

Data and digital tools for PEDs – challenge or support?

ATELIER Final Conference – Bilbao

March 12th 2026



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Data and digital tools for PEDs – challenge or support?

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Practical applications & limitations

Dr. Roberto Garay Martinez
University of Deusto

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No.864374



Practical applications & limitations

Applications

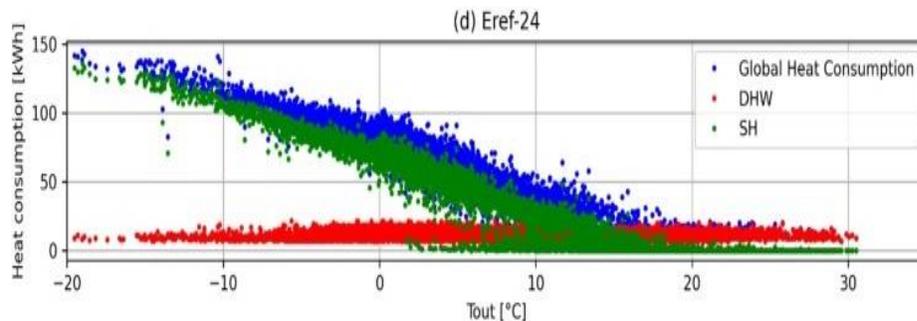
- Better understanding of heating/cooling/electric loads
- Optimization of energy distribution, while ensuring service levels
- Impact Assessment for the integration of RES

Limitations on data availability

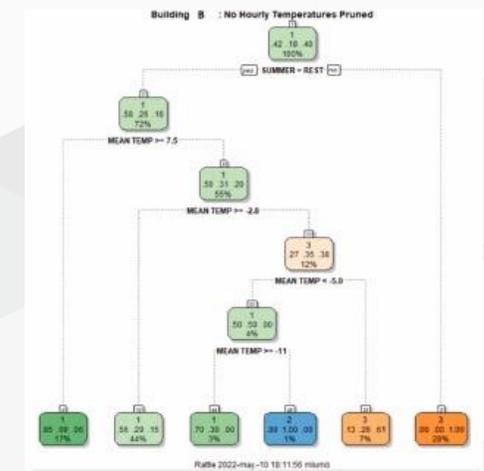
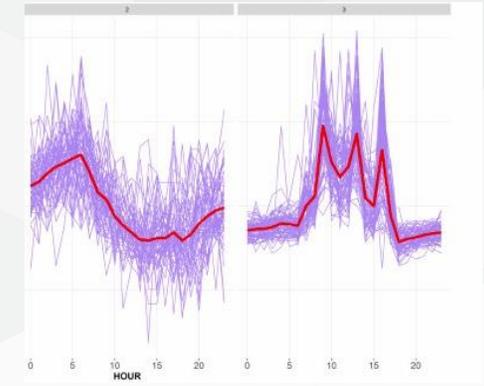
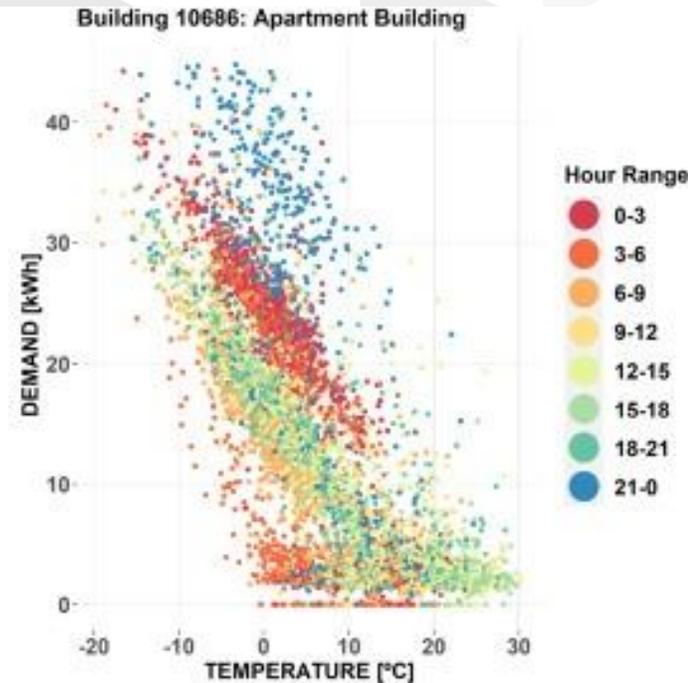
- Quality
- Availability
- Resolution

Better understanding of

- **loads** stable all-year-long?
- Is there a daily/weekly pattern?
- Holidays,...?
- Space heating vs DHW



Nicola Borgato, Sara Bordignon, Enrico Prativiera, Roberto Garay-Martinez, Angelo Zarrella, Enhanced methodology for disaggregating space heating and domestic hot water heat loads of buildings in district heating networks, Applied Thermal Engineering, 2025, <https://doi.org/10.1016/j.applthermaleng.2024.125296>

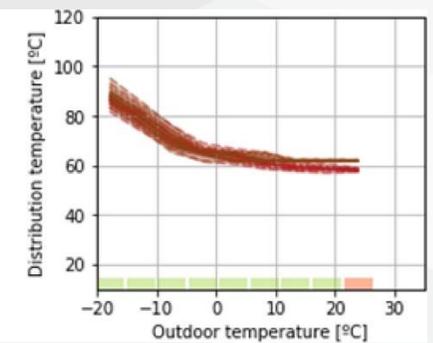
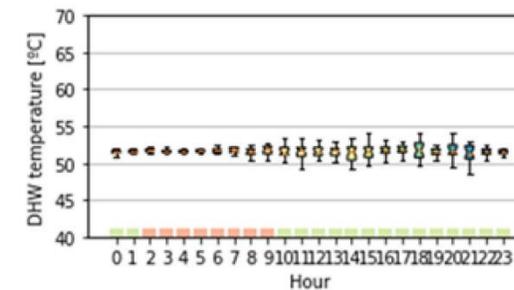
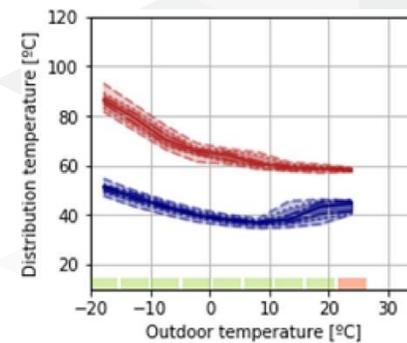
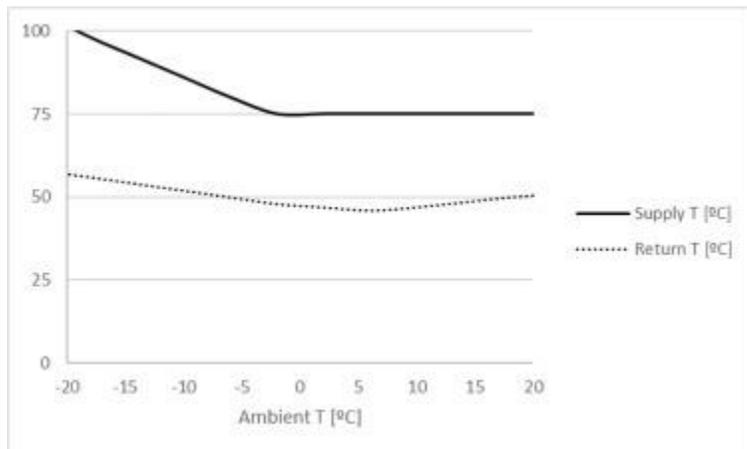


Mikel Lumbreras, Roberto Garay-Martinez, Beñat Arregi, Koldobika Martin-Escudero, Gonzalo Diarce, Margus Raud, Indrek Hagu, Data driven model for heat load prediction in buildings connected to District Heating by using smart heat meters, Energy, 2022, <https://doi.org/10.1016/j.energy.2021.122318>

Mikel Lumbreras, Gonzalo Diarce, Koldobika Martin, Roberto Garay-Martinez, Beñat Arregi, Unsupervised recognition and prediction of daily patterns in heating loads in buildings, Journal of Building Engineering, 2023, <https://doi.org/10.1016/j.jobee.2022.105732>

Optimization of DH distribution conditions

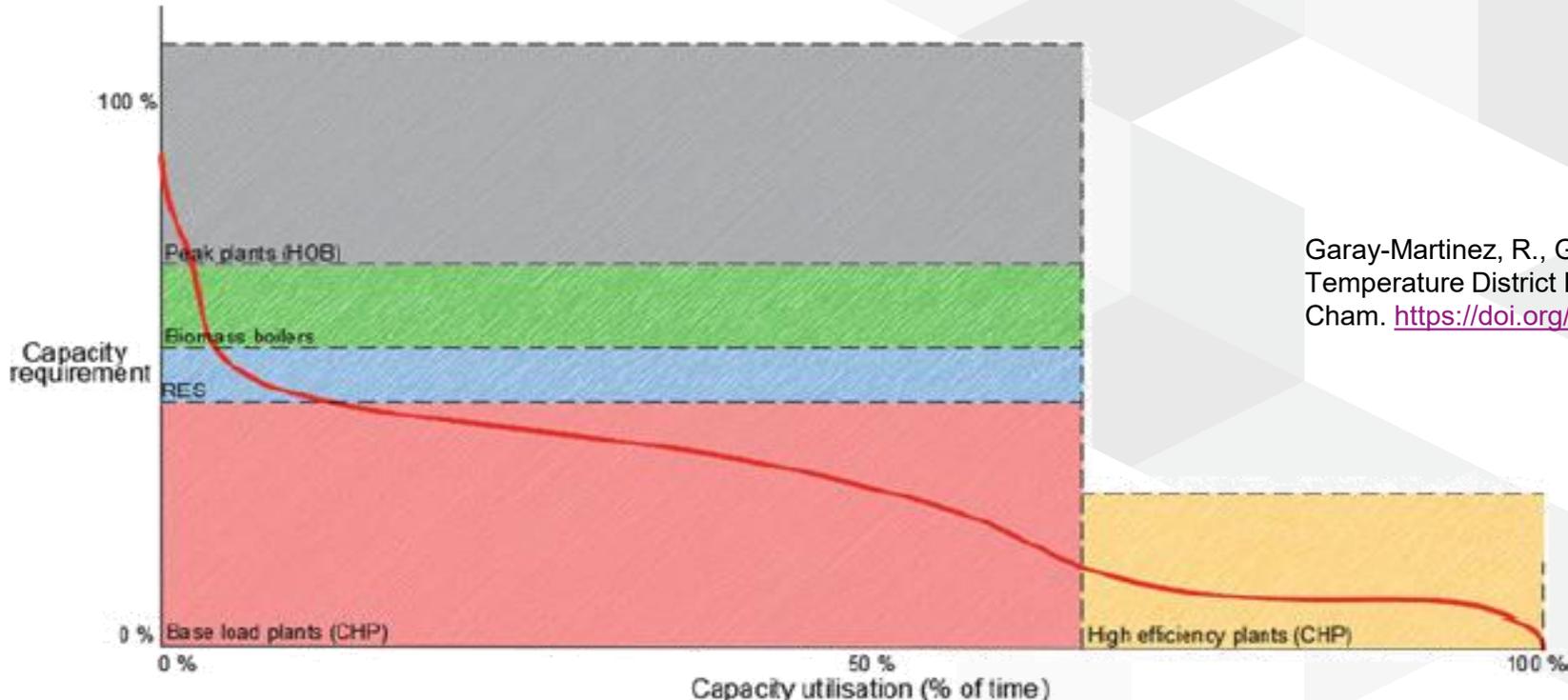
- Infrastructure design/sizing is standardized. Many times, considering worst-case climate, redundancies, partial system unavailability,...
- Operation routines are static/analogic/old
- Can we adapt operation routines to take advantage of oversizing and operate with better performance?



Olaia Eguiarte, Antonio Garrido-Marjuan, Roberto Garay-Martinez, Margus Raud, Indrek Hagu, Data-driven assessment for the supervision of District Heating Networks, Energy Reports, 2022, <https://doi.org/10.1016/j.egy.2022.10.212>

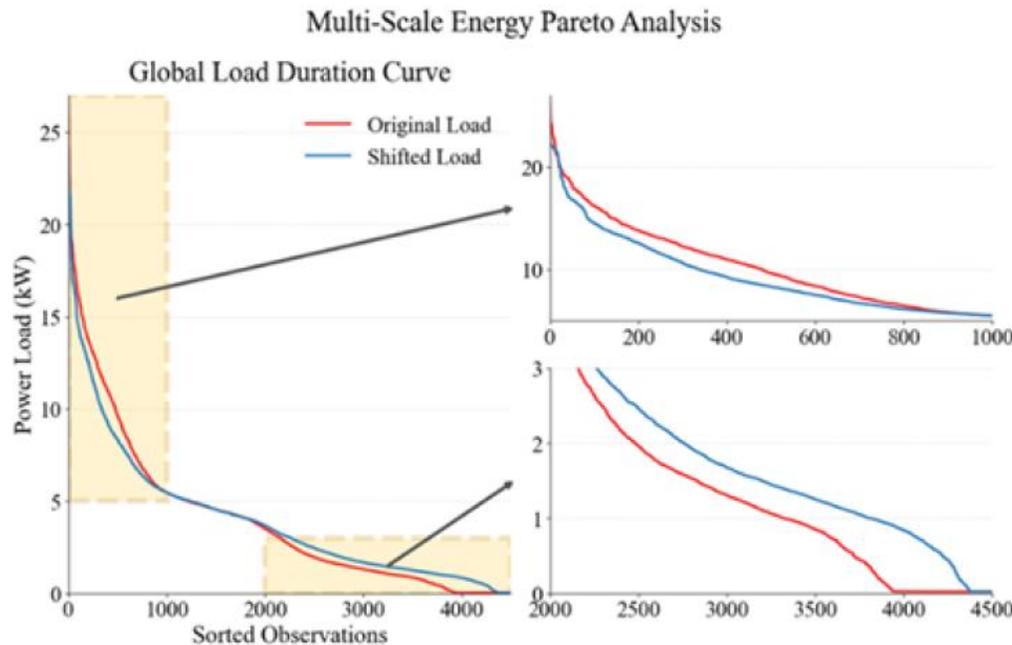
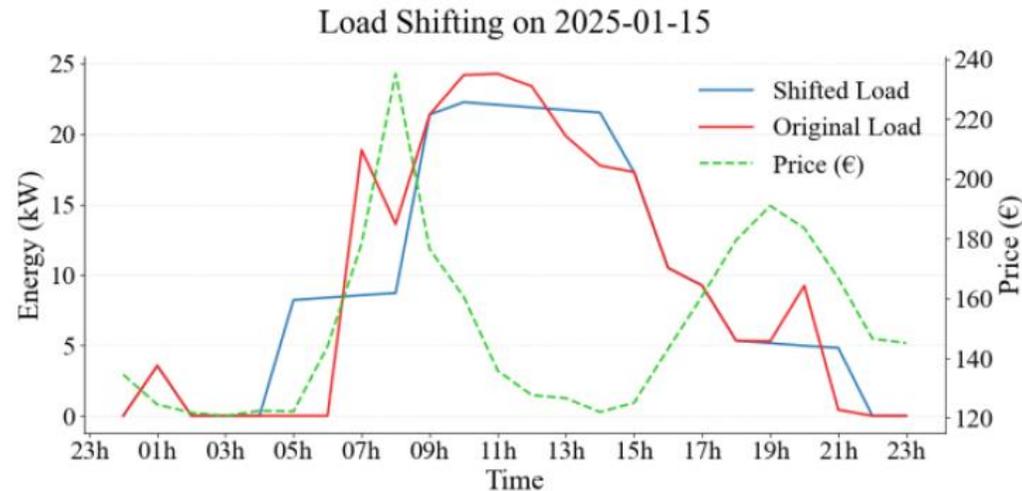
Impact assessment of RES in networks

- Given a particular system, can we integrate RES?
- What will be the impact of RES at system level?
- Will baseload still be economically viable?



Garay-Martinez, R., Garrido-Marijuan, A. (eds) Handbook of Low Temperature District Heating. Green Energy and Technology. Springer, Cham. <https://doi.org/10.1007/978-3-031-10410-7>

Load shifting and flexibility estimations

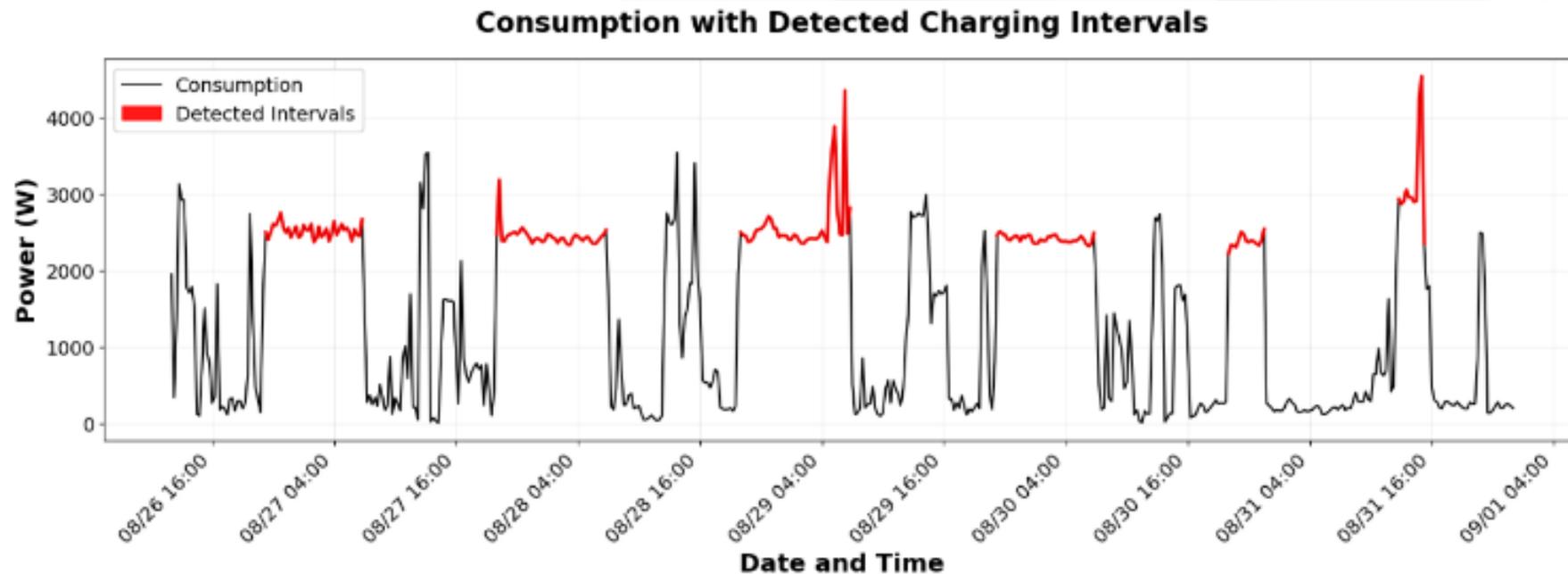


- BMSs
 - Planners do not have access to in-building BMS
 - legacy buildings/asset management approach (>90% of cases), local BMS does not help
- Utility data is commonly the only source
 - No information on building usage, only energy load
 - Now. How much energy can we shift?

Aitor Díez Mateo, Roberto Garay-Martinez, Jose Ignacio García Quintanilla, Algorithmic Thresholding and Baseline Detection for Residential EV Charging Event Identification, To be published, 2026.

Electric Vehicle usage

- People is switching to EV
- EVs are installed behind the meter
- Can we screen how many EVs are out there?
- How often are they plugged-in? How much are they used?

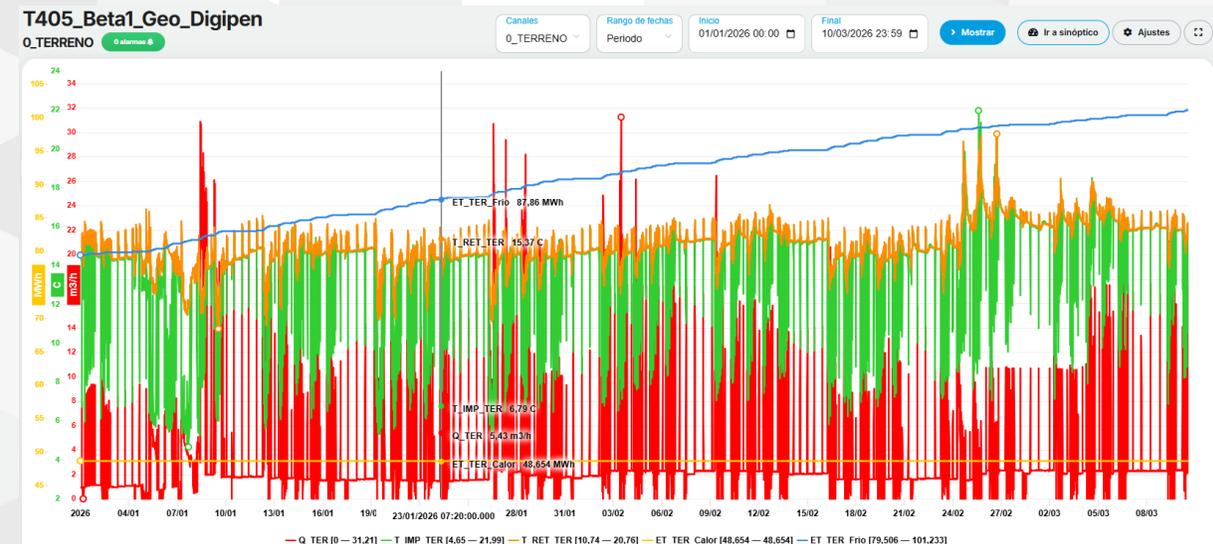


Limitations on data availability

- Quality
- Availability
- Resolution

Data quality

- BMS data is commonly of poor quality
- Utility data (i.e. DSO) is properly standardized and managed
- Local service provider:
Varies case by case.
 - TELUR/Iberdrola are great!
Continuous time series, with >~hourly resolution
 - Some others: Only billing information, every 1-2months, sometimes in € instead of kWh



Data availability

- Existing BMSs and SCADAS at building level
 - >90% without historic data
 - Even for assets deployed in the last few years
- Utility data. Standardized.
 - Daily resolution or better for Electricity.
 - Monthly resolution or better for Natural Gas.
 - Heating, highly dependent on metering infrastructure.
- Local service providers: Varies case by case.
 - Some service providers take ownership of data and use GDPR to avoid collaboration

Summary

Applications

- Better understanding of heating/cooling/electric loads
- Optimization of energy distribution, while ensuring service levels
- Impact Assessment for the integration of RES

Limitations on data availability

- Quality
- Availability
- Resolution

Digital Twins - Energy Analysis of the Republica Pilot Site

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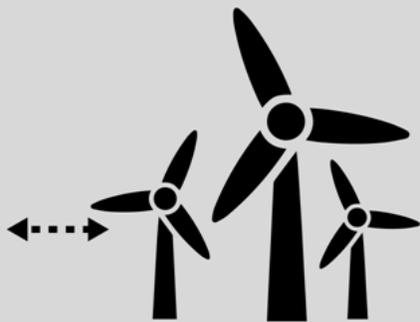
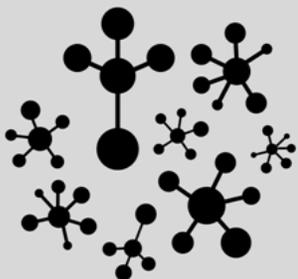


Building Smart District Decentralized energy production



Control

Data analytics



Digital Twin Building

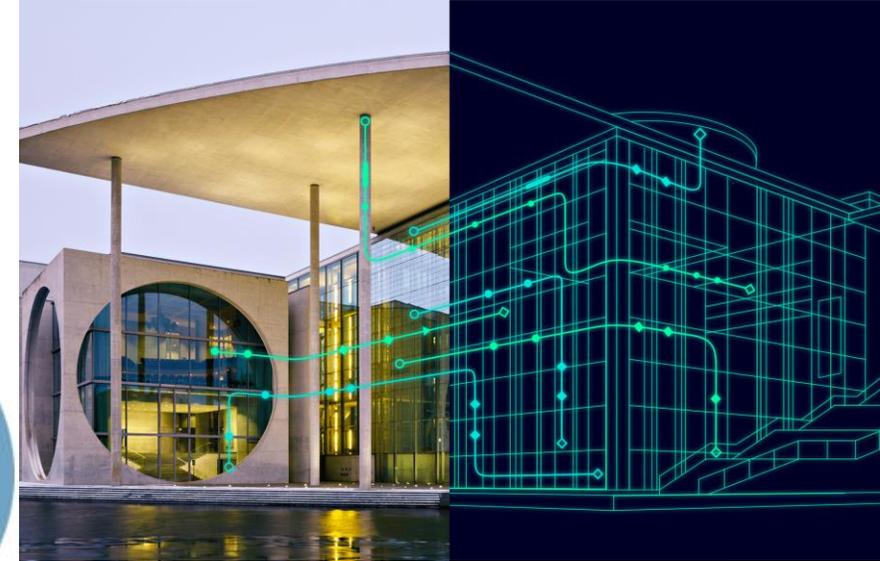
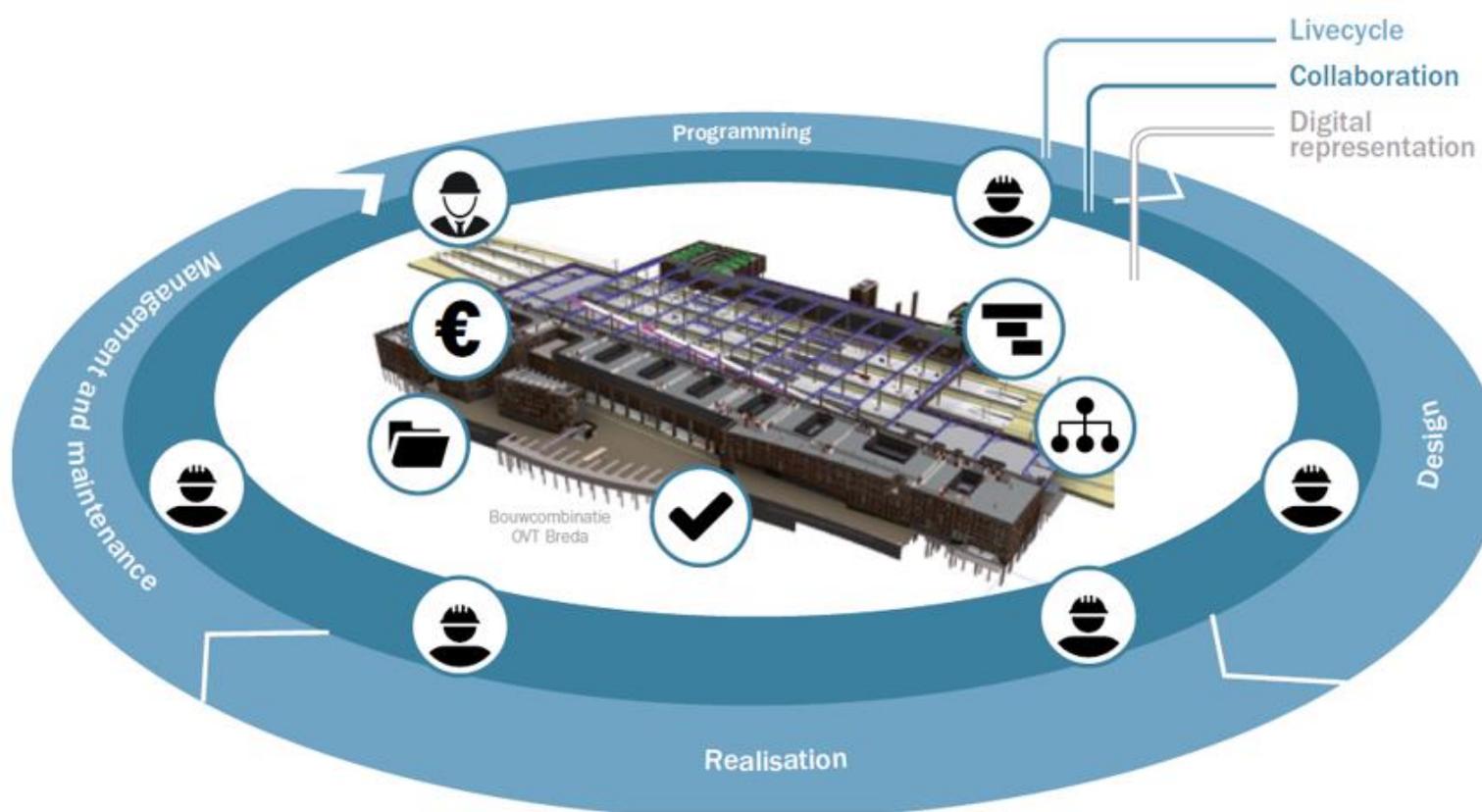
Digital Twin Smart District

Digital Twin Decentralized energy production



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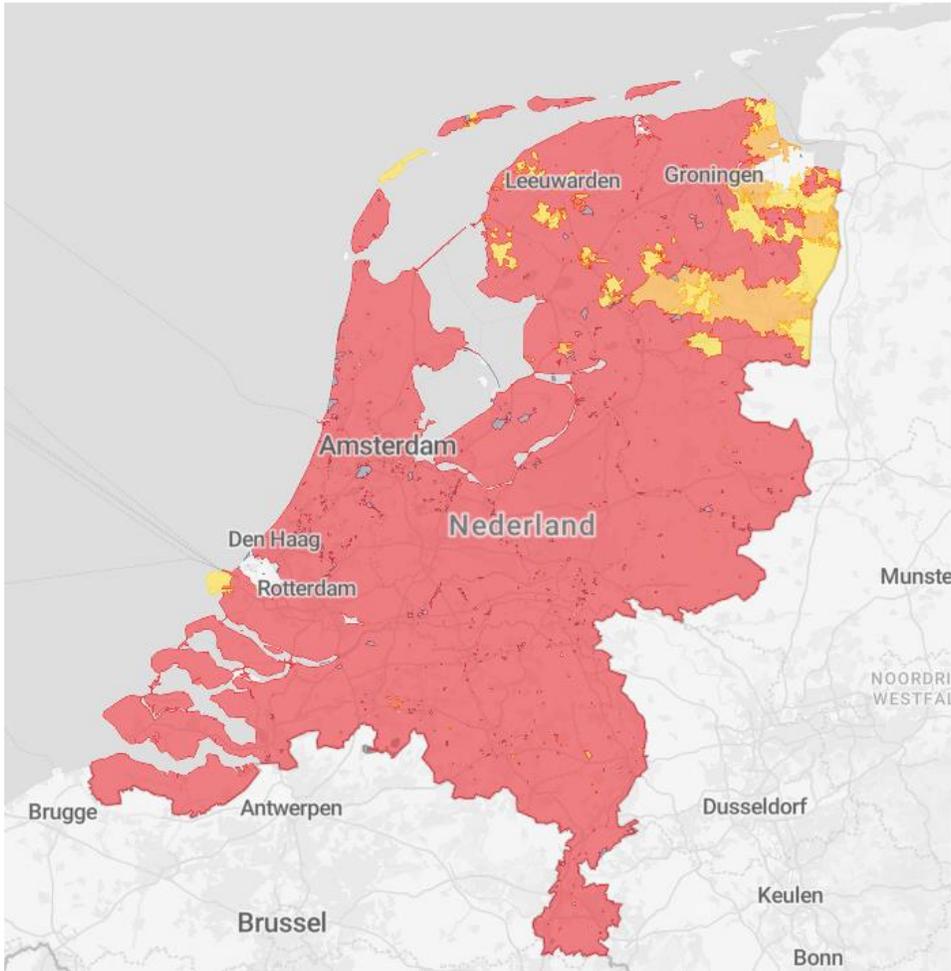
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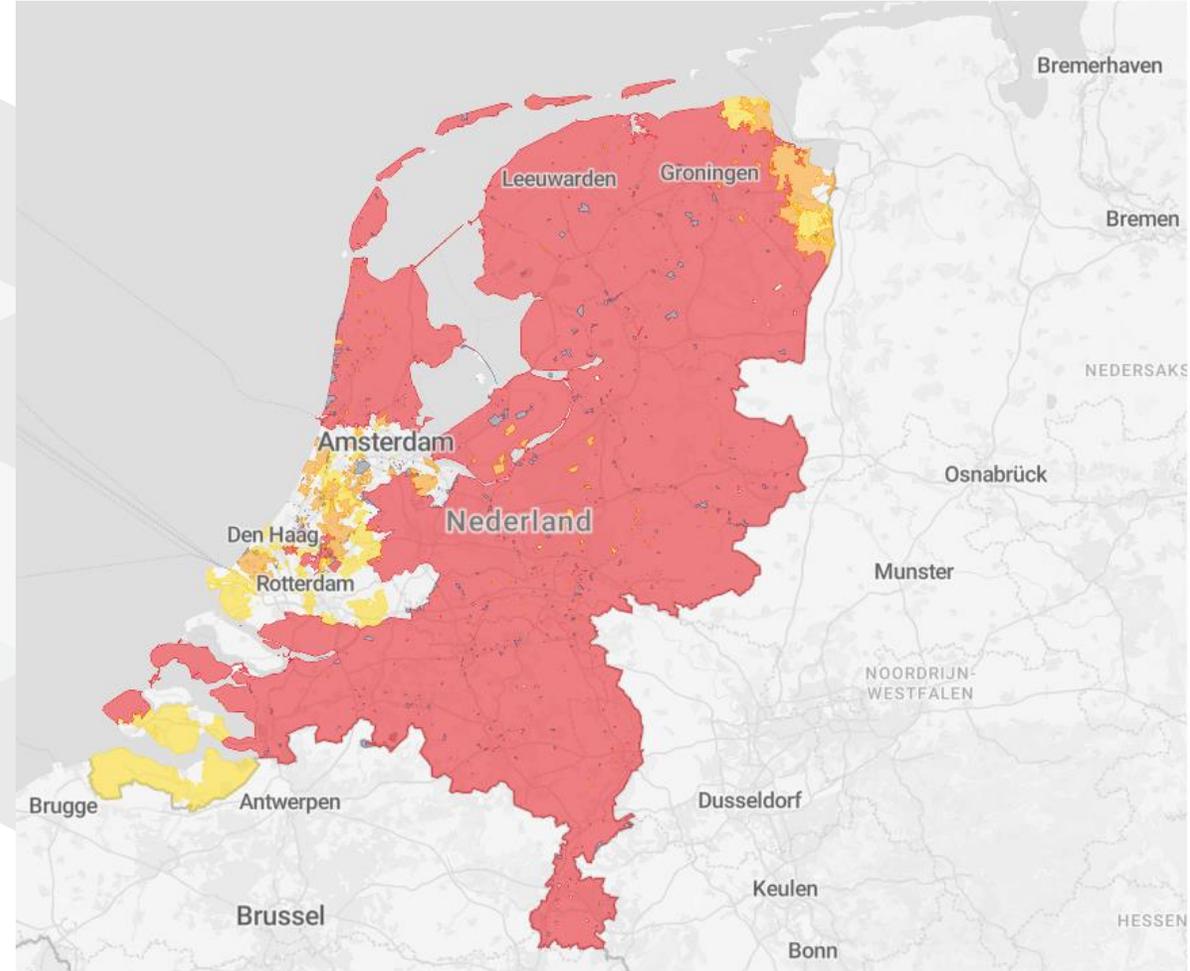
Netcongestion Netherland, no capacity ..

Afname ↓

Afname ↓ Teruglevering ↑



demand of electricity

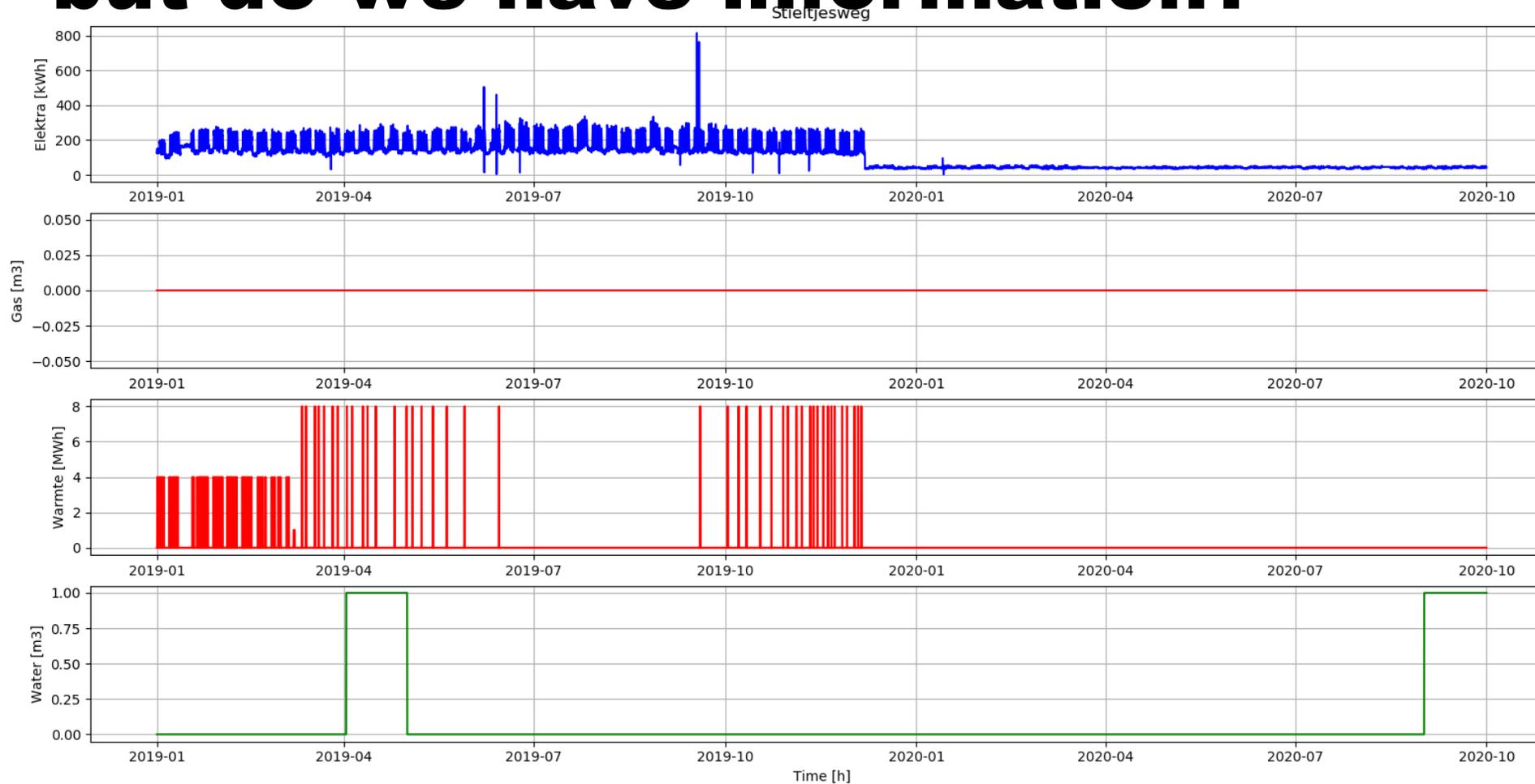


Supply of electricity

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No.864374

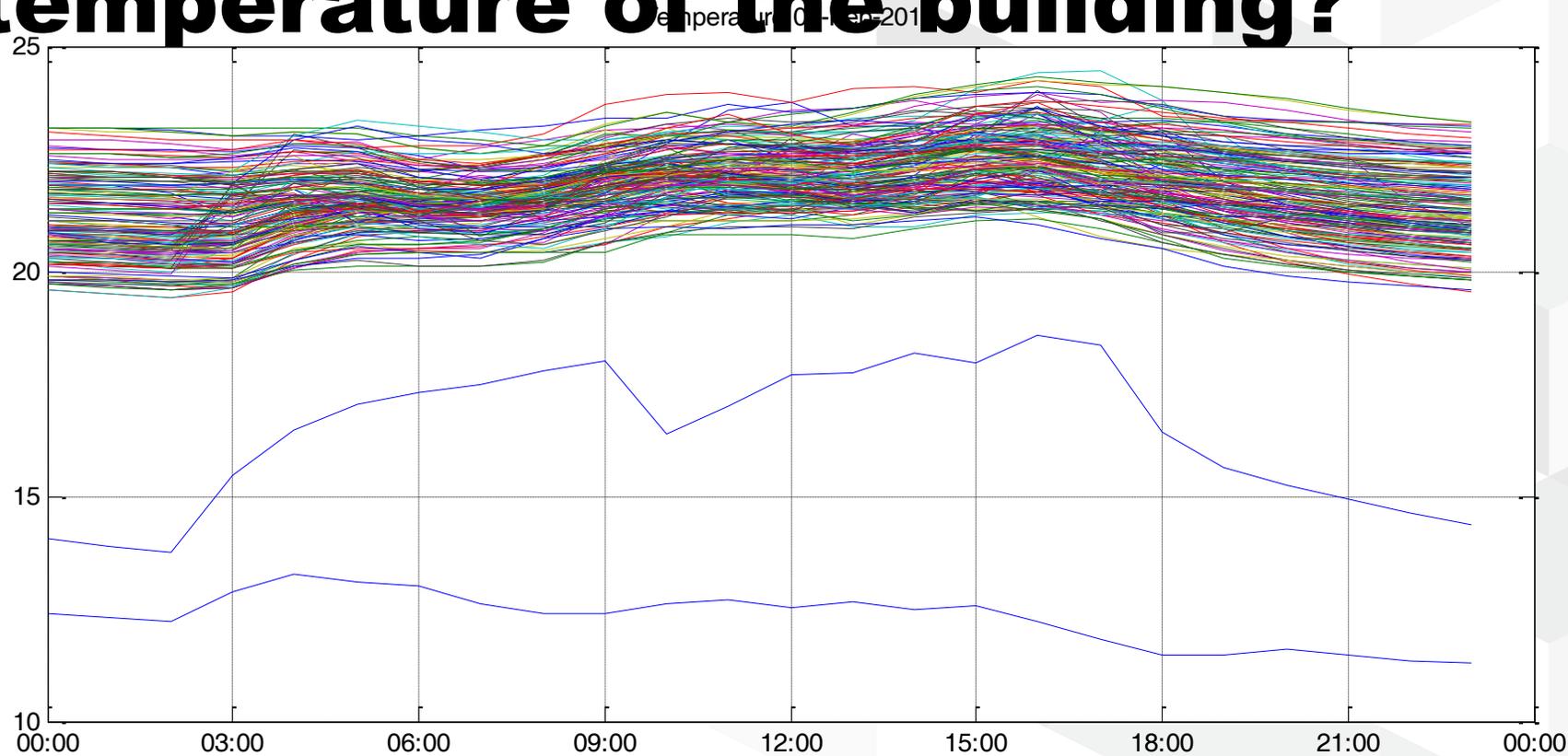


Buildings provide tons of Data, but do we have information?



We didn't receive any useful energy data for almost one year, what to use?

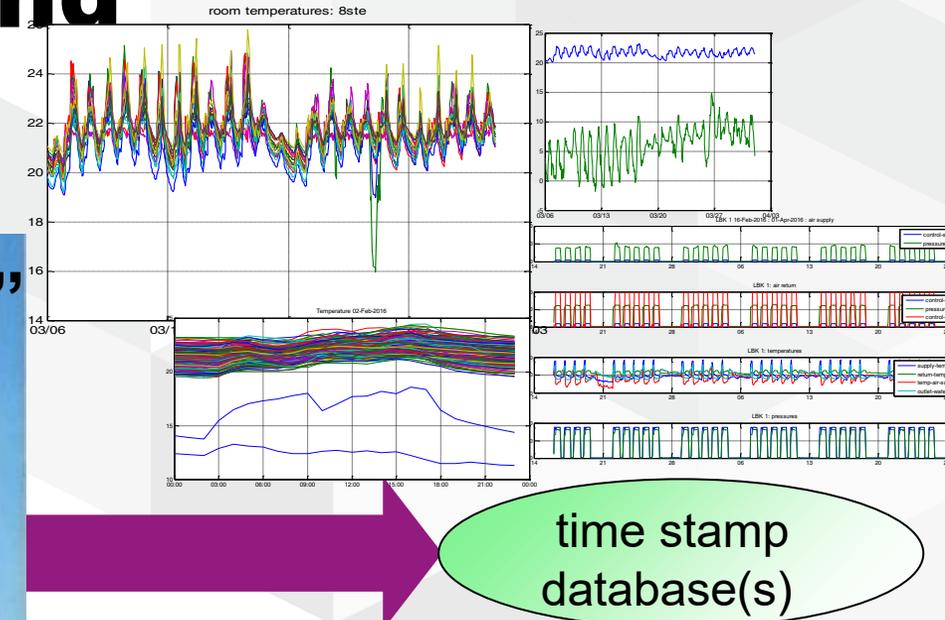
Room temperatures office building, what is the room temperature of the building?



Predictive twins: decision-making requires reliable and informative data



“Data Tsunami”

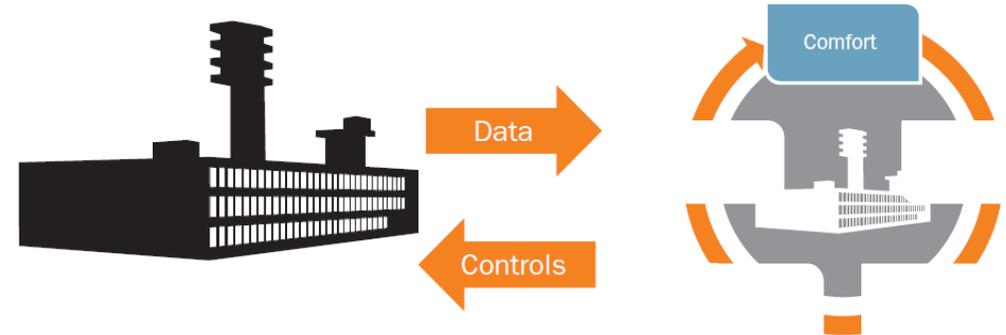


Data consistency
Data ≠ Information

What is monitored?

- Data from the building management system: room thermostats, air handling units, DIDs, coolers, etc.
- Energy meters.
- IoT data
- Additional systems: access gates, awnings, complaints, etc.
- AIM: services, renovation, maintenance

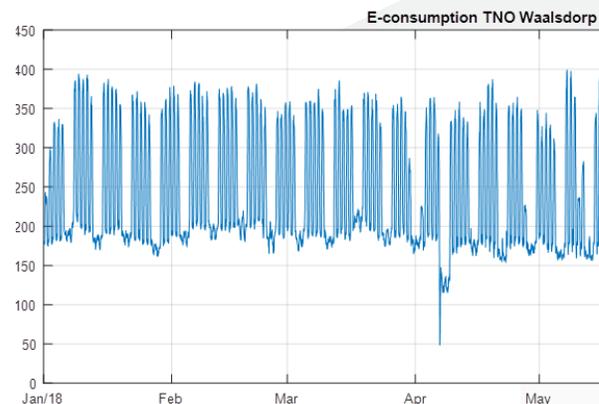
But how are digital solutions really going to make a difference to these challenges?



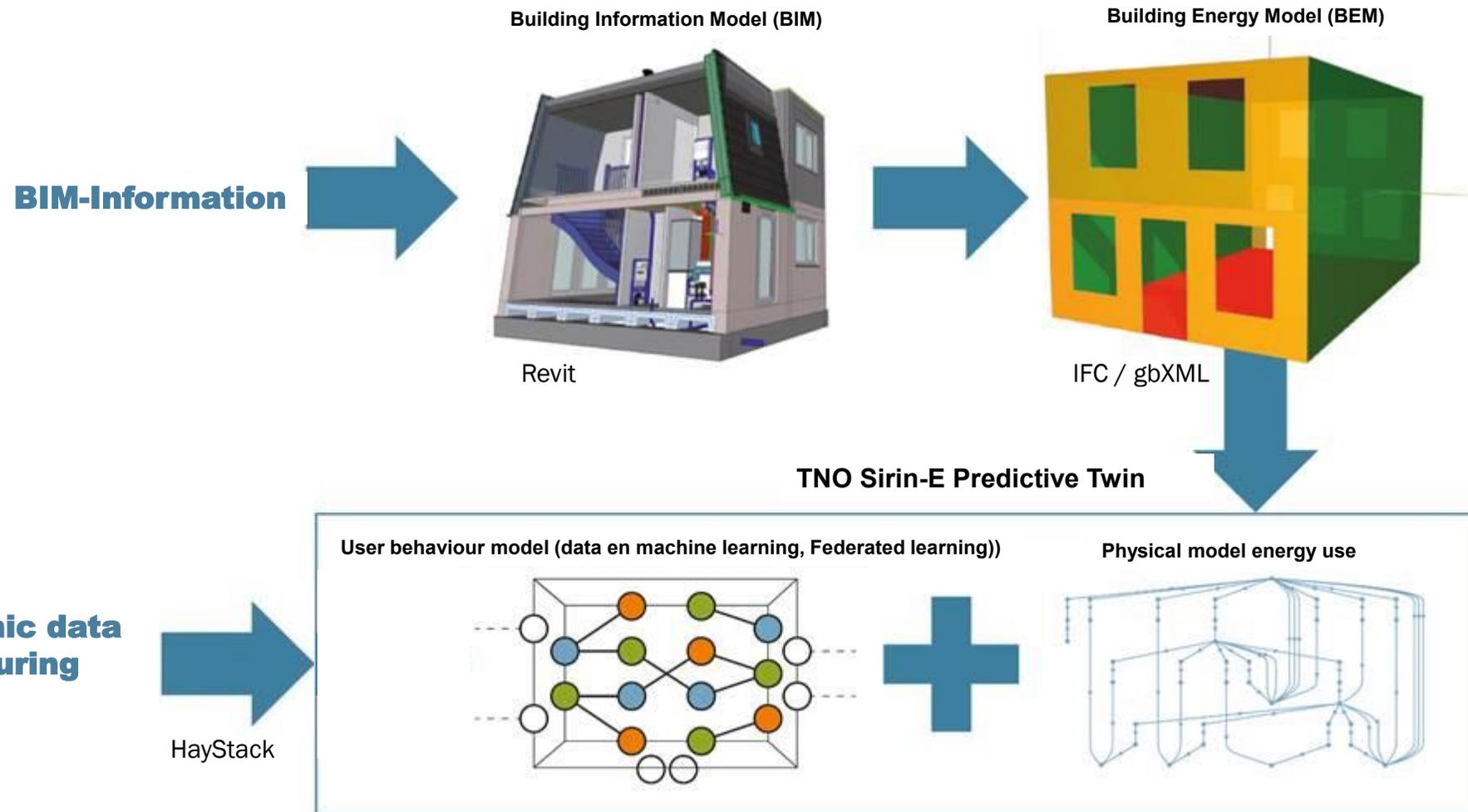
Physical building

Predictive building
Digital Twin

Predictive twins are predictive digital replicas of physical structures such as bridges, tunnels, homes and offices. With these twins, the future behaviour and use of structures and networks of structures can be predicted and influenced

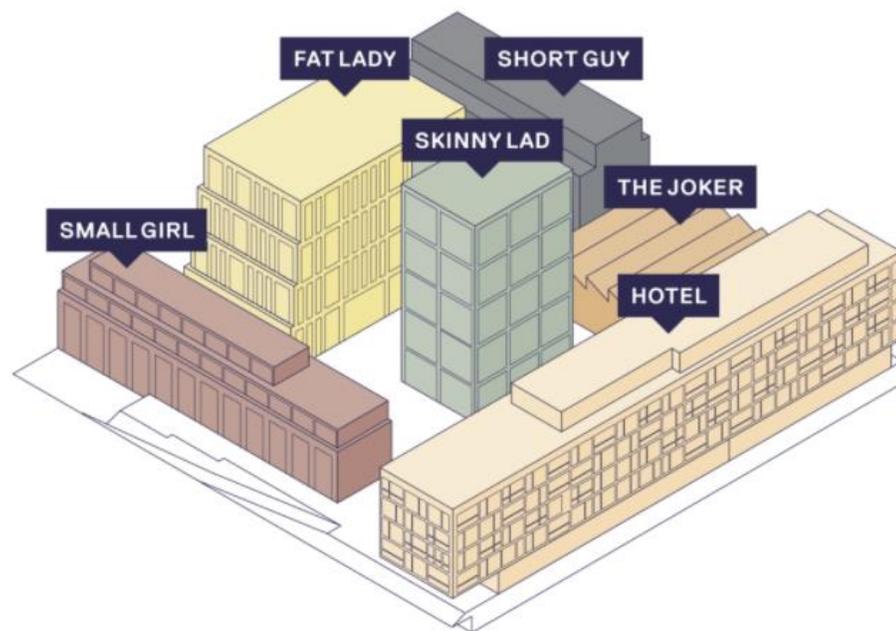


BIM 2 predictive Twin for IAQ and energy use



SirinE
Hybrid building model, analyze, predict, control

Capacity restrictions Republica



Fat Lady

- 20 (koop)appartementen vanaf 54 tot 182 m²
- Eigen grond, geen erfpacht
- Inclusief complete badkamer
- 3 bedrijfsruimten (schakelbaar) van 143, 236 en 329 m²
- Eigen energieopwekking



Skinny Lad

- Superlofts
- 10 (koop)appartementen vanaf 108 tot 165 m²
- Diverse indelingsvarianten
- Eigen grond, geen erfpacht
- 1 bedrijfsruimte van 365 m²
- Eigen energieopwekking



Hotel

- Hotel (116 kamers)
- Amsterdamse 'boutique hotel' partij
- Restaurant en (flex)werkplekken op begane grond
- Rooftop bar, gym en zwembad (mogelijkheid tot gebruik bewoners van de kavel)



Small Girl

- Buurtcfé & horeca
- Kantoorruimte 1e verdieping (beschikbare oppervlakte 300 m²)
- 10 hotelappartementen



Short Guy

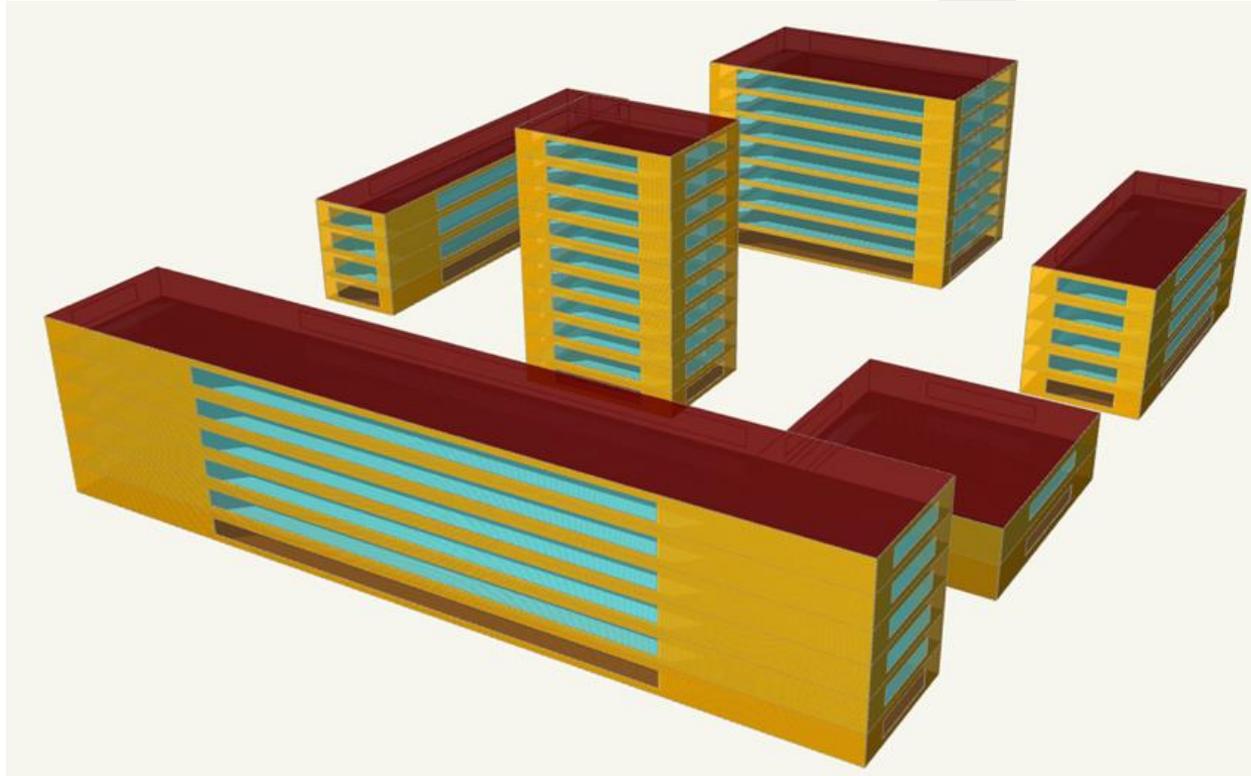
- 23 vrije sector huurappartementen
- Eigen energieopwekking



The Joker

- Vrij indeelbare commerciële ruimte(n)
- Beschikbaar vanaf 240 tot 480 m²
- Huur, afwerking in overleg
- Max 5% retail (kruimeiregeling)
- Eigen energievoorziening

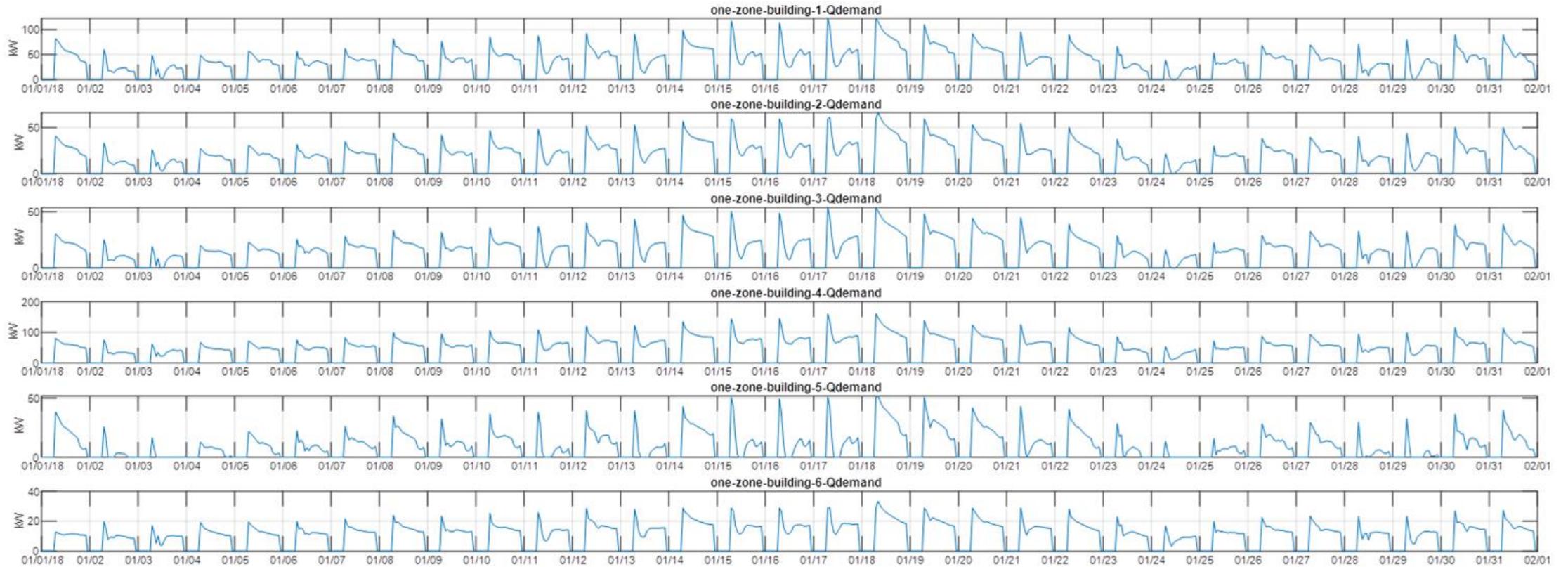
Data needed for electricity prediction



- Heating, cooling energy demand heat pump (TNO):
- BIM input file
 - Per block: temperature, occupancy, electricity (excl. HP), hot-water use
 - HVAC: collective heat pump, district heating, thermal buffers, booster HP

Household profiles, EV charging profiles, Batter (Spectral)

Heating demand per building



Heating demand per demand and system

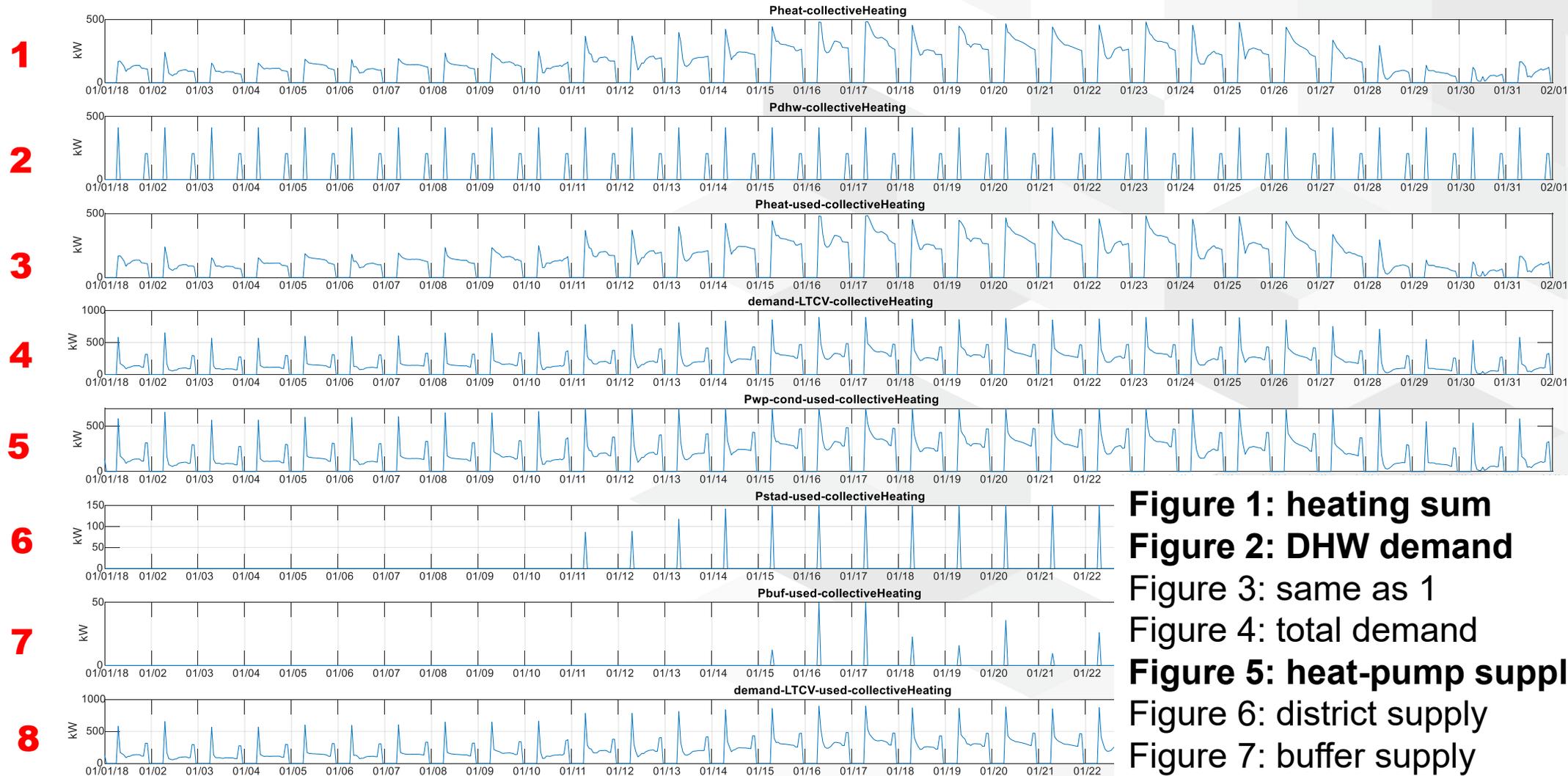


Figure 1: heating sum

Figure 2: DHW demand

Figure 3: same as 1

Figure 4: total demand

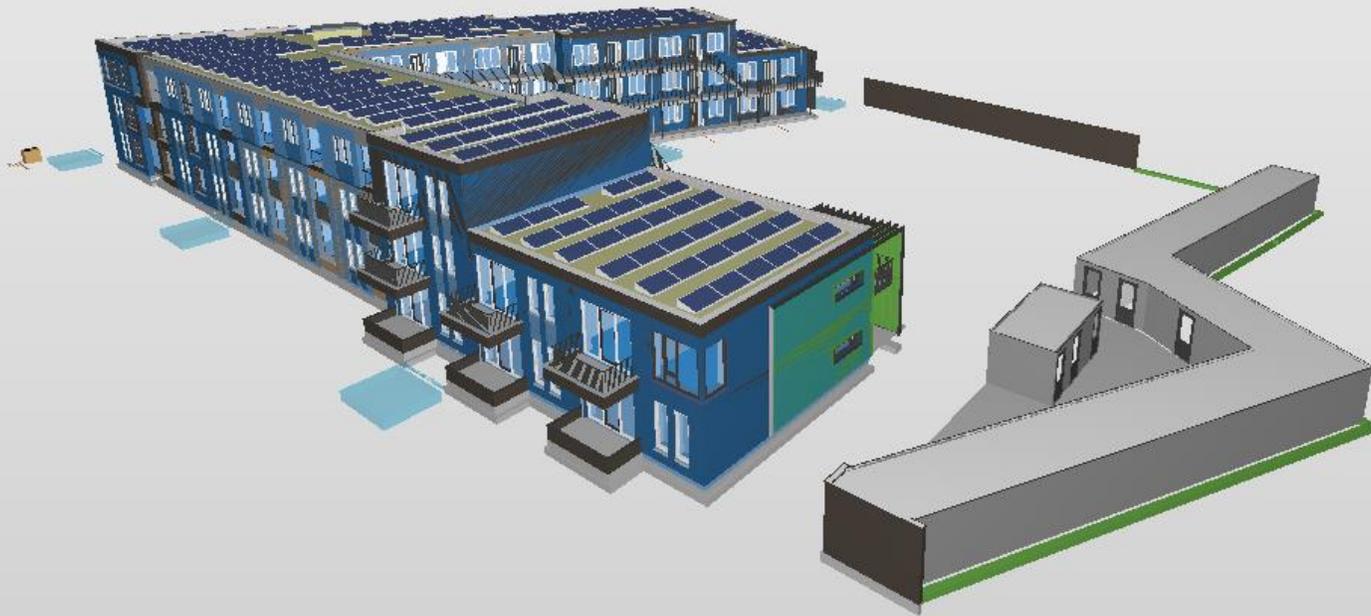
Figure 5: heat-pump supply

Figure 6: district supply

Figure 7: buffer supply

Figure 8: total supplied

Housing corporation AREA: double use of local PV of heat pump with SirinE predictive TWIN



SirinE

Hybrid building model, analyze, predict, control

Apartment complex in Uden with local Photovoltaic and a digital twin to control the individual heatpump,

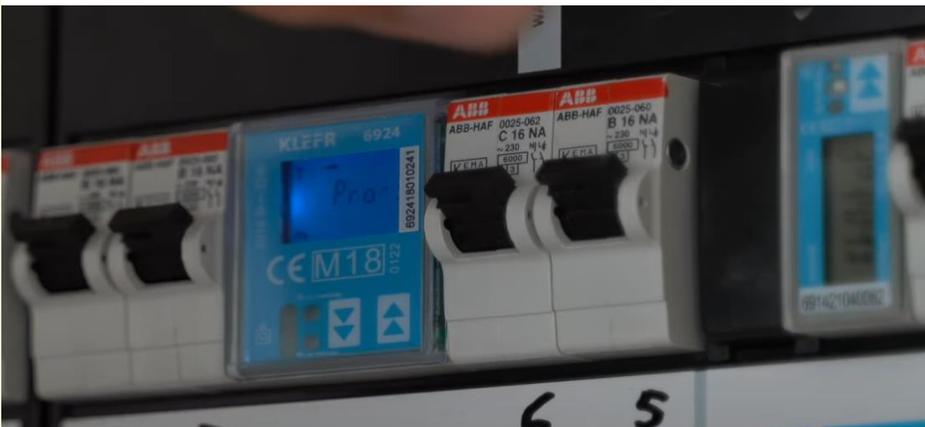
Monitor and control UDEN in apartment



Smart heat pump



Monitor and control gate-way and smart electricity meter



Smart sub meter: PV and ventilation



Room and window open/close sensor



Predictive twins Challenge or support

Support

- Helps predict capacity profile
- Helps increase pv consumption
- Help reduce maximum grid capacity

Challenge:

- Building properties even in BIM are mostly incomplete
- Time series data is mostly bad quality
- Control of data connector of equipment is time consuming and risky



Reduction of 1500 kVA grid capacity

Data collection in the context of an EMS

Practical implications of unlocking and processing data

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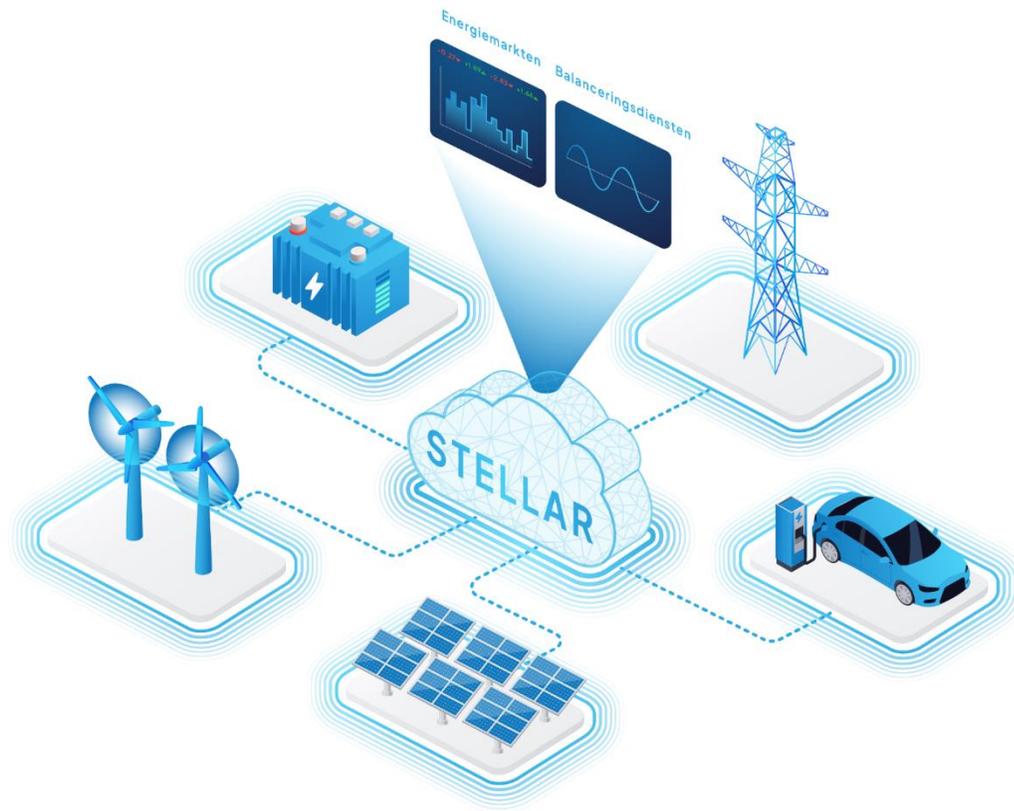
Ir. Stefan Kop
Spectral

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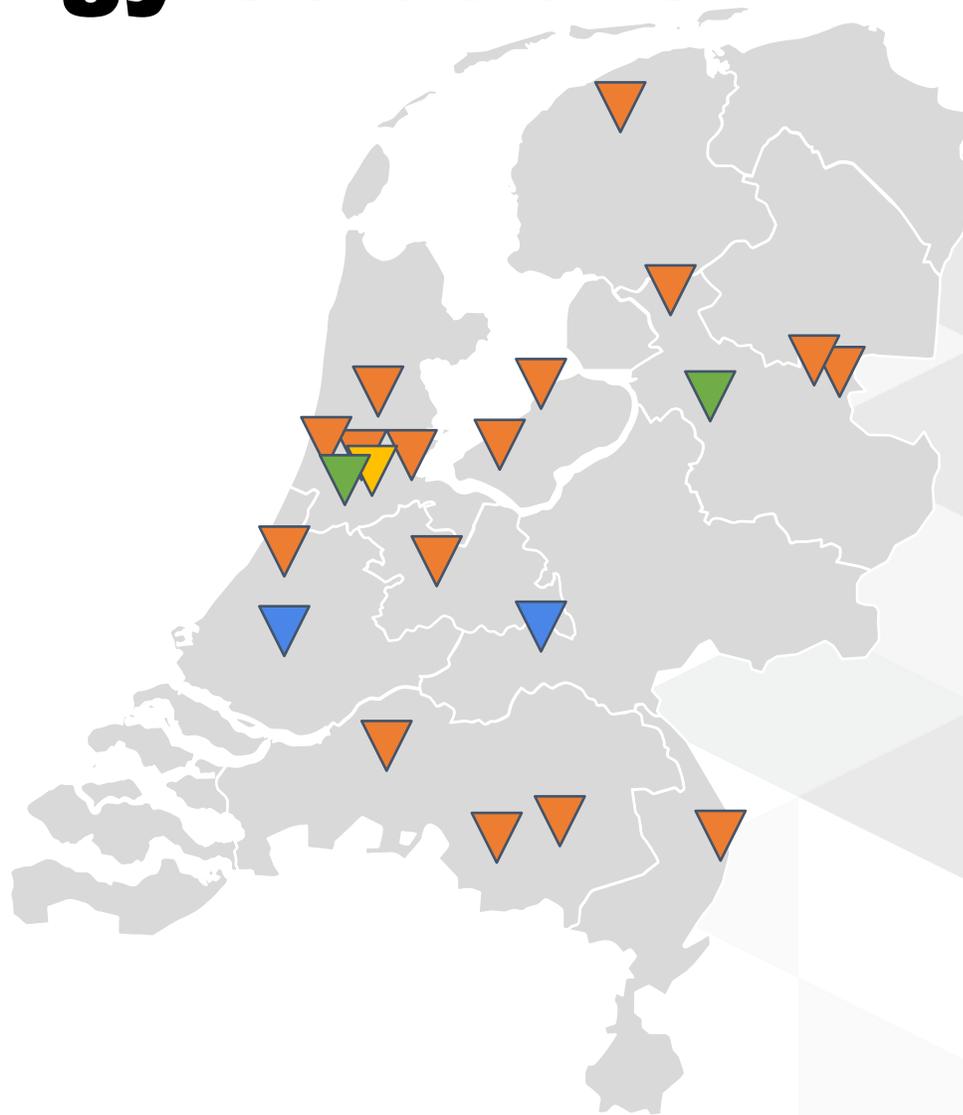
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Ir. Stefan Kop
Project Coordinator ATELIER

Experience with Collective Energy Solutions



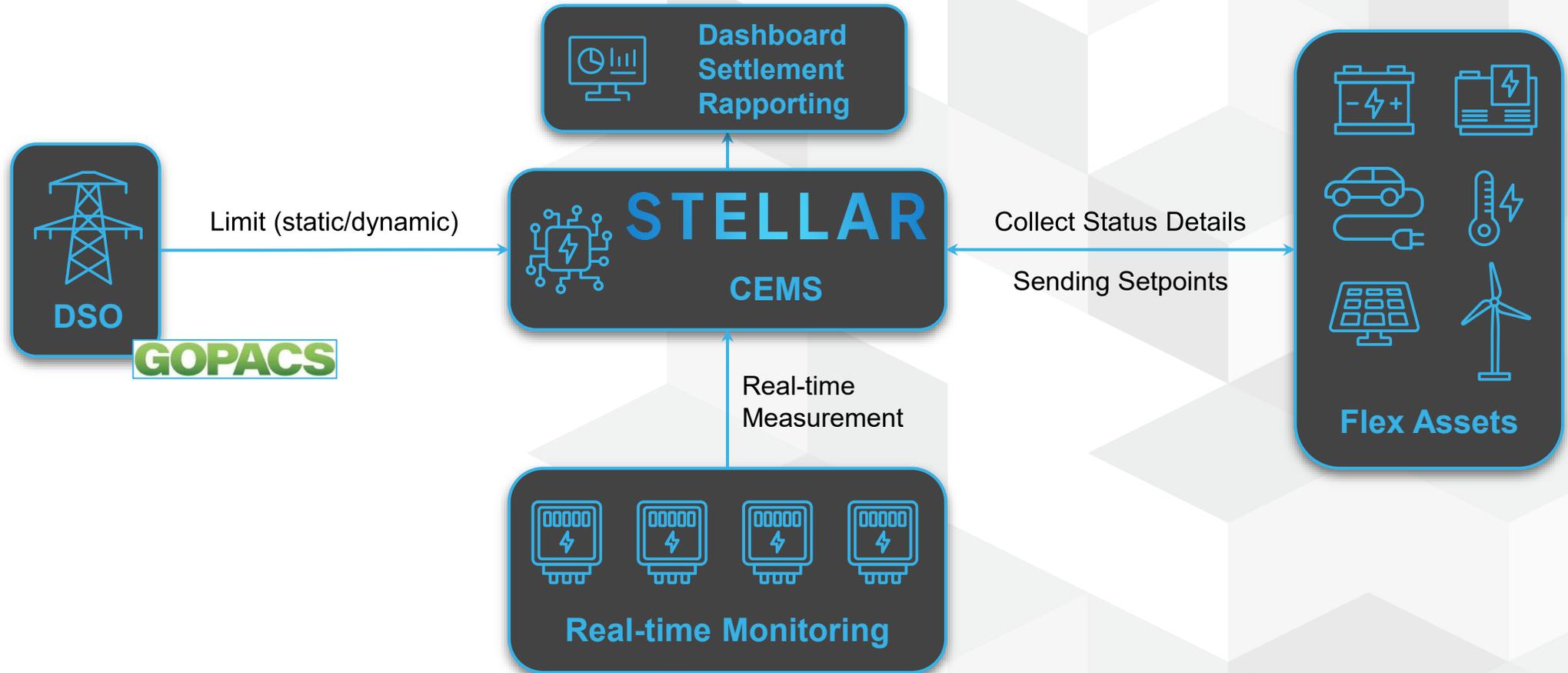
- ▼ Investigation Phase
- ▼ Design Phase
- ▼ Implementation Phase
- ▼ Live

Agenda

1. Introduction
2. System Architectuur (C)EMS
3. Building Blocks for (C)EMS Realisation
4. Preconditions and Challenges

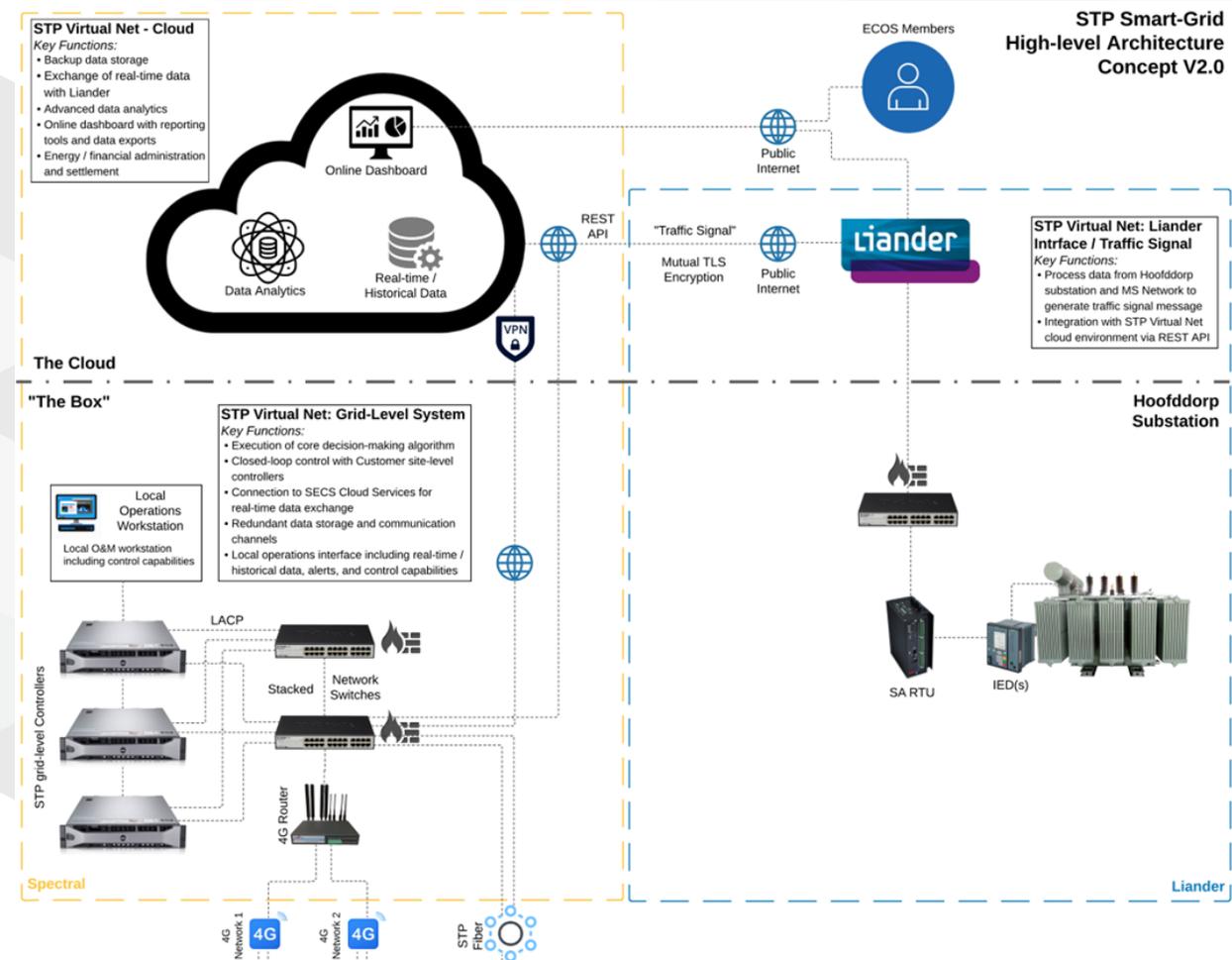
System Architecture

Collective Energy System



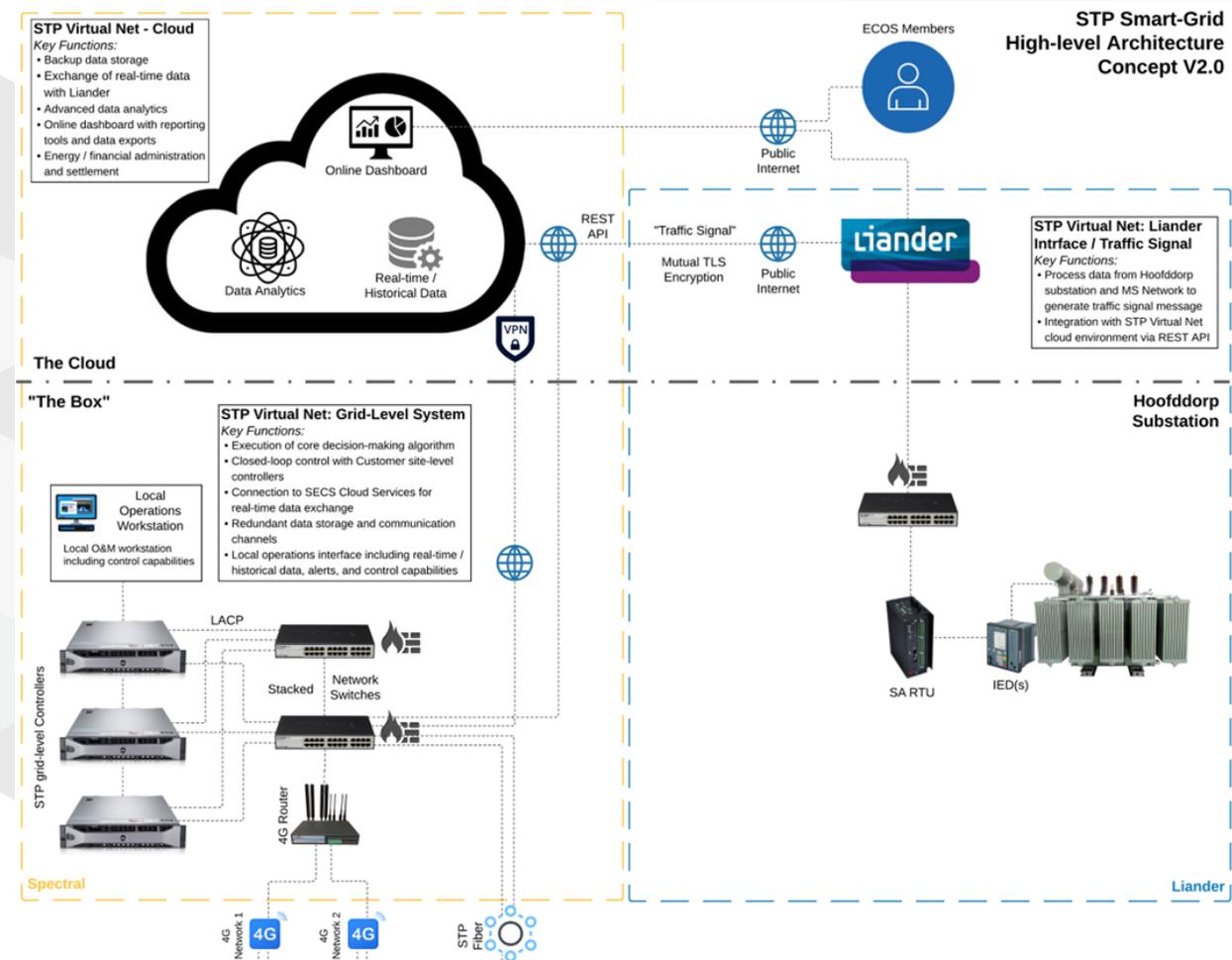
Example Schiphol Trade Park

- Cloud system with links to DSO and local grid systems
- Real-time link to substation
- Real-time link to power measurements in the fields
- Local system control
- Redundant design



Example Schiphol Trade Park

- Connections to real-time energy meters in buildings
- Connections to controllable assets such as gas generators, batteries, and solar energy systems



Building Blocks for CEMS



What turns out to be the biggest obstacle to the implementation of a CEMS so far?

- Integration with flexible assets
- Installation of gateways
- Implementation of wired connections (assets and meters)
- Configuration of control logic

Required Hardware

- Gateway for receiving and sending data, executing control logic
- Own gateways vs. third-party gateways
- Different types of gateways, depending on desired functionalities
- Installation can be organised in different ways



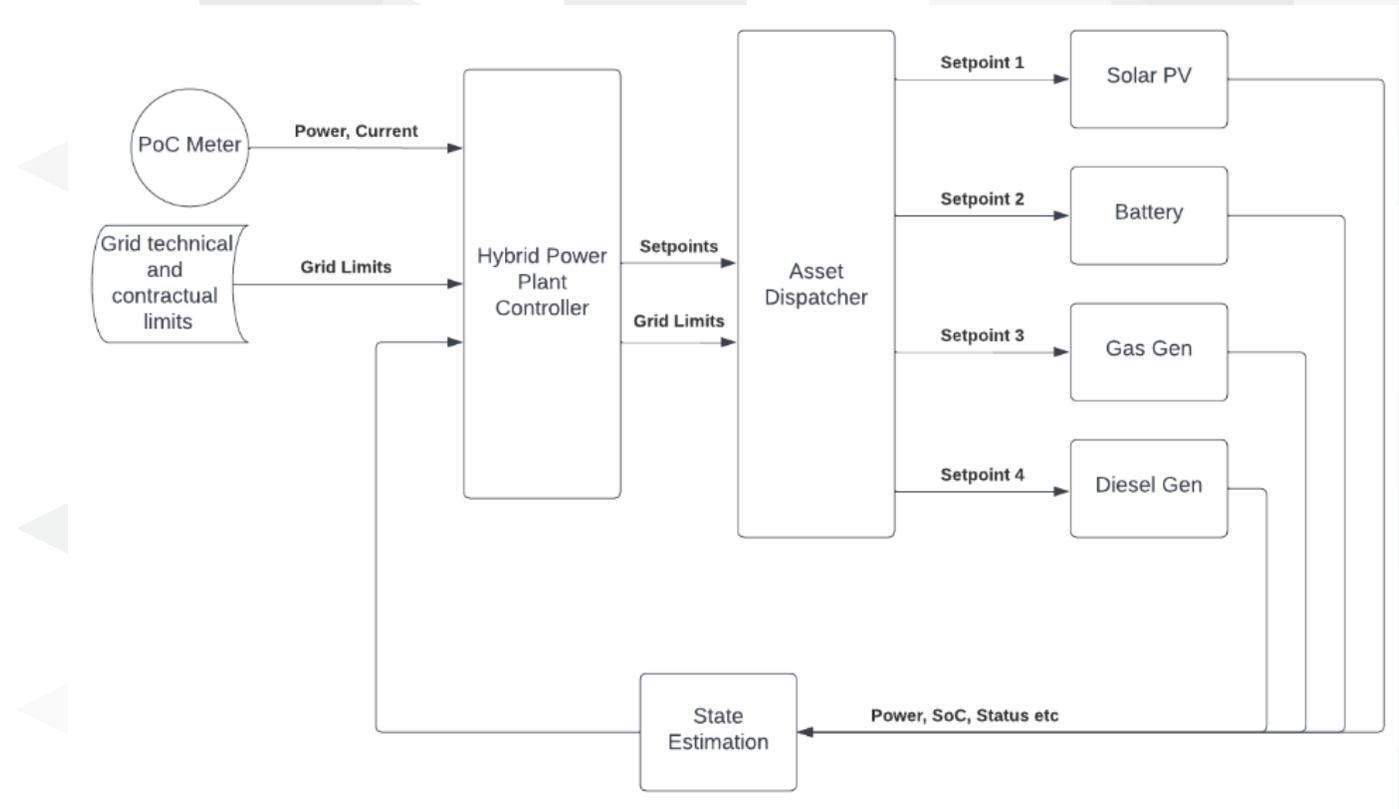
Connectivity and Redundancy

- Wired connection preferred - (V)LAN
- 4G as backup
- Assets and meter in the local area network (LACP) or direct connection to gateway
- Redundancy possible at various levels



Control Logic

- Logic at local level (behind the meter) and at collective level
- Logic in the cloud or also locally
- Fallback scenarios
- Merit order



Dashboard

ADMIN INTERFACE

CIRCULAIR-AV-4

Bekijk Assets

Bekijk Communities

STELLAR GRID MANAGEMENT

Dashboard

Bedrijf

STP

Energiestroom

Tarievenlijst

Limiet Overzicht

Energie Gegevens

Download Meetgegevens

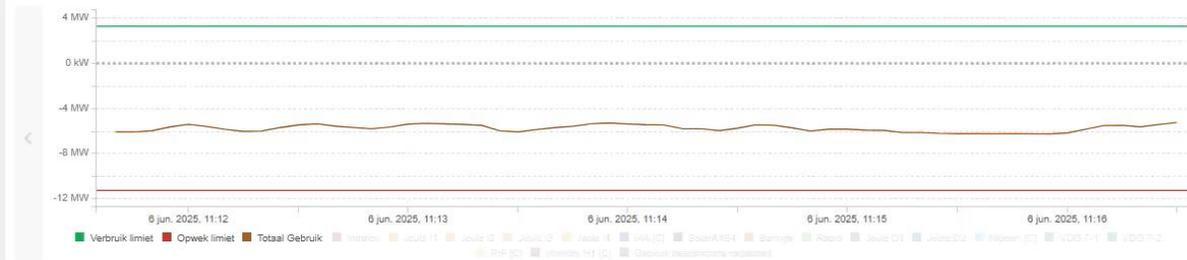
Informatie

Deze Periode

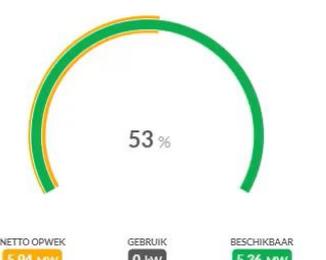
Afgelopen 5 min. tot nu

Resolutie: 5 seconden Nu Dag Week Maand

Gebruik en Capaciteit



Gebruik beschikbare capaciteit



Overzicht



TOTAAL GEBRUIK
-465 kWh



TOTAAL IMPORT
21 kWh



TOTAAL EXPORT
-486 kWh



MAX. PIEK
-5,3 MW



MIN. PIEK
-6,3 MW

Verdeling Gebruik Totale Capaciteit



TOTAAL CAPACITEIT
227,66 kW

Preconditions and Challenges

- Good coordination with participating parties
- Providing of information to participants
- Taking differences in knowledge levels into account
- Step-by-step approach
- Starting preparatory work in good time; inspection, collection of documentation assets
- Accepting that it is an iterative process with multiple dependencies
- Learning and innovating together

Contact



Thanks you for your attention



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