

OpenADR



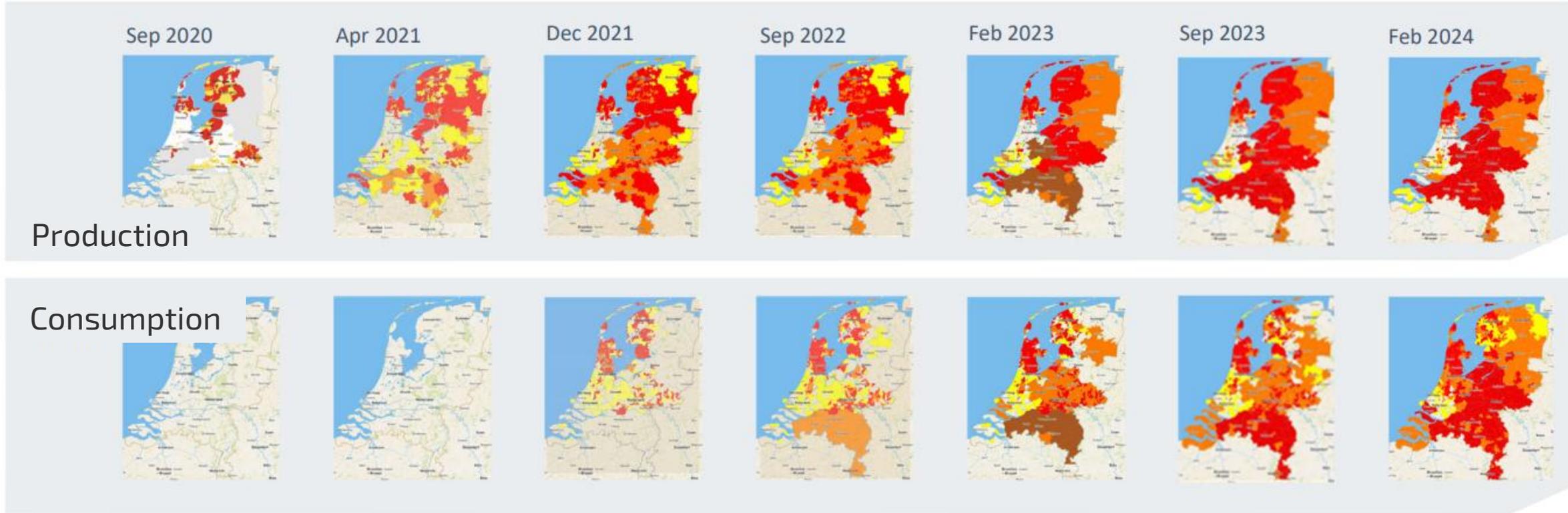
- For Grid Aware Charging (GAC)
- OpenADR / GAC deepdive
- OpenADR for DSOs

A photograph of a public electric vehicle charging station. The station is a tall, grey metal cabinet with a charging cable and a green indicator light. In the background, there are other charging stations and a blurred car. The scene is outdoors with trees and a clear sky.

OpenADR for Grid Aware Charging

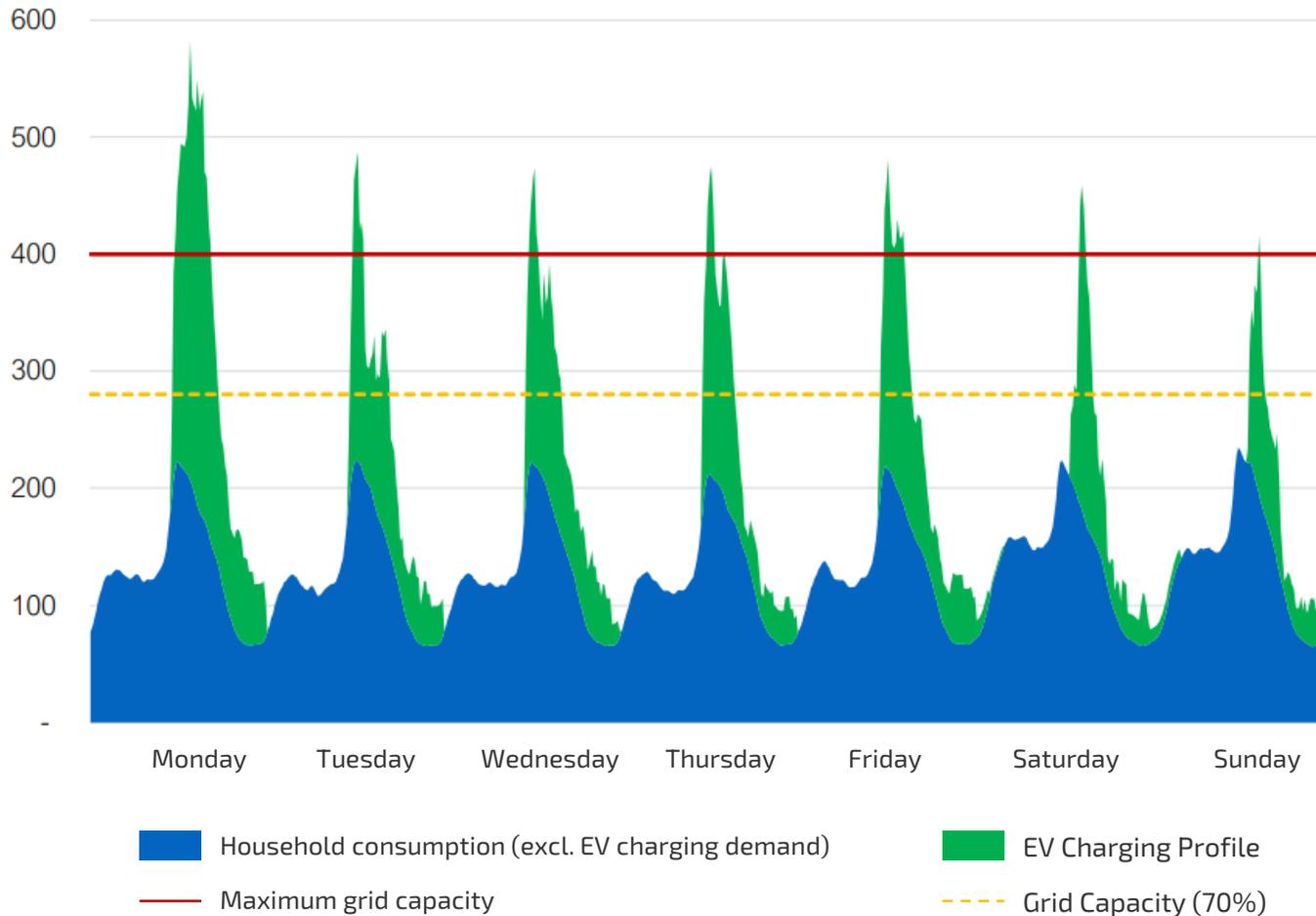
Demand response for public charge infrastructure in the Netherlands

Development of congestion



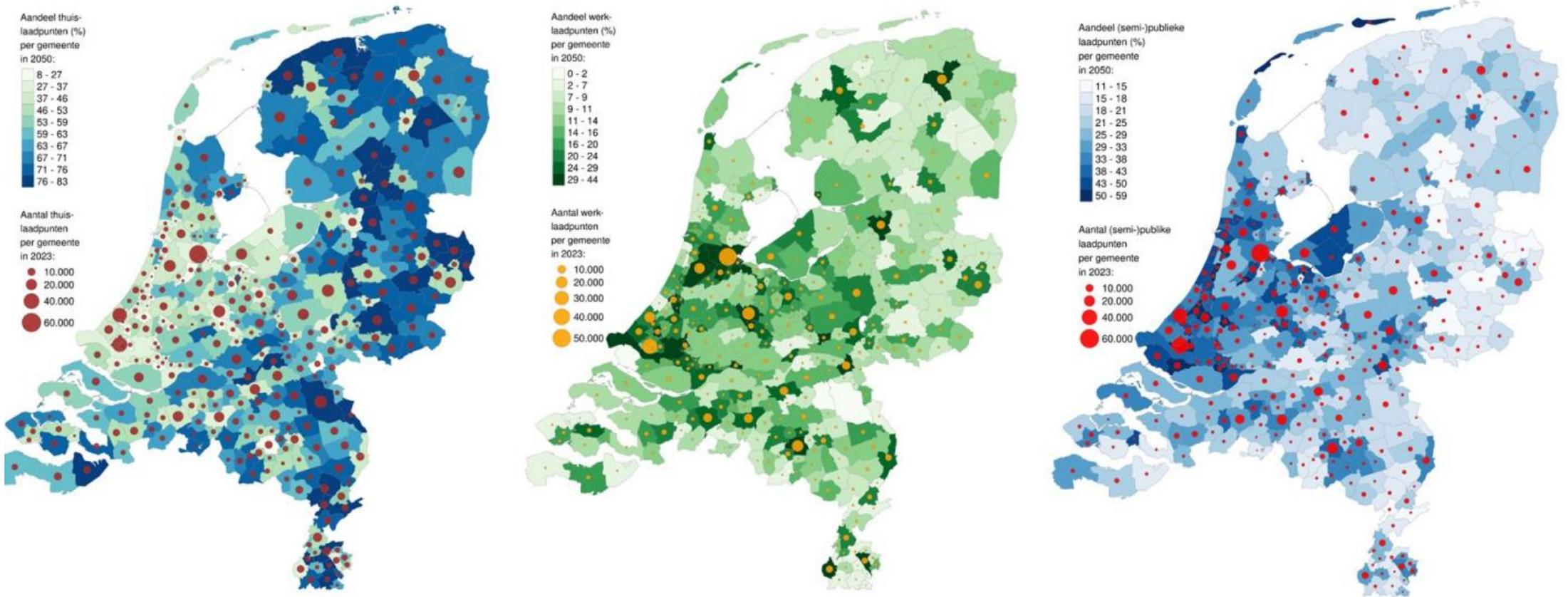
Increasing grid capacity demand

EV capacity demand on top of household demand



EV Hotspots

Capacity bottlenecks are not evenly spread

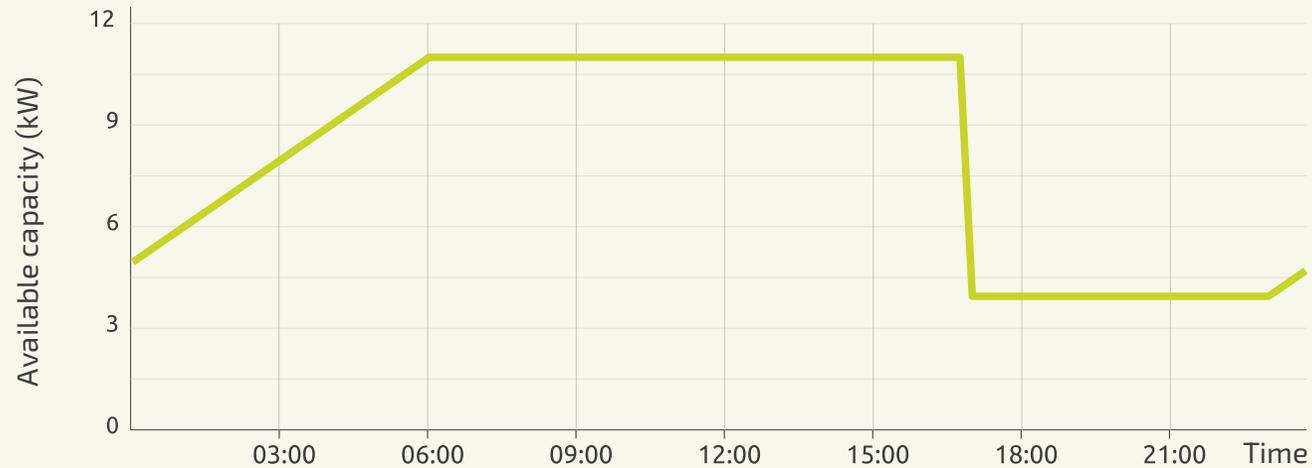


Grid aware charging

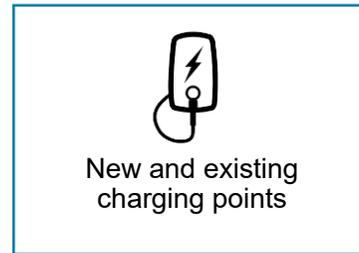
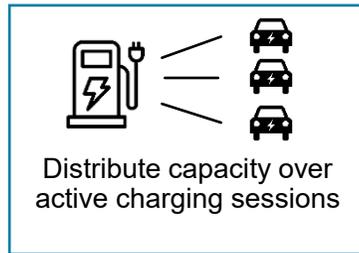
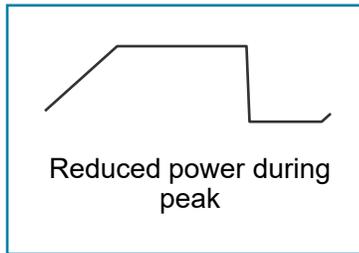
Communication of a capacity frame



Basic capacity per charge point



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



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



- 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

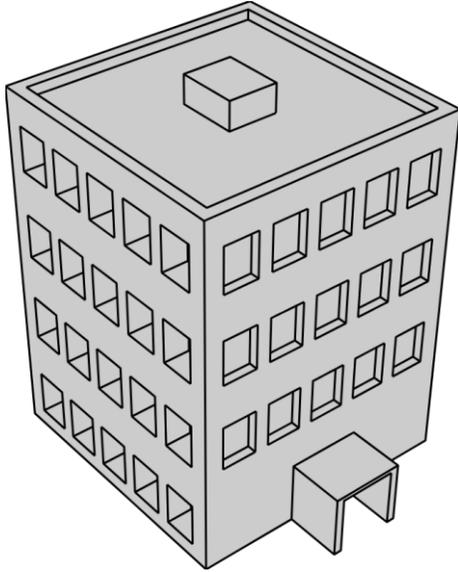
- Used or considered in the US, DE, UK, AU and SE, besides the Netherlands.

Distribution System Operator (DSO)

Charge Point Operator (CPO)

Virtual Top Node (VTN)

Virtual End Nodes (VENs)



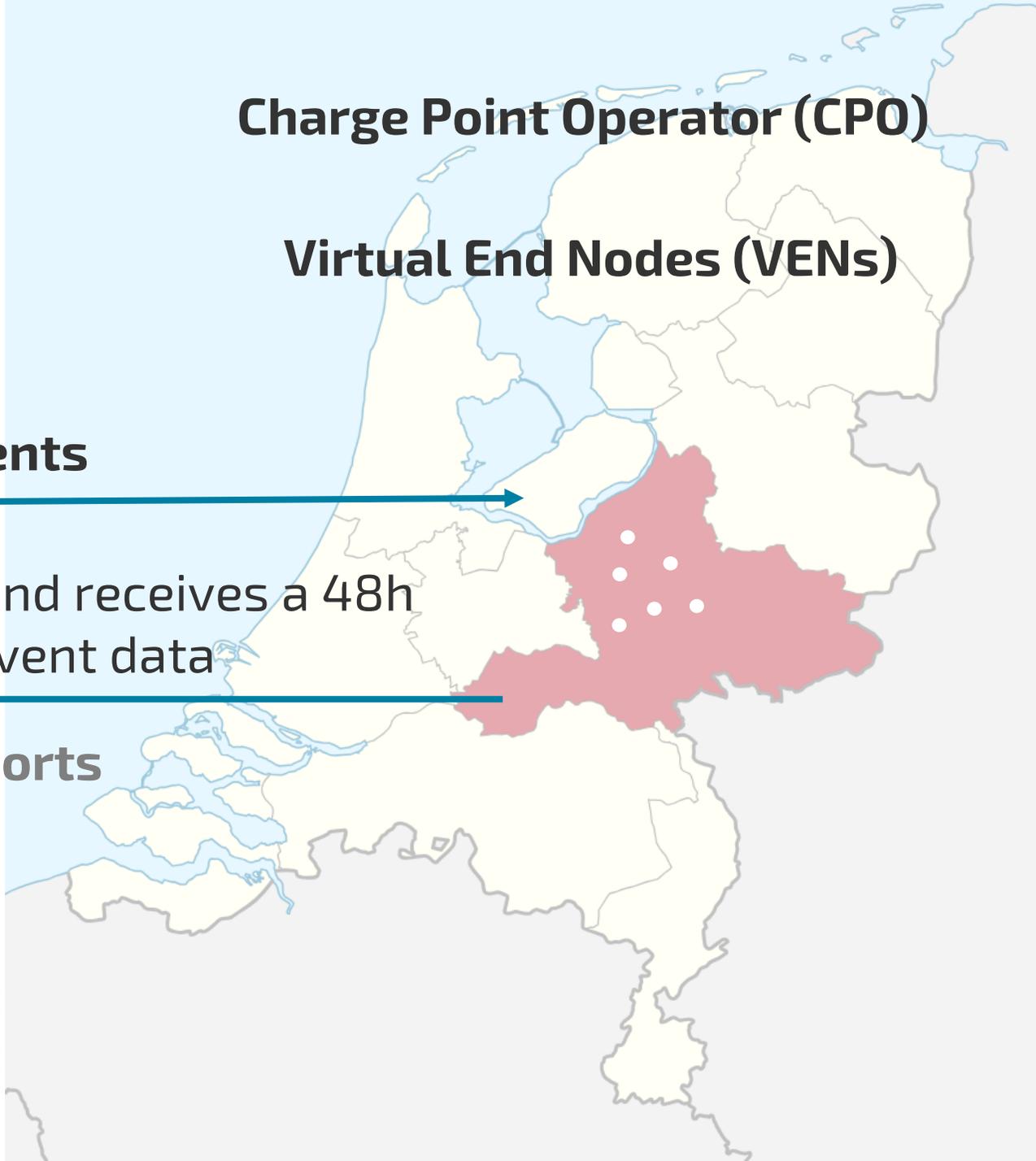
Events



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



Reports



OpenADR for Grid Aware Charging (GAC)

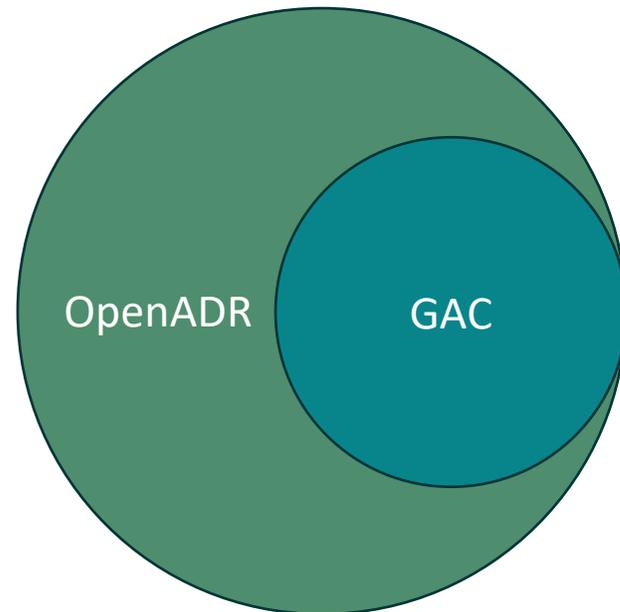


- In the Netherlands, OpenADR is used as the technical basis for Grid Aware Charging.
- The GAC-implementation is fully compliant with version 3.0 (3.1 coming soon).
- ElaadNL is part of the OpenADR Alliance working group and will ensure that the necessary adjustments are included in later versions.

OpenADR for Grid Aware Charging (GAC)

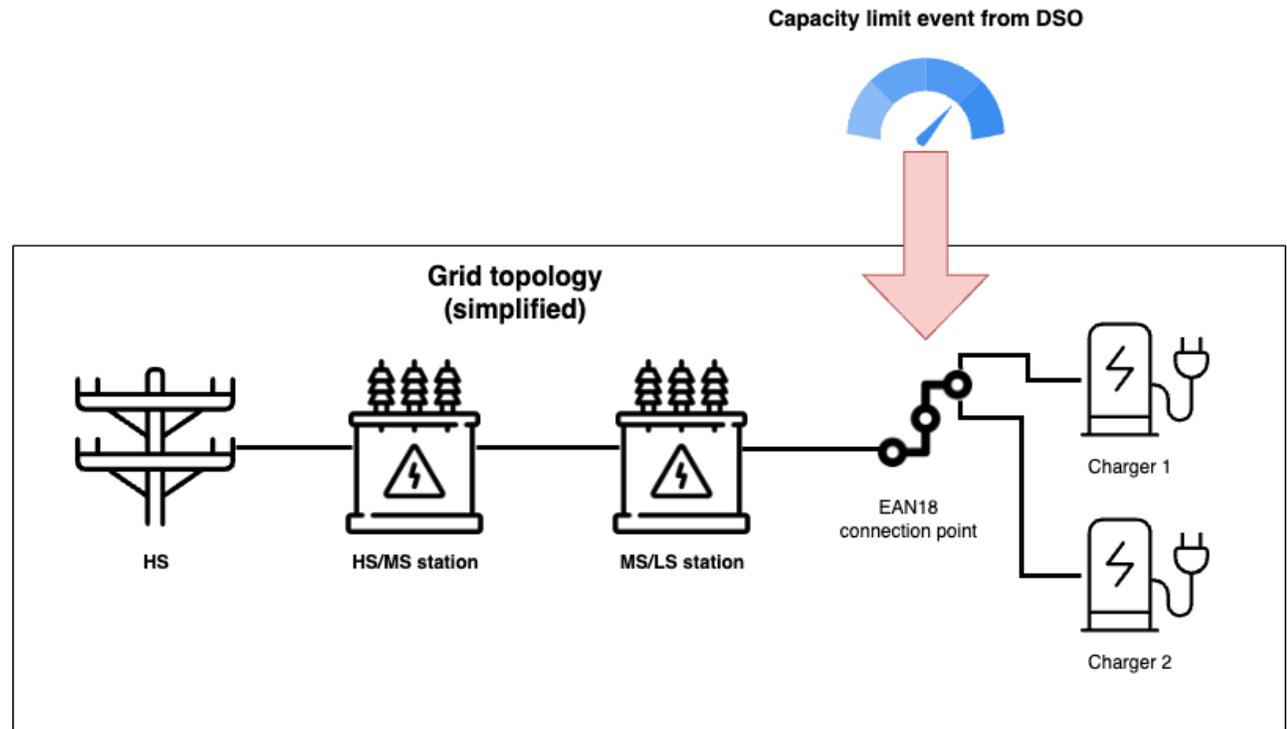


- The OpenADR profile for GAC
 - o Uses a subset of features
 - o Imposes additional restrictions



Current scope

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



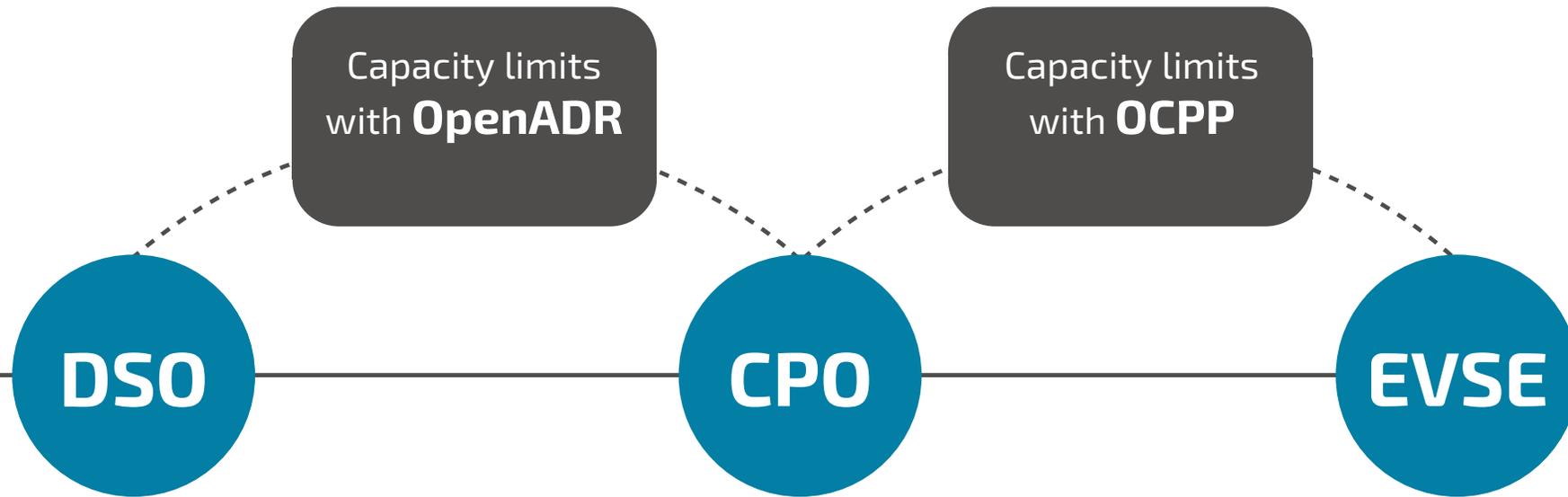
Implementation

- 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

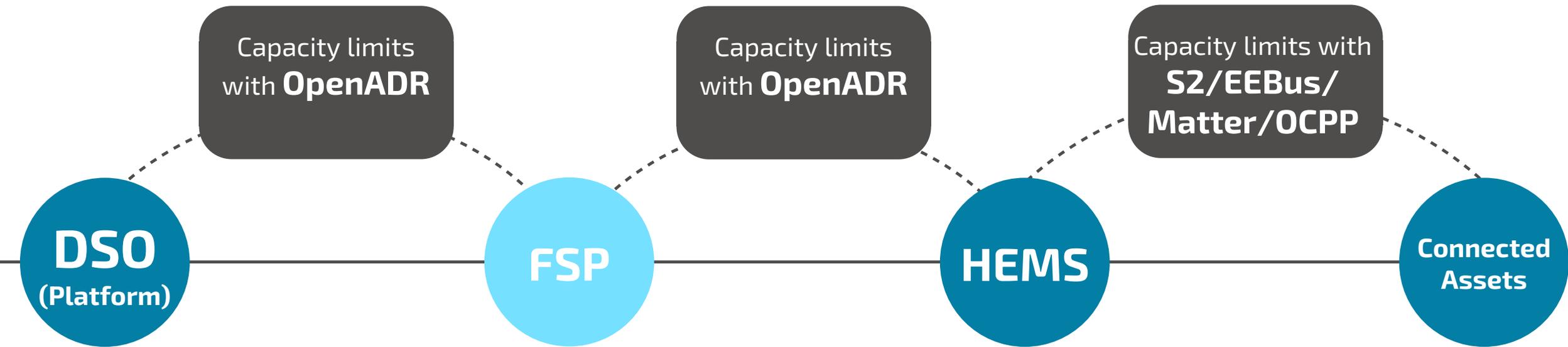
Broader ecosystem

- 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

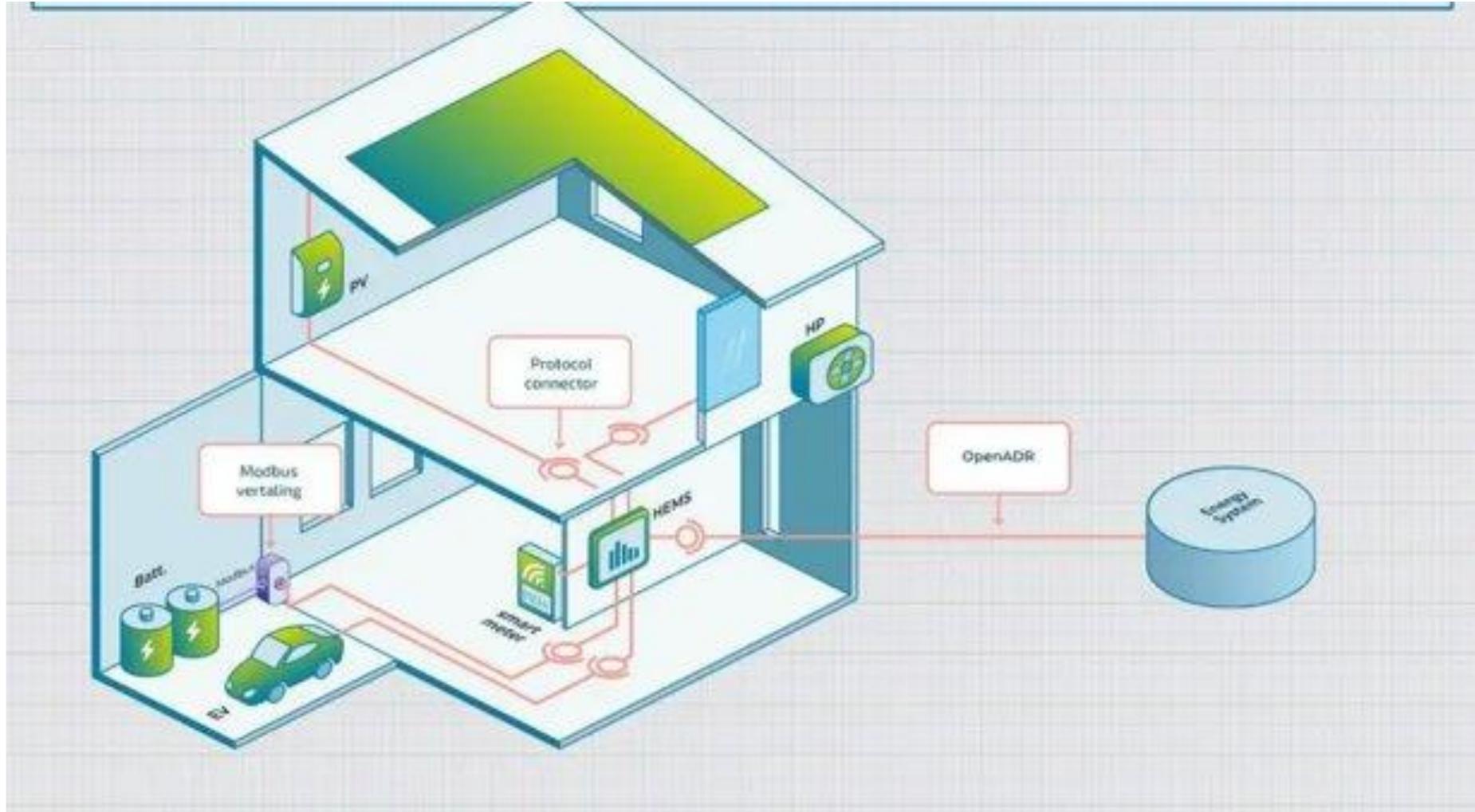
Grid Aware charging chain



Re-use this chain?



Re-use this chain?





Elaadnl

The logo for Elaadnl is centered within a large white circle. The text 'Elaadnl' is written in a sans-serif font, with 'Elaadn' in blue and 'l' in yellow. A yellow lightning bolt graphic is positioned below the text. The background of the entire image is a vibrant green and blue gradient, featuring a wind turbine on the right, a white car at the bottom, and various green plants and flowers in the foreground.



Residential Flexibility Event

OpenADR and the DSO

Harold Pul

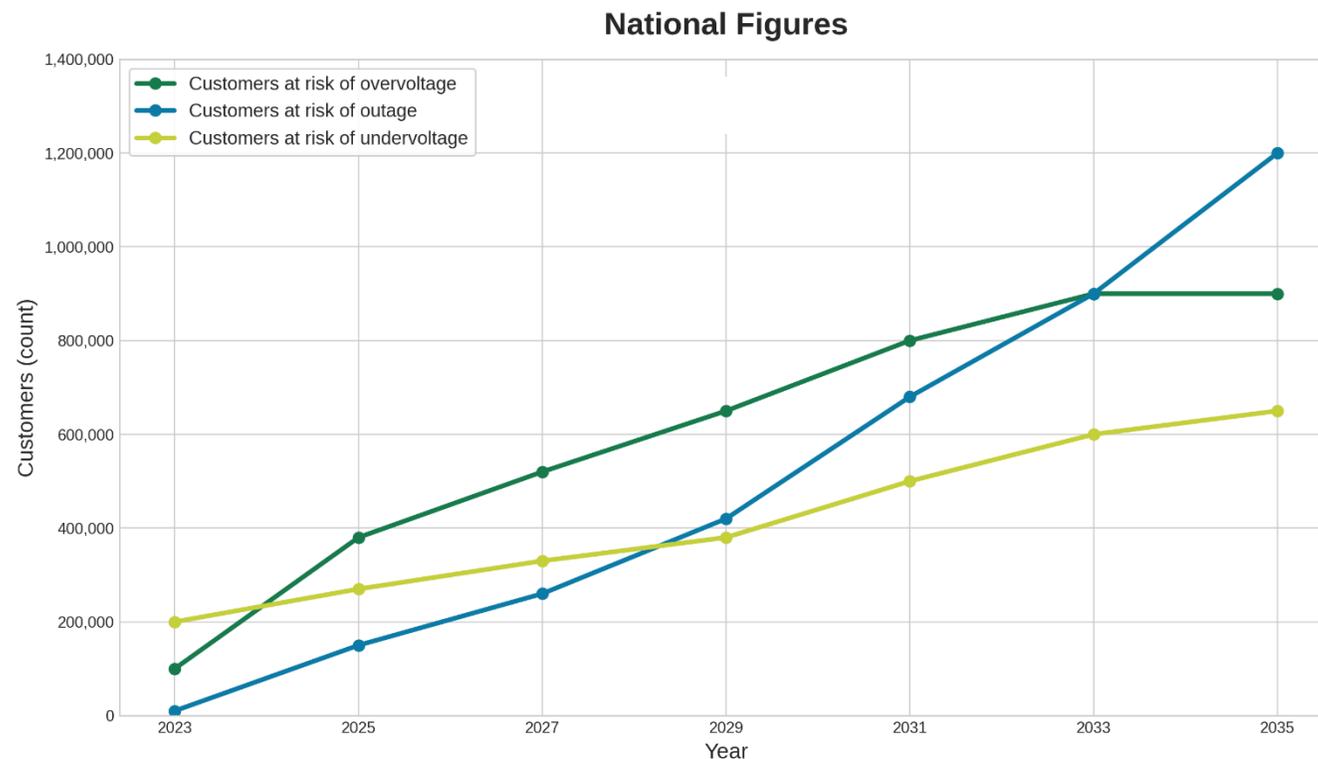
09 March 2026

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

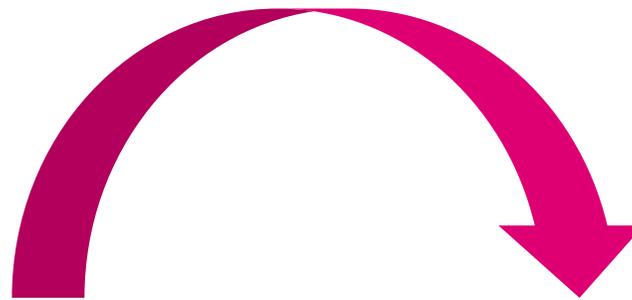




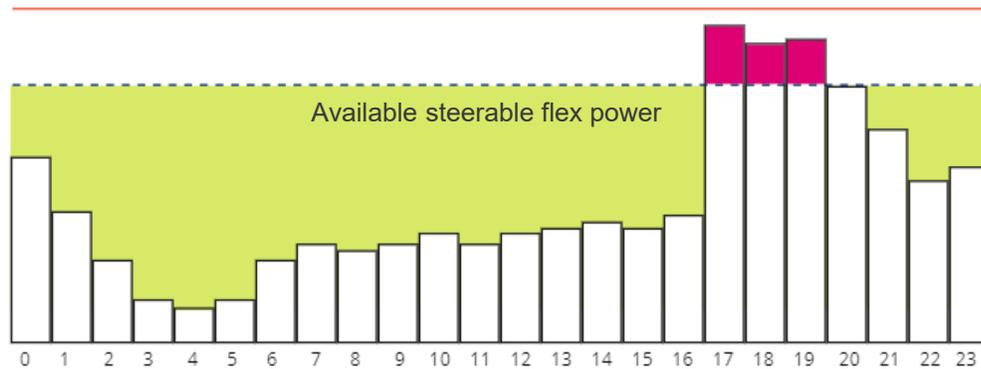
Expected impact



FROM



TO





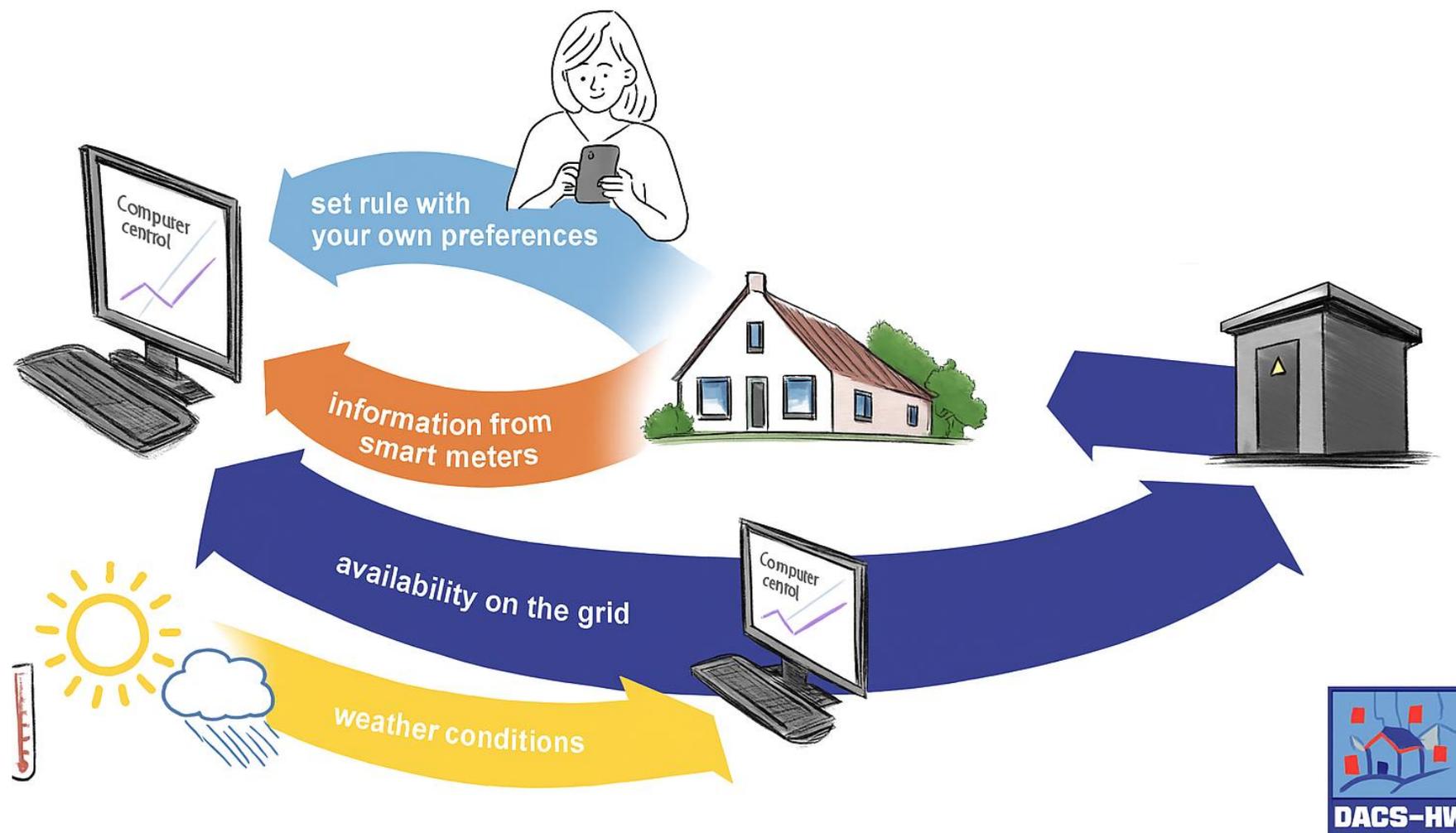
Previous learnings

Pilots with hybrid heat pumps and home batteries

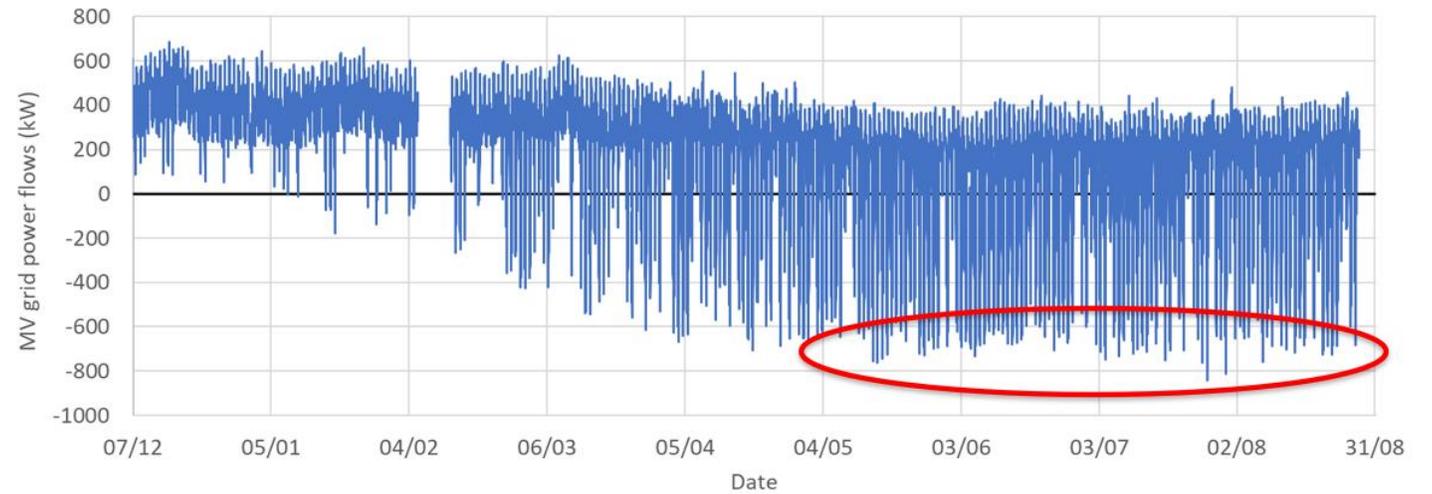


Smart control of heat pumps while maintaining comfort

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

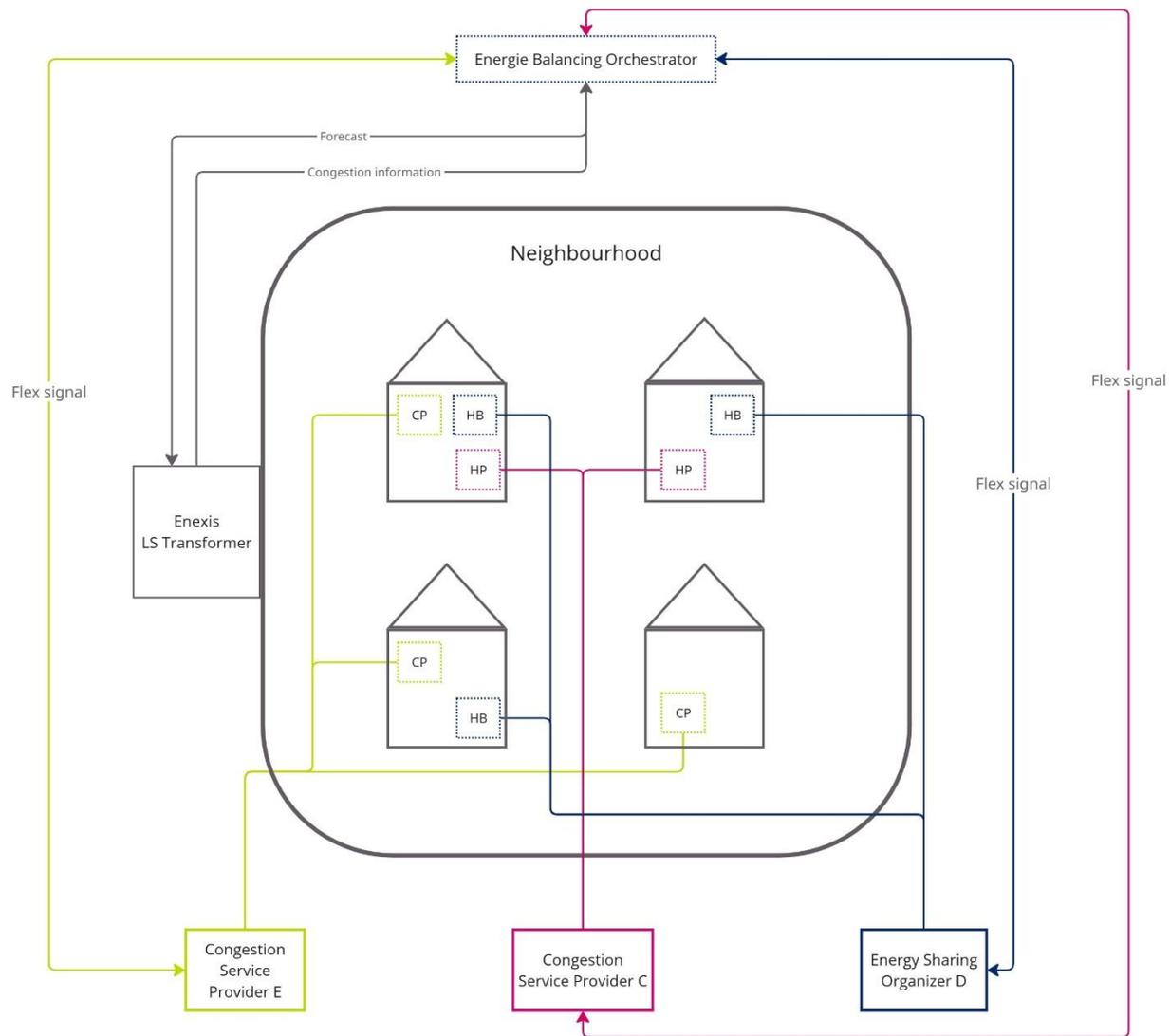
The Energy Balancing Orchestrator **enables** (market) participants and households to **consistently activate** a large amount of **flexible grid capacity** through effortless and comfortable participation





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

Dashboard Flex Assets Flex Asset Config Transformer Config

Dashboard

Monitor energy consumption, compare forecasts, and view district notifications

5247HK-8 Jan 9

Forecasted vs Adjusted Energy Overview

Overview of the AI impact on the power consumption

80 kWh (1.8%)
Today's Total Energy Reduction

4.273 kWh
Adjusted Energy (from 4.353 kWh)

Forecasted Data Actual Data Model Adjusted Forecasted Data

System Notifications

Recent alerts and updates

System Notifications View all

- Battery (Horizon Elektrisch / Zonnezone2) pool capacity reduced by -10.97kW (2.74% of transformer max load, 13.72% of pool capacity) 20:45
- Battery (Horizon Elektrisch / Zonnezone2) pool capacity reduced by -40.00kW (10.00% of transformer max load, 50.00% of pool capacity) 20:30
- Battery (Horizon Elektrisch / Zonnezone2) pool capacity reduced by -40.00kW (10.00% of transformer max load, 50.00% of pool capacity) 20:15
- Battery (Horizon Elektrisch / Zonnezone2) pool capacity reduced by -40.00kW (10.00% of transformer max load, 50.00% of pool capacity) 20:15

Flexibility Overview

Aggregated flexibility for all asset pools

Energy Assets

Deconstructed Signal Metrics

Energy asset performance overview

Battery High

80.00kWh

Flex Consumed: 100%



Energy Balancing Orchestrator

Platform - Flex registration



Energy Balancing Orchestrator

Dashboard Flex Assets Flex Asset Config Transformer Config

Configure Flexibility Asset Pools

Set up and manage technical parameters for all energy

Asset Pool Configuration

Configure general settings for each type of flexibility asset

Battery Pool
Horizon Elektrisch / Zonnezone2
Power Capacity: 45 kW
Number of assets: 12

Feed-in Limits: 10 kW / 40 kW
Off-take Limits: 10 kW / 0 kW

Solar Panel Pool Configuration

General Settings

Power Capacity (kW): 20,0
Energy Capacity (kWh): 40,0

Pool Status: **Active**

Flexibility Settings

Feed-in Flexibility Range: 10.0 kW - 20.0 kW
Off-take Flexibility Range: 0.0 kW - 0.0 kW

Create Asset Pool

Power Capacity (kW): 0,0
Energy Capacity (kWh): 0,0
Number of Assets: 0

Asset Category: Select Category
Provider: Select Provider

Solar Panel
Electric Vehicle
Heat Pump
Battery

Active Inactive Maintenance

Set the operational status of the asset pool.

Feed-in flexibility limits: 0 kW - 80 kW
Upper and lower bounds for flexibility control.

Off-take flexibility limits: 0 kW - 80 kW
Upper and lower bounds for flexibility control.

Cost of Adjustment: 1

Base Rate (\$/kWh): 0
Peak Rate (\$/kWh): 0

Cancel Create

5247HK-8

+ Create Asset Pool

Active

Off-take Limits: 0 kW / 0 kW

Cost of Adjustment: 1

Active Inactive Maintenance

Set the operational status of the asset pool.

Peak Rate (\$/kWh): 0

Cancel Save Configuration



OpenADR as a service

Join with your flex



Technical pilot OpenADR as a 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.

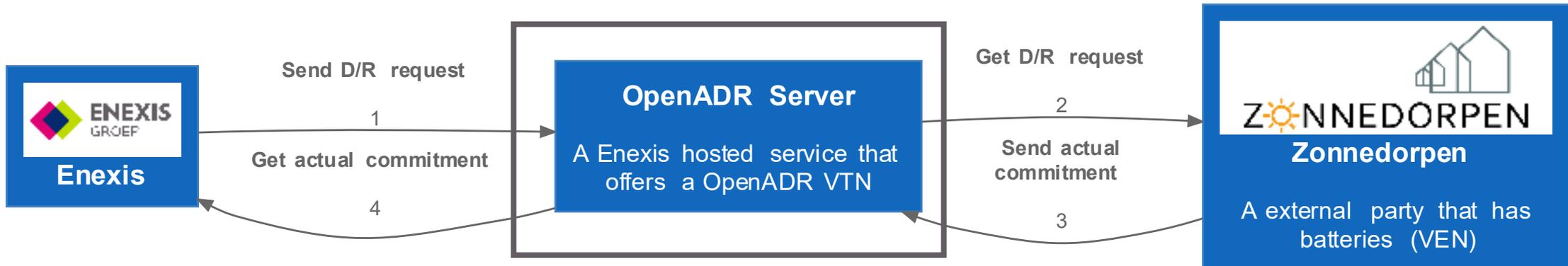
Assess whether OpenADR is suitable for scaling up.

Zonnedorpen as flex provider





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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