatie.....		
4.2.2	Kosten en in de (nabije) toekomst te verwachten kosten.....		18
4.2.3	Potentie van het materiaal / product voor inpassing in een circulaire grondstoffencyclus.....		18
4.2.4	Praktische hanteerbaarheid bij aanbrengen / uitvoering.....		19
4.2.5	Architectonische kwaliteit.....		19
4.3	Rockwool voorzetgevel.....		19
4.3.1	Isolatiewaarde en energetische prestatie.....		19
4.3.2	Kosten en in de (nabije) toekomst te verwachten kosten.....		19
4.3.3	Potentie van het materiaal / product voor inpassing in een circulaire grondstoffencyclus.....		19
4.3.4	Praktische hanteerbaarheid bij aanbrengen / uitvoering.....		20
4.3.5	Architectonische kwaliteit.....		20
4.4	Rockwool RockRoof Sidefix dakisolatie.....		20
4.4.1	Isolatiewaarde en energetische prestatie.....		20
4.4.2	Kosten en in de (nabije) toekomst te verwachten kosten.....		20
4.4.3	Potentie van het materiaal / product voor inpassing in een circulaire grondstoffencyclus.....		20
4.4.4	Praktische hanteerbaarheid bij aanbrengen / uitvoering.....		21
4.4.5	Architectonische kwaliteit.....		21
5	Toepassingen houtvezel.....		21
6	Toepassingen vlas, hennep, etc.....		21
7	Toepassingen cellulose.....		21
8	Toepassingen zeewier.....		21
8.1	iCell.....		21
9	Toepassingen mycelium.....		21
10	Toepassingen metisse en gerecycled katoen.....		21
11	Toepassingen EPS.....		21
12	Toepassingen polyurethaan.....		21
12.1	Bio-EPS.....		21
13	Toepassingen PIR.....		21
14	Toepassingen Kingspan Wall-in-one.....		21
14.1	Kingspan Wall-in-one.....		21
14.2	Isowall.nl, woningisolatie in 1 dag (challenge).....		21
15	Toepassingen resolschuim.....		21
15.1	StoSystain X - herbruikbare gevelisolatie (challenge).....		22
15.2	Kingspan Kooltherm K6 Buitengevelplaat.....		22
15.3	Kingspan Kooltherm K118 Binnenisolatie Element.....		22
16	Toepassingen vacuumpanelen.....		22
16.1	Patchwork van vacuumpanelen en PIR (challenge).....		22
16.2	FORRO, een warme voering voor elk huis (challenge).....		23
16.3	Vacuumpouwisolatie/Quavity (challenge).....		23
17	Toepassingen aerogels.....		23
17.1	Bluedec.....		23
18	Toepassingen silicaten.....		23
18.1	Slentite.....		23
19	Toepassingen folies.....		23
20	Systeemtoepassingen en overig.....		23
20.1	Steenstrippaneel op een isolatie naar keuze (challenge).....		30
20.2	Iso-Skin (challenge).....		30
20.3	EWS External Wall System (challenge).....		30
20.3.1	Isoleren met nanotechnologie (challenge).....		30

Pilot 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)



sensor
Meter (X1)

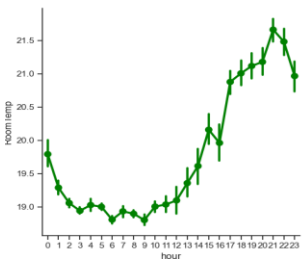
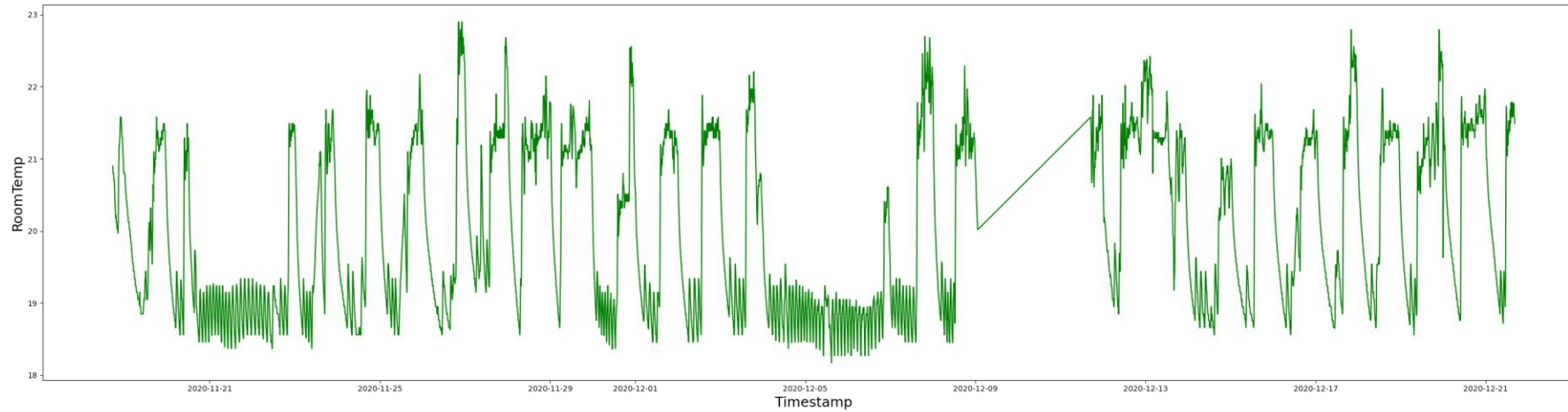


Mini PC

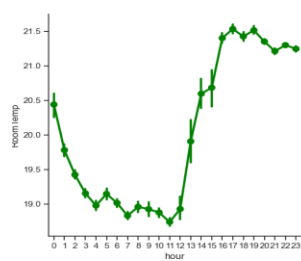


Measurements in dwellings with a supply temperature of 55 °C

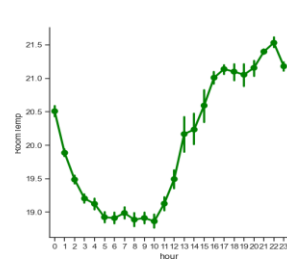
Temperature



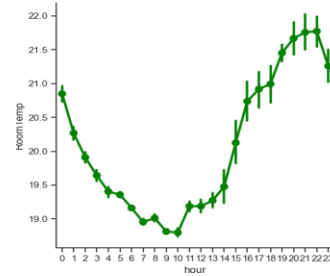
Monday



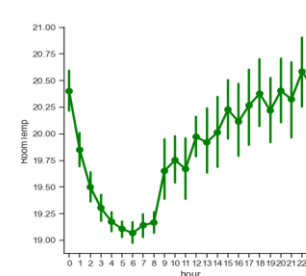
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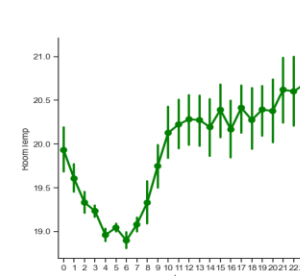
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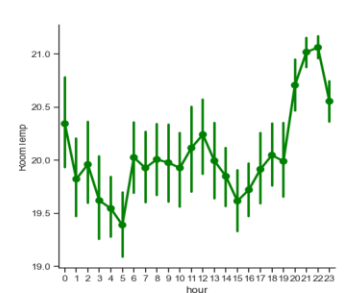
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Friday



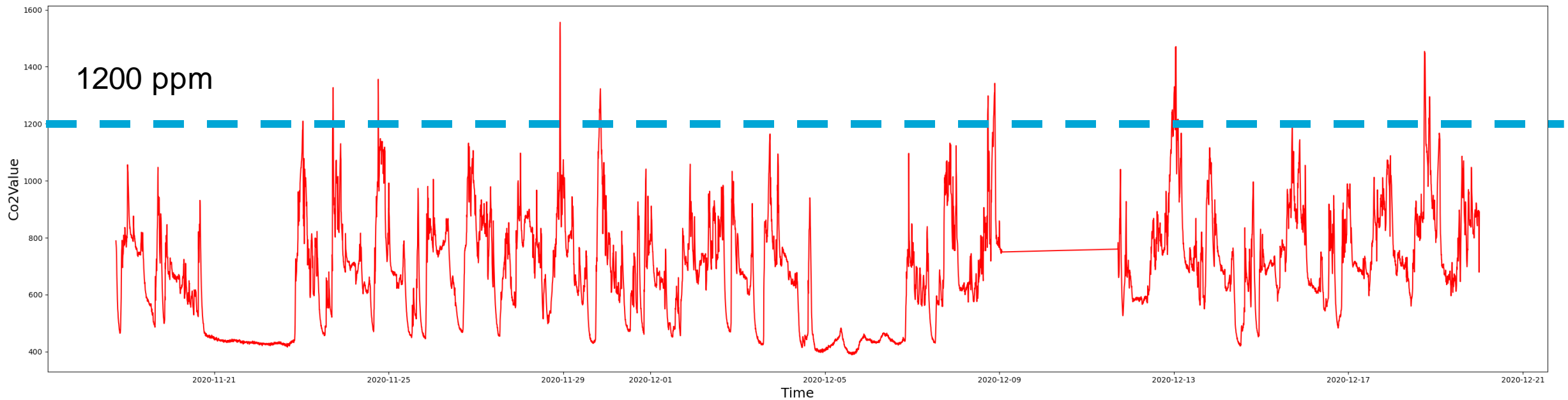
Saturday



Sunday

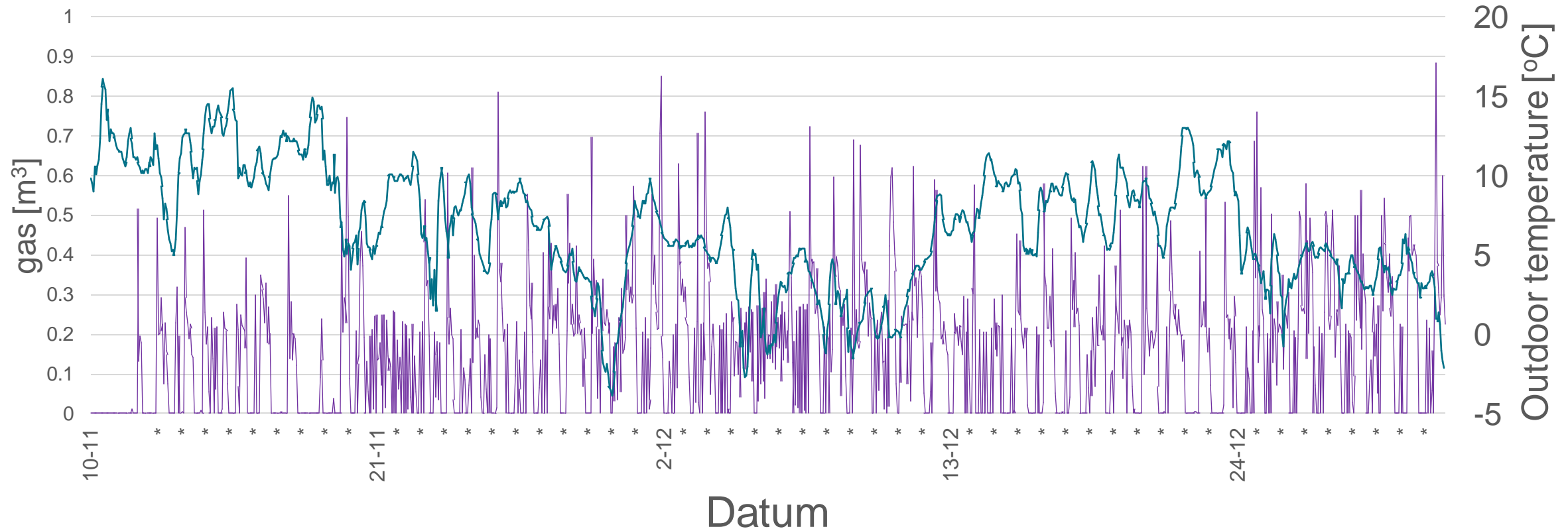
Measurements in dwellings with a supply temperature of 55 °C

CO₂



Measurements in dwellings with a supply temperature of 55 °C

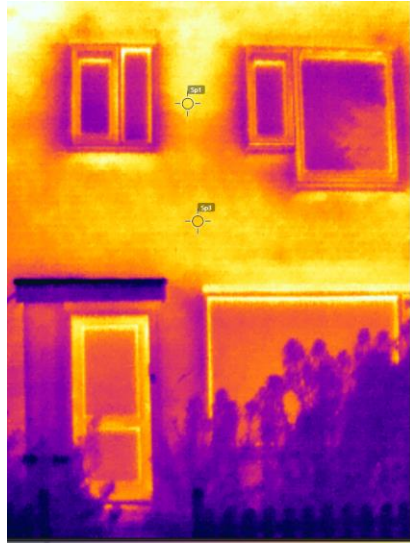
Gas use and outdoor temperature



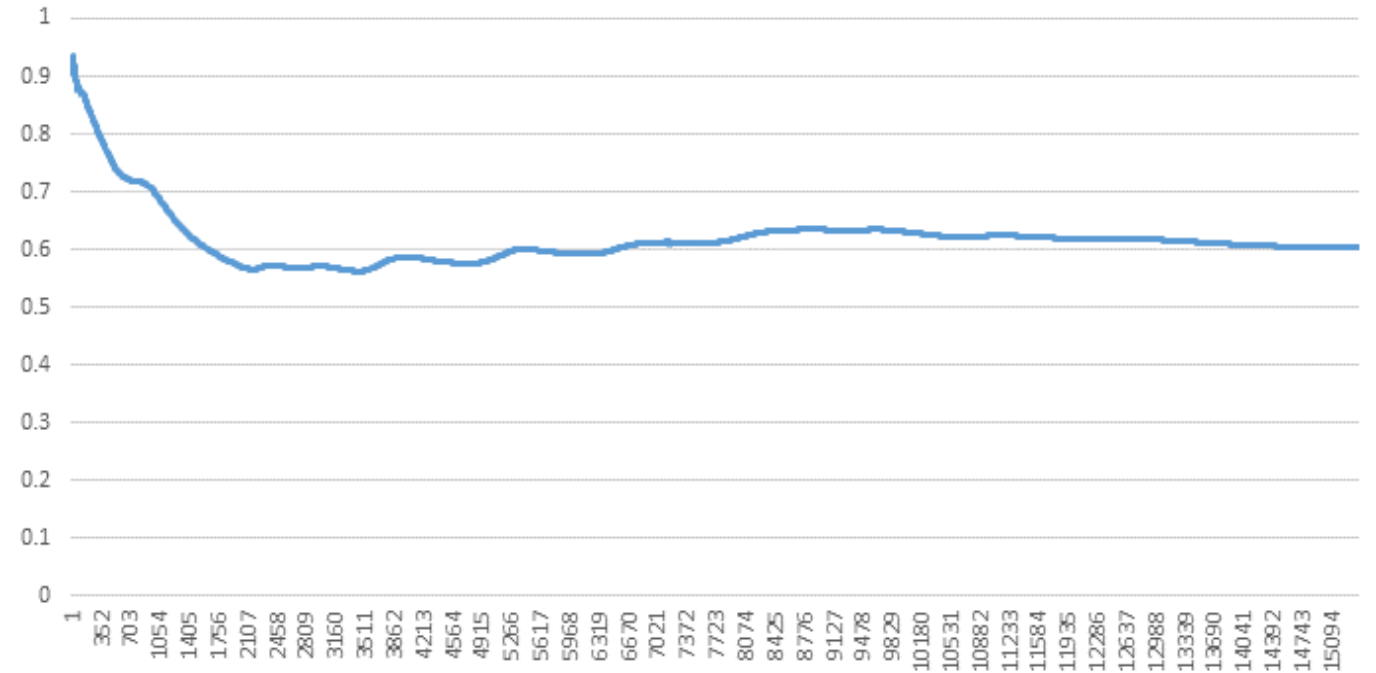
Measurements in dwellings with a supply temperature of 55 °C



U-value measurements



U-value measurements



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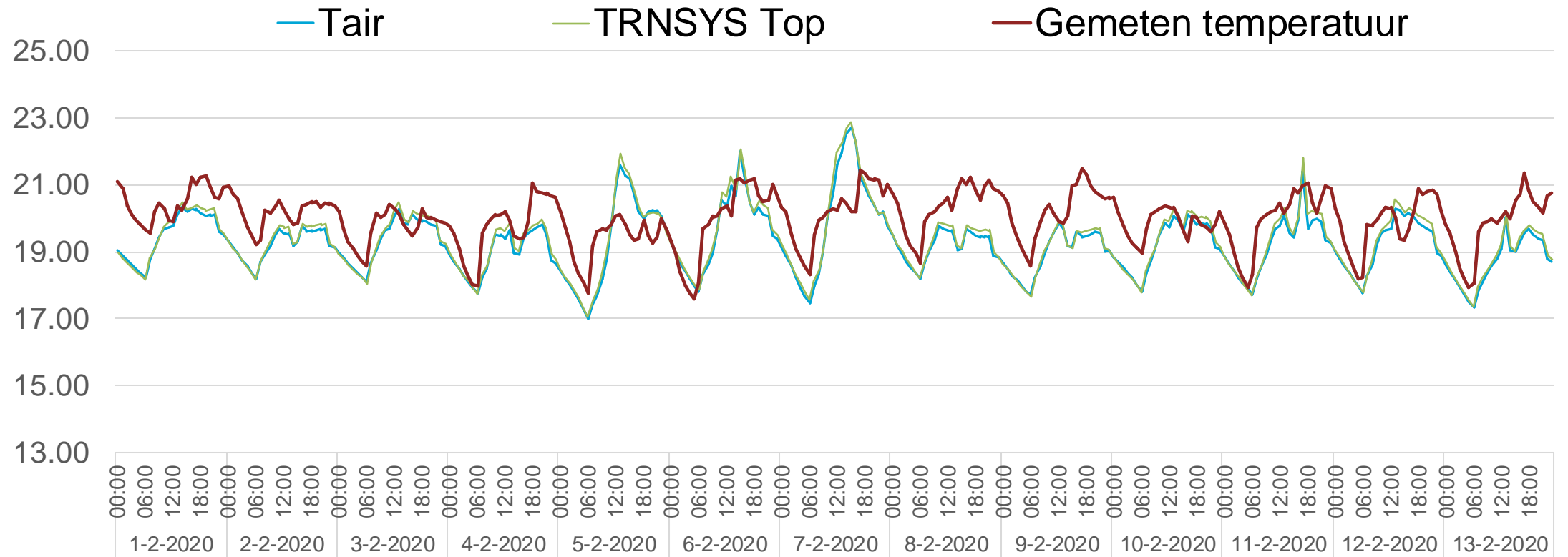
However we can **not** conclude that the dwelling is LT ready because the outdoor temperatures were relatively high during the measurement period

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

Definition LT-ready

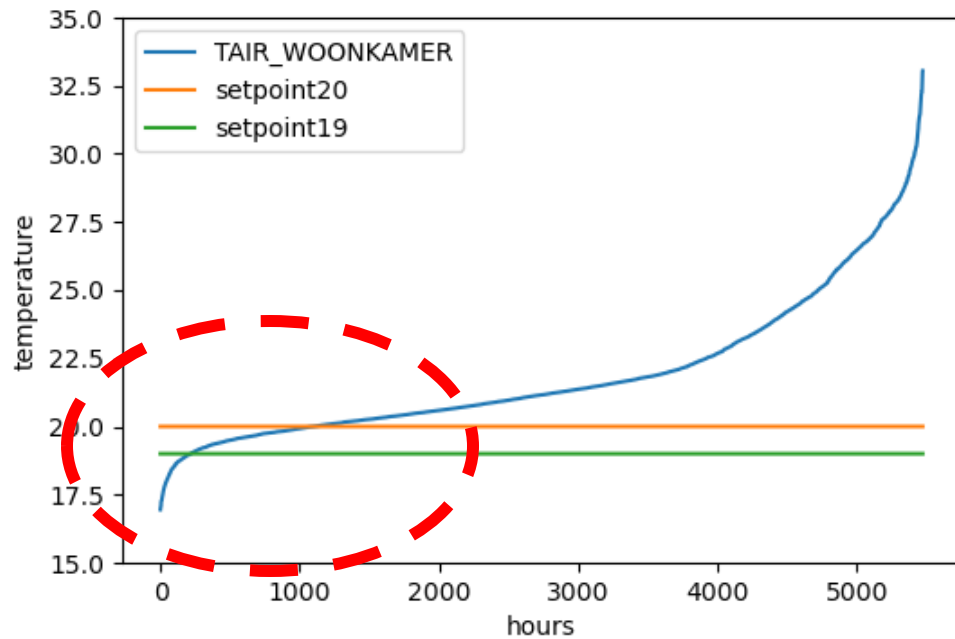
- 'LT-ready' in this project means that the house can be heated with a low temperature, a maximum of 55 °C by using the current heat emitter systems such as radiators or underfloor heating.
- Renovating a house to level: 'LT ready' means that after renovation the house can switch from high temperature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

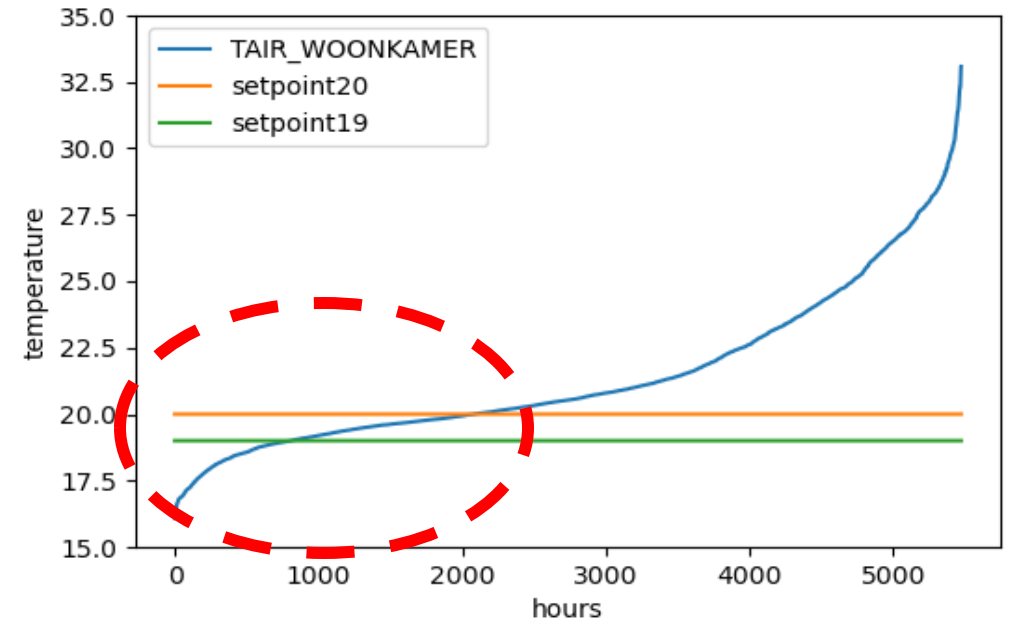


Analyse LT-readiness of dwellings – high versus low temperature heating

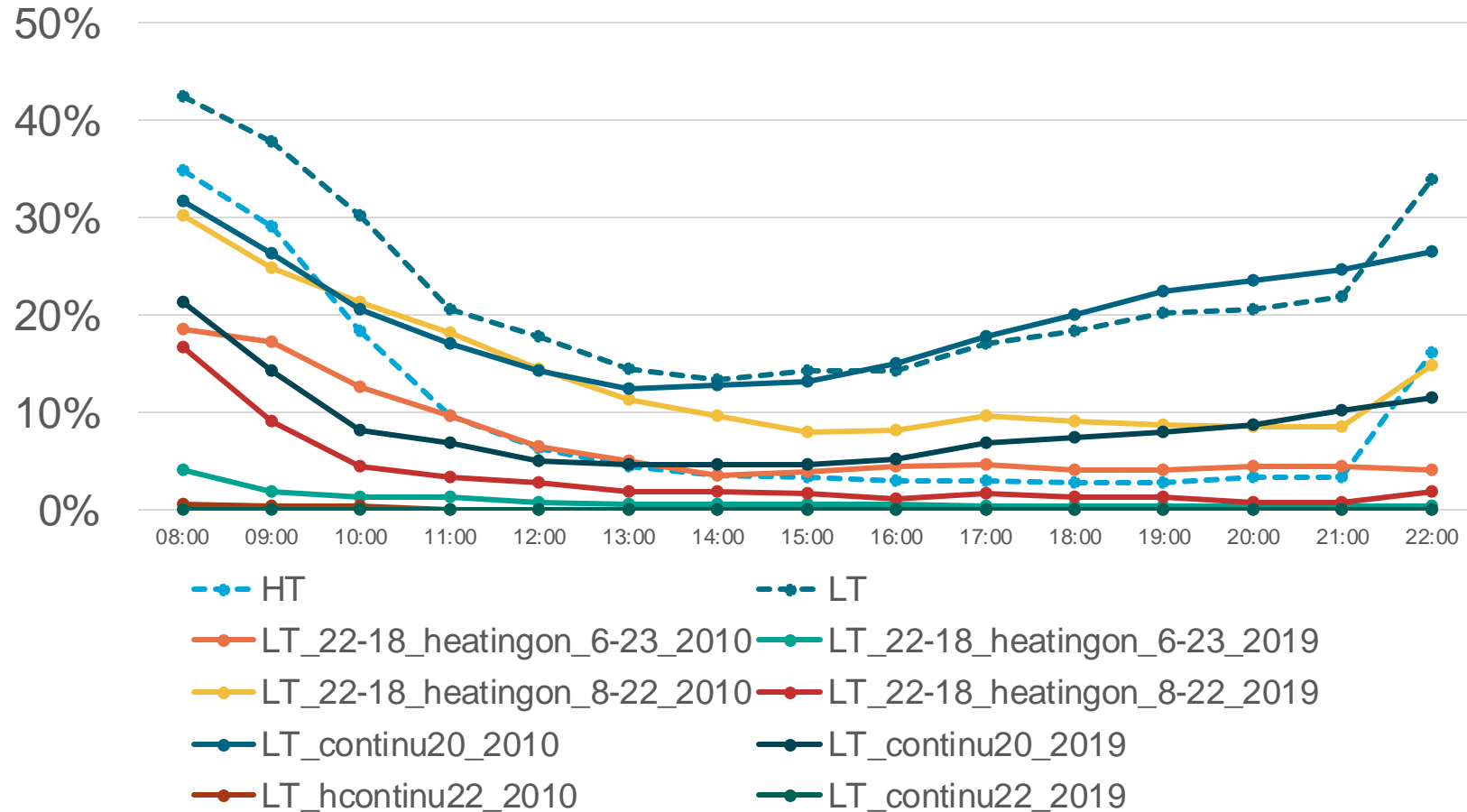
High temperature heating



Low temperature heating



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



Comfort

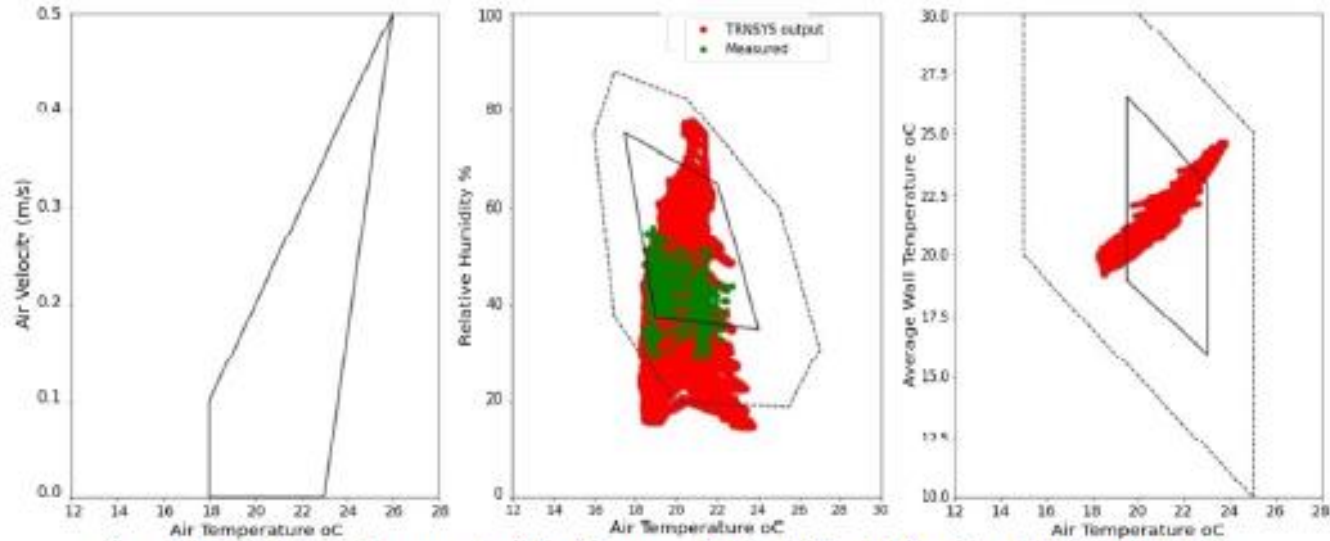
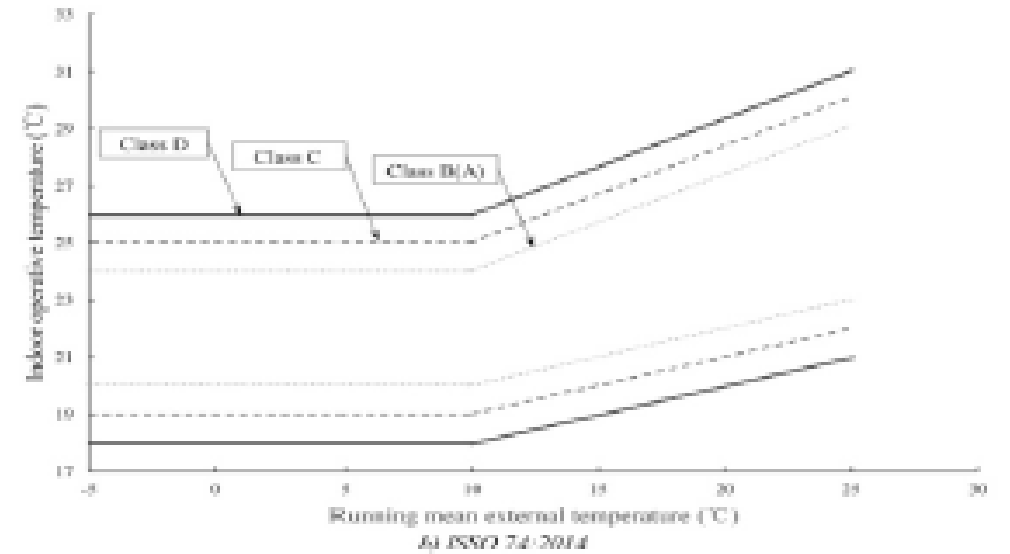
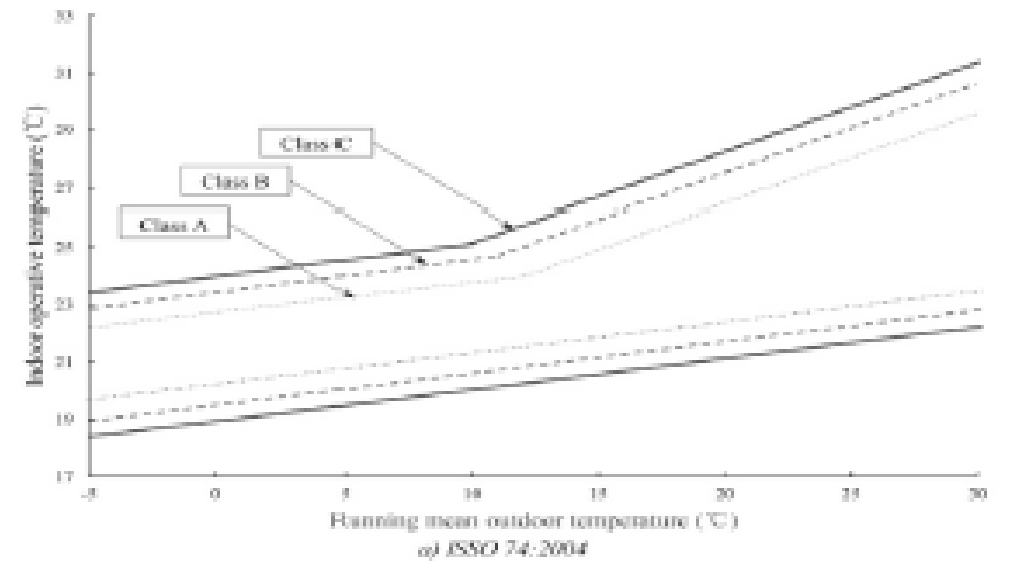


Figure 5.65: Individual comfort parameters in the living room with LT underfloor heating with updated façade properties

By: Victor Ghering



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

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

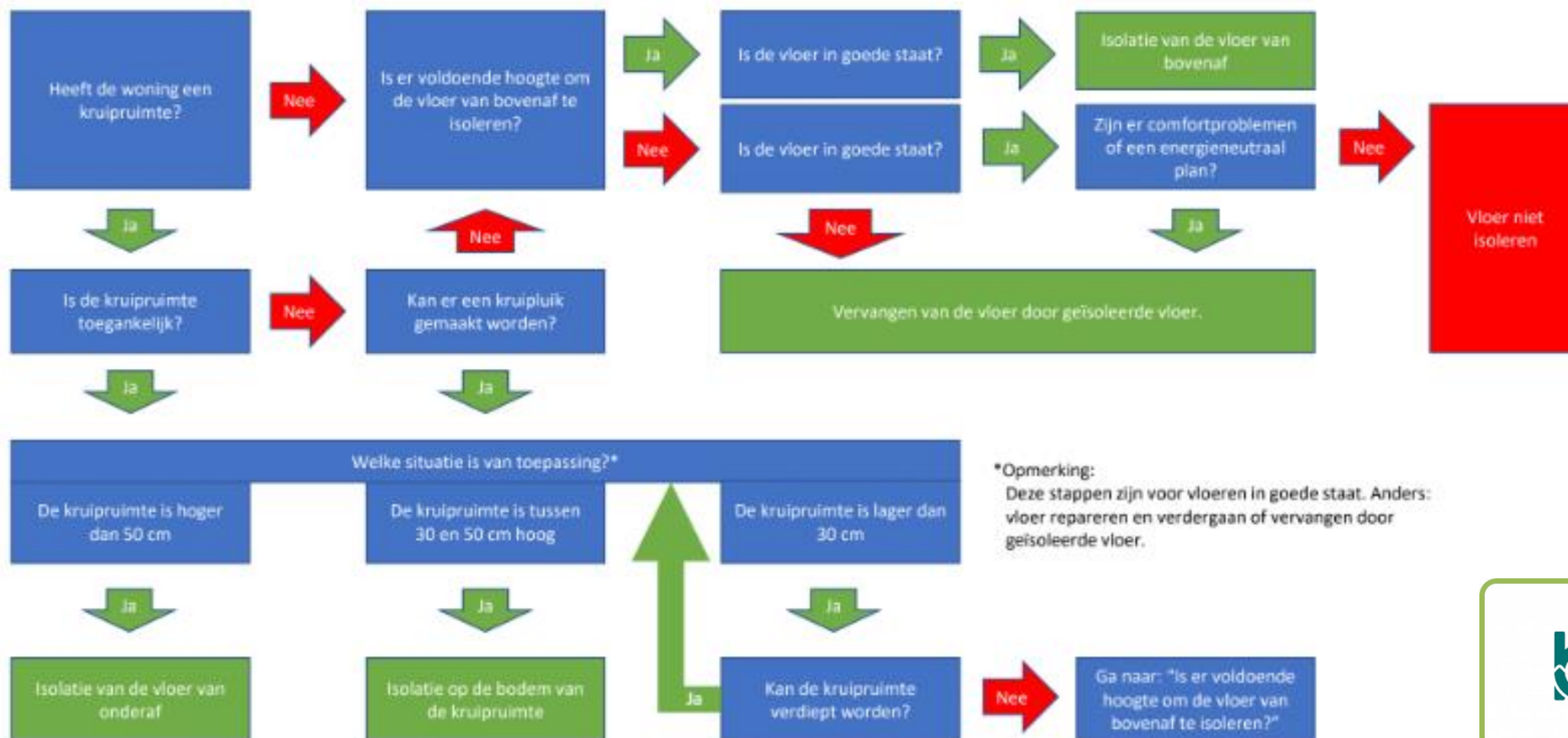
Alternative:

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)

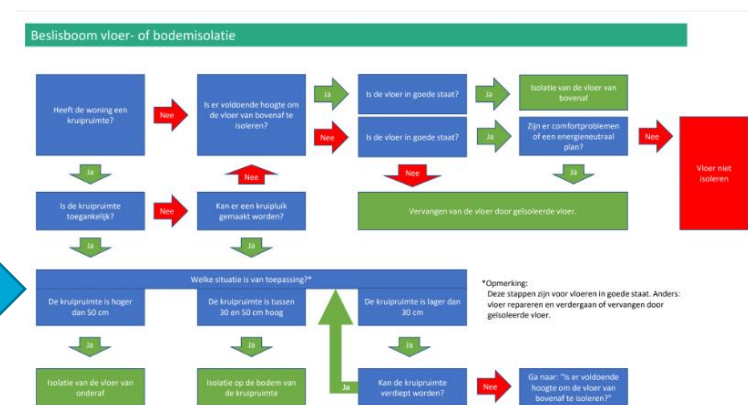
Technical aspect – decision trees

Beslisboom vloer- of bodemisolatie

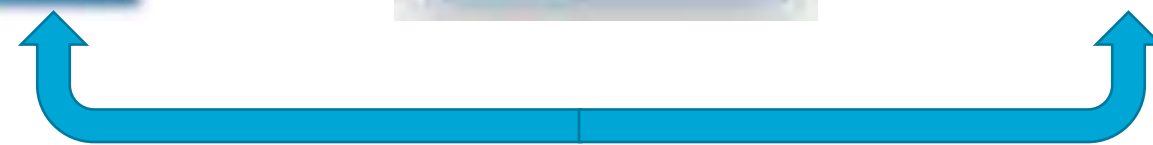


LT-ready tool

- 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



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

With Thanks to:

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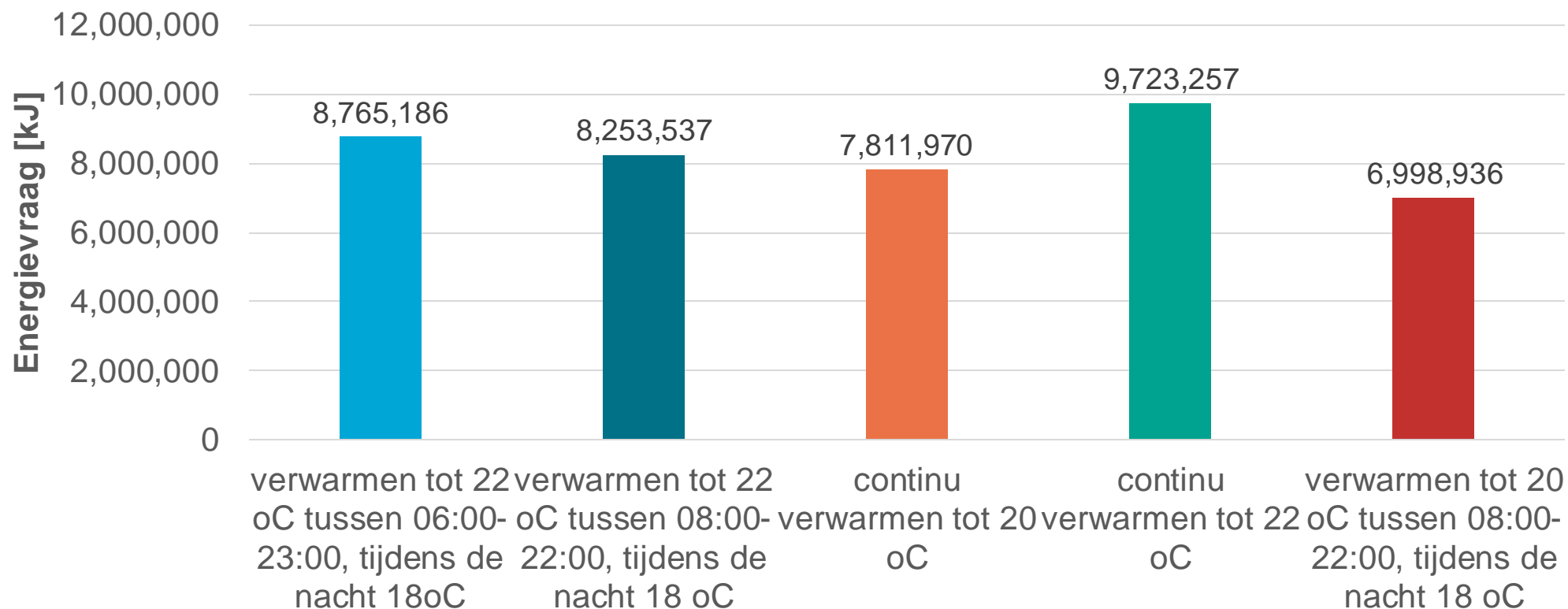
Victor Ghering;

Martin Tenpierik;

Regina Bokel



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



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

