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Retrofitting -> smart building

Smart Buildings: Some Easily Forgotten Issues

April 21 2022
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DWA: Making Sustainability Work

GOUDA VEENENDAAL RIJSEN AMSTELVEEN

ruim **120** professionals

Strategisch advies
Energy transition

Smart buildings

Monitoring en analytics
Building services

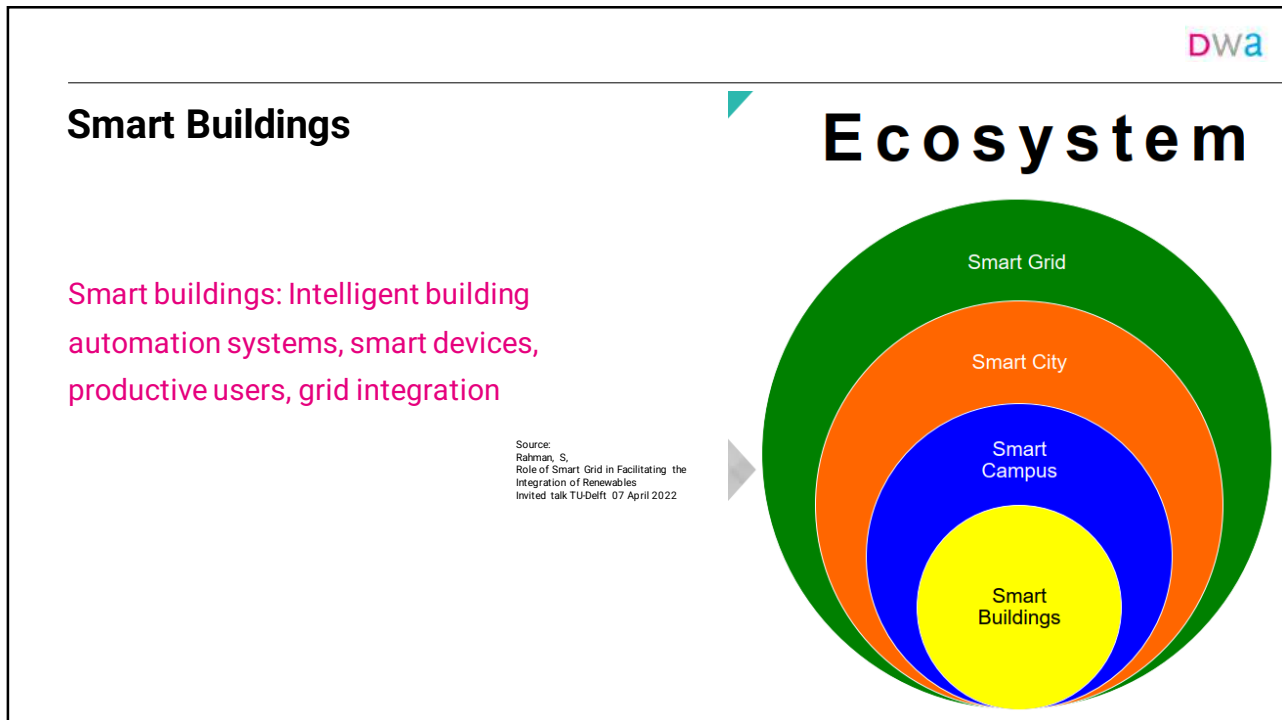
Building services
Commissieoning

Gezonde gebouwen

Verduurzaming gebouwen en gebieden
Energy transition

Beheer en onderhoud
Building services

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Designing and Operating Smart Buildings

A Multidisciplinary Approach

- Mechanical systems, the potential and its limitations
- Intermezzo: beware of the quality of your data
- How business models can change current practice
- A business case
 - *Load shifting*

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'Hardware' of the Building for Heating, Cooling, Ventilation (1)

Heat Pumps / Aquifer storage / Hydronic Circuits / Buffer Tanks

Air Handling Units

Source: DWA

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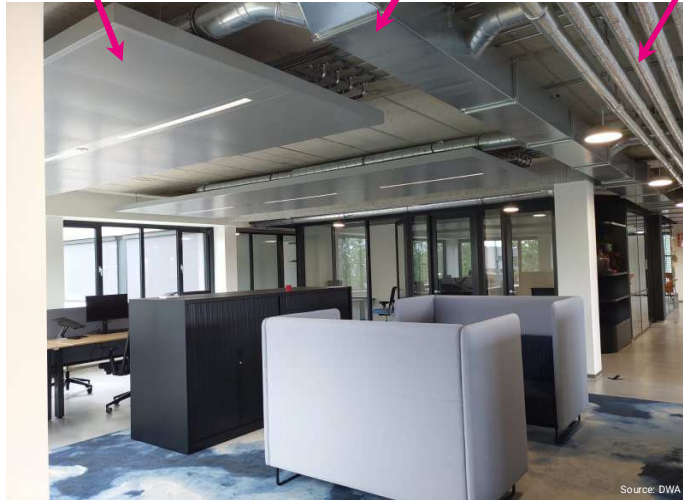
'Hardware' of the Building for Heating, Cooling, Ventilation (2)

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Room Supply Heating /Cooling

Air Distribution
(for Ventilation)

Piping (Water)



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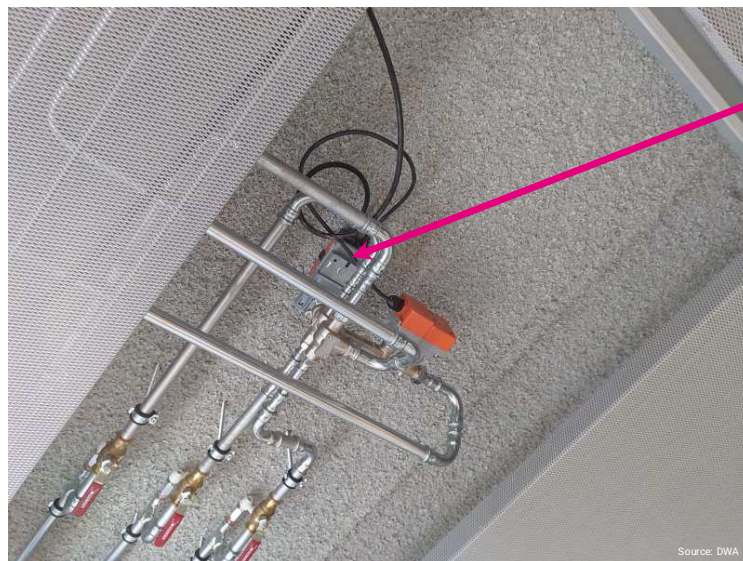
Source: DWA

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Flexible Heating and Cooling Supply (Water Circuit)

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Depending on the User and Room Requirements



Valves
to
Supply
Heating
or
Cooling

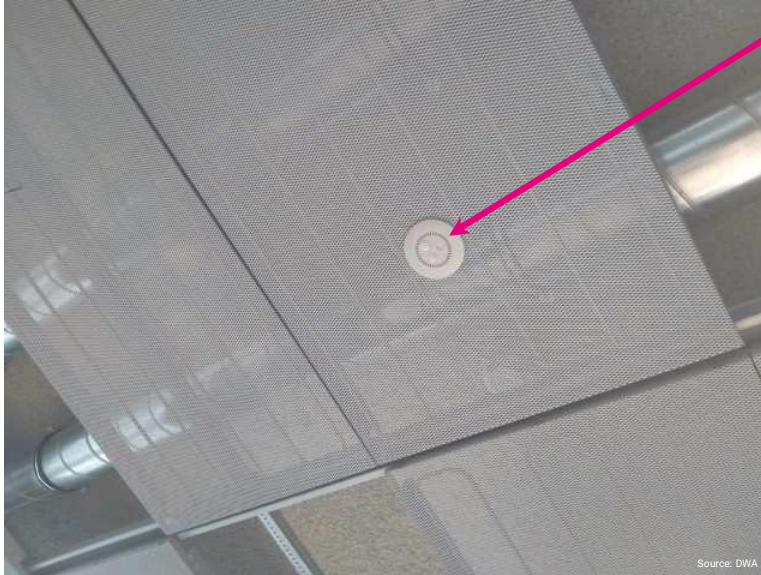
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Source: DWA

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The 'Eyes' of the Building: Sensing

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- Multi-sensor
- Occupancy
- Air quality
- Humidity
- Temperature
- Light
- Sound

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Source: DWA

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Personal Comfort Smart Buildings

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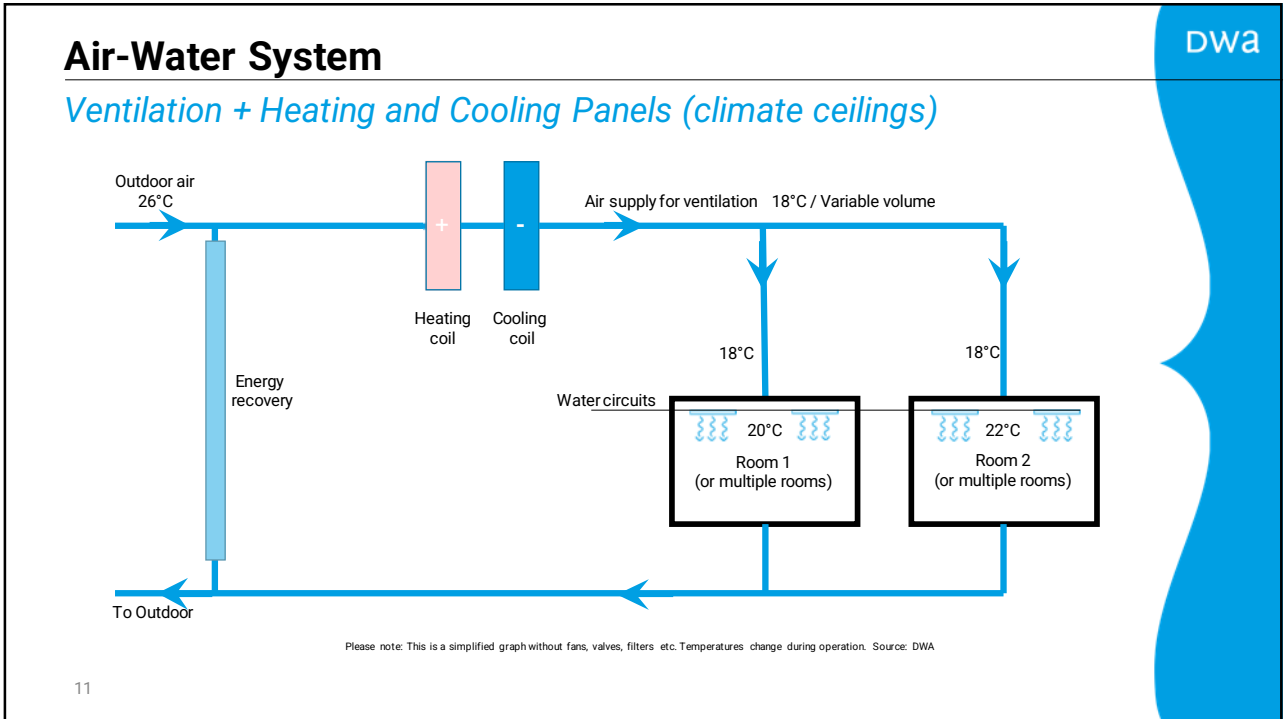
Personal preferences may differ from standards
Intelligent buildings 'respond' to their occupants

Suitable 'hardware' of the building!



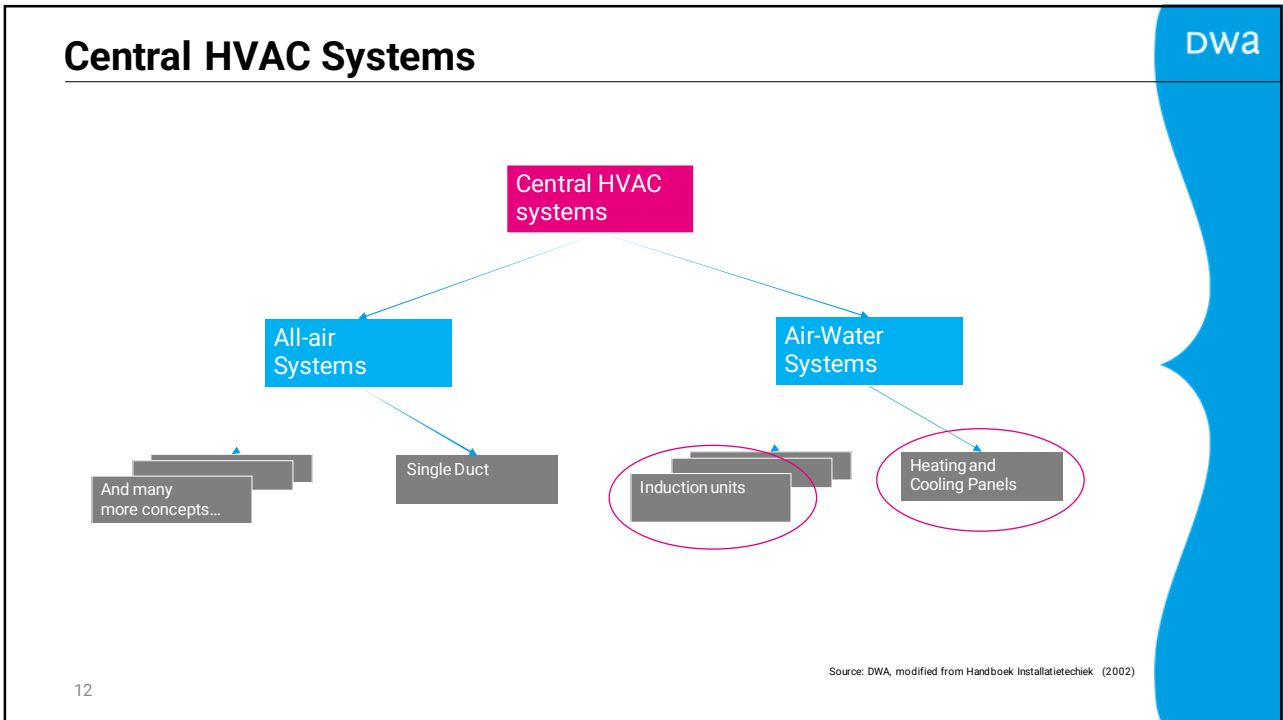
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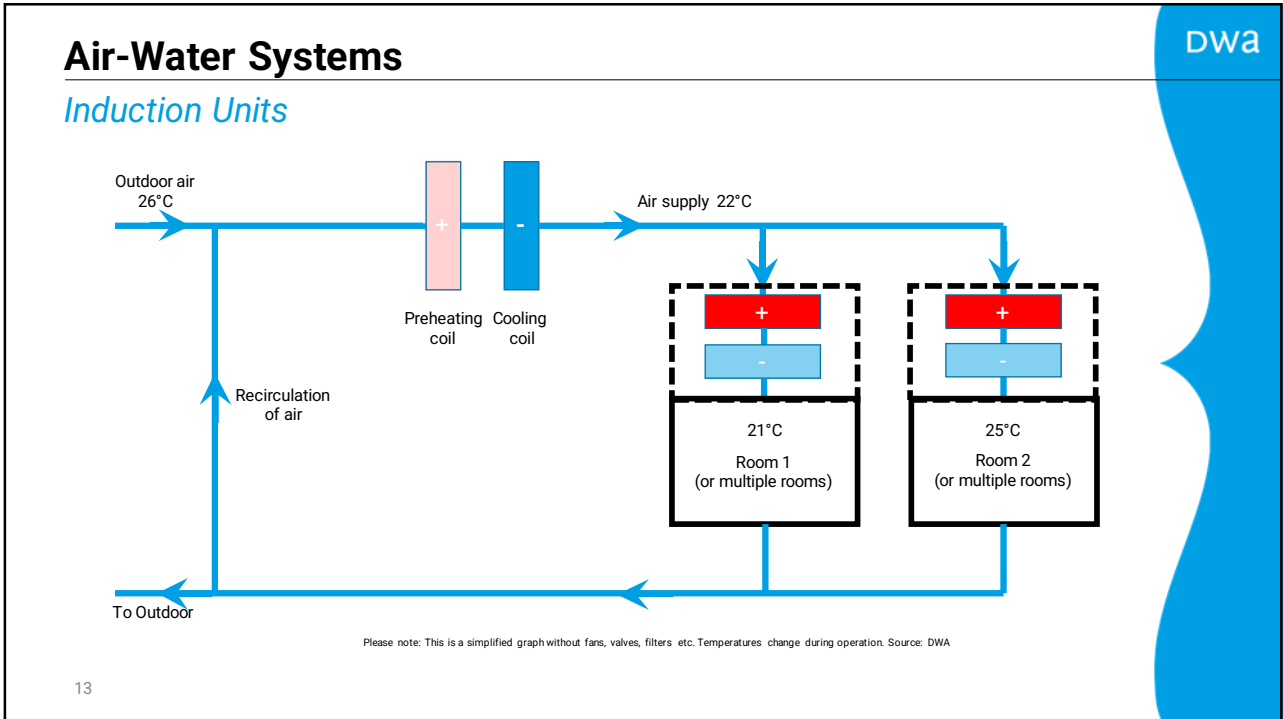
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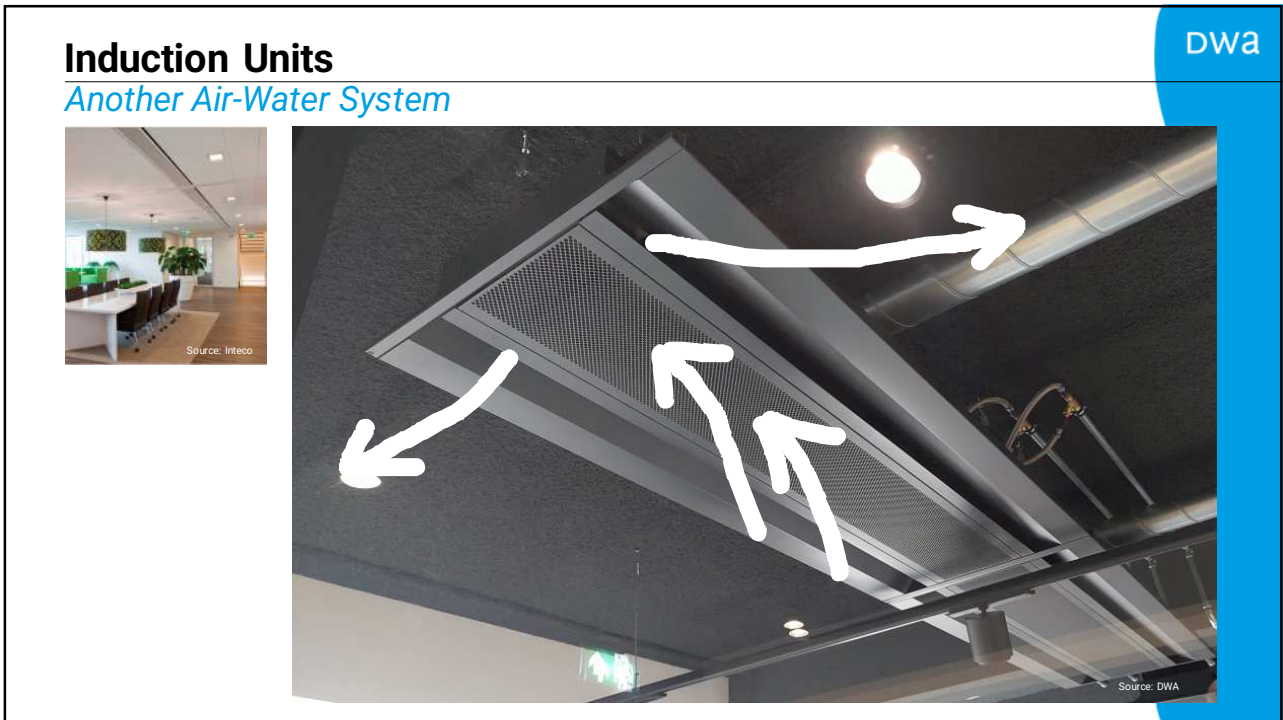


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Smart control in the built environment

Don't forget the limitations of the mechanical systems

Existing buildings: not that flexible

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Further learnings

Data quality: check, check, check

Metadata / tagging of data and the human factor

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Data Quality, Challenges and Solutions

Increasing number of sensors in buildings

Every multi-sensor:

- > 7 parameters
- multiple disciplines
- *different sensor anomalies*

Symptom detection - options

- Rule based
- Machine learning

ppm

Time

rule based

based on machine learning

Deviating CO2-sensor

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Multi-sensor Anomaly Detection

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Eye on 2030 Towards digitalized, healthy, circular and energy efficient HURC

REHVA 14th HVAC World Congress
22nd – 25th May, Rotterdam, The Netherlands

Health monitoring: a machine learning approach for anomaly detection in multi-sensor networks.

Bram Hajee ^a, Kees Wisse ^a, Peyman Mohajerin Esfahani ^b

^a DWA, The Netherlands

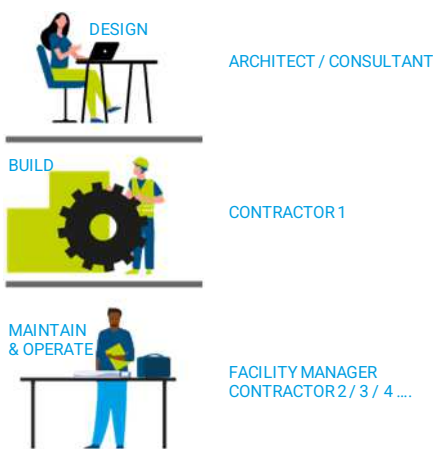
^b Delft Center for Systems and Control, Delft University of Technology

Abstract. Multi-sensor networks are becoming more and more popular in order to assess the post-occupancy performance of smart buildings, since they enable continuous monitoring with a high spatial resolution of the occupancy, thermal comfort and indoor air quality. An urgent, but poorly attended topic in this field is the automated detection of sensor anomalies. For

More Attention for Data Quality by Changing Business Models

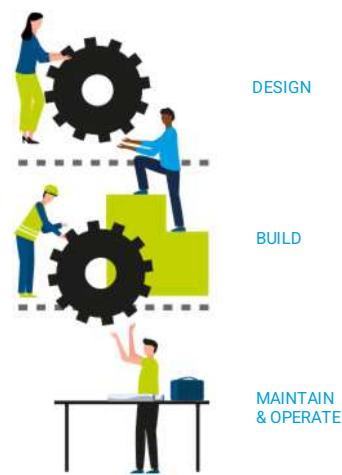
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Conventional Approach: Splitted Responsibility



Upcoming Approach: Integral Responsibility

Consortium | Architect | Consultants | Contractors

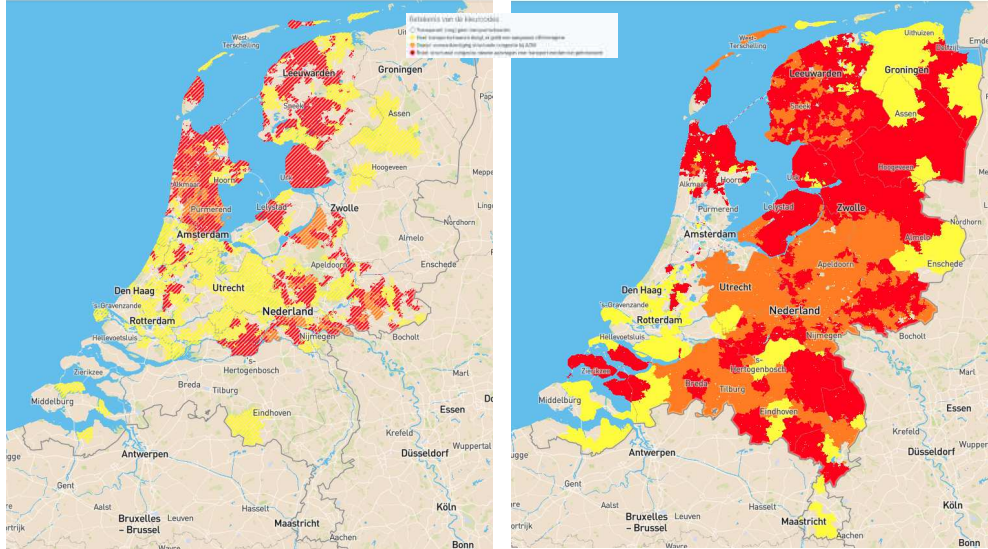


Business Case: Load Shifting

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Capaciteitskaart afname elektriciteitsnet
Biggewerkt: 04-04-2022 08:11

Capaciteitskaart invoeding elektriciteitsnet
Biggewerkt: 04-04-2022 08:11



Source: <https://capaciteitskaart.netbeheer.nl/>

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Understanding Demand Profiles

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Building systems, occupants, EV chargers, heatpumps, PV



Source: DWA

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Understanding Demand Profiles

Conclusions

- Due to PV solar, electric vehicles and heat pumps demand profiles get more and more complex
- Many, many concepts for the mechanical systems
 - *Each concept has its own potential and limitations for energy flexibility*
 - *HVAC Heating Ventilation Air Conditioning*
 - *Developing models? Take care!*

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Summary

Brains for buildings

- *Must fit the available 'hardware'*

Data quality

- *Don't forget the basics*
- *Automated sensor anomaly detection*

Get people interested in the data

- *Change the business model*
- *Define the right business case*



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