WARMINGUP

Innovatief Duurzaam Warmtecollectief

# How low can you go?

14/10/2021

# Goal

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2050 carbon neutral  and affordable => sustainable heat!

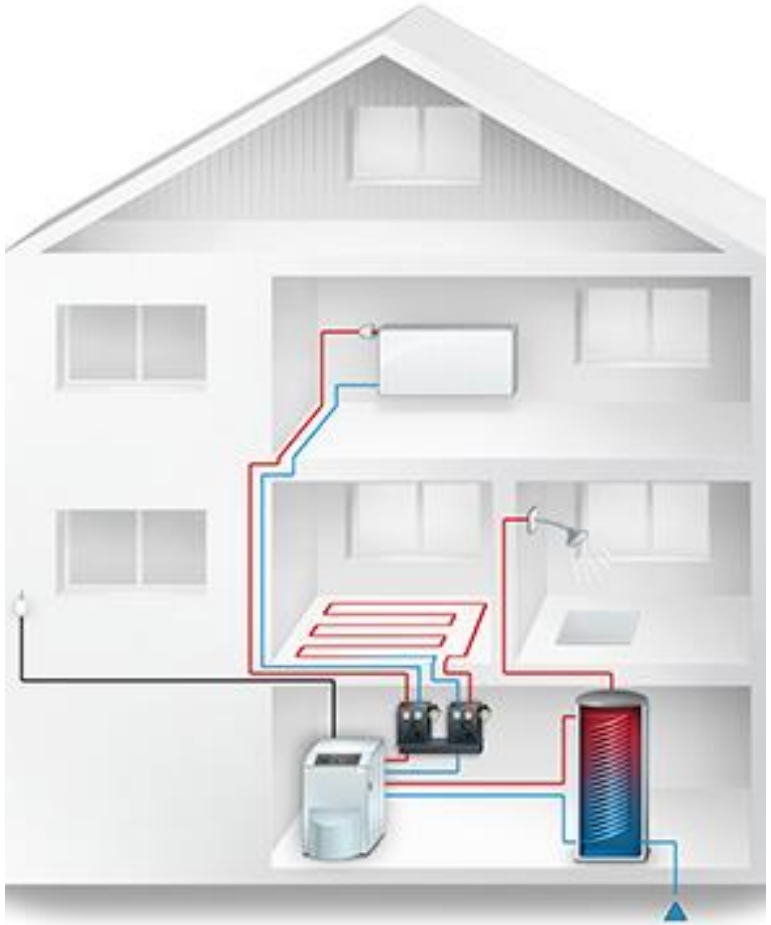
Are houses ready? Hypothesis overdimensioning.

Lower temperatures

⇒Sustainable supply

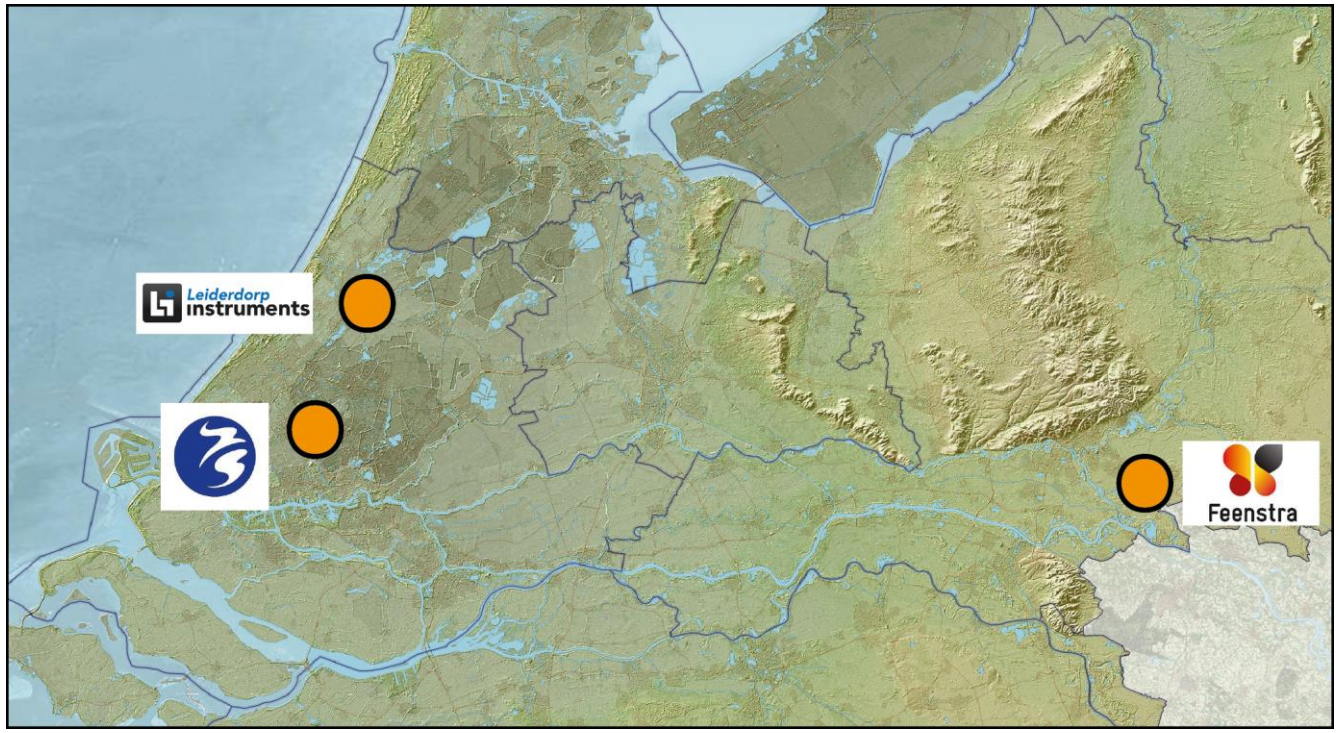
⇒Less Energy losses/more effective systems

⇒Overcapacity so less renovation costs



# WUP2A in time and space

*Website: warmingup.info*




2020

Zomer — Opzetten database met woningen - steekproef
Organiseren meetcampagne

Herfst — 220 deelnemers

Schouw

Inregeleling warmtesysteem
+ installatie meetapparatuur

2021

Winter — Meting 1 +
feedback warmte comfort

Zomer — Data analyse
minimale temperatuur

220 deelnemers
controlegroep

Herfst — Aanvoertemperatuur
verlagen

2022

Winter — Meting 2 +
feedback warmte comfort

Lente — Data analyse
minimale acceptabele temperatuur
+ demonteren

# Approach: measurements

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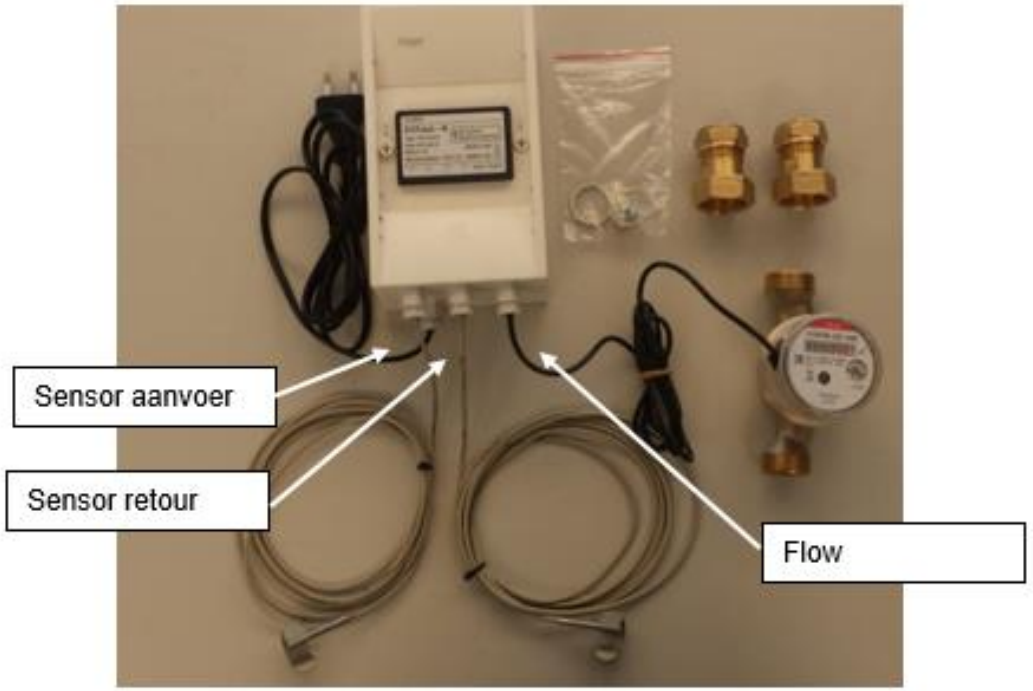
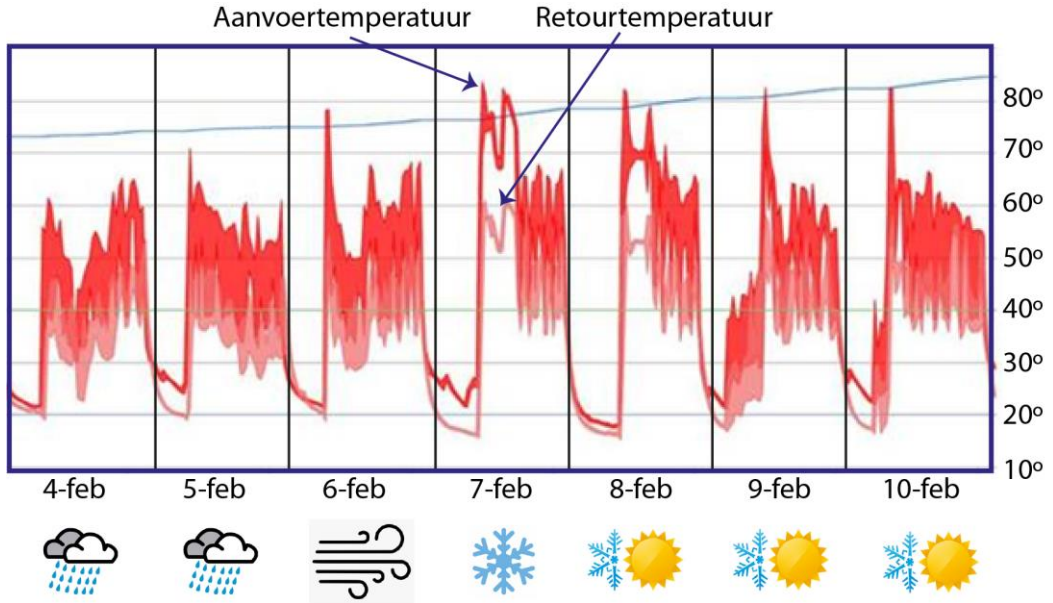
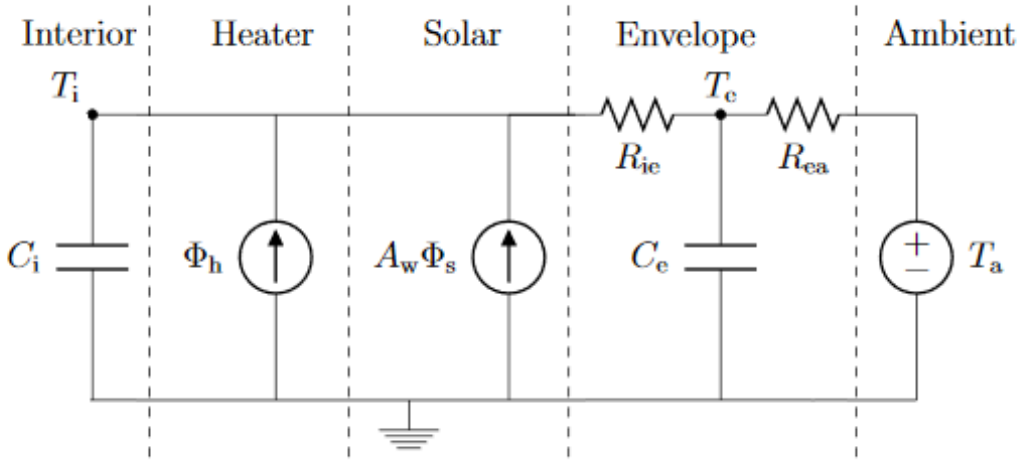
- 40 households dataset winter 2021



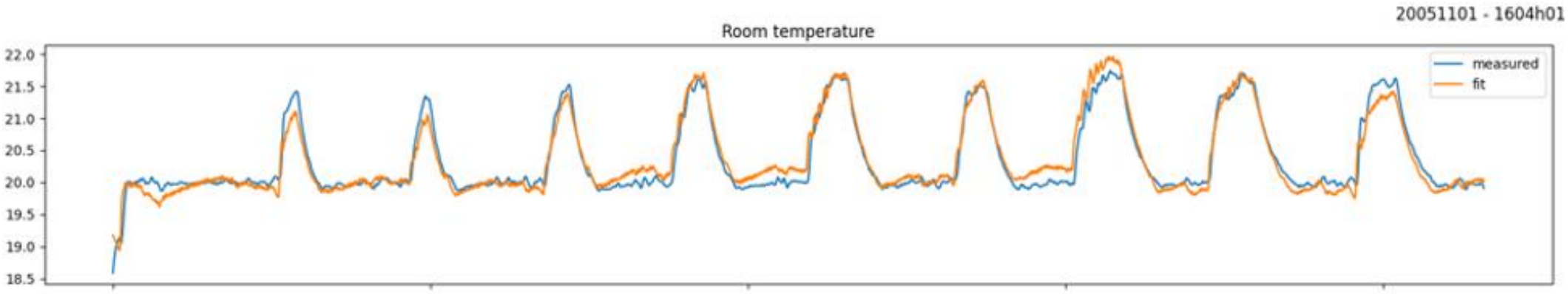



# Approach: lumped RC model and fitting




**Steady state heat supply:**

1. Fit 2R2C-model on three 10-day periods
2. Determine heat flux for steady state design conditions (-10 C outside, 20 C inside, no solar influx)
3. Margin of 24 / 18 (i.e. supply in 18 hr)



# Approach: lowest supply temperature

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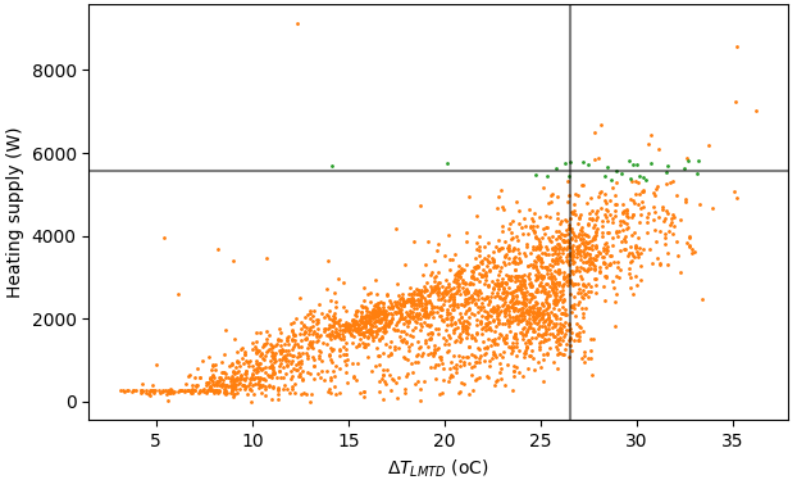
1. Steady state heat supply RC-model
2. Select at least 1% of data points around steady state heat supply **60-min** averaged input data.
3. Get 25th percentile of dT_LMTD
4. Get 25th percentile of dT
5. Solve optimization problem:

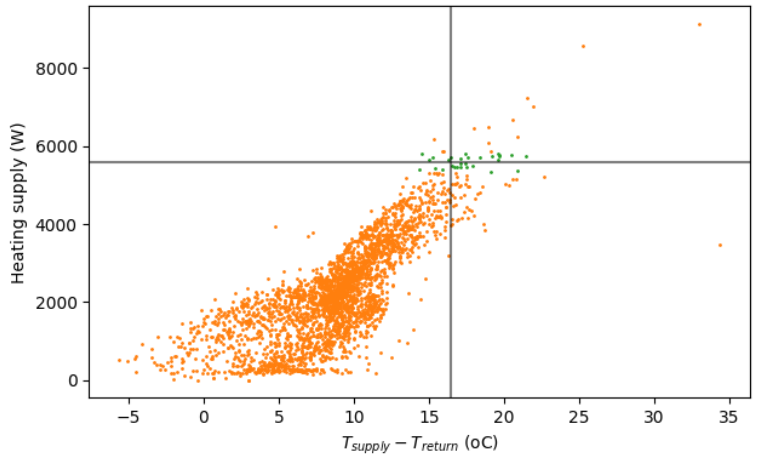
$$min \quad T_{supply}$$

$$s.t. \quad \Delta T_{LMTD} \geq \Delta T_{LMTD,25th}$$

$$T_{supply} - T_{return} \geq \Delta T_{25th}$$

$$\Delta T_{LMTD} = \frac{T_{supply} - T_{return}}{\log\left(\frac{T_{supply} - T_{indoor}}{T_{return} - T_{indoor}}\right)}$$



# Results: The search for patterns

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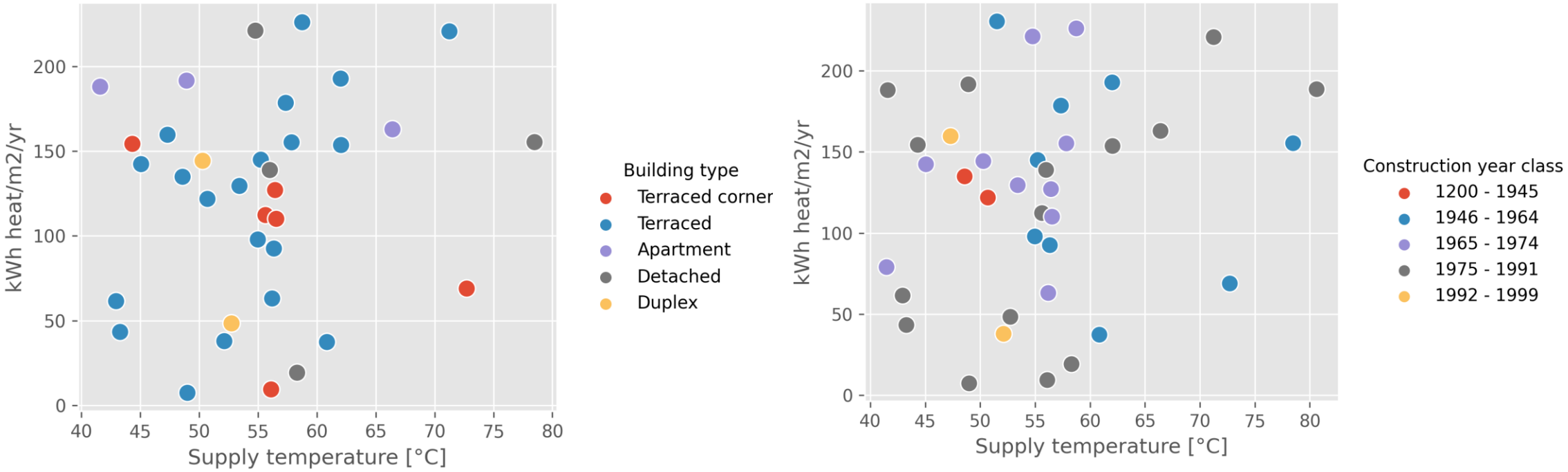

# Follow-up

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- Validate RC model against detailed house model
- October: T lowering 40 households + monitor comfort for all households – control group
- December: calculate lowest T for all households
- Januari: T lowering for all households + monitor comfort in 2 steps for 180 woningen
- March-July: data analysis and publication
- 1 year longer? Higher chance cold periods + analysis impact ‘inregeling’ + link Tsupply ⇔ relevant parameters (Kwhm2?)