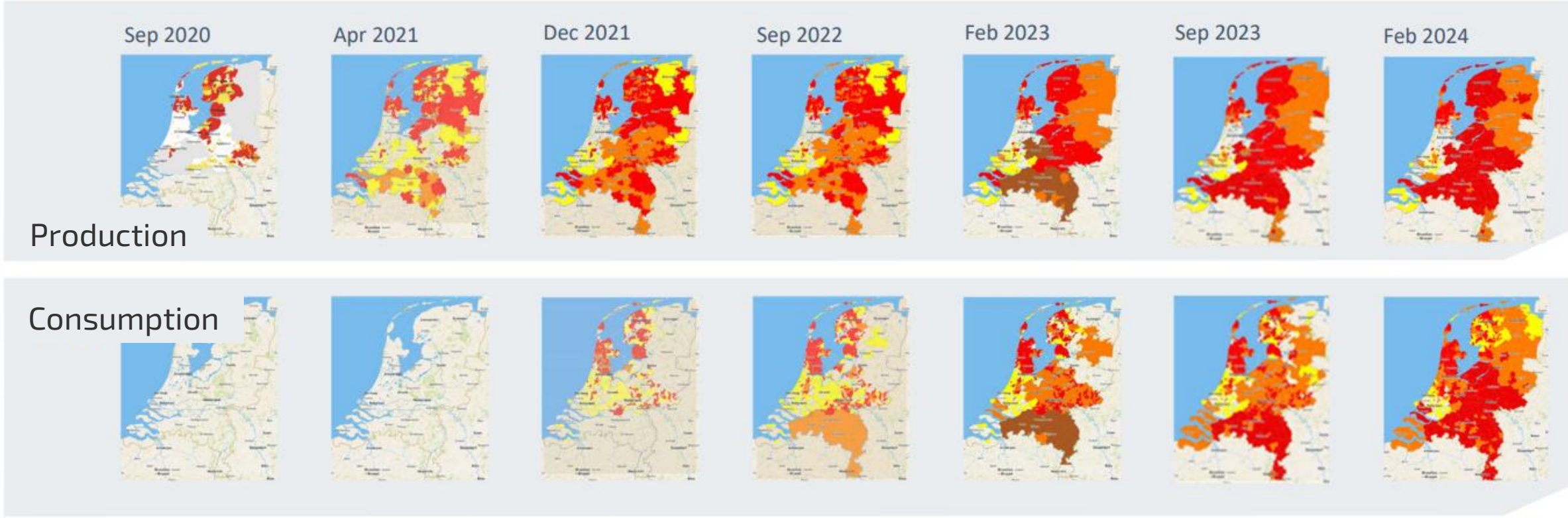
# OpenADR

- For Grid Aware Charging (GAC)
- OpenADR / GAC deepdive
- OpenADR for DSOs

OpenADR for Grid Aware Charging

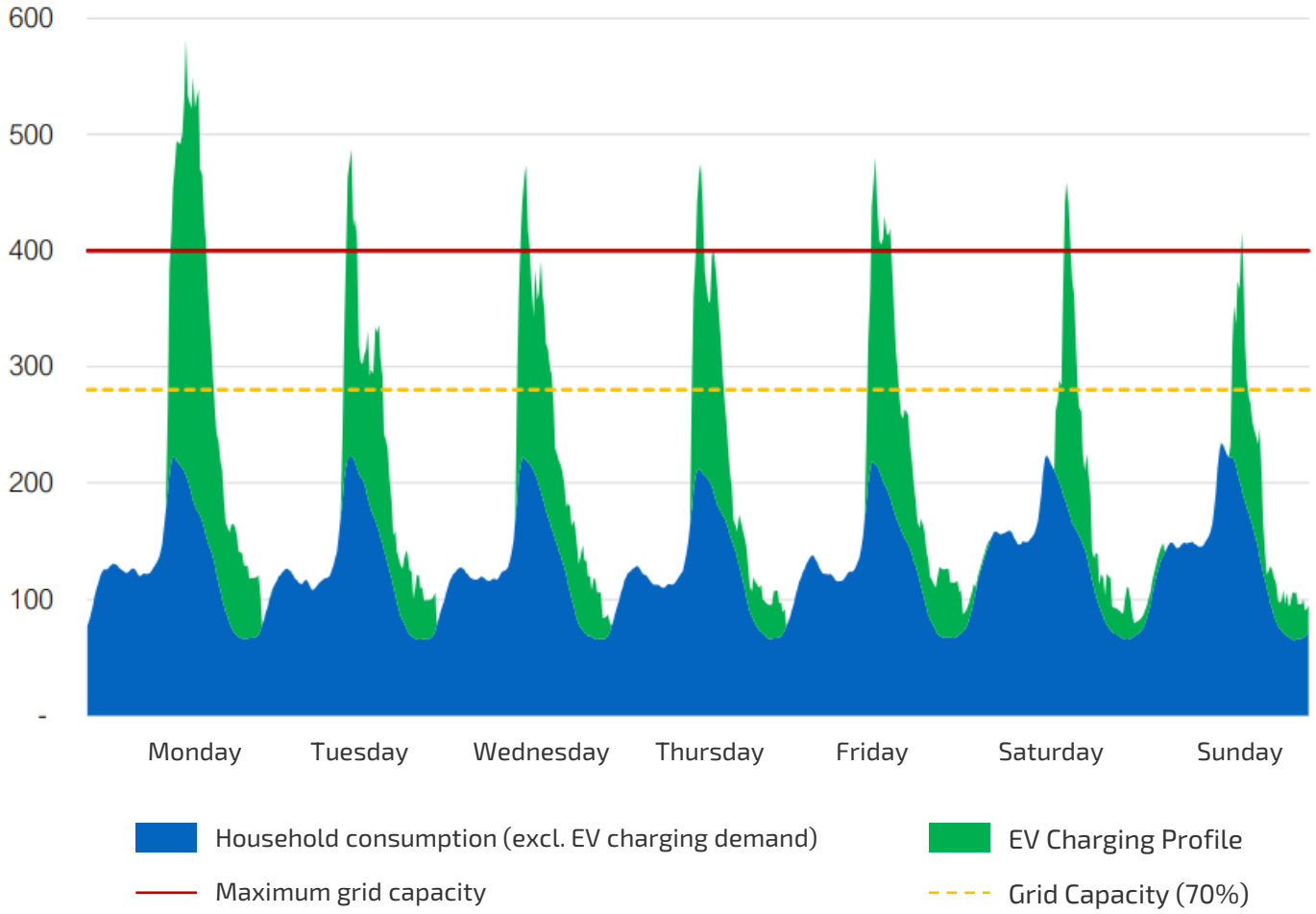
# *Demand response for public charge infrastructure in the Netherlands*

# Development of congestion



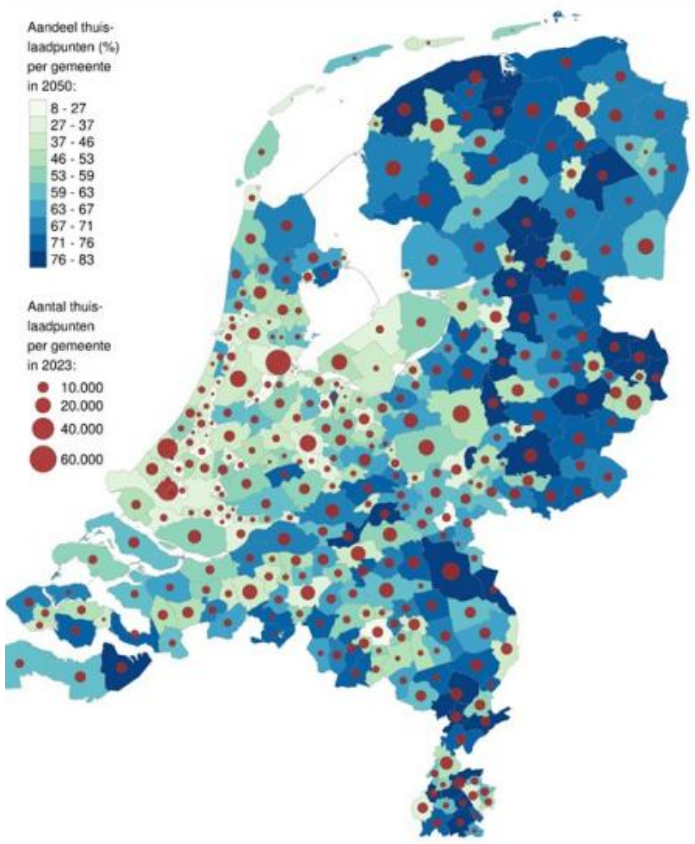
# Increasing grid capacity demand

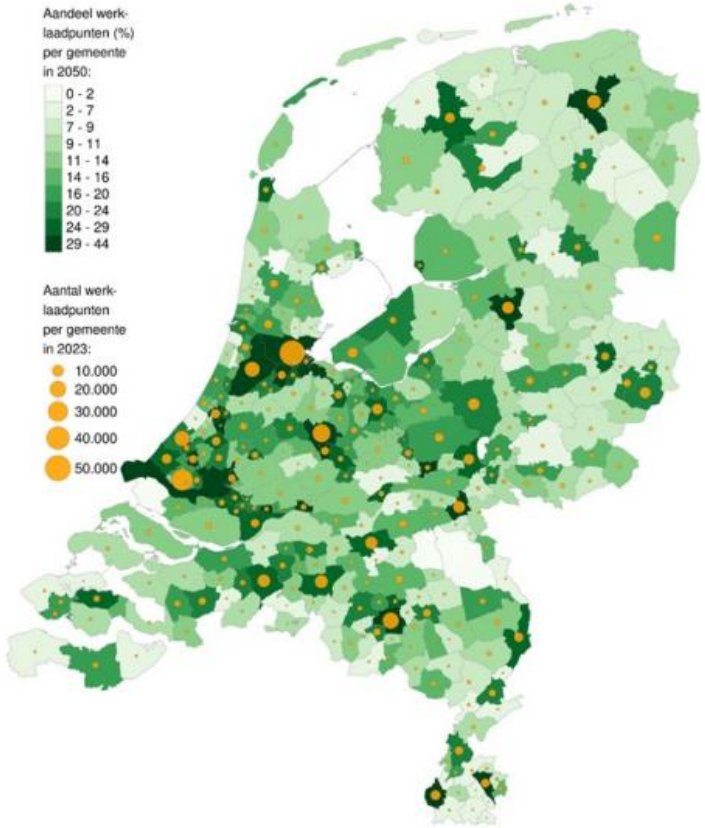
## EV capacity demand on top of household demand

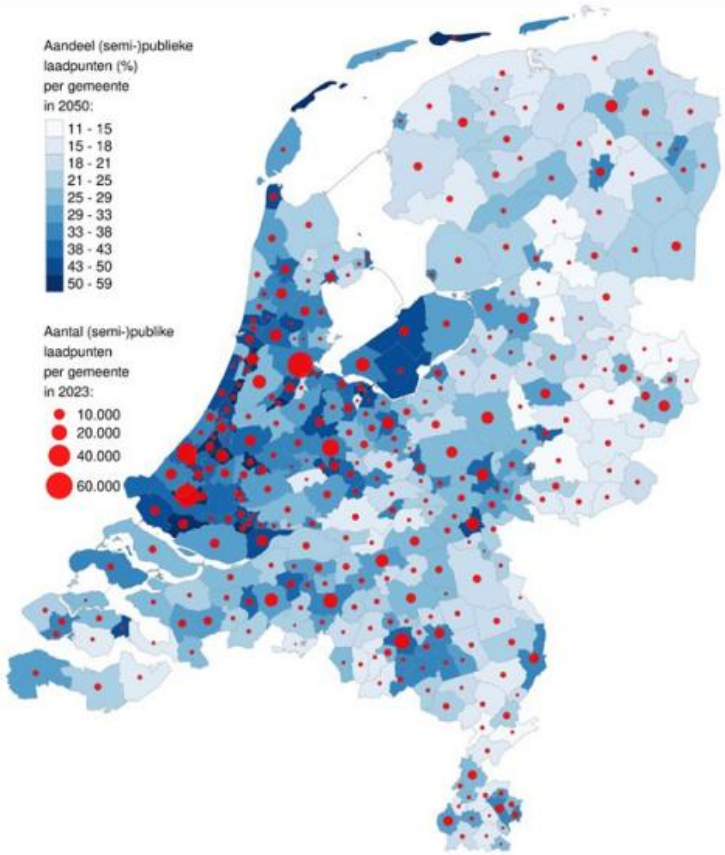


# EV Hotspots

## Capacity bottlenecks are not evenly spread

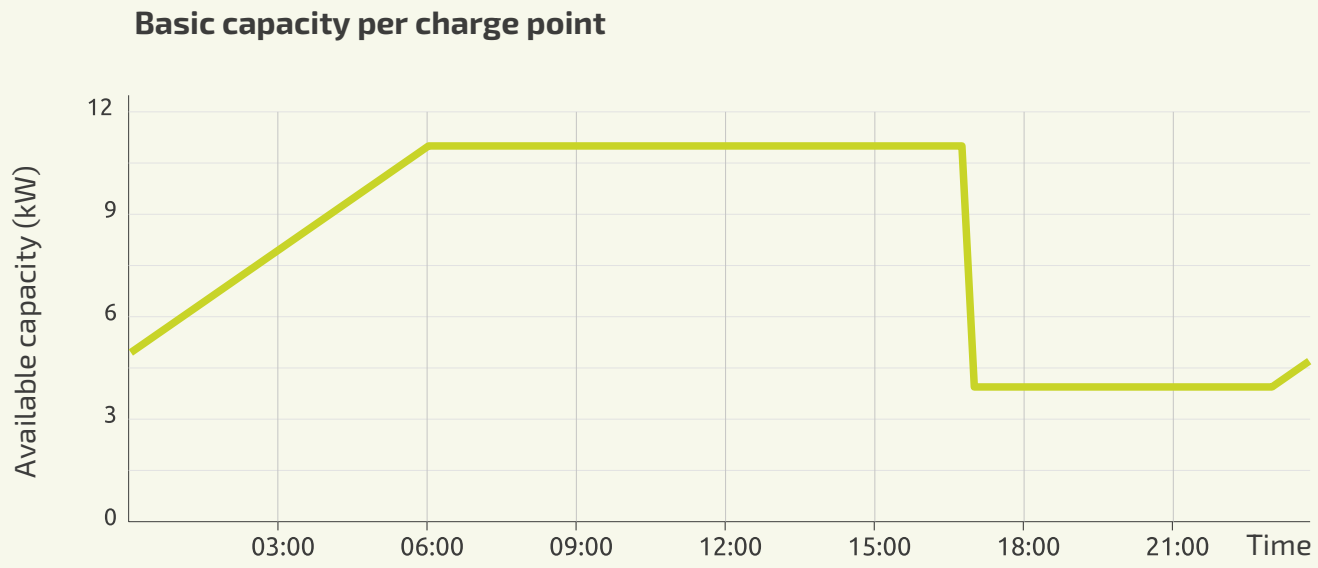


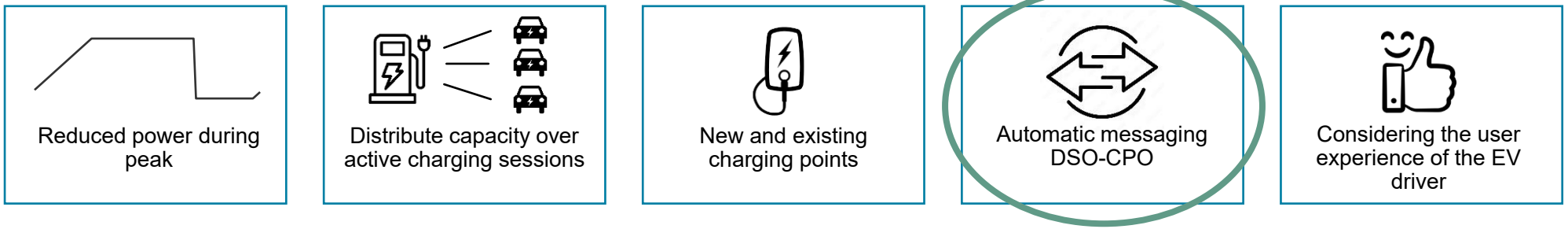



# Grid aware charging

## Communication of a capacity frame



# Grid aware charging




Based on the 'Grid Aware Charging Guidelines' (May 2024):

- Reduce available capacity when and where needed
- Capacity frame for clusters of chargers
- Minimum guaranteed capacity
- Agreements between DSO – CPO in a Capacity Limitation Contract

# Interop through open standards

Open standards accelerate the energy transition:

- Lower integration costs and shorter time-to-integration
- Reduced vendor lock-in and greater freedom of choice. Less reliance on specific OEMs
- (International) collaboration broadens standards to support a wider array of use cases → faster innovation
- Less risk and faster troubleshooting through shared knowledge
- Open standards are easier to implement → faster adoption (network effect)
- Consensus takes time

# Grid Aware Charging

Nationale Agenda Laadinfrastructuur

Protocol requirements:

- Clear boundaries between DSO and CPO responsibilities
- Communication of available capacity for a group of chargers. No direct commands to assets.
- Scalable across multiple CPOs and DSOs in a N-to-N relationship
- Minimal implementation effort for all market participants
- Modern technology stack

# Grid Aware Charging

Nationale Agenda Laadinfrastructuur

- IEEE 2030.5: Protocol for direct control of individual energy devices.
- IEC 61850: Industrial-grade protocol for real-time control of grid infrastructure.
- OSCP: Day-ahead grid capacity forecasts for smart charging systems.
- DNP3: Operational control protocol for utility-owned field equipment.
- OpenADR 3: Standardized way to exchange grid capacity signals with market parties.

# OpenADR

## Clear role separation

- Enables DSOs to set capacity boundaries while CPOs retain control over charging behavior.

## Capacity-based steering model

- Communicates operational limits instead of issuing direct control or curtailment commands.

## Scales across the ecosystem

- Supports many-to-many interactions between multiple DSOs and CPOs.

## Low implementation effort

- Integrates cleanly with existing CPO backends without deep device-level integration.

## Modern, future-proof standard

- REST-based,  established governance structure, and extensible beyond EV charging use cases.

## Internationally used

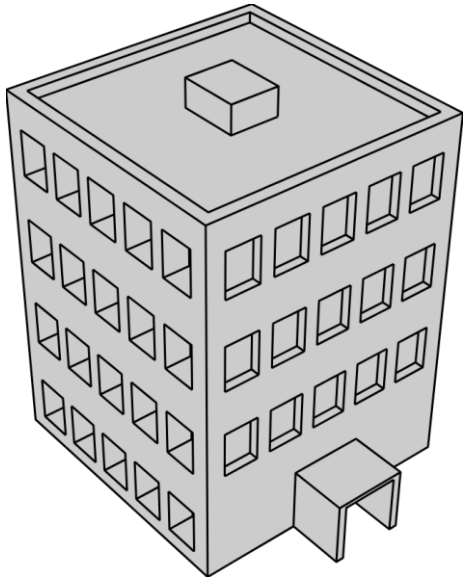
- Used or considered in the US, DE, UK, AU and SE, besides the Netherlands.

## Distribution System Operator (DSO)

## Charge Point Operator (CPO)

### Virtual Top Node (VTN)

### Virtual End Nodes (VENs)



**Events**

CPO polls for data and receives a 48h rolling window of event data

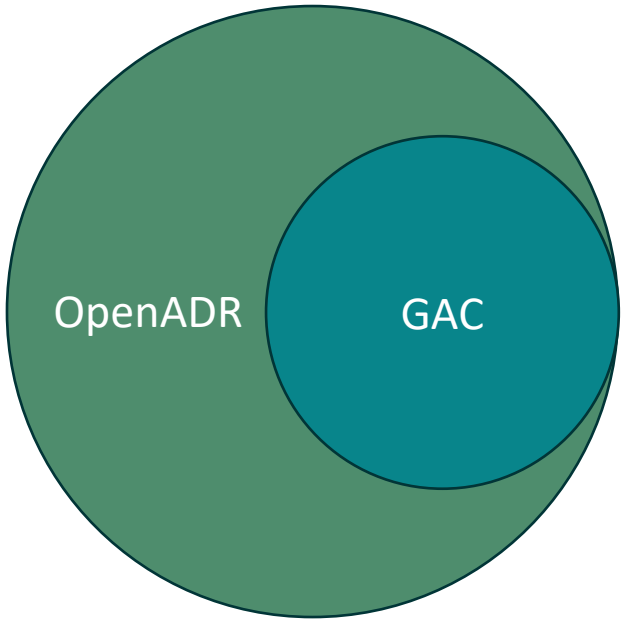
**Reports**

# OpenADR for Grid Aware Charging (GAC)

- In the Netherlands, OpenADR is used as the technical basis for Grid Aware Charging.
- The GAC-implementation is fully compliant with version 3.0 (3.1 coming soon).
- ElaadNL is part of the OpenADR Alliance working group and will ensure that the necessary adjustments are included in later versions.

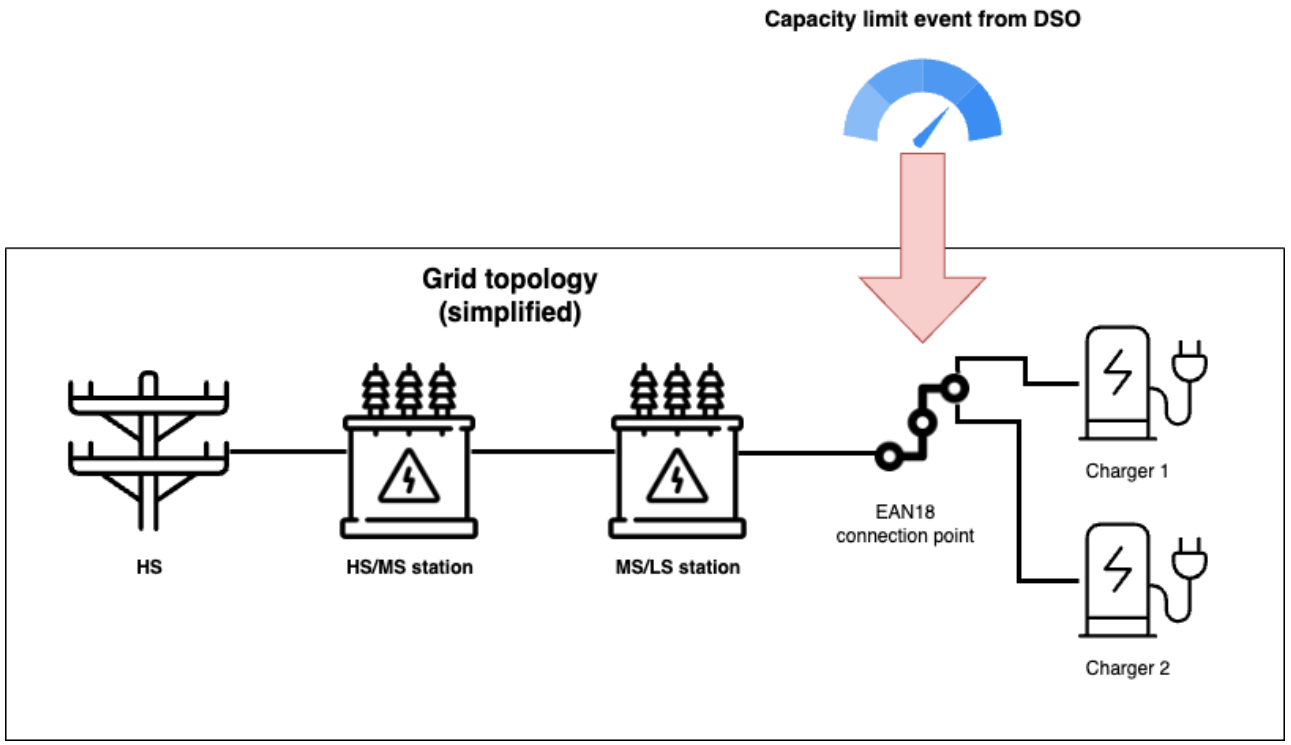
# OpenADR for Grid Aware Charging (GAC)

- The OpenADR profile for GAC
  - Uses a subset of features
  - Imposes additional restrictions



# Current scope

- Public (slow) charging stations
- Dutch DSOs and CPOs
- Simple DR signals: limit per cluster



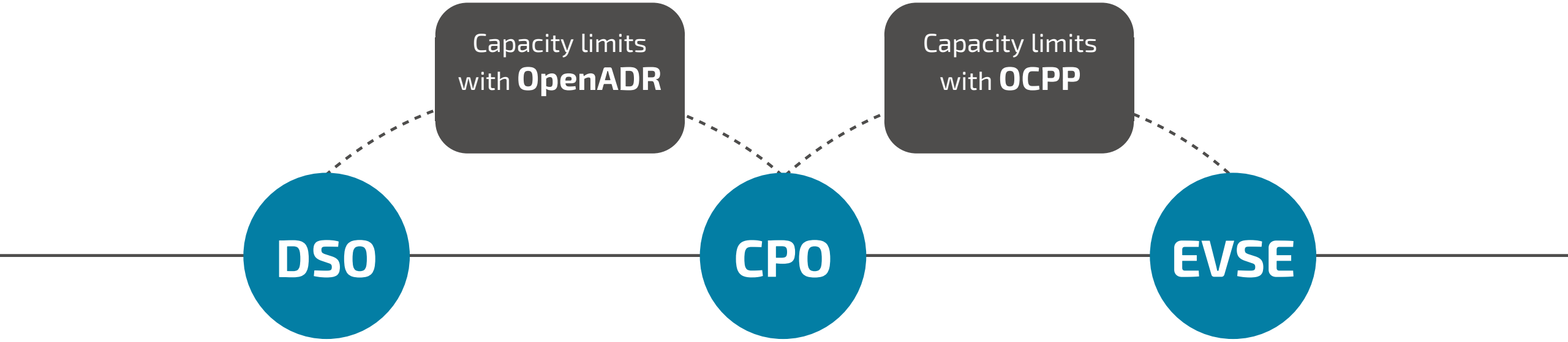
# Implementation

- Specifies the subset of OpenADR features used
- Constraints on:
  - Field values: timezones must use UTC
  - Identifiers
  - Payload types: only "IMPORT_CAPACITY_LIMIT" is used
- Functional constraints:
  - Polling time and publishing deadlines

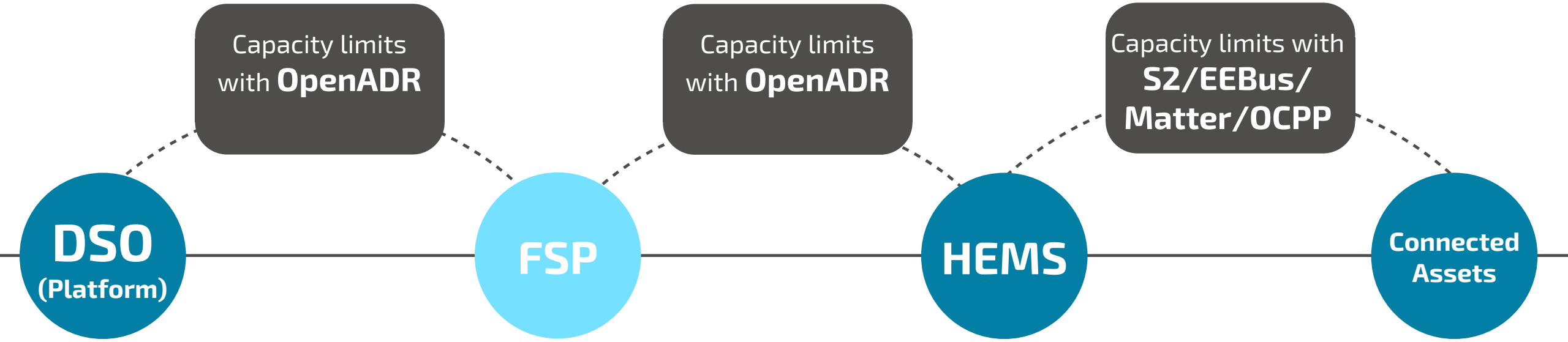
# Broader ecosystem

- OpenLEADR-rs
  - Open-source implementation of OpenADR VTN (server)
  - Developed by Tweede Golf with ElaadNL
  - 3.0 supported, ongoing development on 3.1.
- OpenADR3-client
  - Open-source Python SDK for the VEN (client)
  - Developed by ElaadNL
- OpenADR3-GUI
  - Open-source graphical user interface for the VTN (server)
  - Developed by ElaadNL

# Grid Aware charging chain



# Re-use this chain?



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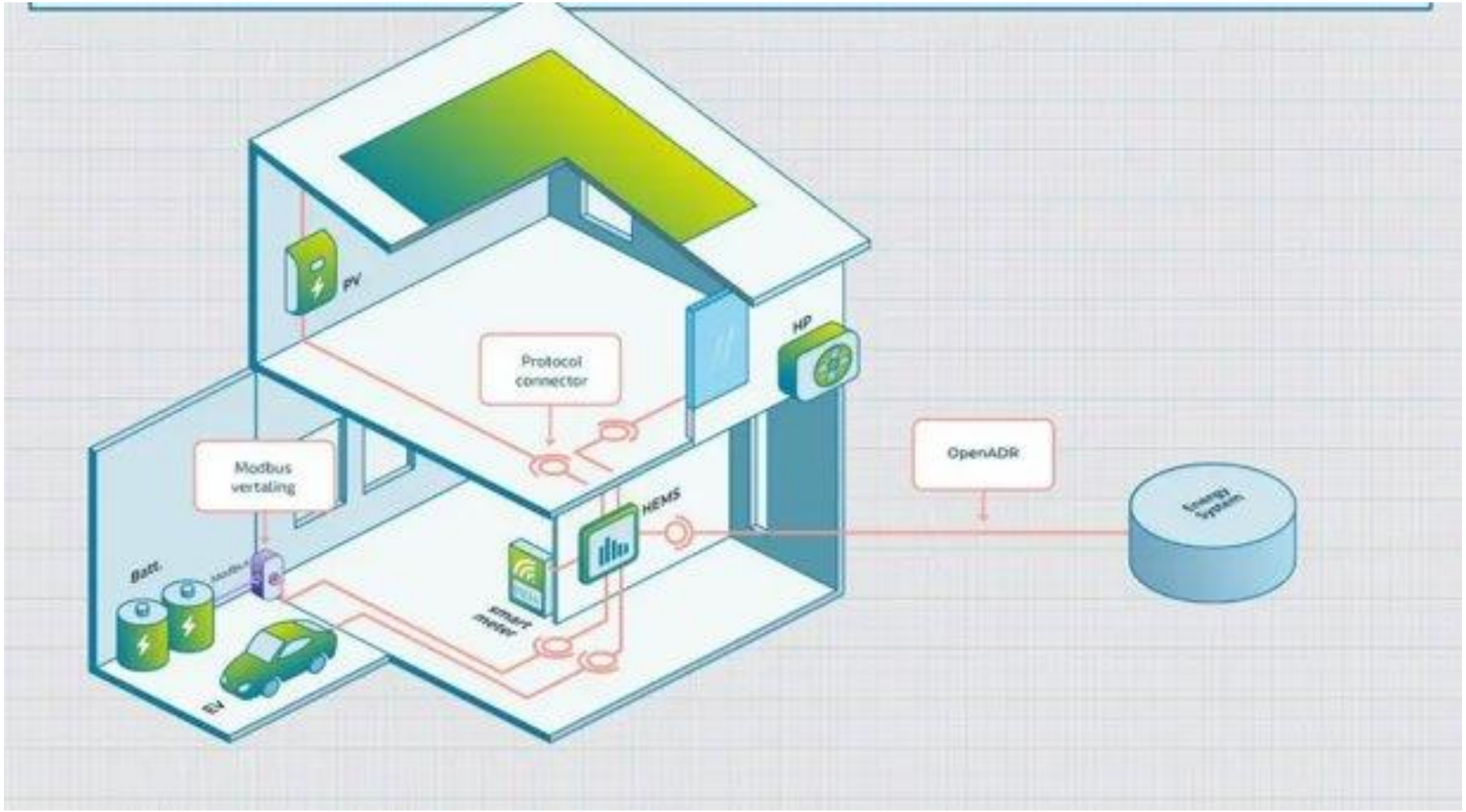


Elaadnl

# Residential Flexibility Event

## OpenADR and the DSO

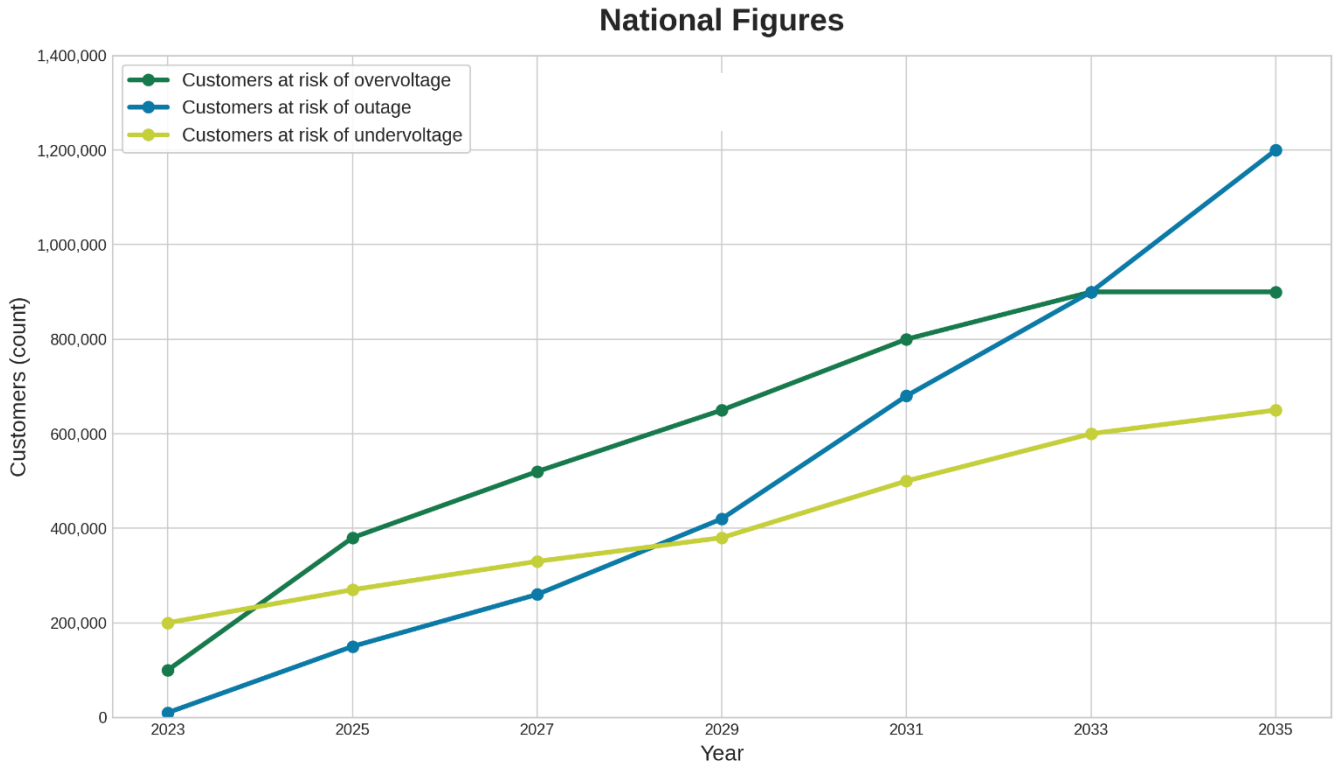
**Harold Pul**

09 March 2026

# Cause

In the current energy transition, Enexis faces the challenge of managing the increasing consumption and generation of electricity overall.

This leads to issues such as under-voltage, over-voltage, and overload of the low- and midvoltage grid, which threatens the reliability of the energy supply for our customers.



# Opportunity

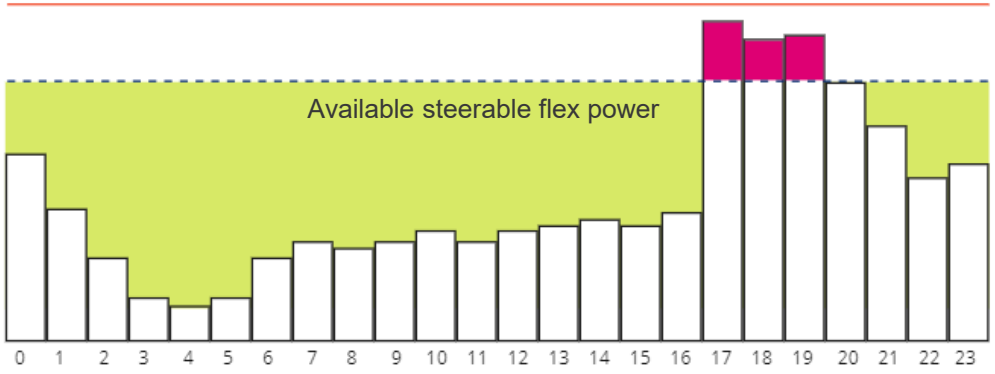
After gathering insights from various market participants, we see an opportunity to use available flexible capacity in the low-voltage grid

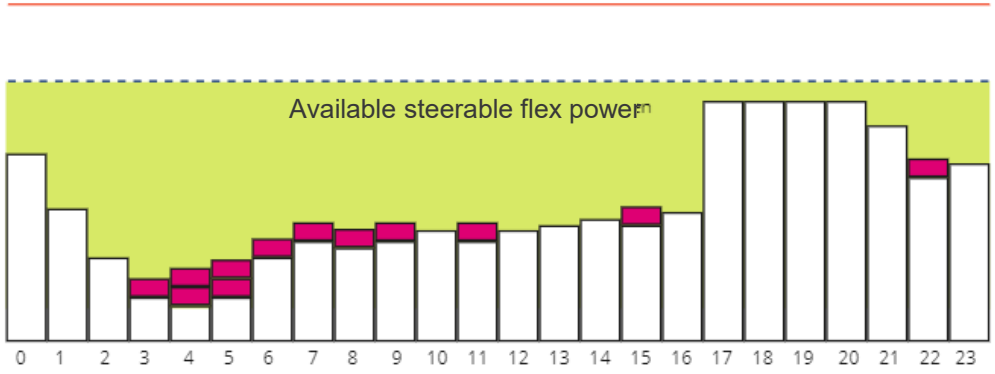
by shifting energy over time through demand response

# Expected impact

FROM

TO



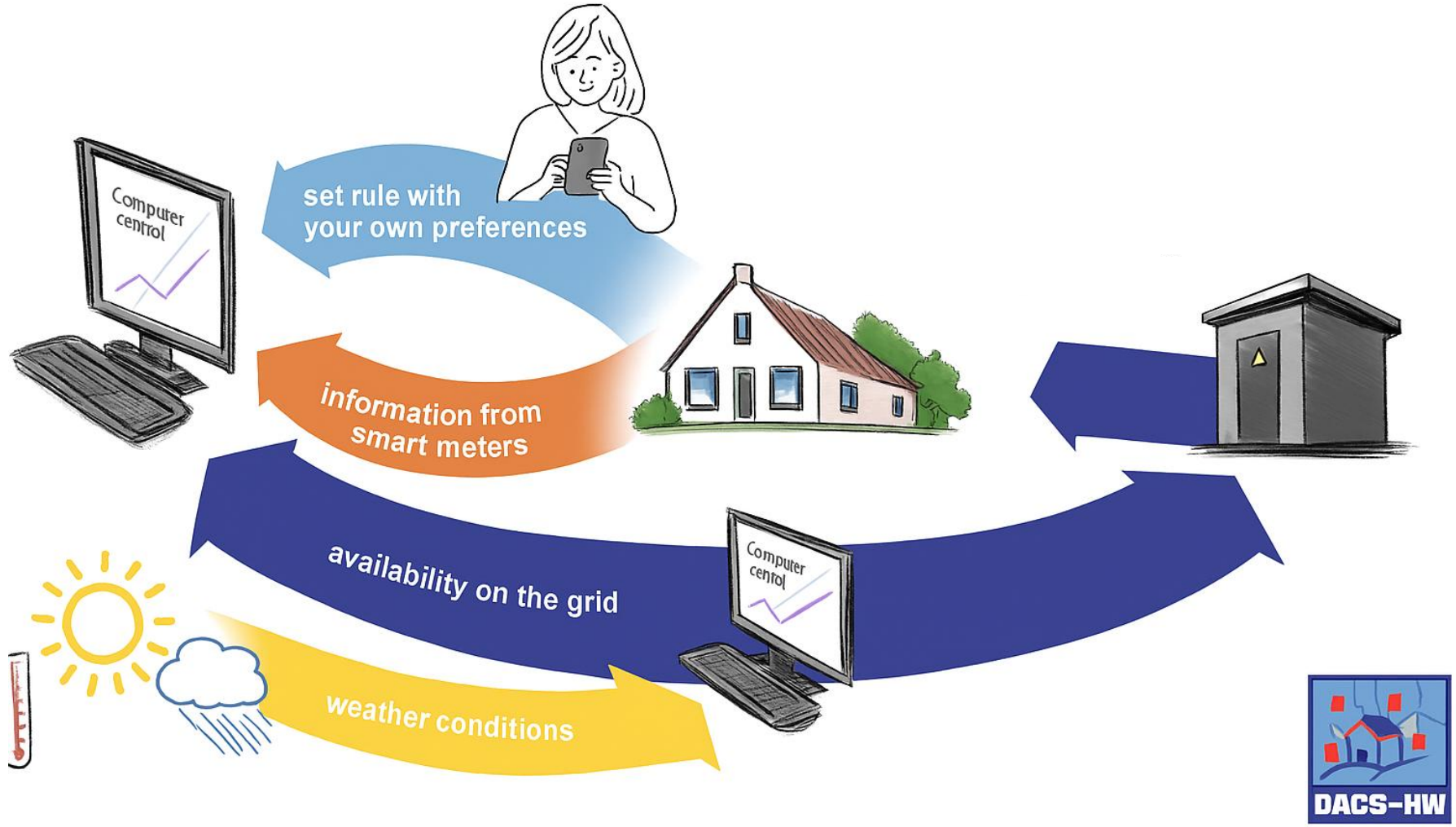



# Previous learnings

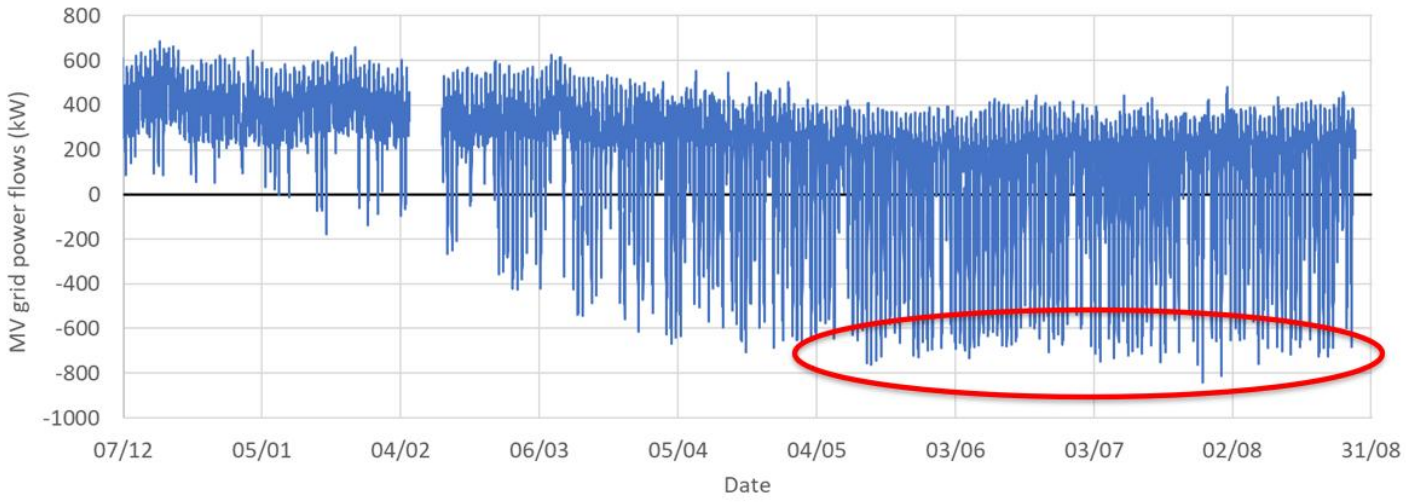
## Pilots with hybrid heat pumps and home batteries

# Smart control of heat pumps while maintaining comfort

DACS-HW



# NO-GIZMOS - Ansen




9 x 10 kWh batteries

>800 kW PV op 1 MW grid

# Important recommendations

- Use OpenADR as the standard for grid operators
- Build a nationwide generic platform that translates OpenADR signals to devices
- Make OpenADR suitable for multiple asset types (EVs, batteries, Heatpumps)
- Apply OpenADR for real-time, fine-grained low-voltage grid control

# Energy Balancing Orchestrator

## Orchestrating the low voltage grid

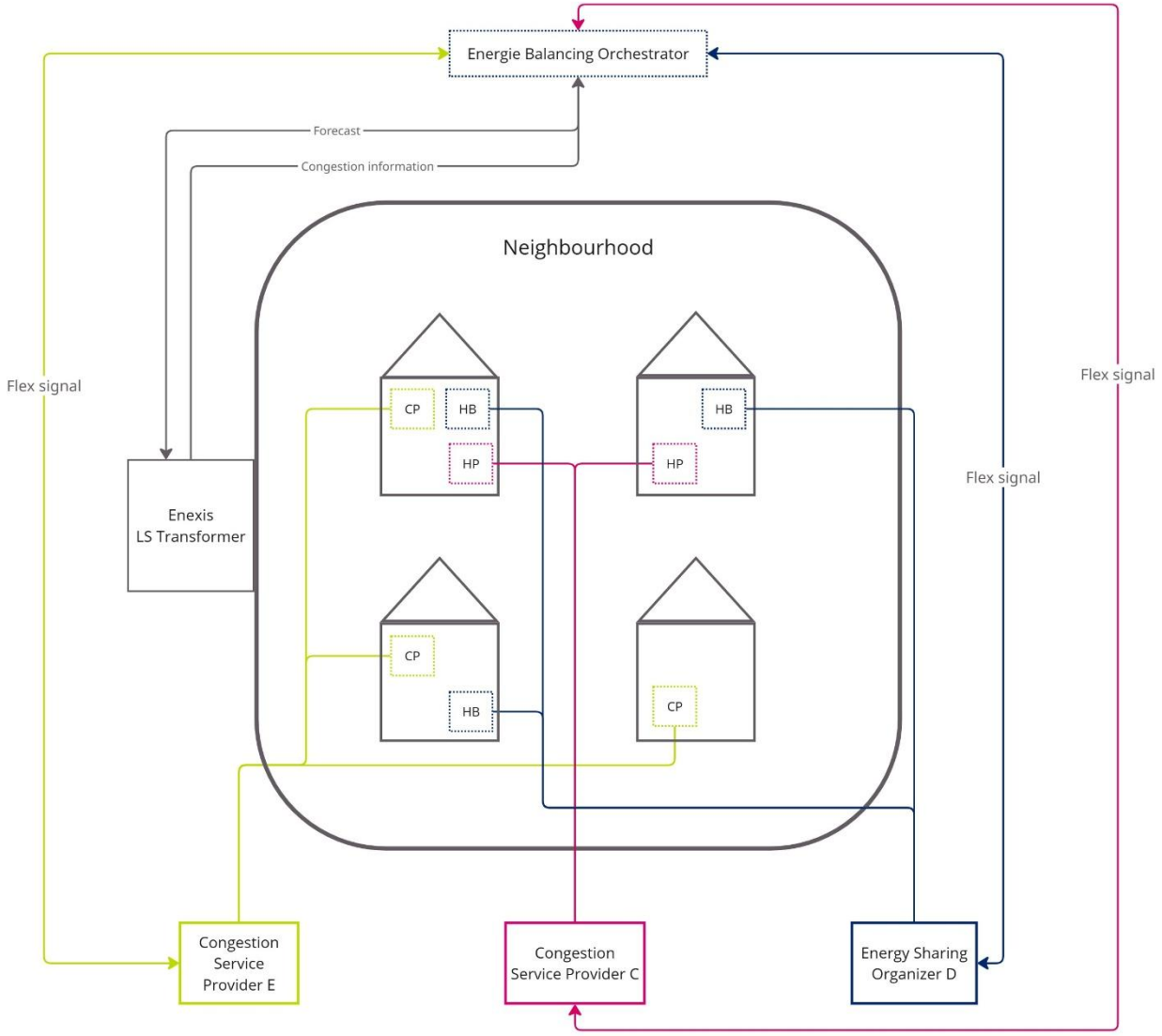
## Our ambition

# Energy Balancing Orchestrator

The Energy Balancing Orchestrator enables (market) participants and households to consistently activate a large amount of flexible grid capacity through effortless and comfortable participation

# Orchestration by flex signals

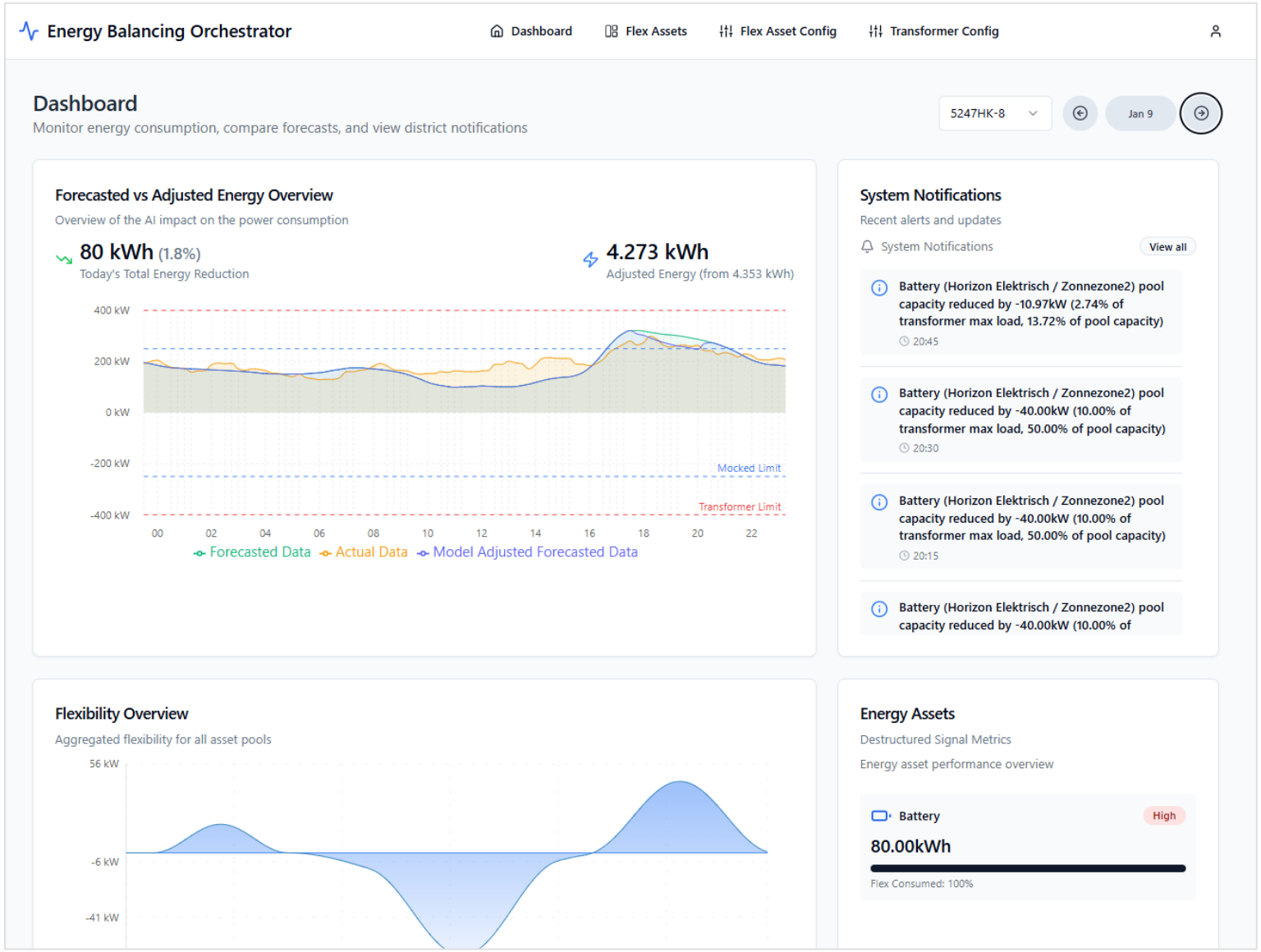
## Energy Balancing Orchestrator




- Neighbourhood
- LS transformer
- Multiple participants and assets
- Data
- Available flex
- Orchestration

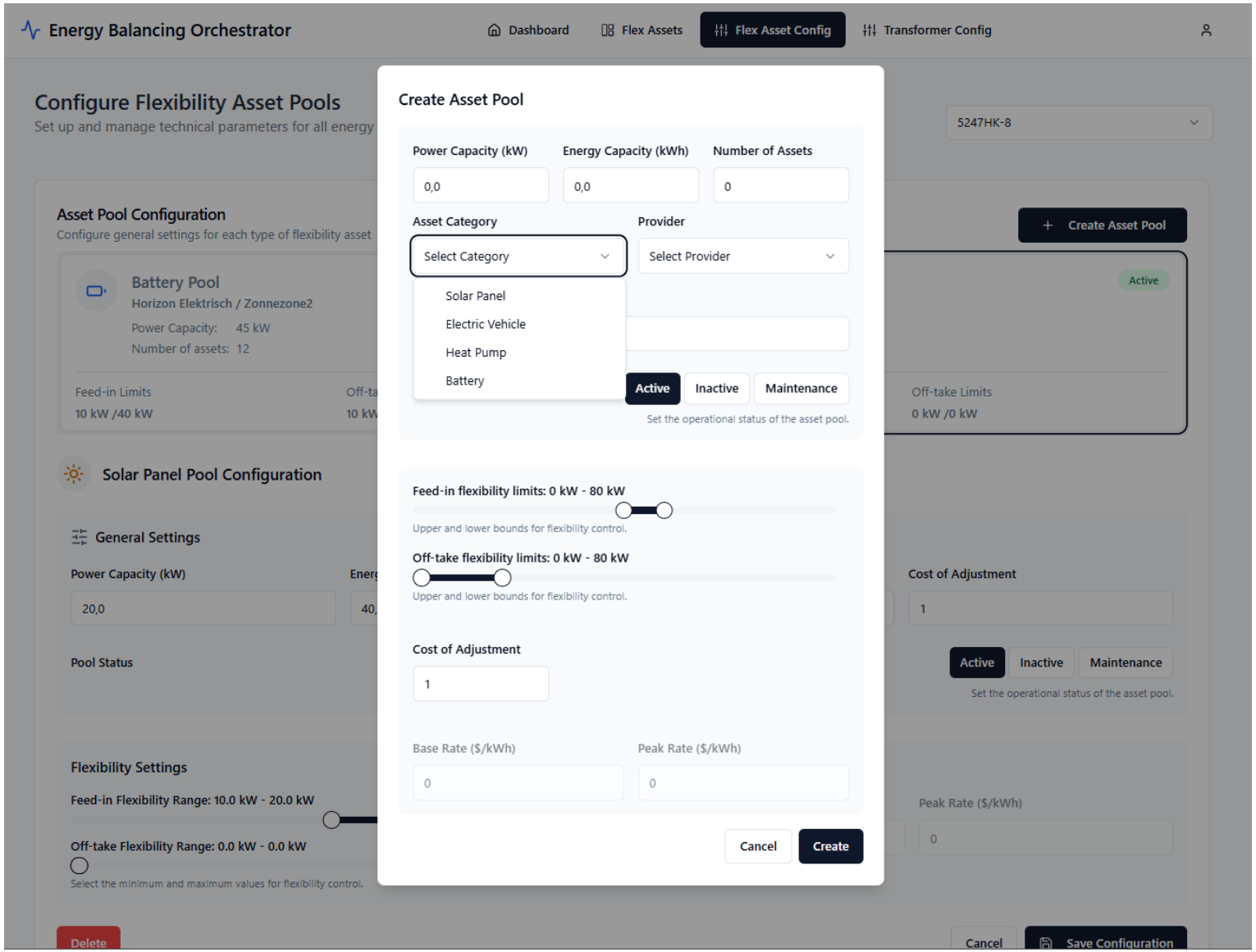
# Energy Balancing Orchestrator

## Platform - Dashboard



# Energy Balancing Orchestrator

## Platform – Flex registration



# OpenADR as a service

# Join with your flex

# Technical pilot OpenADR as as service

Cooperation between Enexis Innovation and Enexis Digital R&D

To create maximum flexibility capacity for the Energy Balancing Orchestrator platform, it is crucial to remove as many technical barriers as possible for flexibility providers.

## Assignment for R&D

| | | |
|---|---|---|
| Develop a working end-to-end OpenADR prototype | Receive and process standardized responses. | Assess whether OpenADR is suitable for scaling up. |

# Zonnedorpen as flex provider

ZONNEDORPEN

Flex capacity registration

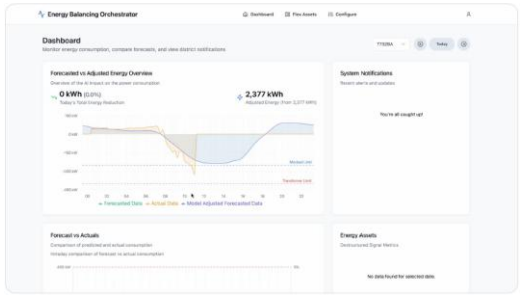
ENEXIS GROEP

LS forecast information

+

Asset capacity per participant

Energie Balancing Orchestrator




Flex request

Verification data

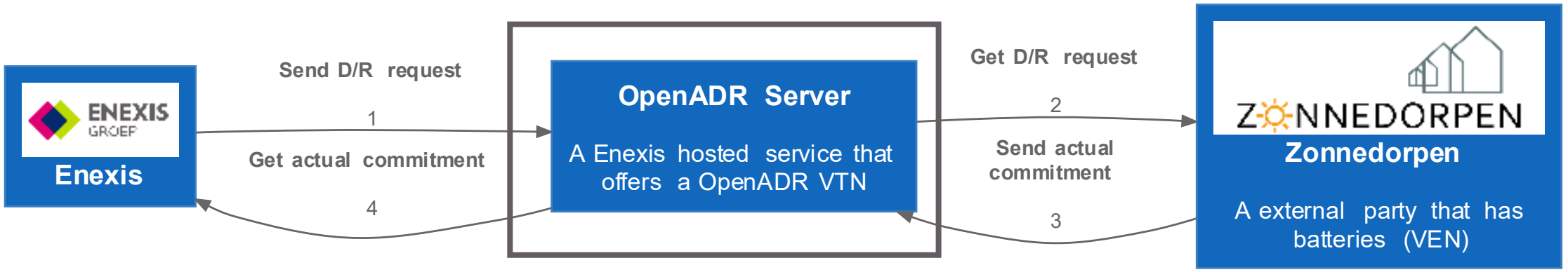
ZONNEDORPEN

Flex request overview

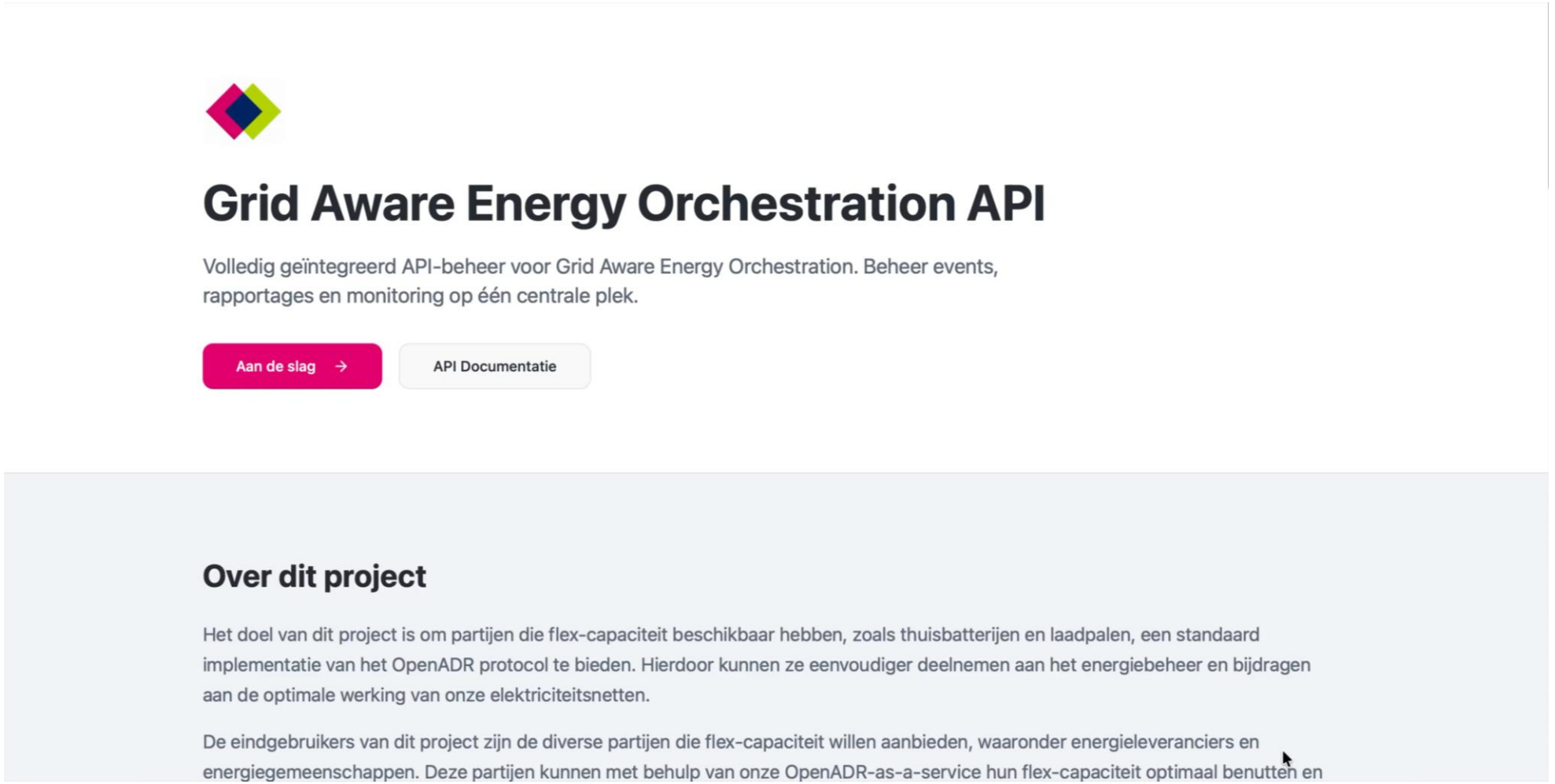
ENEXIS GROEP

# Architecture - Level 1

**Level 1 - Grid Aware Asset Orchestration Prototype**



# Long term vision:



## Grid Aware Energy Orchestration API

Volledig geïntegreerd API-beheer voor Grid Aware Energy Orchestration. Beheer events, rapportages en monitoring op één centrale plek.

Aan de slag →

API Documentatie

### Over dit project

Het doel van dit project is om partijen die flex-capaciteit beschikbaar hebben, zoals thuisbatterijen en laadpalen, een standaard implementatie van het OpenADR protocol te bieden. Hierdoor kunnen ze eenvoudiger deelnemen aan het energiebeheer en bijdragen aan de optimale werking van onze elektriciteitsnetten.

De eindgebruikers van dit project zijn de diverse partijen die flex-capaciteit willen aanbieden, waaronder energieleveranciers en energiegemeenschappen. Deze partijen kunnen met behulp van onze OpenADR-as-a-service hun flex-capaciteit optimaal benutten en

# Questions?

## End of presentation

### Contactgegevens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