Empowering Utilities with Advanced Energy Disaggregation

Thessaloniki, Greece
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NET2GRID

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NET2GRID is an Energy AI company that **unlocks value from energy data**

US
- CrescoNet
- accelerated innovations
- aws Itron

Europe
- luminus
- e·on
- NeN
- SAP Silver Partner
- Greenbird
- eni
- ENGiE
- edp
- envia M
- maxeon
- Rabobank

Australia
- INTELLIHUB

Founded in 2011

The Netherlands
Greece
USA

Agenda

- Energy transition
- Energy disaggregation
- NET2GRID services

Energy transition

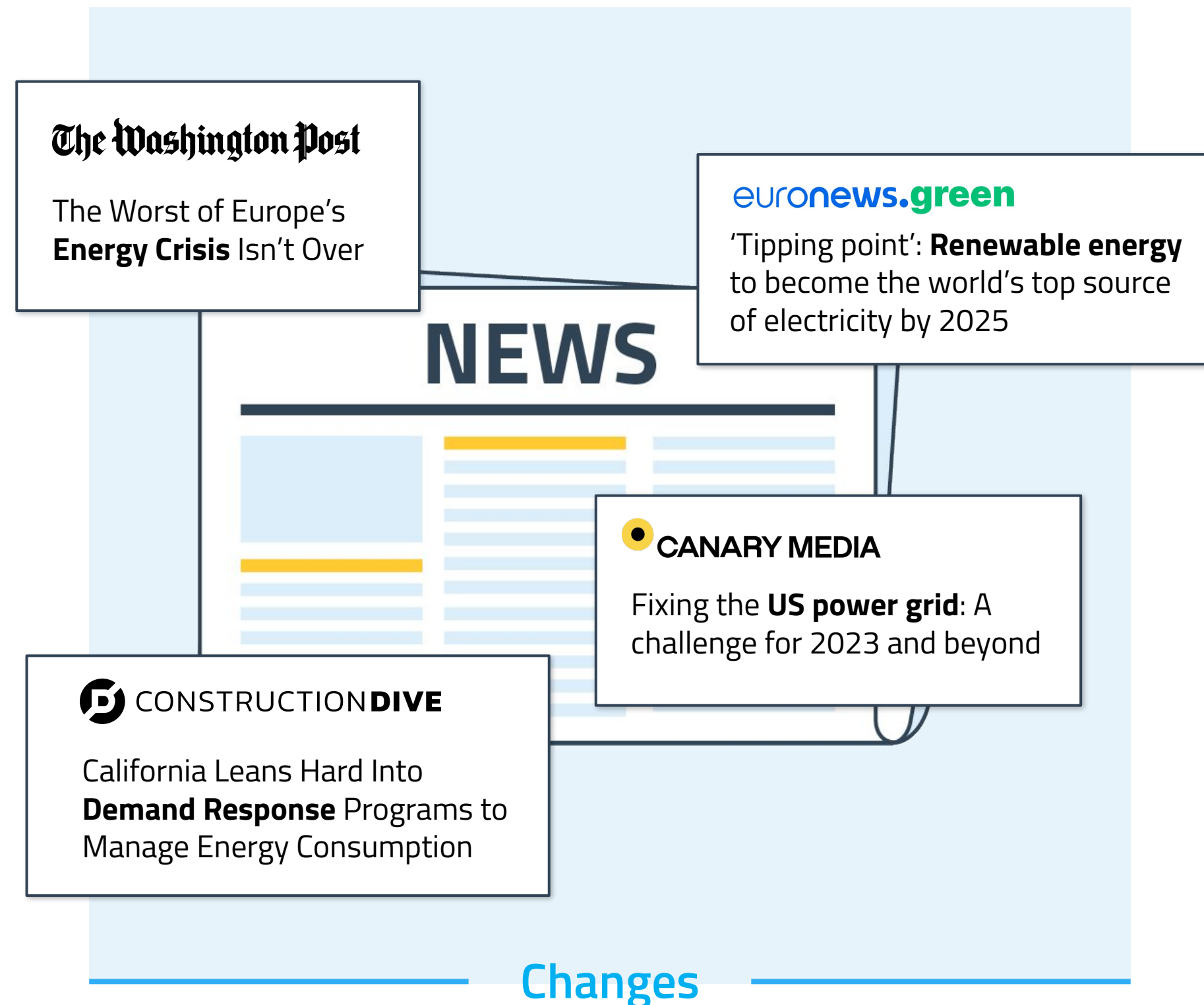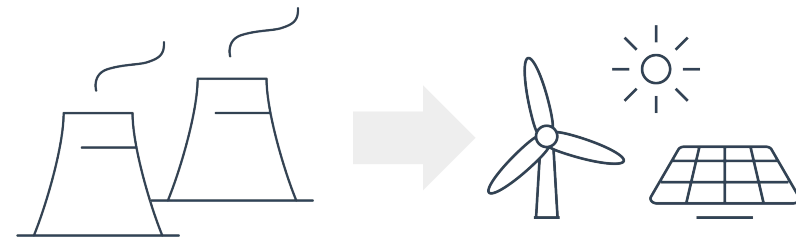**NET2GRID**

The **energy transition** shakes the energy industry...

The Washington Post

The Worst of Europe's **Energy Crisis** Isn't Over

euronews.green

'Tipping point': **Renewable energy** to become the world's top source of electricity by 2025

NEWS

CANARY MEDIA

Fixing the **US power grid**: A challenge for 2023 and beyond

CONSTRUCTIONDIVE

California Leans Hard Into **Demand Response** Programs to Manage Energy Consumption

Changes

Changes in the energy market ...

Grid modernization
turns consumers into energy producers
(and forces them to electrify)

Rising energy prices
Make energy costs (reduction) a high priority for
consumers
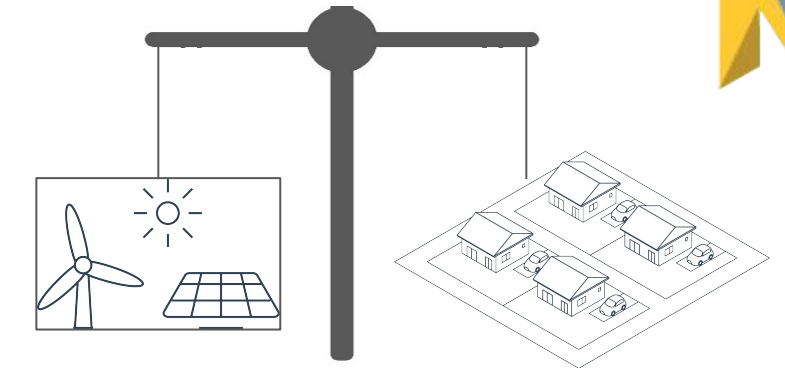
Balancing supply and demand
Weather-dependent power generation and increased
energy demands, force companies to better align
production and consumption to offload grid

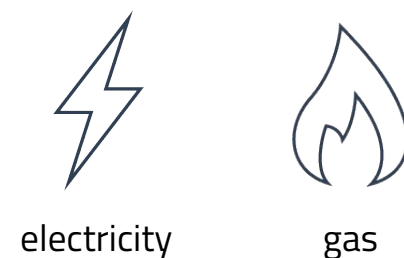... are creating opportunities for **utility companies** to ...

help their customers invest and
reduce energy costs

build longer and more profitable
relationships with these customers

enable growth by better balancing
supply and demand

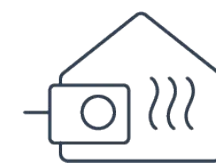... by broadening their portfolio of products and services.

Commodity

electricity   gas

Energy as a Service - Installing, financing, and managing smart energy assets

variable tariffs   heat pumps   local energy storage   high efficiency appliances   Solar PV   Smart charging   Home Energy Management

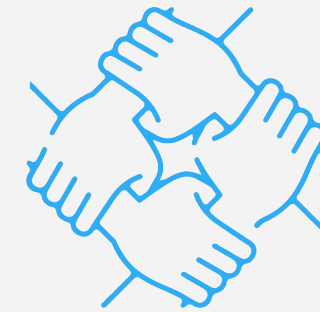# What does the energy transition mean for energy retailers?

Engage

Help customers understand their energy consumption

Empower

Help customers take direct action and experience quantifiable savings

Collaborate

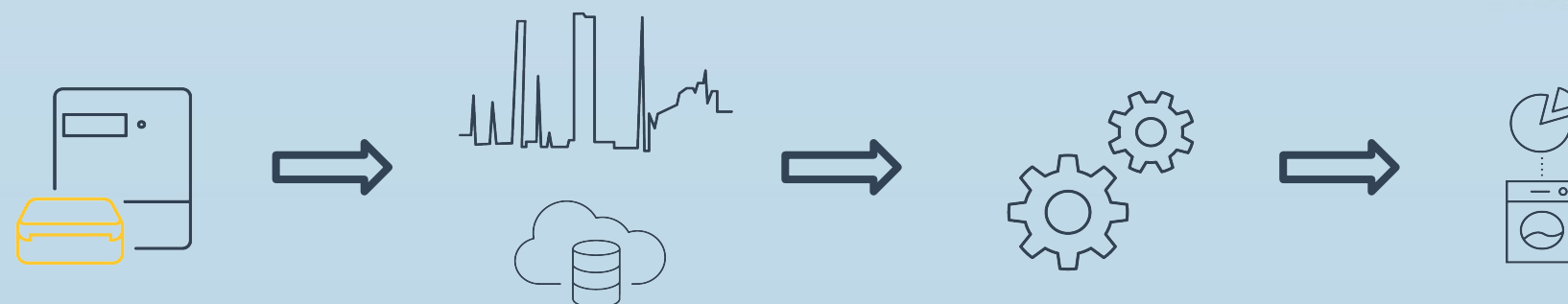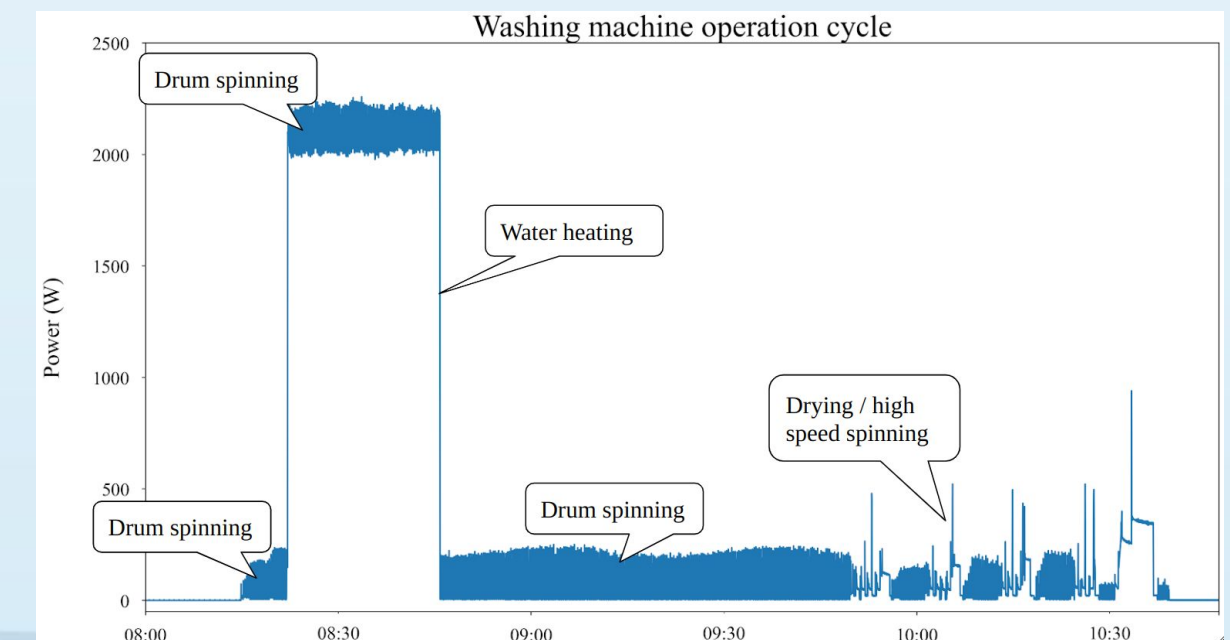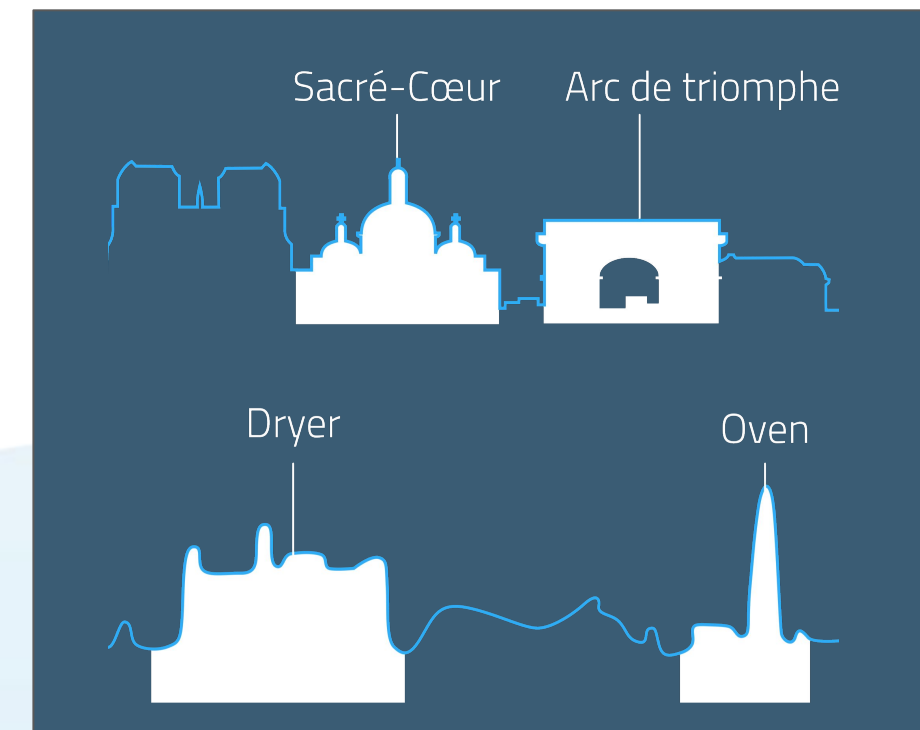Help customers optimize the efficiency of their DER assets

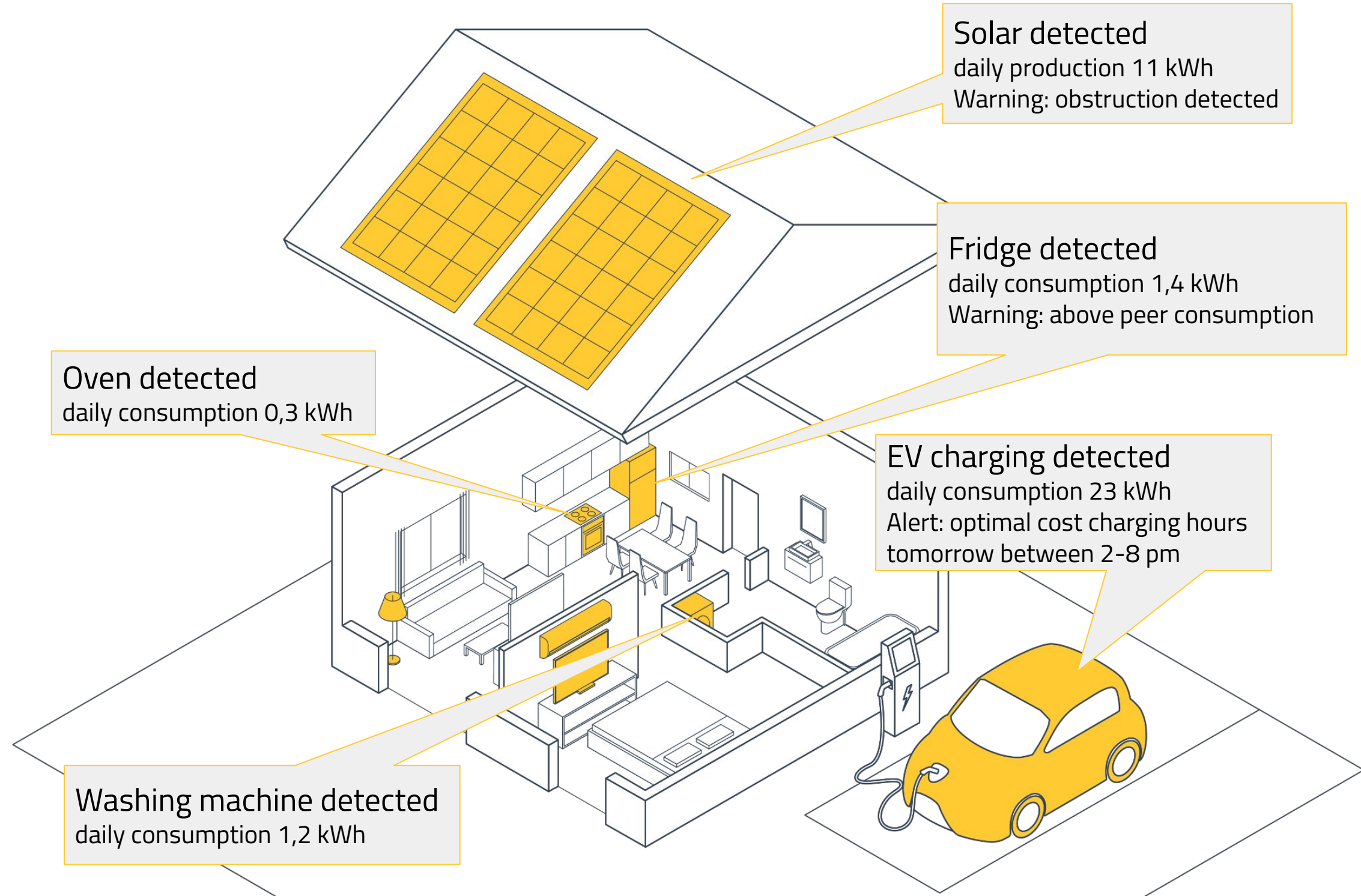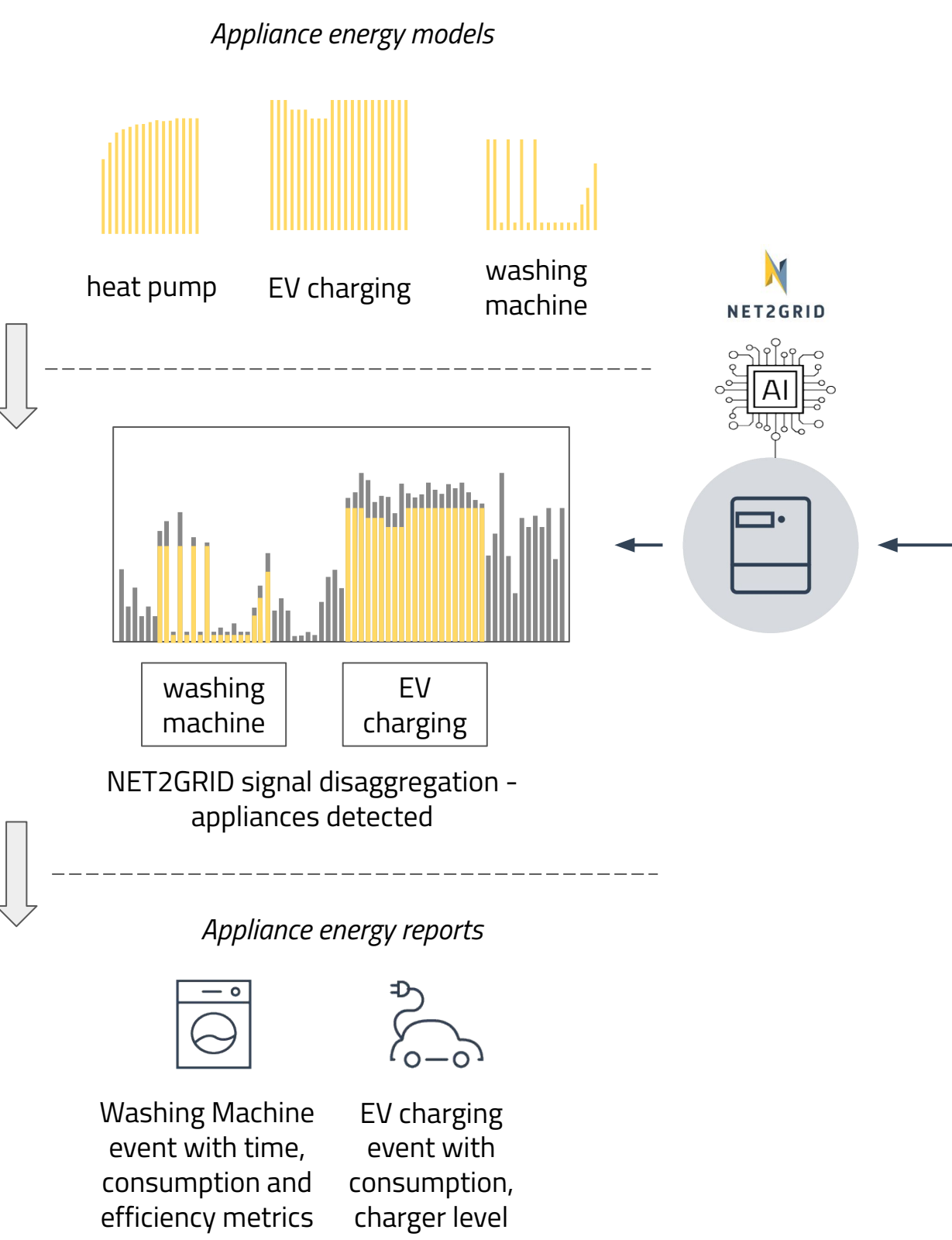# Energy disaggregation

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Definition

- Consumption breakdown at appliance/activity level

  - = Estimate the energy of each appliance or activity

- Intrusive Load Monitoring

  - Hardware-based approach

  - Install a meter behind each appliance

- Non-Intrusive Load Monitoring (NILM)

  - Software-based approach

  - Analyze SM measurements

Example of NET2GRID's disaggregation

Appliance energy models

heat pump   EV charging   washing machine

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AI

washing machine   EV charging

NET2GRID signal disaggregation – appliances detected

Appliance energy reports

Washing Machine event with time, consumption and efficiency metrics

EV charging event with consumption, charger level

Solar detected
daily production 11 kWh
Warning: obstruction detected

Fridge detected
daily consumption 1,4 kWh
Warning: above peer consumption

Oven detected
daily consumption 0,3 kWh

EV charging detected
daily consumption 23 kWh
Alert: optimal cost charging hours tomorrow between 2-8 pm

Washing machine detected
daily consumption 1,2 kWh

Benefits

- Customer engagement
  - Increased energy efficiency and awareness
- Personalized services
  - Understanding end-users' needs
  - Offer meaningful and personalized services
- Grid awareness
  - Locate major behind-the-meter assets (e.g., EVs, PVs, and storage units) in the grid
  - Enable better planning and foreseeing of grid investments

Customer engagement

Design richer & more meaningful touchpoints with end-users

Insight
Energy consumption and bill break down by activities or appliance

Am I Normal?
Implementing self and peer comparisons

How Can I Save?
Personal relevant recommendations

Alert Me!
Heating Cost , Self Consumption and peak activity alerts

Surprise Me!
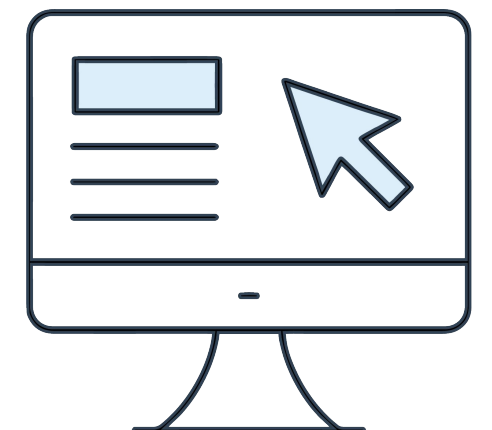Solar and EV Monitoring and Insights Without Hardware
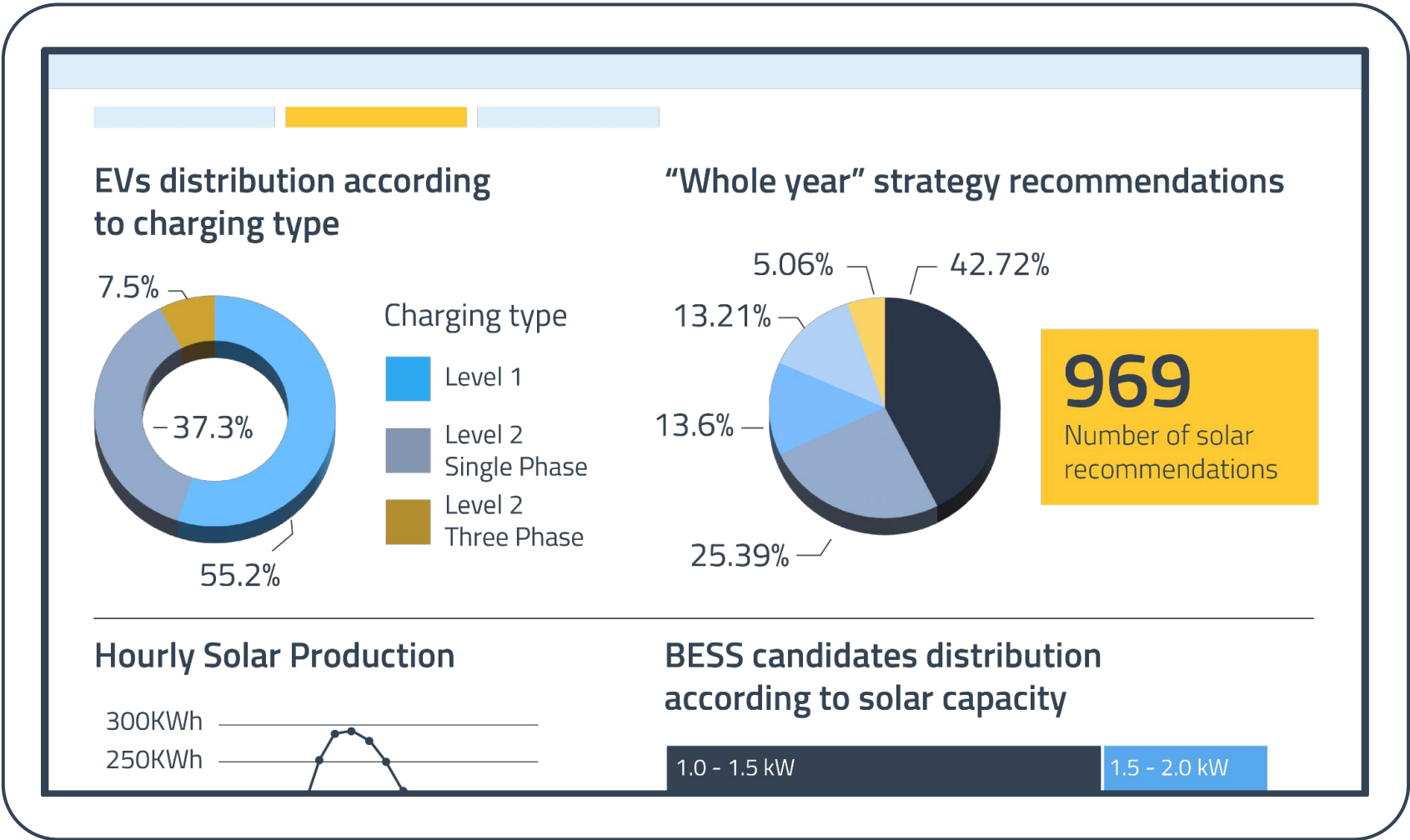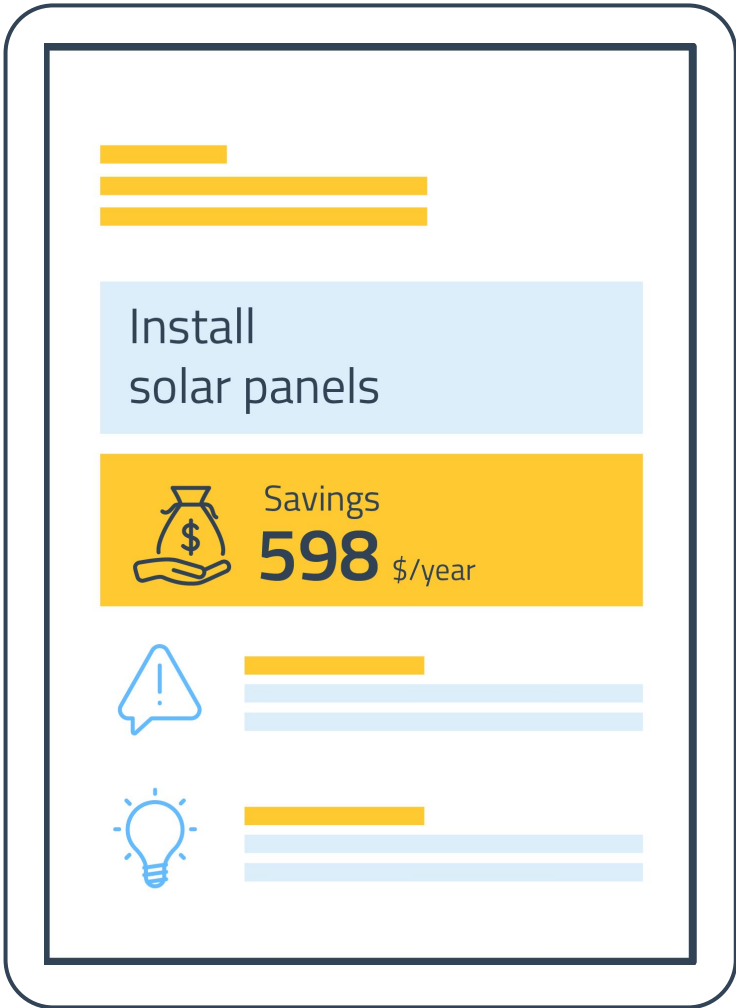
Delivered through API
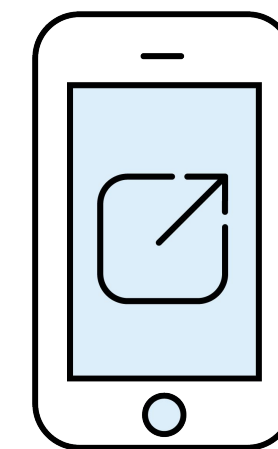
'My utility' app

Call center

Portal

Personalized services

Access richer customer insights to ...

EVs distribution according to charging type

7.5%

~37.3%

55.2%

Charging type

- ■ Level 1
- ■ Level 2 Single Phase
- ■ Level 2 Three Phase

"Whole year" strategy recommendations

5.06%

13.21%

42.72%

13.6%

25.39%

969
Number of solar recommendations

Hourly Solar Production

300KWh

250KWh

BESS candidates distribution according to solar capacity

1.0 - 1.5 kW | 1.5 - 2.0 kW

Switch to our special EV tariff

Savings **132** $/year

Install solar panels

Savings **598** $/year

Make marketing more efficient

offer personalized contracts

and upsell to new energy saving solutions & products

Grid awareness

- Create a digital twin of the distribution network
- Enhance grid visibility by locating major behind-the-meter assets
- Enable better grid planning and management

Grid awareness – Digital twin

PRODUCTION

3 MW

power failure

maintenance needed

2.7 MW

48 MW

DISTRIBUTION

90% of capacity

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CONSUMPTION / PRODUCTION

Inefficient heating / cooling

solar production performance

EV charging daily 15 kWh

EV charging daily 25 kWh
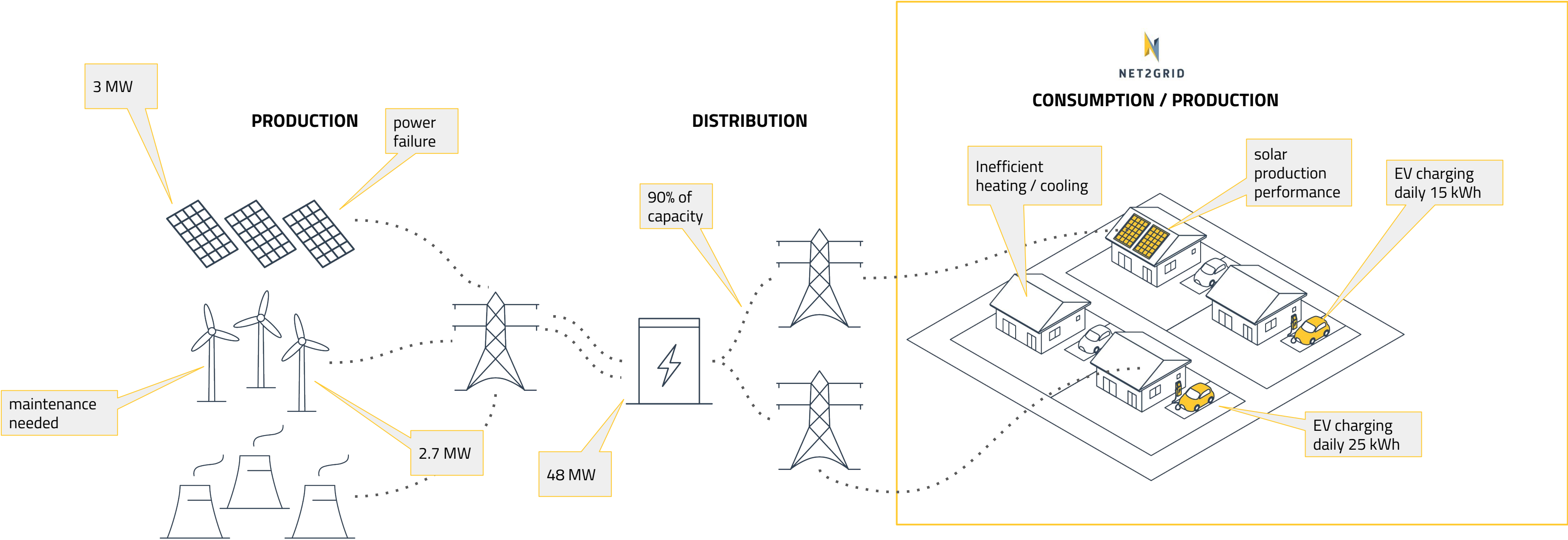
One stop solution for disaggregation of all granularities

15-30-60 min
MDM

1-10 sec
realtime

Data Ingestion

Data Retrieval

Data Hub or
MDM system

Smart Meter
Data Interface

NET2GRID IoT Hardware
& Embedded Software

Real-Time
Data Interface

AI, ML,
Data Analytics
& Services

Customer
Intelligence Interface

Customer
Engagement Interface

CRM or BI system

Customer Apps
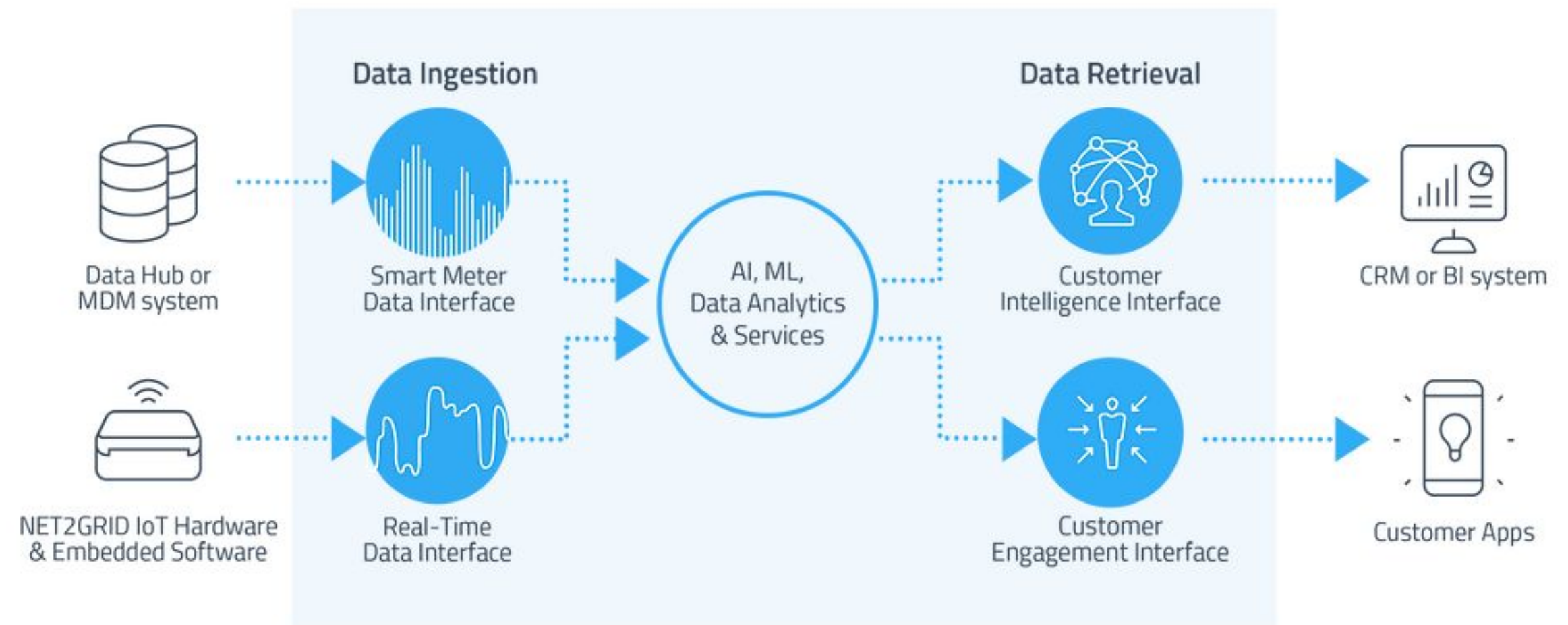
Data granularity

- ## Low resolution
  - 15/30/60 min. data
  - Typical SM measurements
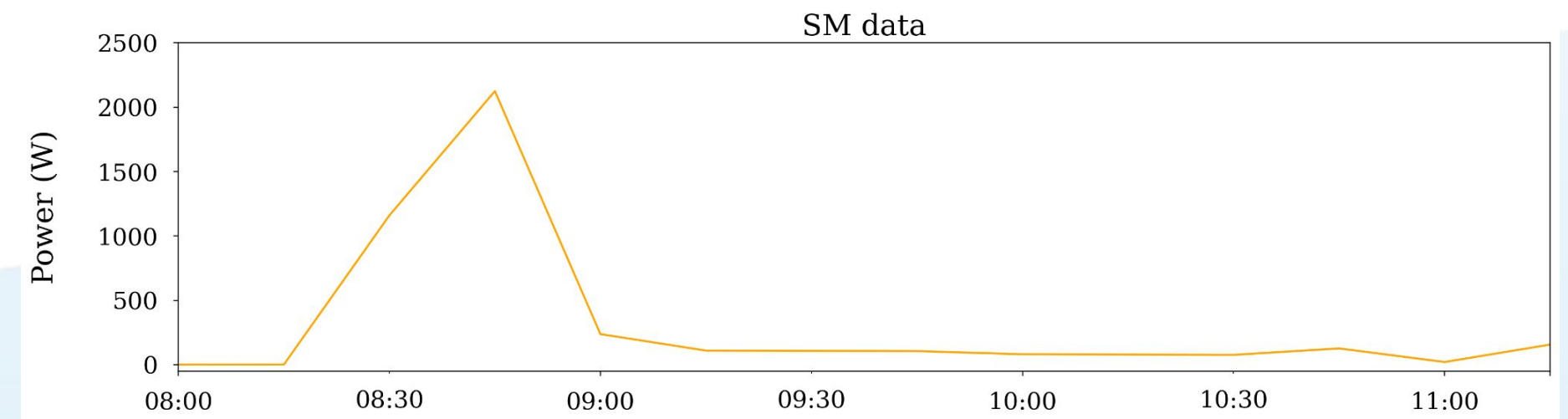
- ## High resolution
  - 1-10 s. data
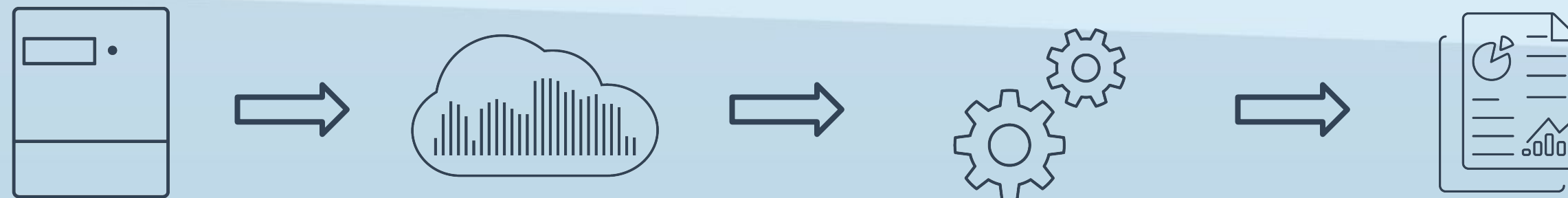 - More advanced meters (AMI 2.0) or additional hardware
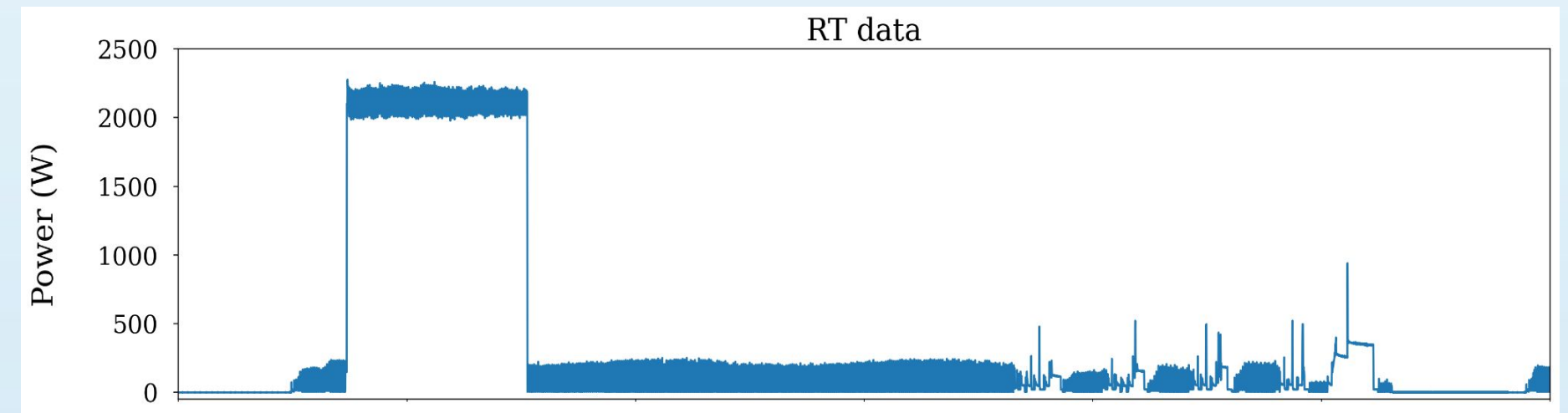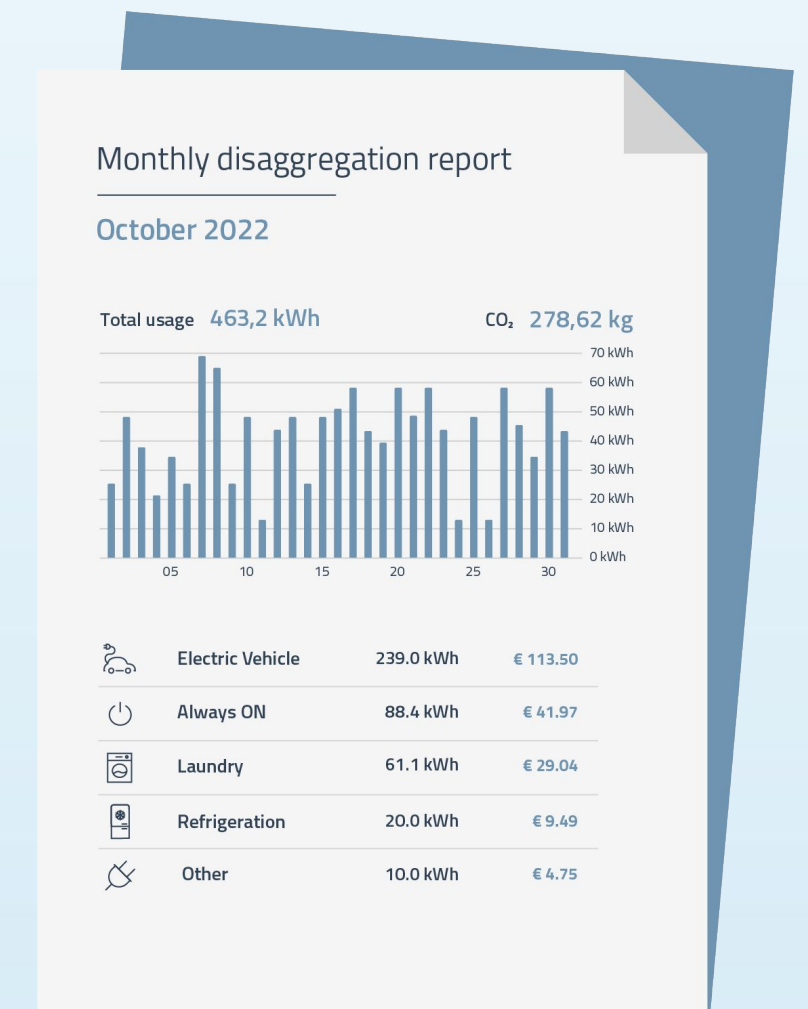
Low resolution data (15-60 min.)

Overview

- Low sampling frequency

- Energy measurements at intervals of **15/30/60 min.**

- Already-installed meters owned by DSOs

- Profile Information

- Not detailed enough to provide appliance-level disaggregation

- **Category-level** disaggregation

Produced reports

Reports

Daily Reports

Disaggregation Categories Report

Cumulative per-category breakdown of energy consumption for a month, updated on a daily basis.

Solar Production Metrics Report

Daily solar production estimation along with relevant metrics (e.g., peak value).

Monthly Reports

Insights Report

A comparative overview of the installation's overall and category-level consumption with previous months and peers.

Recommendations Report

A set of recommendations focused on helping the end-users reduce their consumption.

Monthly disaggregation report

October 2022

Total usage   463,2 kWh CO_2 278,62 kg

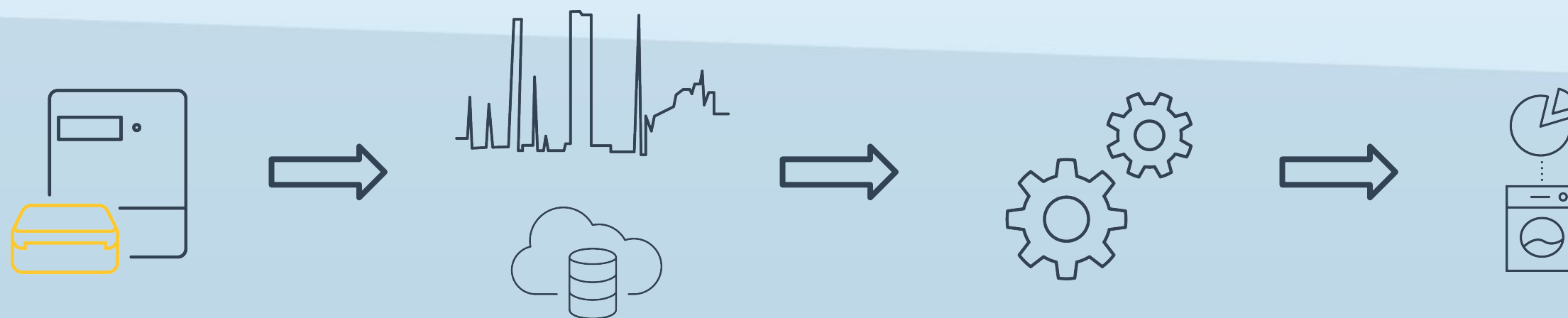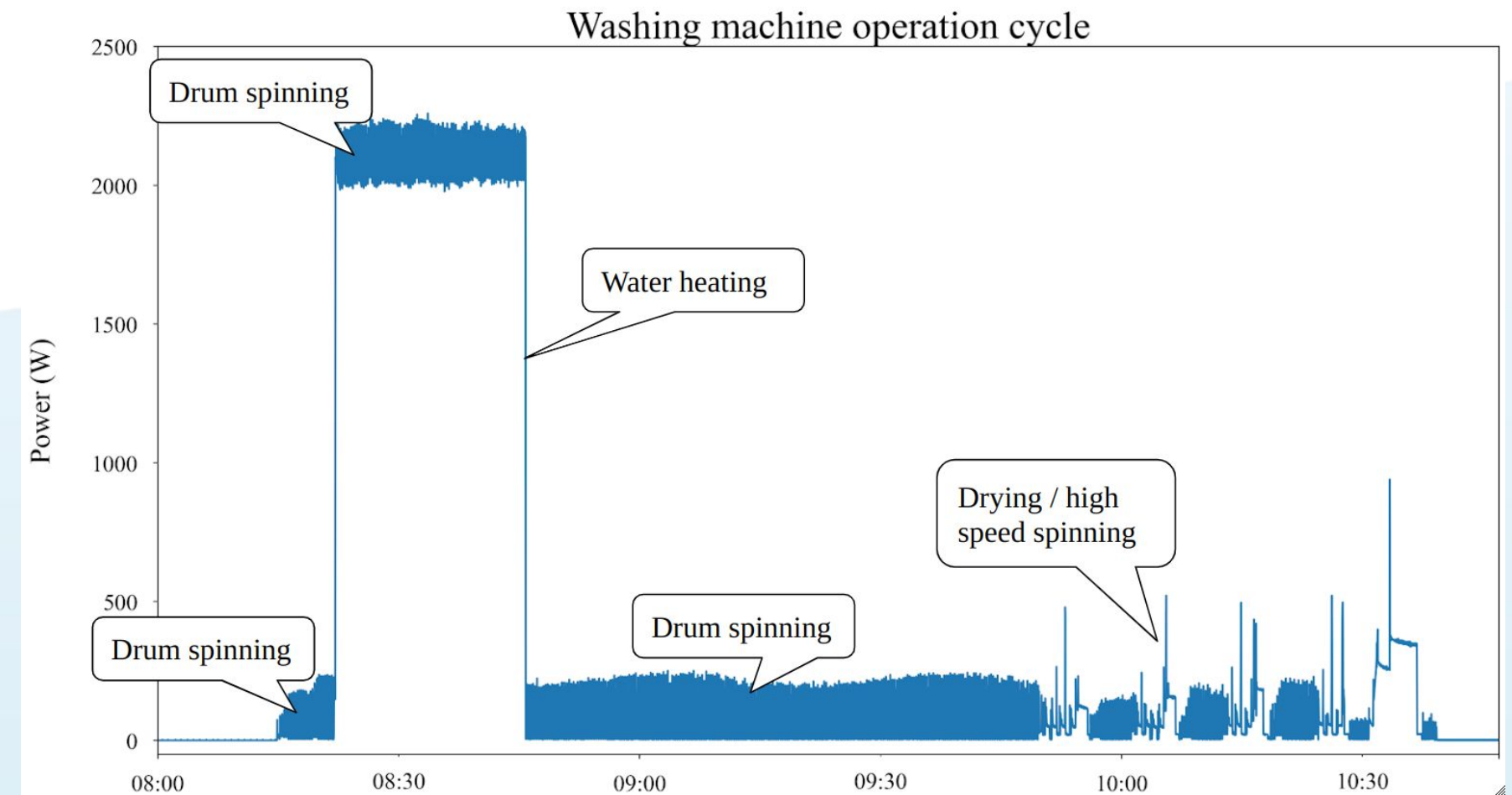|		
Electric Vehicle	239.0 kWh	€ 113.50
Always ON	88.4 kWh	€ 41.97
Laundry	61.1 kWh	€ 29.04
Refrigeration	20.0 kWh	€ 9.49
Other	10.0 kWh	€ 4.75

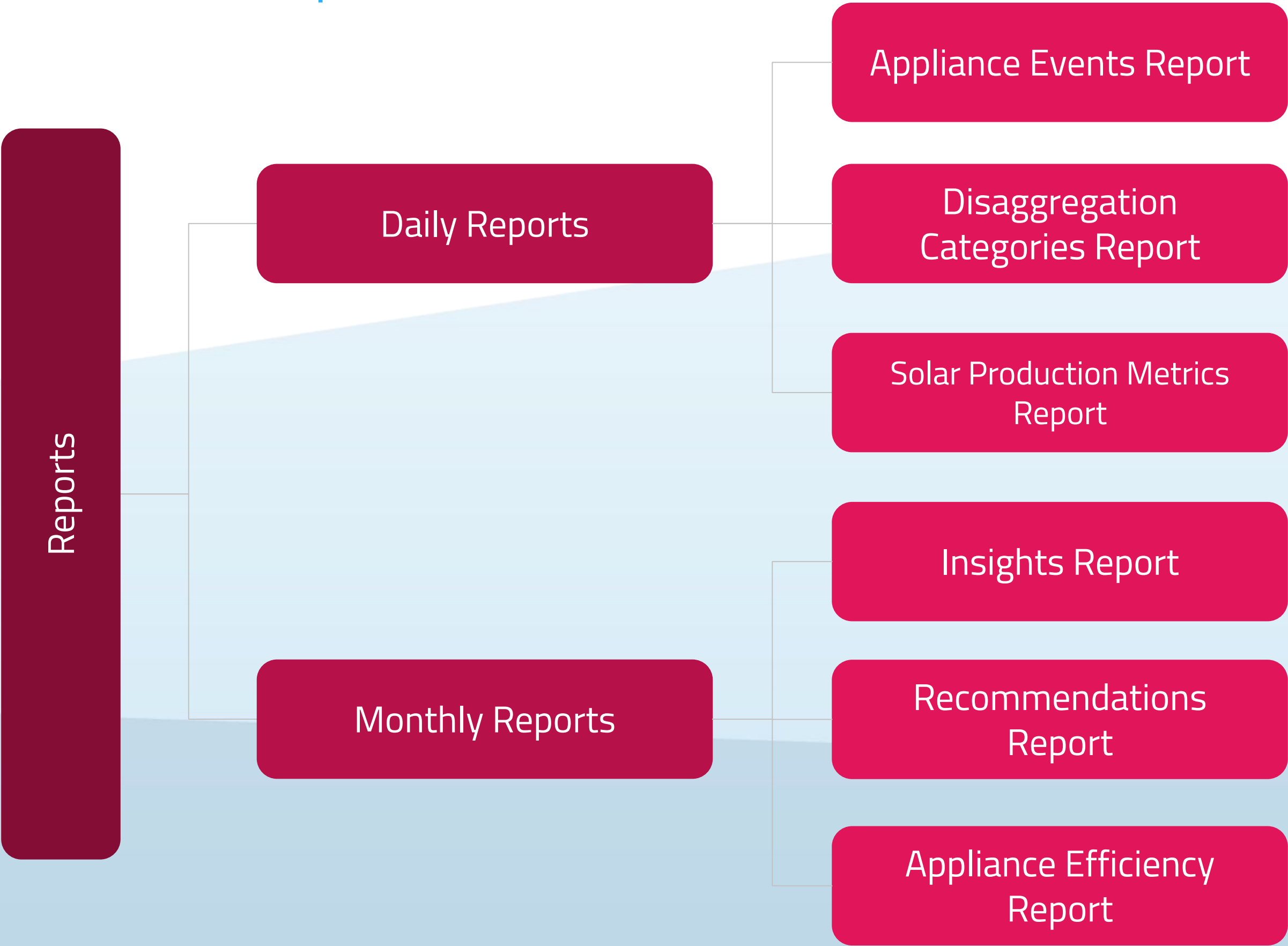# High resolution data (1-10 s.)

Overview

- High sampling frequency

- **1-10 s.** power data

- Very detailed consumption patterns

- Profile Information

- Detection of specific **appliances**

  - **start/stop time and**

  - **energy per event**

- Additional hardware is required

Washing machine operation cycle

Produced Reports

Reports

Daily Reports
- Appliance Events Report
- Disaggregation Categories Report
- Solar Production Metrics Report

Monthly Reports
- Insights Report
- Recommendations Report
- Appliance Efficiency Report

Appliance events (start/stop time, energy consumption per event) for the previous day.

Efficiency score of appliances (dishwasher, washing machine and refrigeration)

DER Intelligence

Overview

- Energy measurements at intervals of **15/30/60 min.**

- **No profile information required**

- Focus on major behind-the-meter assets:

  - **Electric Vehicle:**
    - Monitor the integration and charging sessions of EVs in the network

  - **Photovoltaic Unit:**
    - Estimate decentralized generation in hourly intervals

  - **Battery Energy Storage System:**
   - Detect storage units in the grid
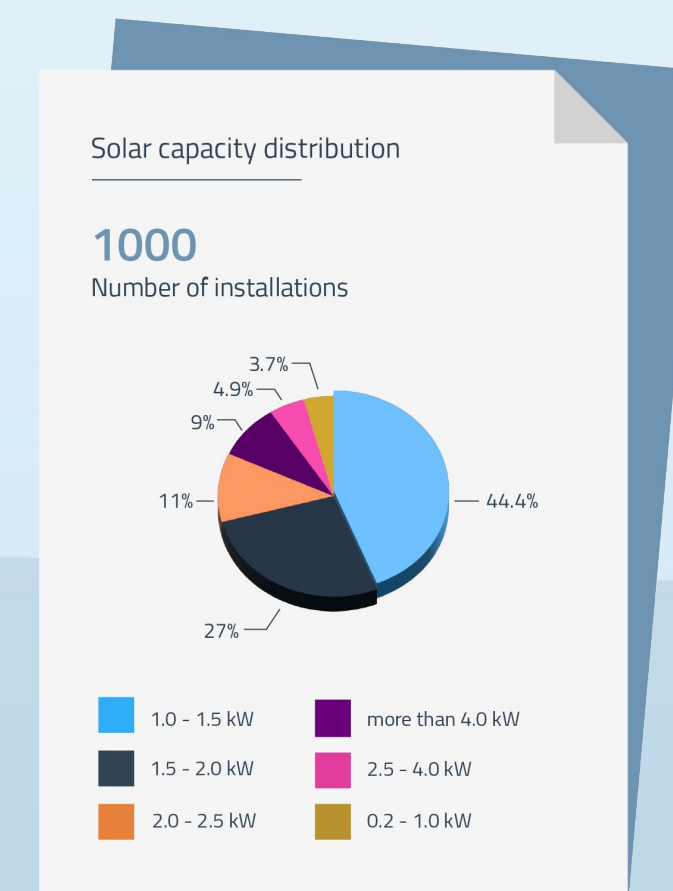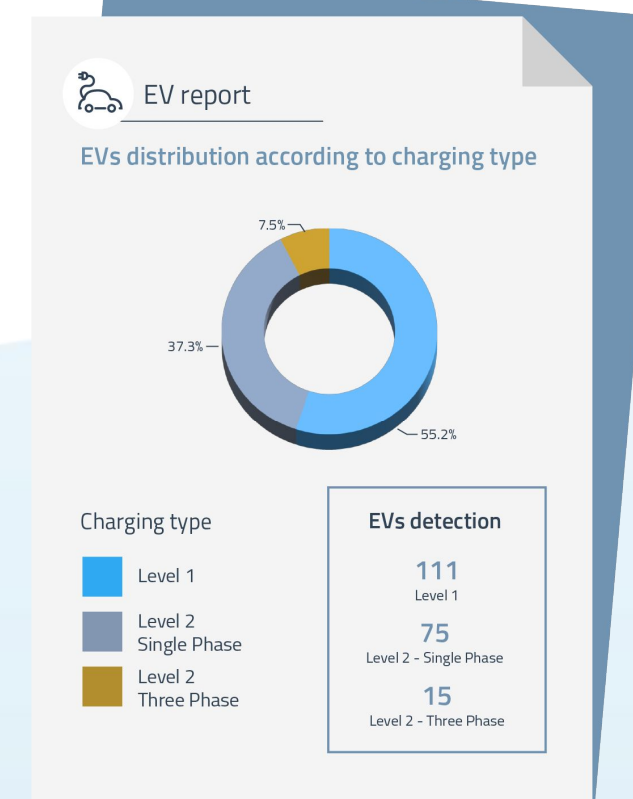
Distributed Intelligence

Overview

- Direct access to high resolution data (1-10 s)
- Data analytics on the edge integrated into smart meters
- Optimized disaggregation models for constraint processing capacity
- **Electric Vehicles:**
  - Installed charger type (L1, L2 single- and multi-phase charger)
  - Charging events (start/stop timestamp and energy per event)

- **Continuous development:**
  - PV and storage insights

EV report

EV detection

EV
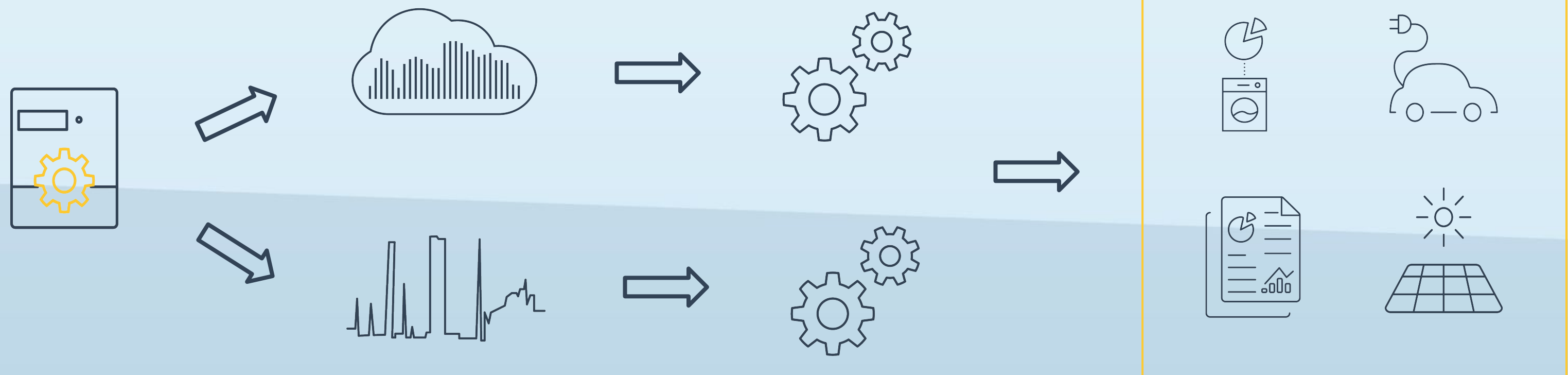
Duration: **2** h
Energy: **6** kWh
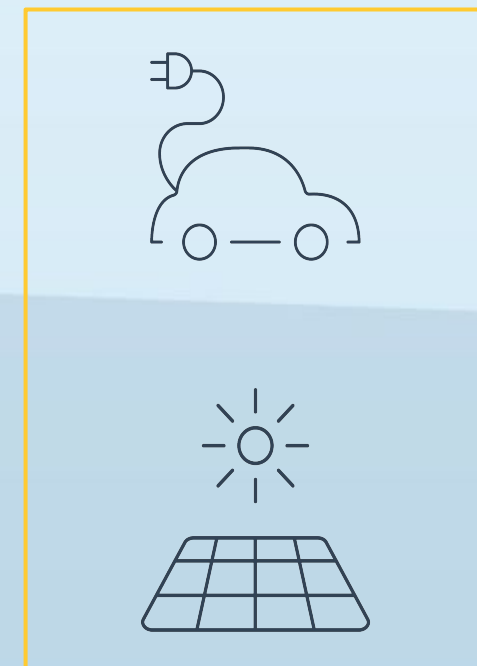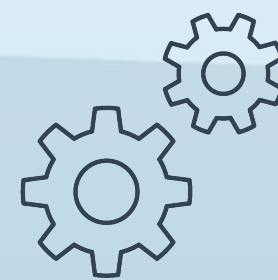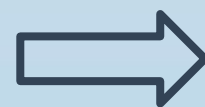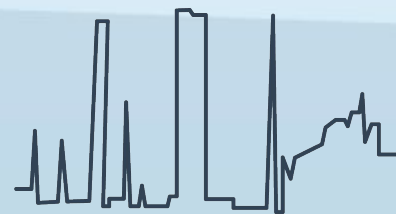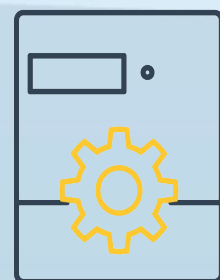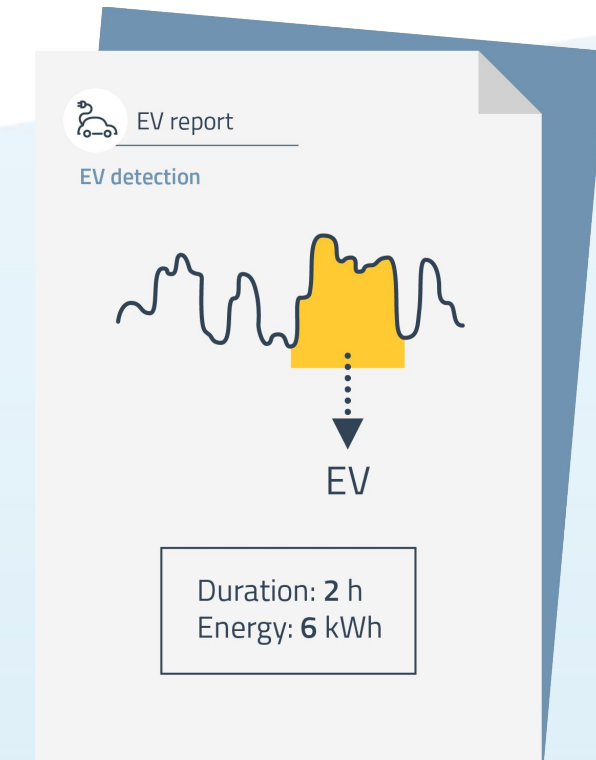
Edge-to-Cloud Continuum

Combining cloud and edge models

- Higher data resolution results in:
  - higher storage costs
  - higher transfer costs
- Combining low-resolution analysis on cloud and high-resolution on the edge to minimize cost and improve accuracy

Thank you!

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