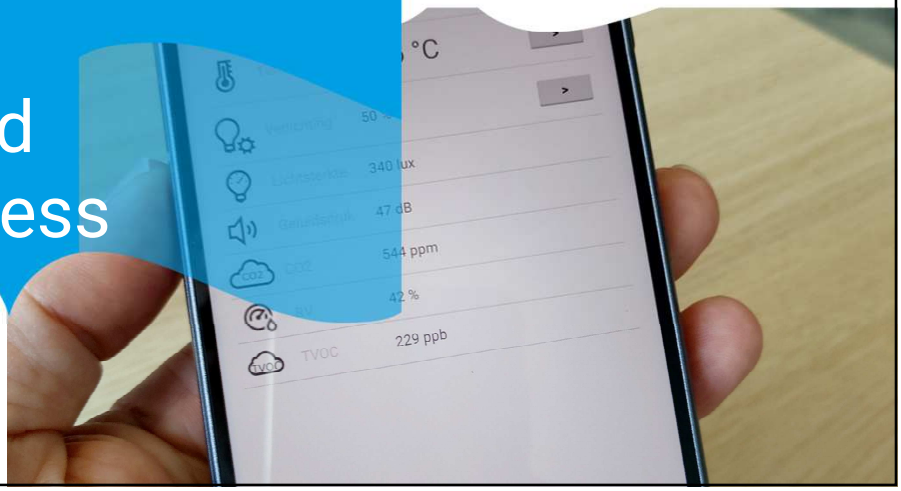
DWA

Case Study

Evaluation of Comfort Apps Its Use and Effectiveness



12 January 2023
Kees Wisse

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After Retrofit

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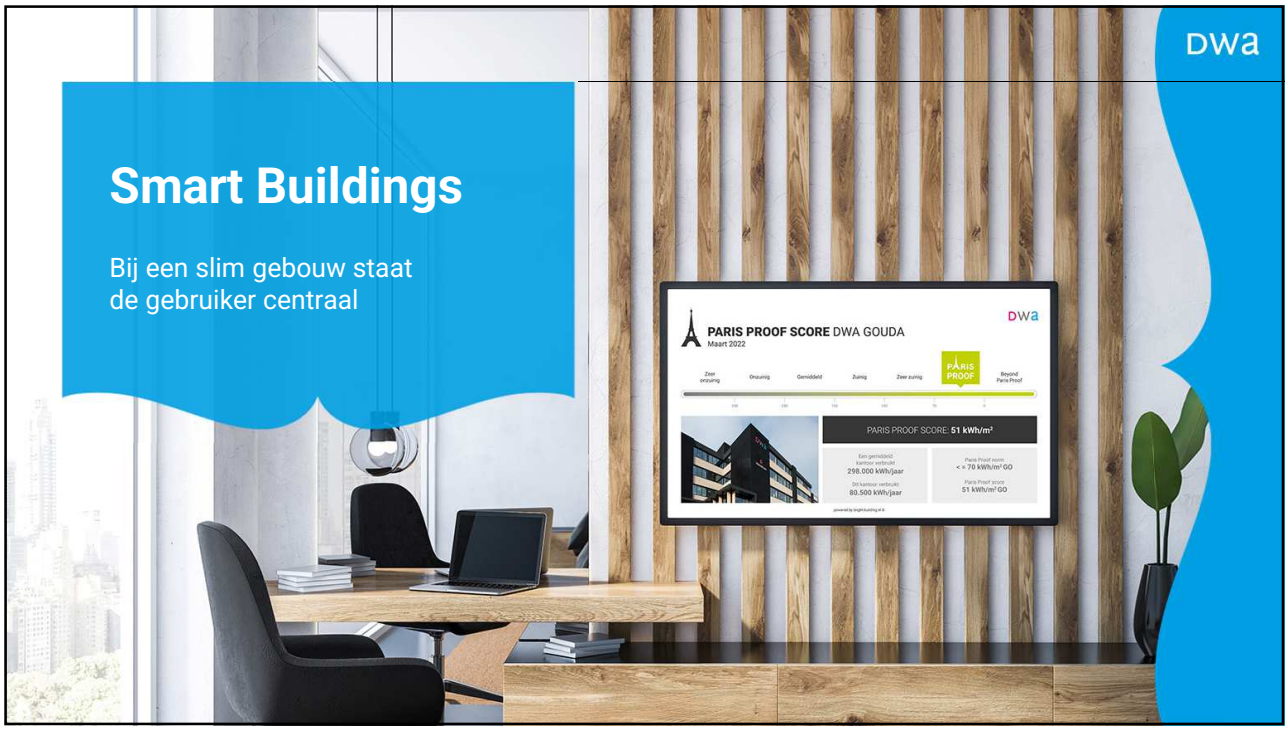
DWa
Smart Buildings
Bij een slim gebouw staat
de gebruiker centraal
PARIS PROOF SCORE DWA GOUDA
Maart 2022
DWa
PARIS PROOF
PARIS PROOF SCORE: 51 kWh/m²
208.000 kWh/jaar
80.500 kWh/jaar
< = 70 kWh/m² GO
51 kWh/m² GO

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Personal Comfort
Personal preferences may differ from standards
Intelligent buildings 'respond' to their occupants
Comfort guideline ISSO 74:
Class B + personal control = Class A
23,3 °C

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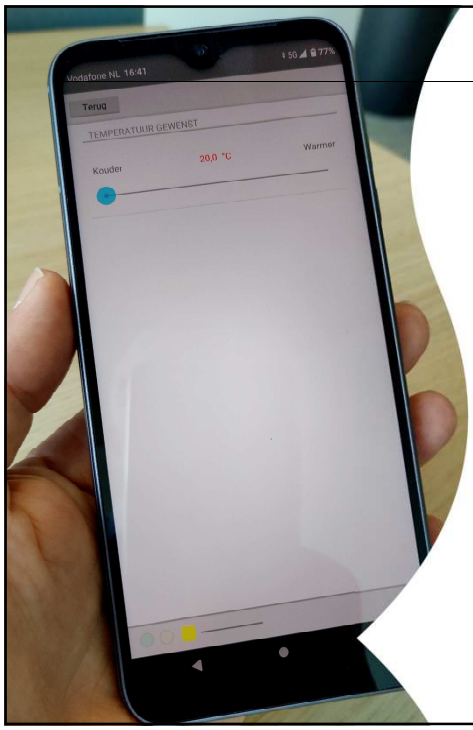

Bezit van de zaak…einde vermaak?

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Research questions

- How often is the app used?
  - *Identify consistent patterns?*
  - *Does the app use 'disturb' the regular operation*
- Relation with objective KPI's
  - *Is the app usage related to objective comfort (Adaptive Thermal Comfort standard)?*
- Effectiveness of the app requests
  - *Do users get what they have asked for?*

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Relation to Workpackages Brains for Buildings

- Workpackage 2: Energy flexibility and Model Predictive Control
  - *Do we have to incorporate the app usage in prediction models?*
  - *What freedom do we have for Model Predictive Control / Energy flexibility related to the thermal comfort range / user requirements?*
- Workpackage 1: Fault Detection; Workpackage 3: User Interfaces
  - *Implicit evaluation of the thermal comfort / fault detection*
  - *Objective comfort related to data from occupants*
  - *Lessons learned user apps*

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Case Study

Data 47 sensors

Evaluation period: 1 Januari 2021 – 1 Juni 2022

On 3’ basis

- *Indoor temperature*
- *Presence of people*
- *Setpoints heating + cooling*
- *Setpoint modifications via App*

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Eerste kantoor met gecertificeerd Binnenklimaat Label

vrijdag 1 oktober

2 min

KLIMAATTECHNIEK | ARTIKEL | BINNENKLIMAAT

Indoor Climate Label A

Survey / continuous monitoring / inspection

In Gouda is het kantoorgebouw van DWA als eerste in Nederland voorzien van een gecertificeerd Binnenklimaat Label. Het gerevitaliseerd kantoorgebouw ontving meteen het hoogst haalbare label: Binnenklimaat Label A ‘zeer goed’. Met dit nieuwe label kunnen zowel gebouweigenaren als werkgevers aantonen dat de werkplek gezond en comfortabel is.

Bron: Duurzaam gebouwd

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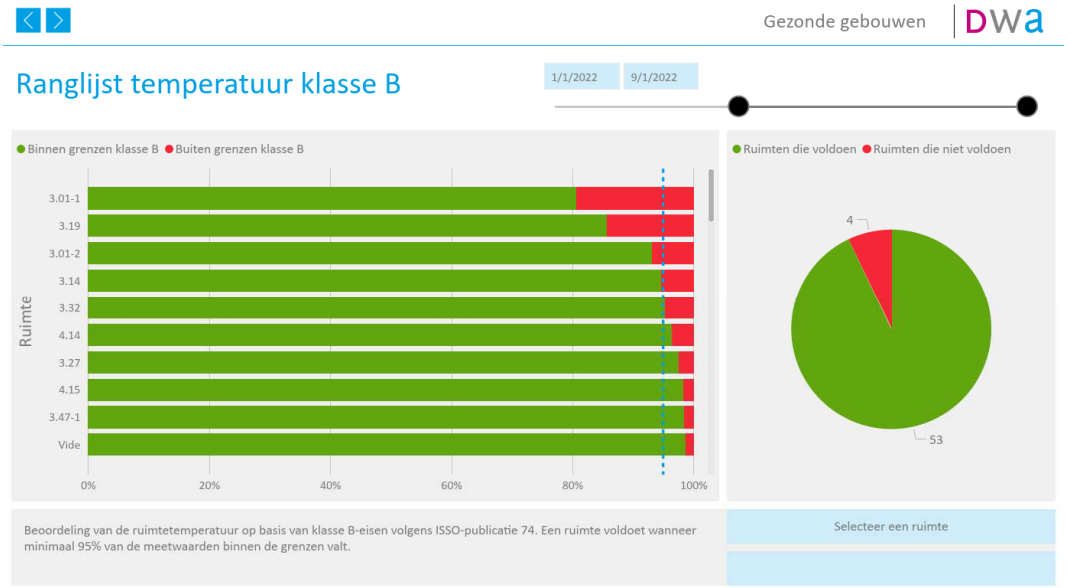
Comfort Perfomance Adaptive Thermal Comfort Limit



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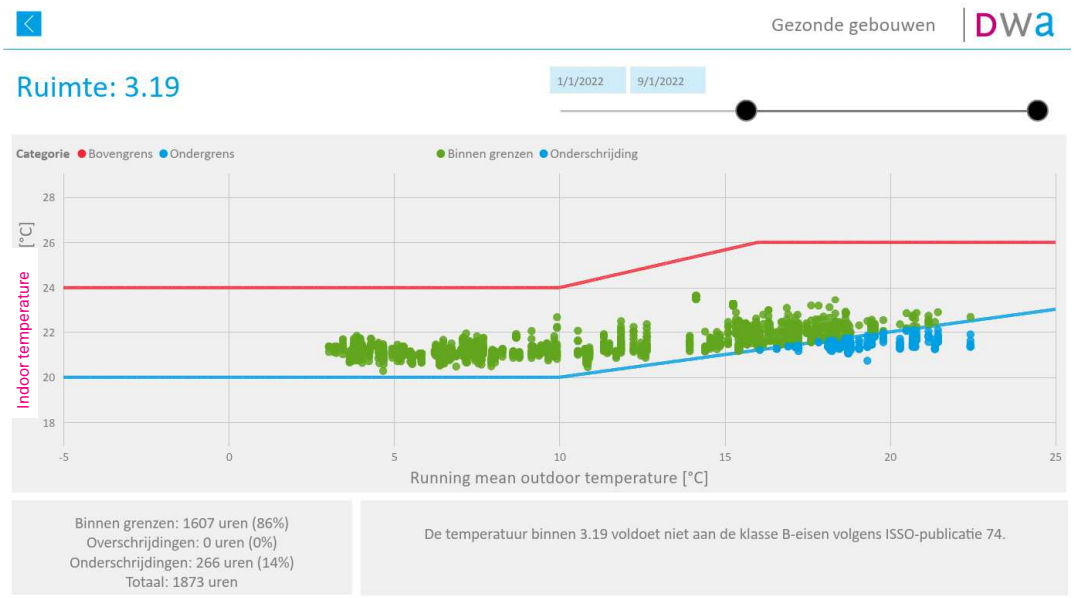
Example ATC Performance



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Do We Use the App?

Yes!

But when and how often?

- *On winter days up to 16% of the occupation time*
- *On summer days up to 15% of the occupation time*

On annual basis: 5% of the occupation time

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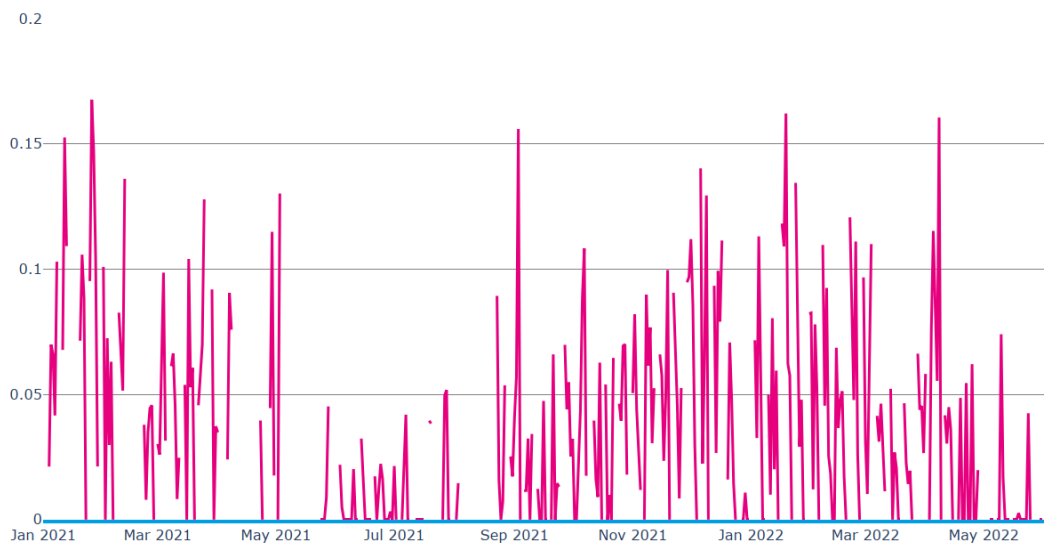
Fraction of Occupation Time (Daily) – Request Higher Temperature



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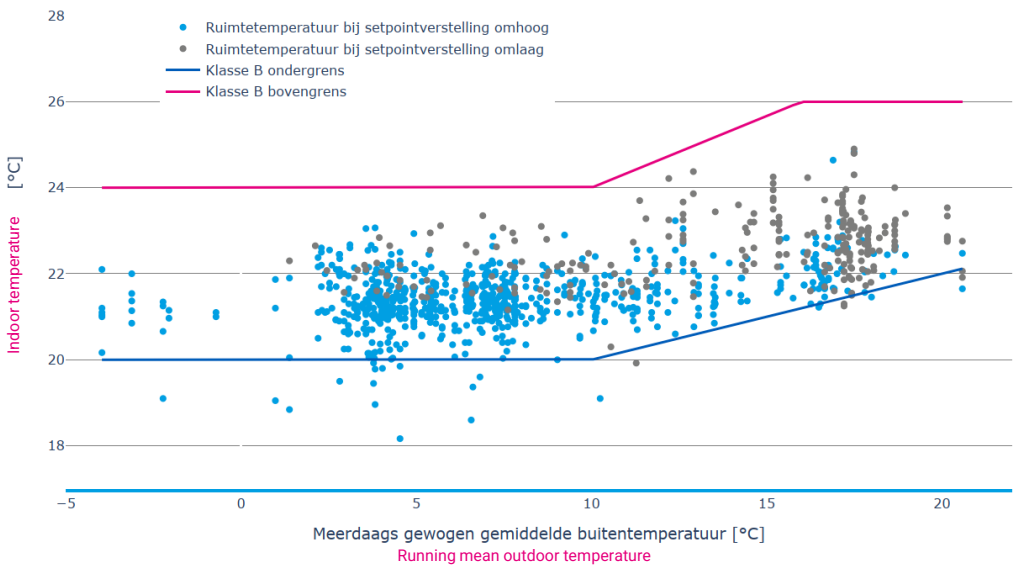
Room Conditions During 'Pushing the Button'



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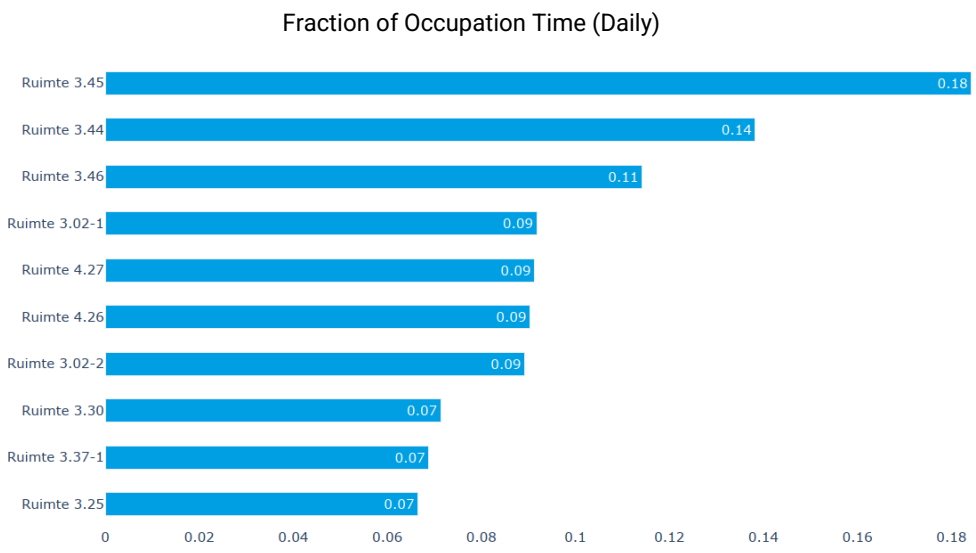
Top 10 Setpoint Modifications (Room Level)



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Intermediate Evaluation

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App usage

- The app is used, but not in an excessive way
  - *Different between rooms (-> personal preferences): up to 18% op annual basis*
  - *Averaged on annual basis: 5%*
  - *Does not disturb regular operation*

- Even when the comfort is 'within the limits', ie satisfies class B, users have individual preferences and like to modify the thermal comfort
- Be careful with utilizing the entire comfort band with Model Predictive Control

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Do Users Get what They Ask for?

- Reasonable requests?
- Sustainability and its impact on energy consumption

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Reasonable Impact?

Following Adaptive Thermal Comfort Standard ISSO 74

- Winter setpoint 21°C (recommended)
- Summer setpoint 24,5°C (recommended)

- +/- 2°C around setpoints
- Thermostat speed 2°C

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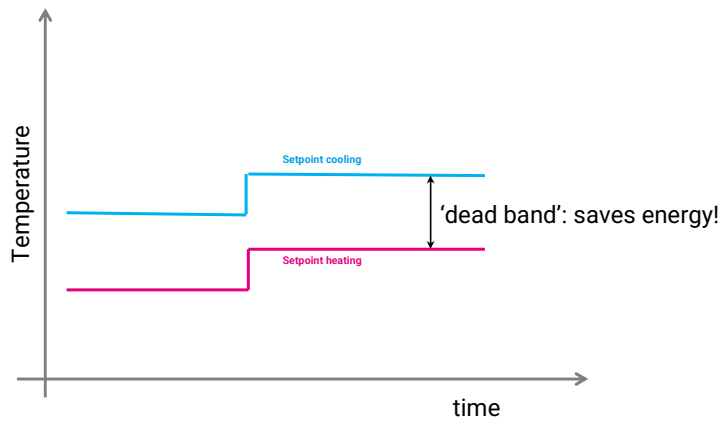
In Practice: Two Setpoints + 'deadband'

Energy savings related to impact



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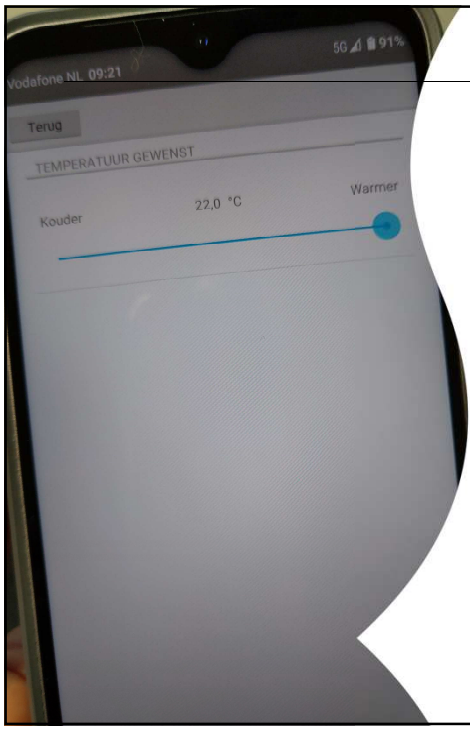

How it Works in Practice

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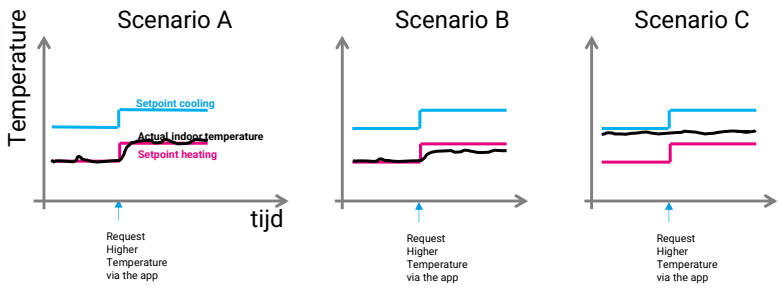
What you see <--> What you get

App request has the DESIRED effect

App request has LIMITED effect

App request has NO effect



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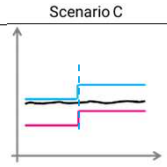
Limitations due to Control Strategy ('deadband')



	Effect (desired or limited)	No effect due to 'deadband'
Request for a higher temperature	70%	30%
Request for a lower temperature	40%	60%

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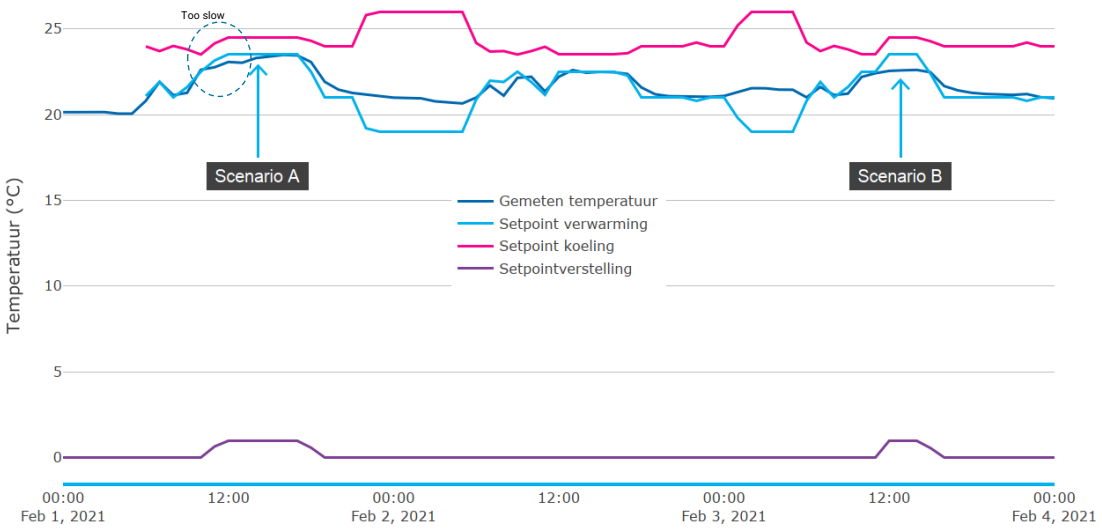
Scenario A: Desired Effect; Scenario B: Limited / Minimal

Assessment using hourly values



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Evaluation

	Fraction of time
Request for a higher temperature	22% setpoint heating not reached
Request for a lower temperature	24% setpoint cooling not reached

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Lessons Learned App Effectiveness

- Providing feedback to the users will help
  - *When / why the system cannot provide the requested temperature*
- Find a way to deal with the 'deadband' control strategy
- Adress these topics during the early and final design

Further reading? Wisse, C.J., Evaluatie klimaatklasse A in de praktijk, TVVL-magazine december 2022

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