



Integrating Energy Signals into Building Automation

OpenADR++ Conference, June 6-7

EEBUS – EMPOWERING THE DIGITALISATION OF ENERGY TRANSITION

What?

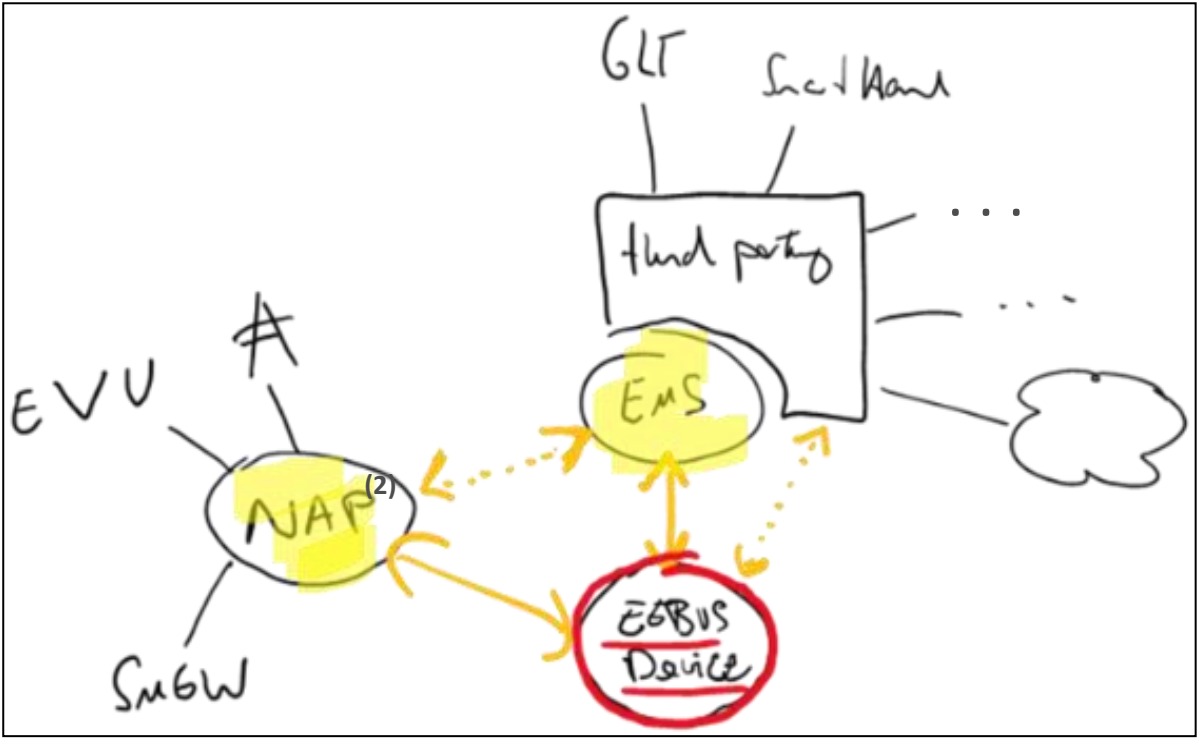
EEBUS describes the **communication interface** (= application, transportation, communication) in order to allow for the **interconnection** between energy management relevant devices as well as corresponding control systems

How?

- EEBUS “Empowers the digitalisation of Energy Transition” via
- **Specification design and implementation documentation** on behalf of the industry
 - Collaboration in international **standardisation bodies**
 - Participation in international **energy research projects**

For whom?

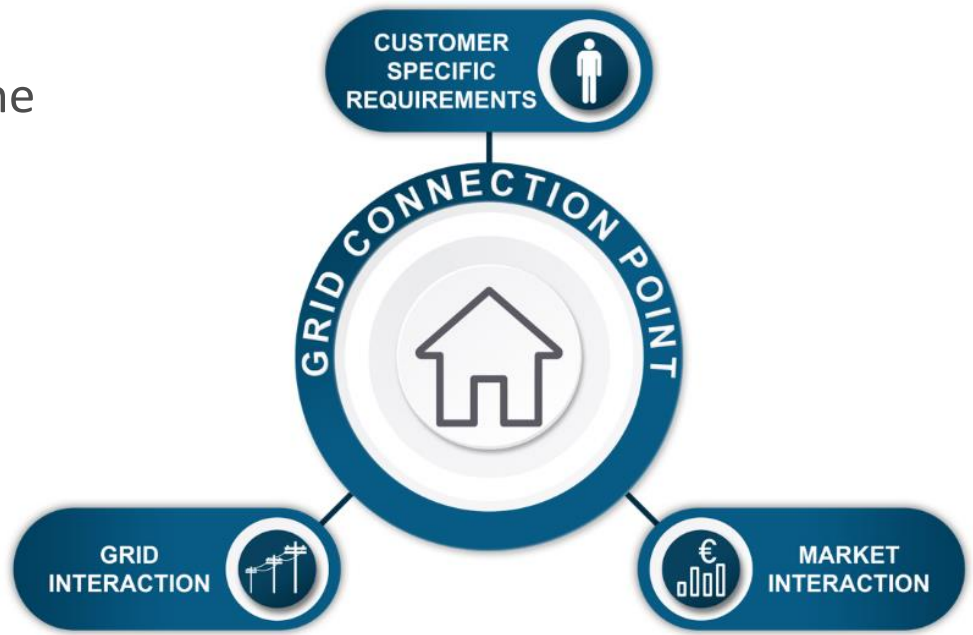
Standardised communication interface between **device manufacturers** (device to device) as well as between **DSOs** ⁽¹⁾ and **device manufacturers** (GCP ⁽²⁾ to device)



(1) DSO: Distribution System Operator = Verteilernetzbetreiber
 (2) GCP: Grid Connection Point = Netzanschlusspunkt (NAP)

THE MISSING „WHY?“ – CHALLENGE OF GRID INTEGRATION

- More and more players want to influence the behaviour of the end customer (and controllable loads)
- Smooth operation of divergent accesses at the same GCP
 - **coordinated, prioritised and standardised** handling of the **various signals** inside the building is required
- EEBUS provides this standardised **interface** for the GCP (VDE AR 2829-6) to coordinate these signals





STRONG COMMUNITY: CROSS-INDUSTRY ASSOCIATIONS RELY ON EEBUS AS NON-PROFIT ORGANISATION



AS WELL AS LEADING COMPANIES

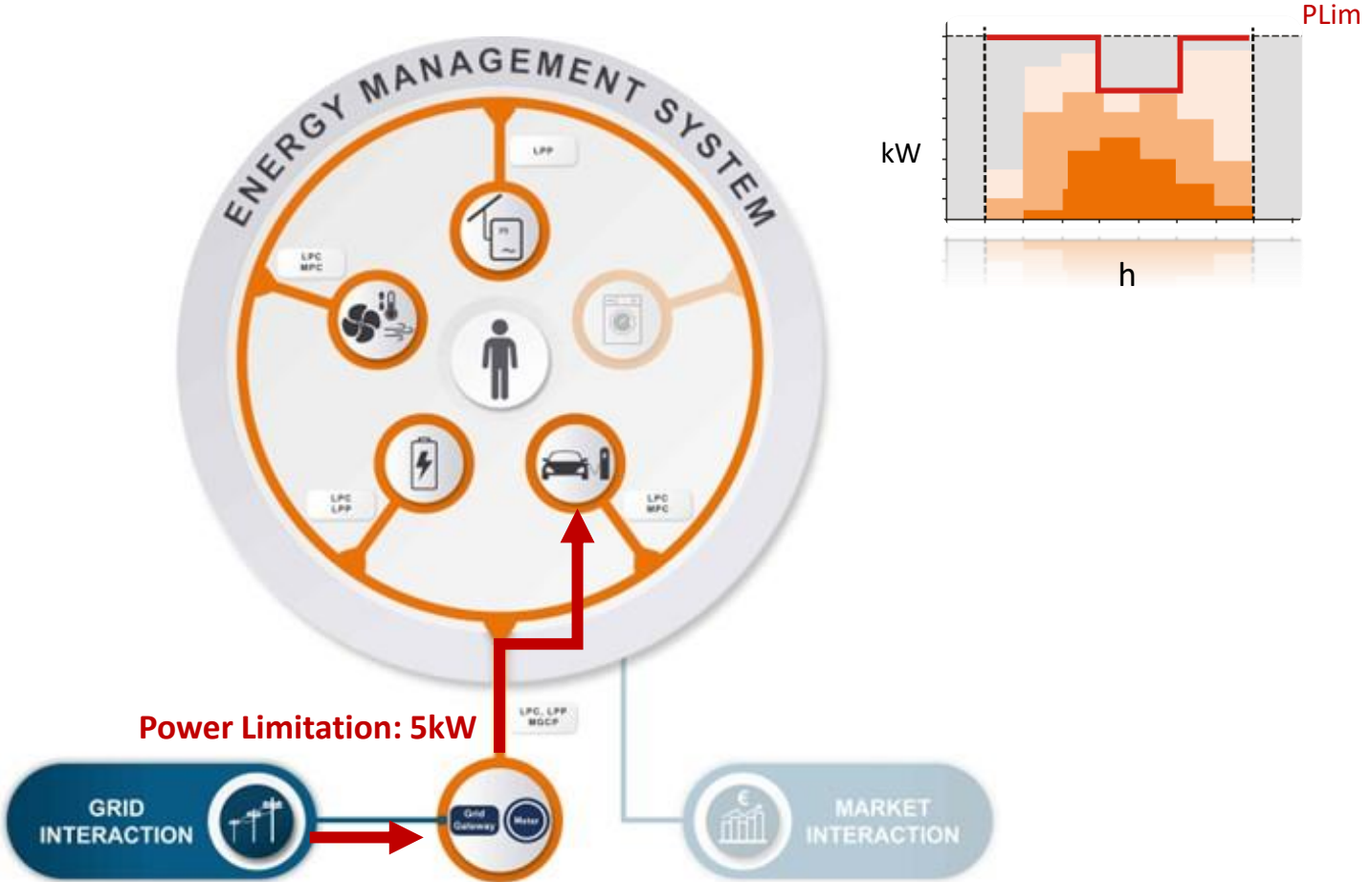


- **Grid protection** at GCP – for secure grid operation (DSO)
- **Dynamic pricing** – to support smart charging (energy supplier)
- Increasing **grid resilience** – for preventive grid-serving behaviour via incentives (aggregator)
- Increasing **energy independency** – for self-consumption optimisation (end customer)



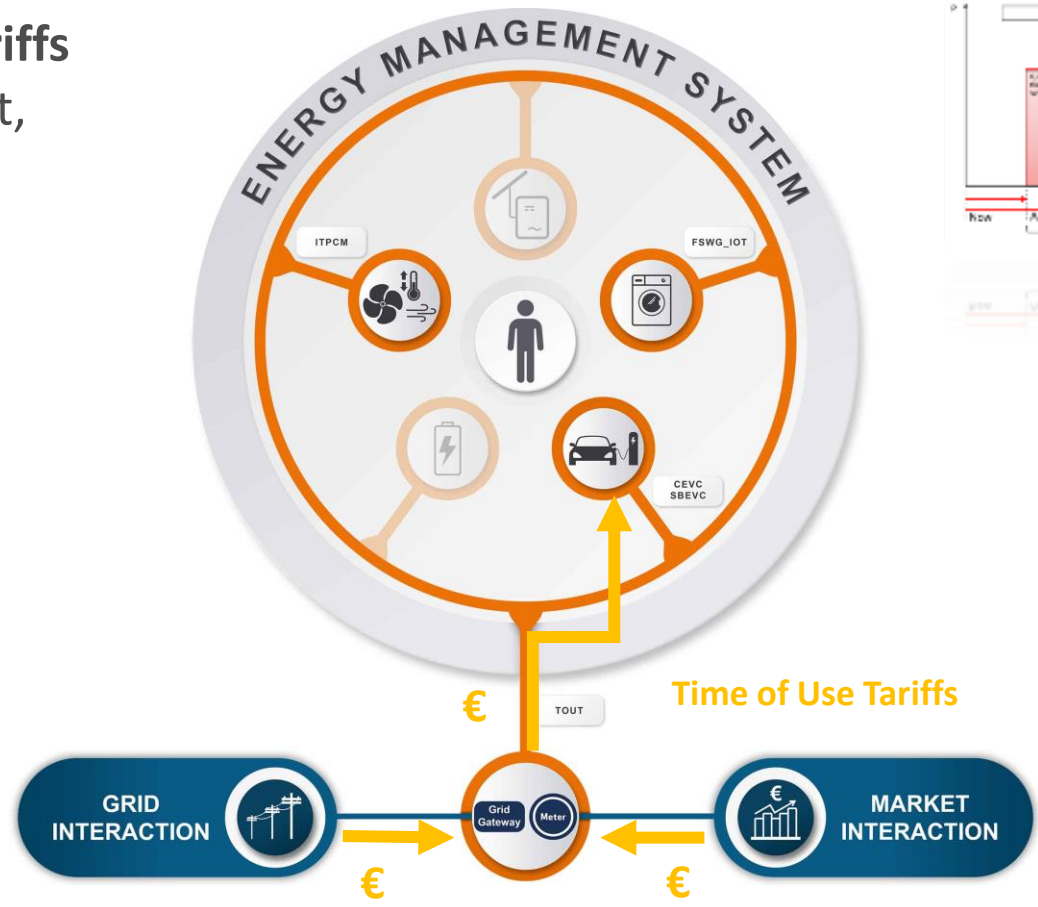
CAPACITY MANAGEMENT ON BUILDING LEVEL

- 01.01.2024 -> required by German law
- **Power limitation**
(on building or device level)
- Add-on: Transparency & control at GCP



TARIFF MANAGEMENT(€/KWH)

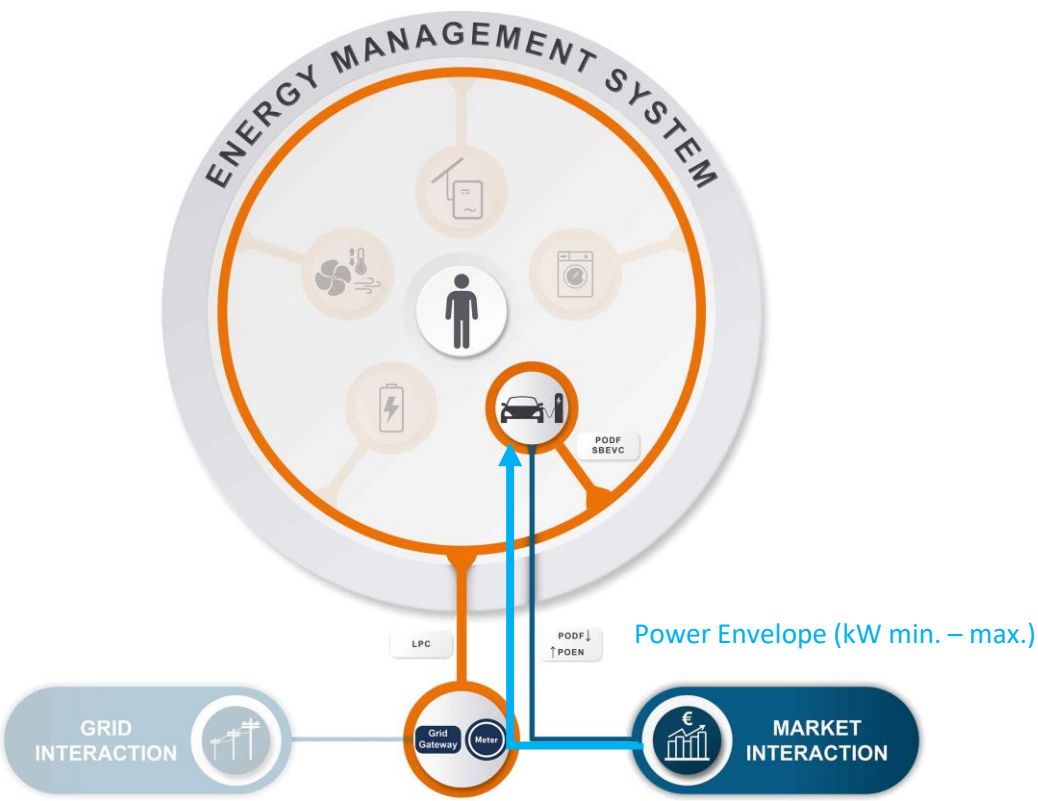
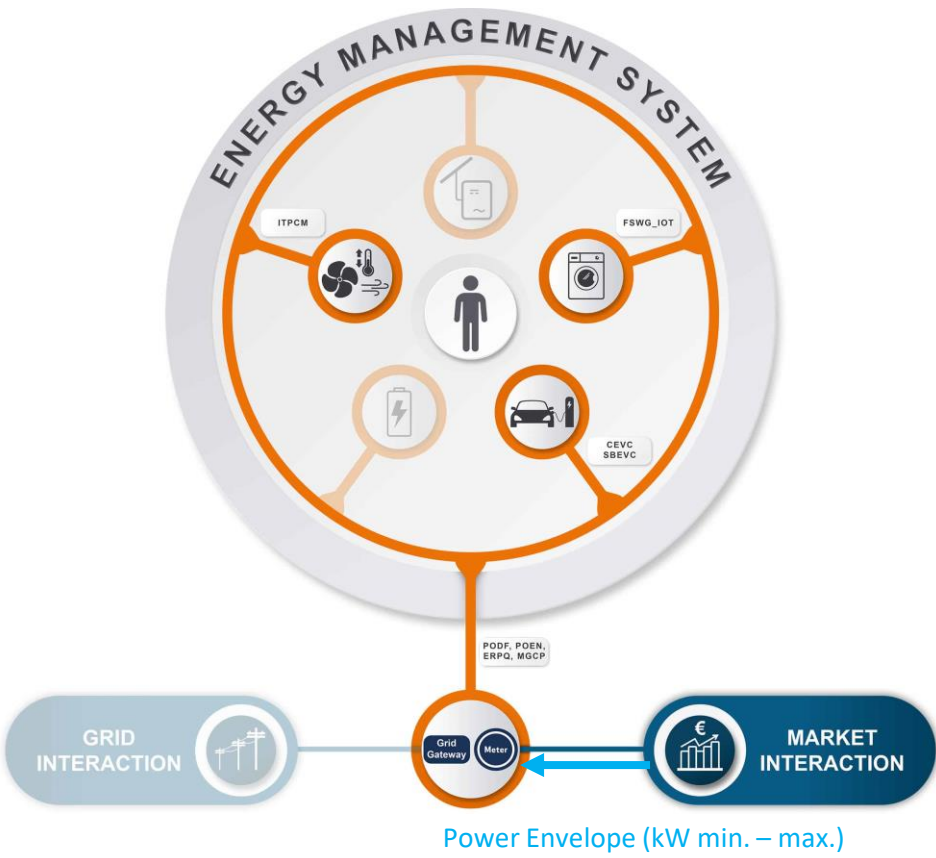
- Transmission of **dynamic** electricity **tariffs**
- Price based on power exchange market, share of CO₂-/renewables or grid fees



PREVENTIVE CAPACITY ALLOCATION

- On building level = Preventive capacity management to avoid **grid congestion** beforehand

- On device level = Aggregation of single devices to participate in **energy trading** (e.g. intraday) or **balancing services** (primary control reserve)



SELF-CONSUMPTION OPTIMISATION

- **Optimal use** of self-generated electricity inside the building
- Via exchange of current and forecasted power consumption and production
- EMS **aligns energy flows** while considering device specific constraints



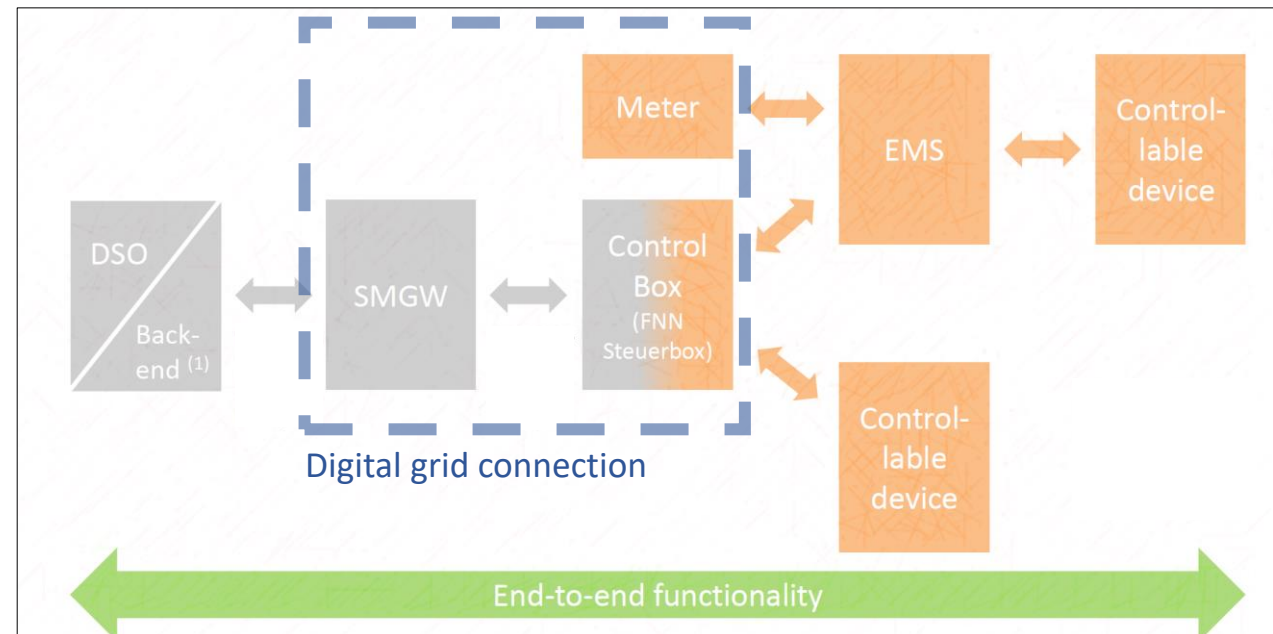
LIVING LAB: TEST CONSISTENTLY INTEROPERABLE ECO SYSTEM FROM ENERGY INDUSTRY UP TO END DEVICE LEVEL



Gefördert durch:



aufgrund eines Beschlusses
des Deutschen Bundestages



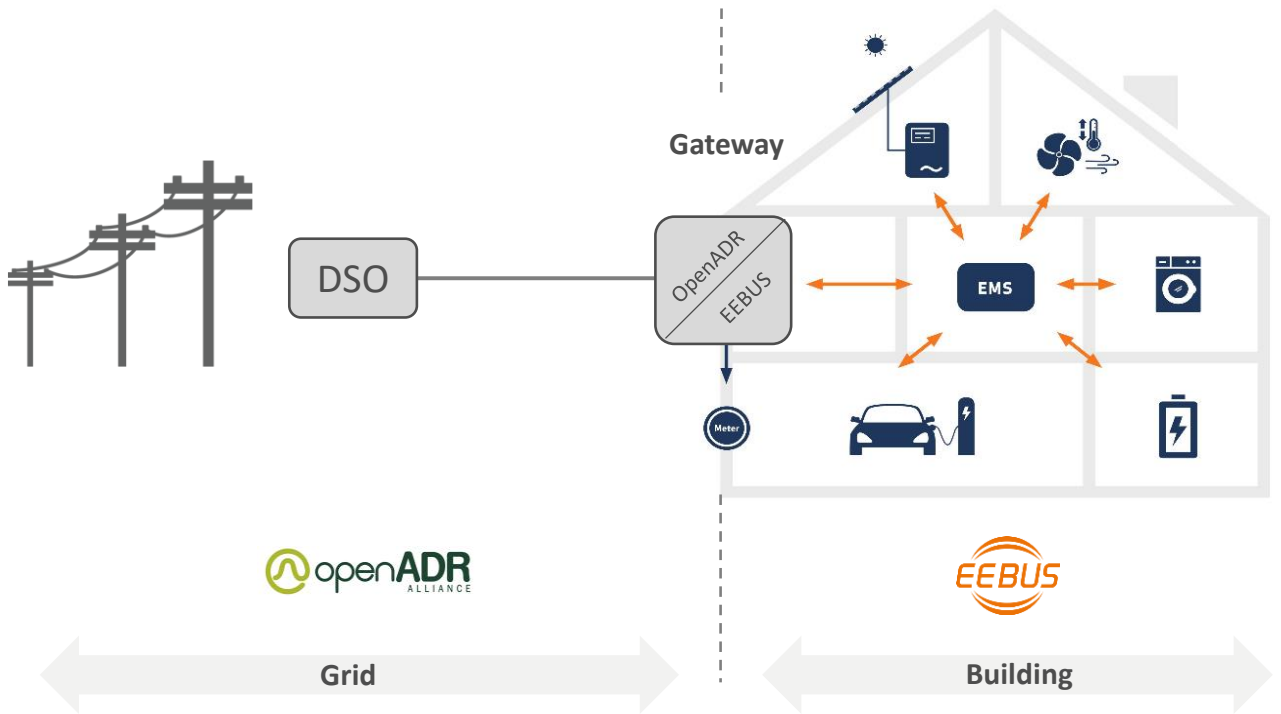
SPEEDING UP THE USE CASE ROLLOUT & RELATED PROCESSES

- **Testing** of practical use case implementations at **Living Lab Cologne** and **alignment** with other research projects
 - Currently **only test lab** to set up and operate **entire system** with all stakeholders **in one place**
 - Input from **regulatory & legislative** authorities and **industry associations** <-> **advise** for key authorities and decision makers
 - **Test specifications** and **implementation instructions** for use cases & processes **are standardised** and **made public**
 - Potential expansion: Living Lab as a **test basis for prequalification** of devices and systems for their participation in different markets
- Basis for a **practice-orientated** and generally **supported** implementation for a **qualified market launch** of use cases & processes



OpenADR / EEBUS COOPERATION ON DSO TO DEVICE COMMUNICATION

- In 2019, at the Global Grid Integration Project test event, OpenADR and EEBUS showed how to power curtail an EV charging session by DSO OpenADR command
- The great fit of DSO communication provided by OpenADR and device communication provided by EEBUS can deliver significant added value



More details can be found in the joint OpenADR/EEBUS white paper



Looking forward to welcoming you soon!

EEBus Initiative e.V.

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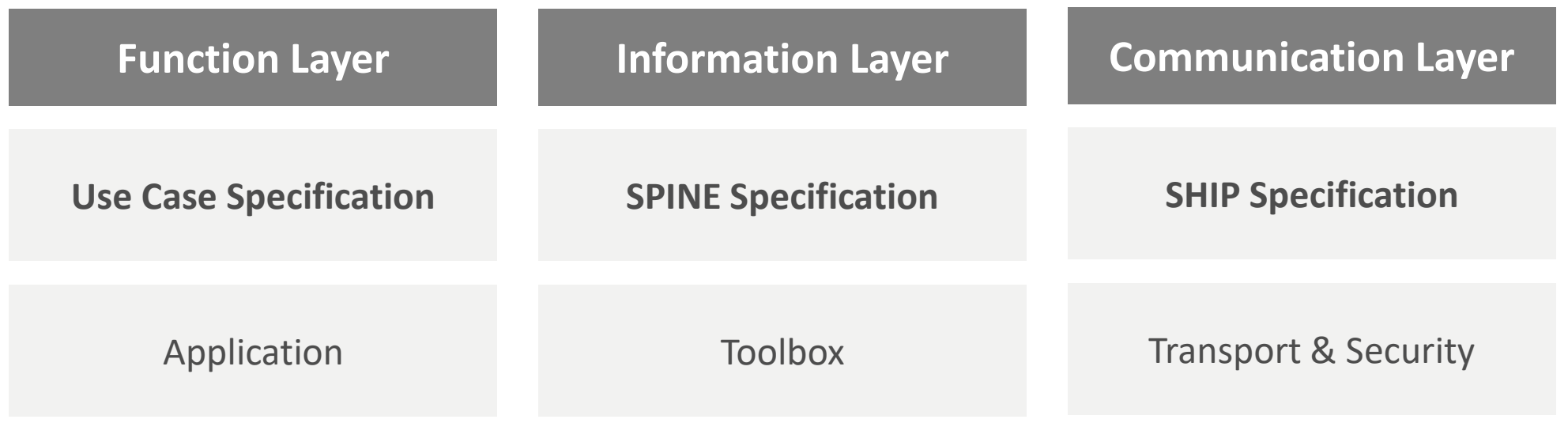
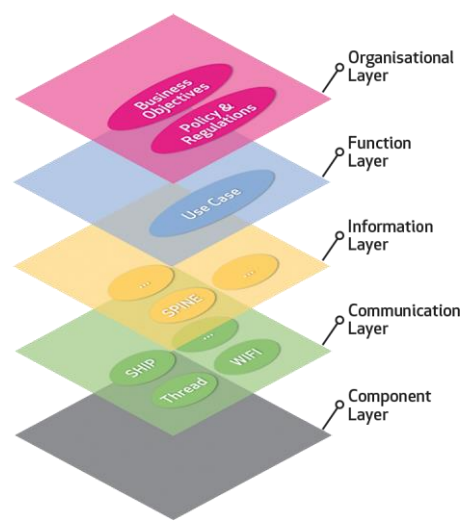
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www.eebus.org



SYSTEM ARCHITECTURE OVERVIEW

The EEBUS architecture is based on the **SGAM** (Smart Grid Architecture Model) and offers solutions for several layers

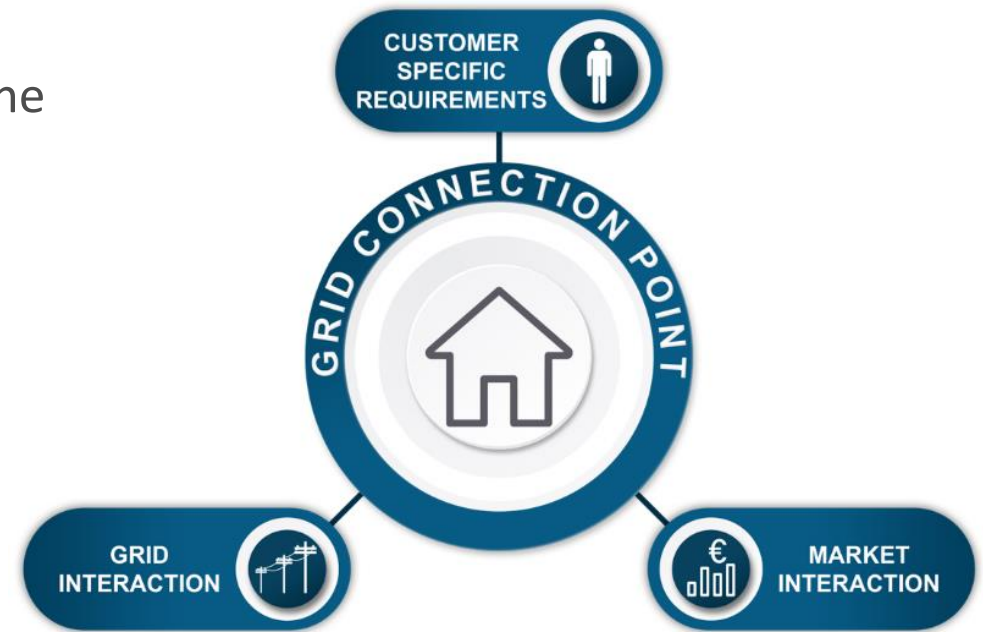


- Already large number of Use Cases available
- Use Case Discovery creating a strong EEBUS eco system

- Highly flexible data model allowing for interoperability of very different (cross industry!) devices

- EEBUS communication protocol with state-of-the-art security mechanism

- More and more players want to influence the behaviour of the end customer (and controllable loads)
- Smooth operation of divergent accesses at the same GCP
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- EEBUS provides this standardised **interface** for the GCP (VDE AR 2829-6) to coordinate these signals



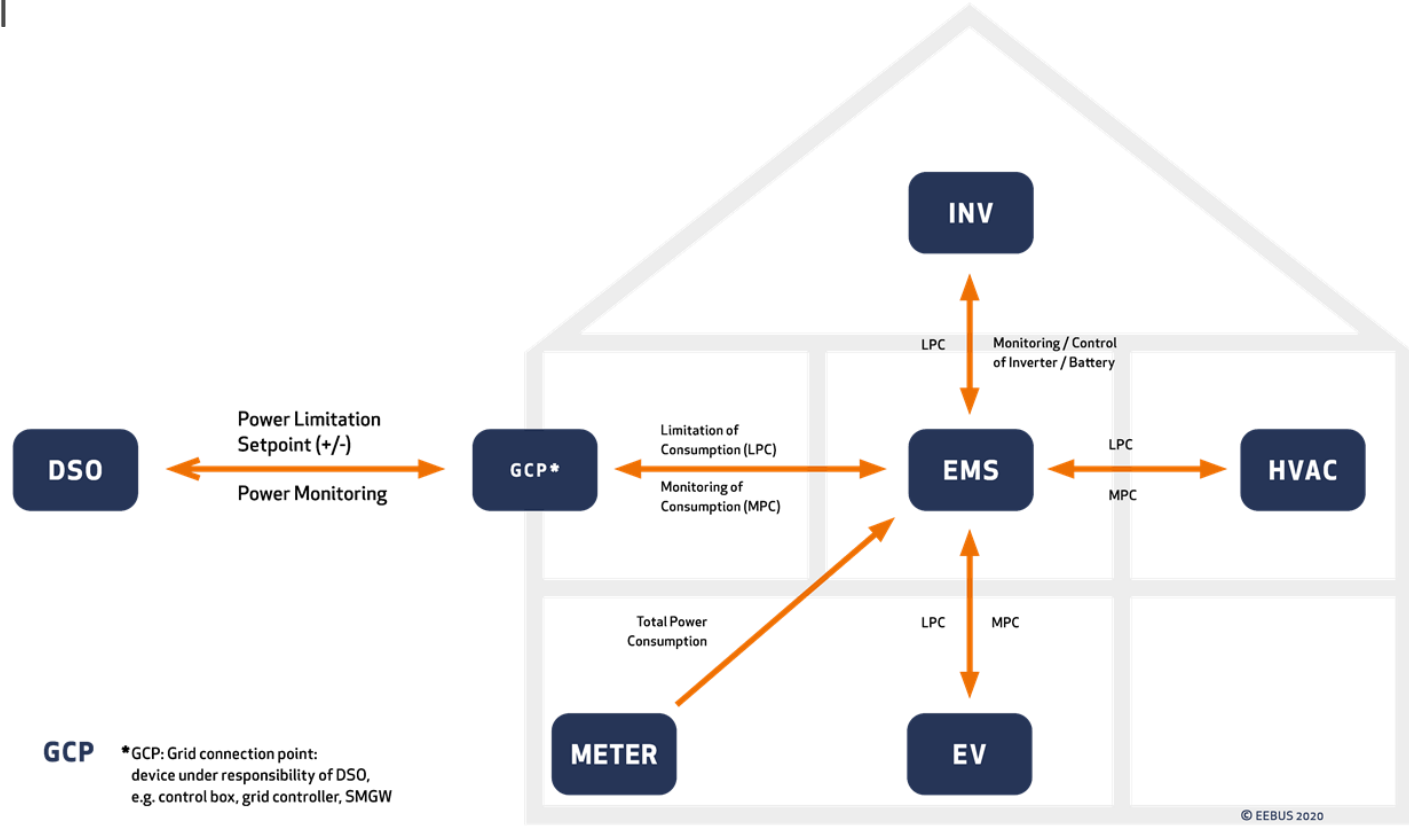
CAPACITY MANAGEMENT GRID DEFINES SETPOINT AT GRID CONNECTION

Distribution System Operators (DSO) solution

- Power monitoring on building or device level
- Power limitation by setpoint

Key Facts

- Through **control box** the energy management system (EMS) or the device directly will be connected to the DSO
- By measuring energy consumption, the DSO may **identify hotspots** and **take in-time corrective action** by limiting power consumption through setpoints
- In addition to controlling the **power demand** or the **feed-in power** may also be controlled

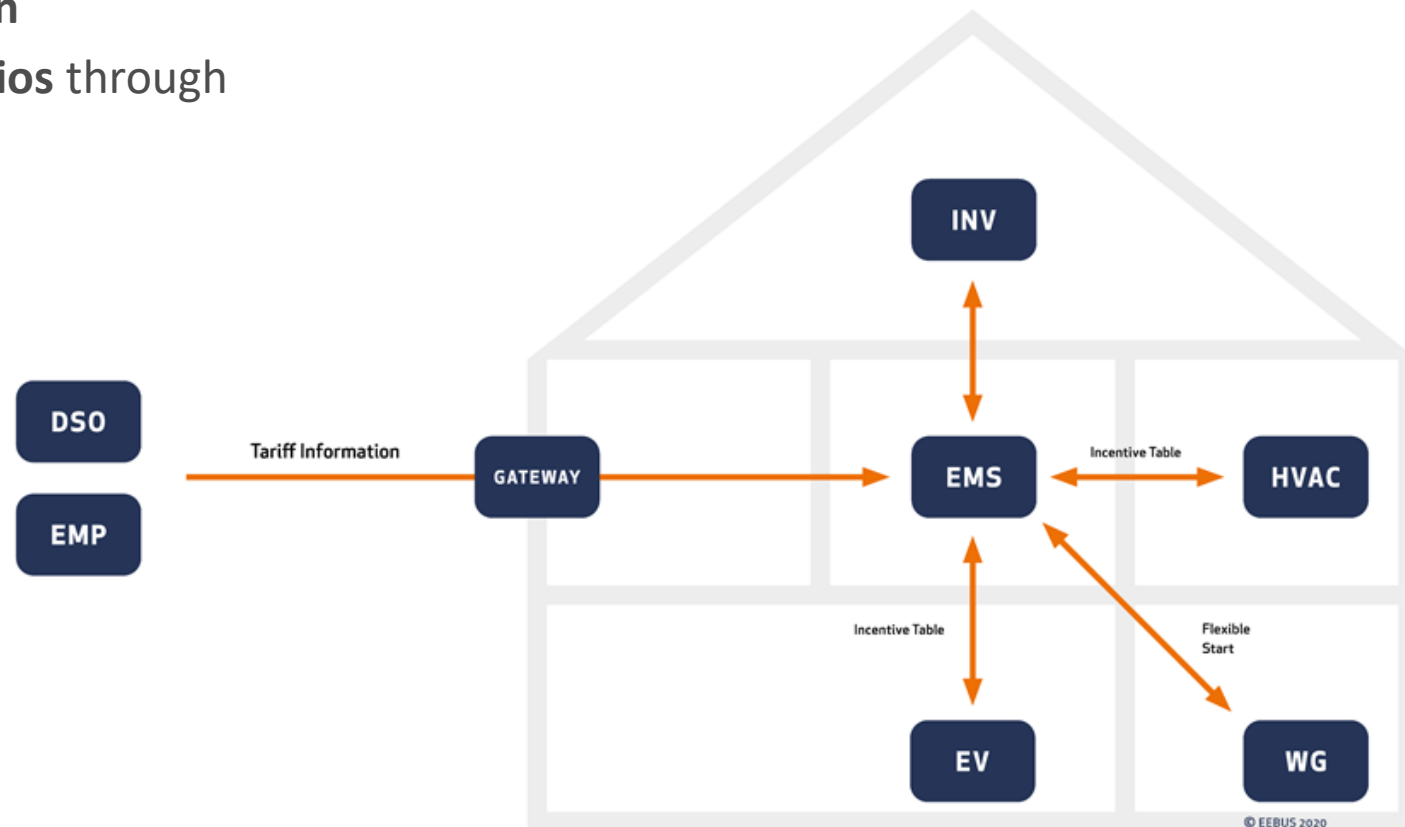


Distribution System Operators (DSO) / External Market Participants (EMP) and end customers solution

- **Management of over and underload scenarios** through transmission fee or price of energy table
- **Cost optimized operation** of devices

Key Facts

- DSO or EMP may submit whether the **transmission fee or price of energy over time information** through gateway or cloud service
- The EMS or the device directly will interpret the time of use tariffs and **optimize the consumption plan** to lower the costs of energy for the end customer
- The DSO may **react on hot spot scenarios** or the EMP may manage if **too much or too less energy** is available

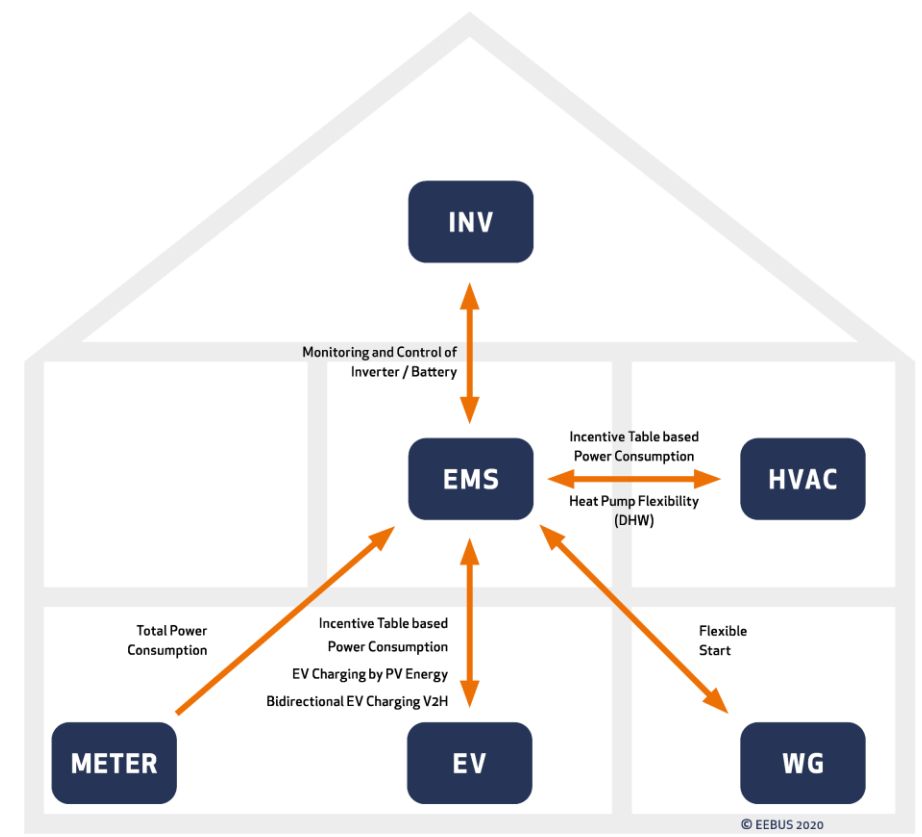


End customers solution

- **Costs of energy** reduction
- **Environmental sustainability** increase

Key Facts

- Increase self consumption by taking advantage of the **local PV production even after sun set**
- Both the **EV's battery or a stationary battery system** store PV energy during PV over production and provide energy to the building after sun set
- All devices including the base load are considered in the energy management to **optimize the energy demand at the grid connection**

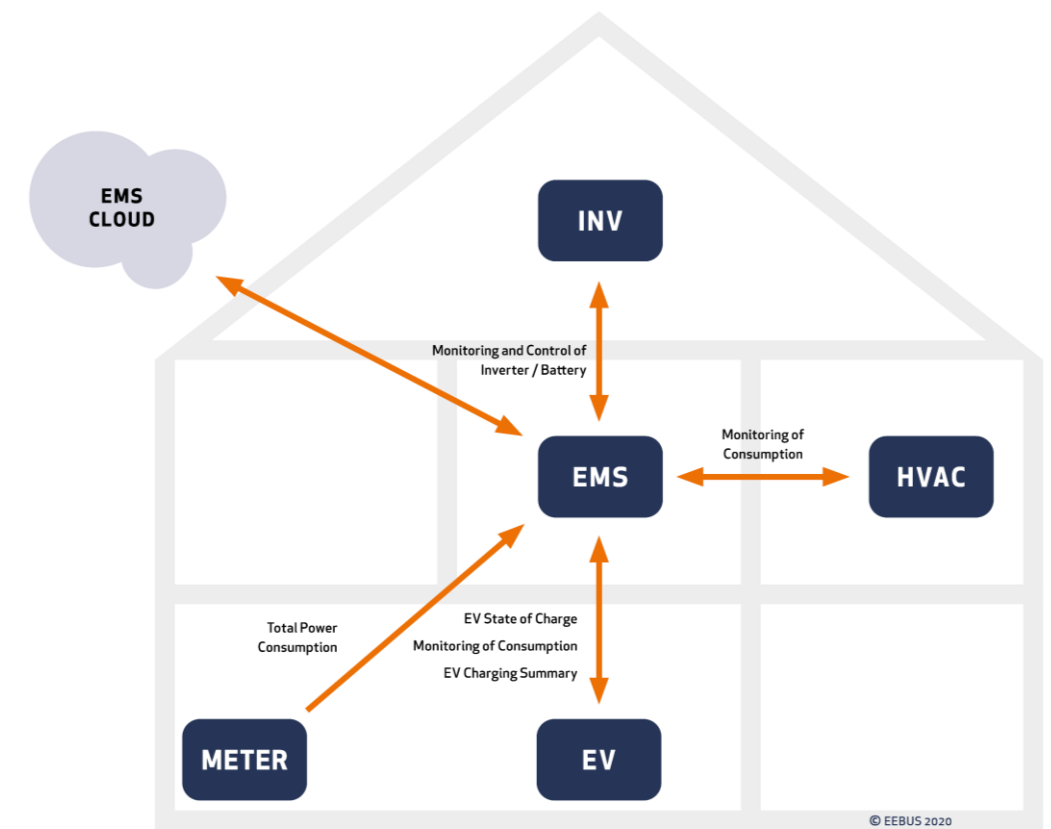


Solution for end customers

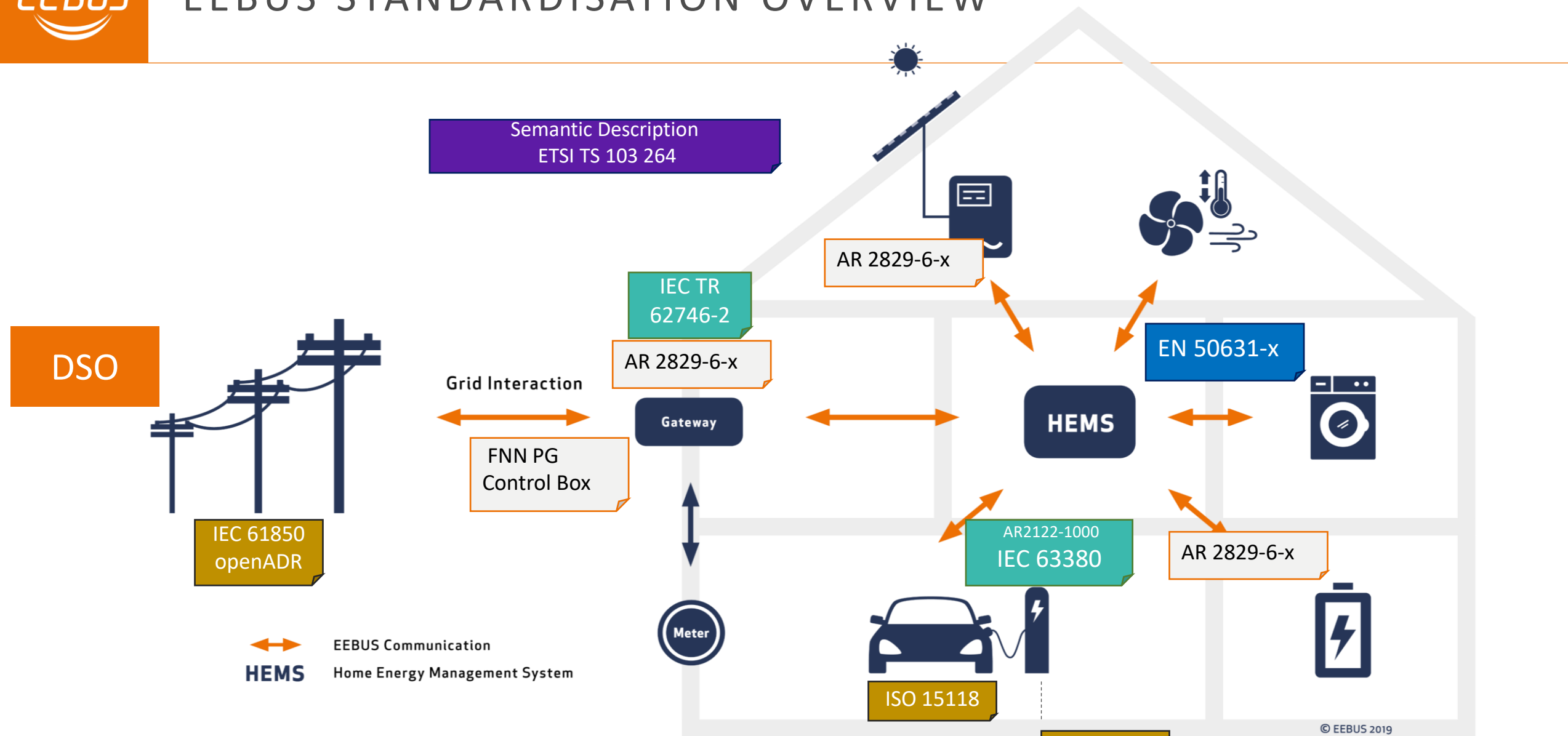
- Visualization of energy flows, production and consumption
- Increase of comfort

Key Facts

- End customer is **well informed** and **able to interact** with the holistic energy management system
- Monitoring functions provides **simple device data** such as power consumption or production for visualization **up to full option device data** such as operation mode or fault code for system monitoring or trouble shooting.
- Through comfort function the end customer may **adjust user settings** such as temperature

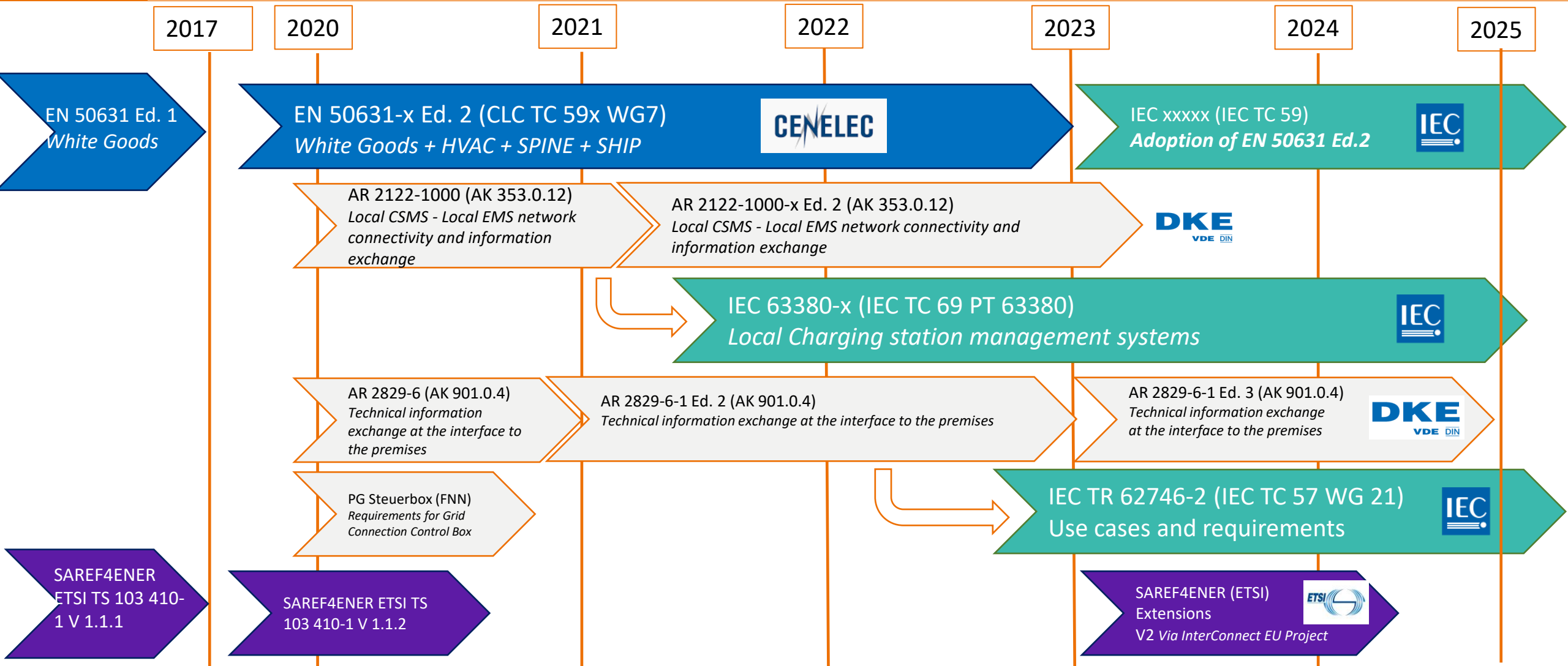


EEBUS STANDARDISATION OVERVIEW

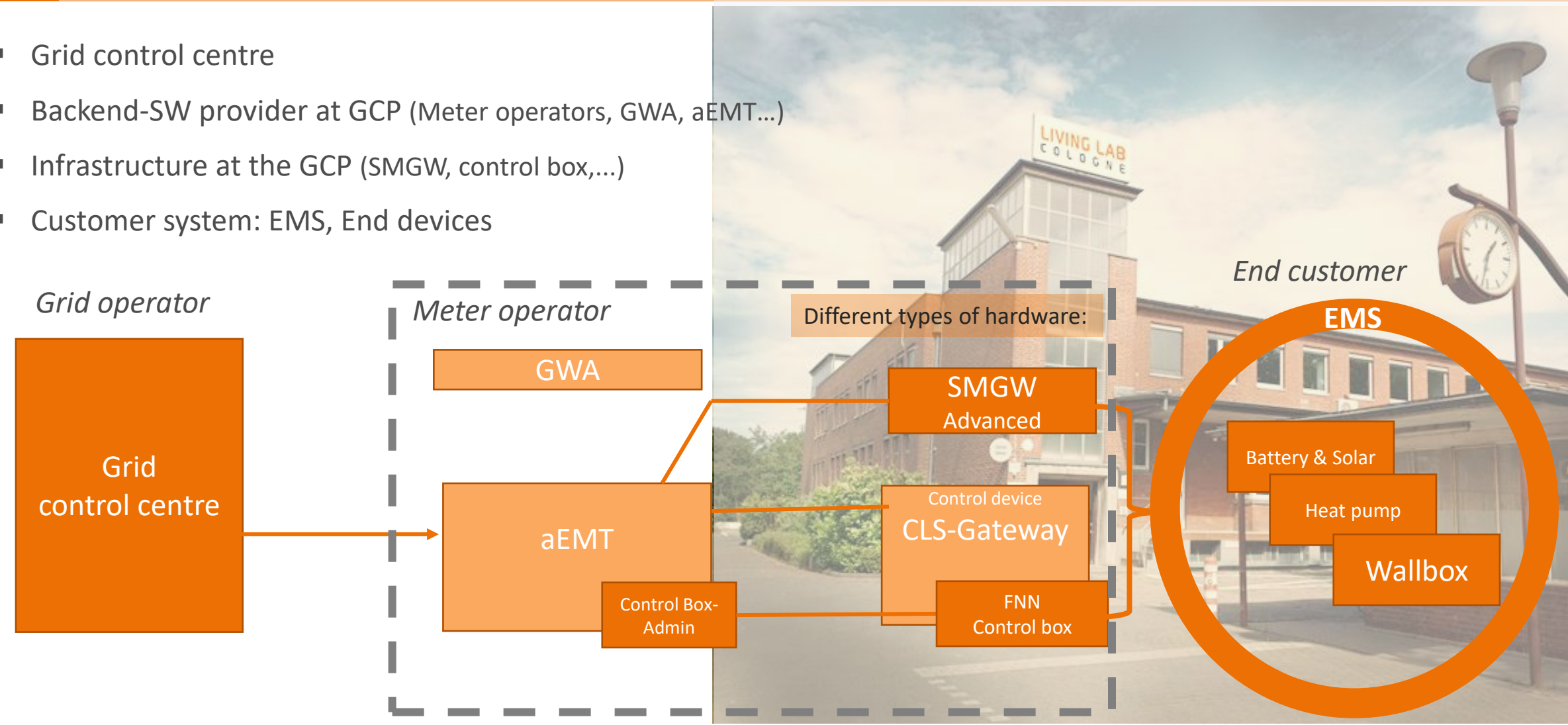


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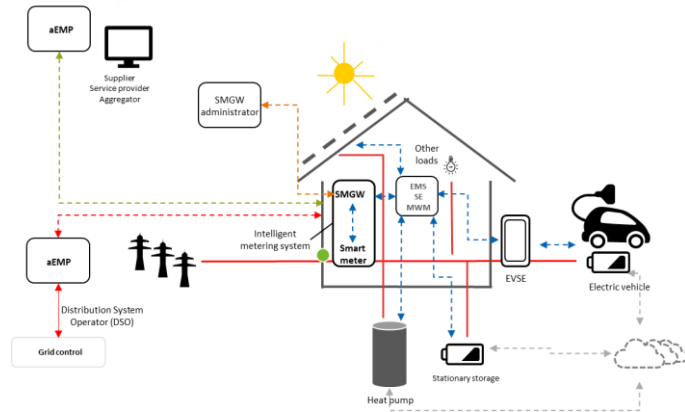
EEBUS STANDARDISATION ROADMAP



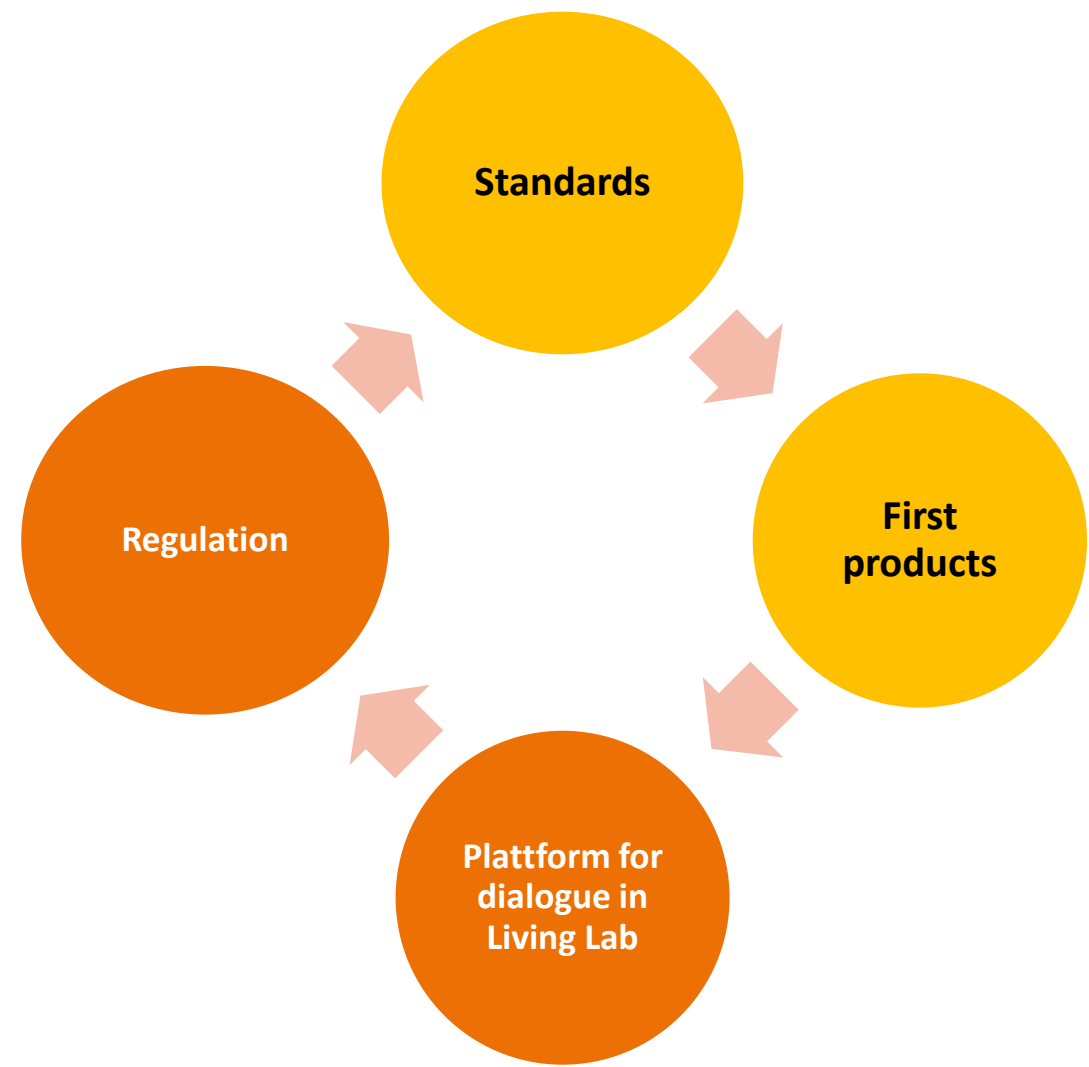
- Grid control centre
- Backend-SW provider at GCP (Meter operators, GWA, aEMT...)
- Infrastructure at the GCP (SMGW, control box,...)
- Customer system: EMS, End devices

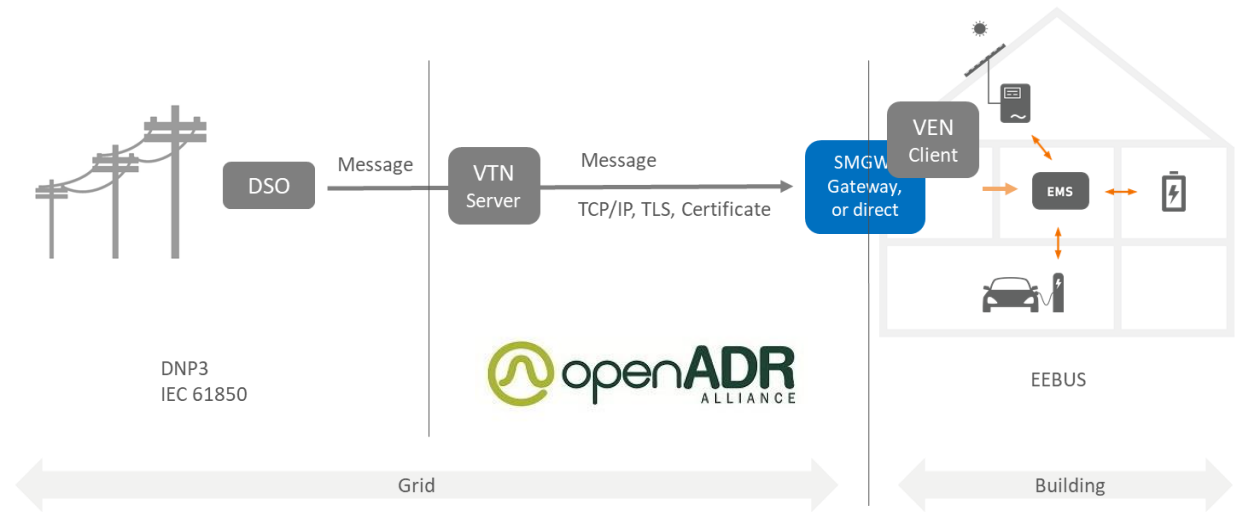
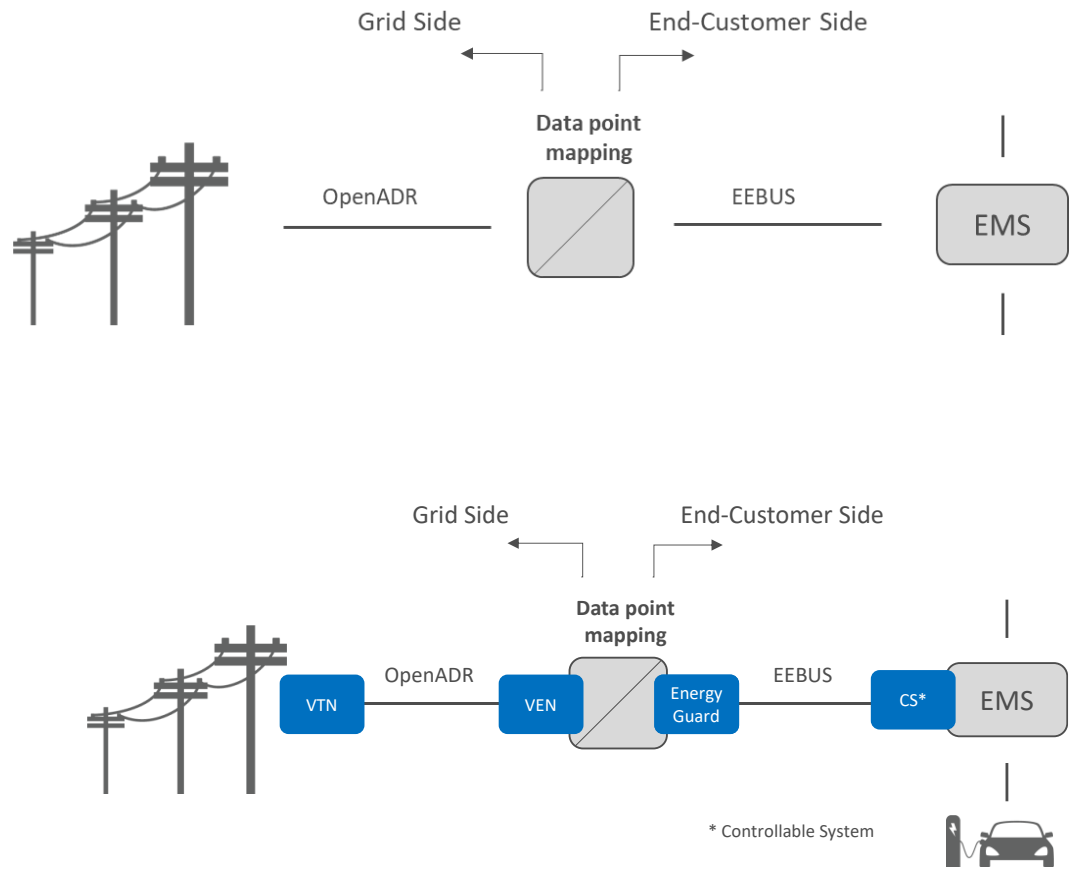


We realise the consistently interoperable eco system from energy industry up to end device



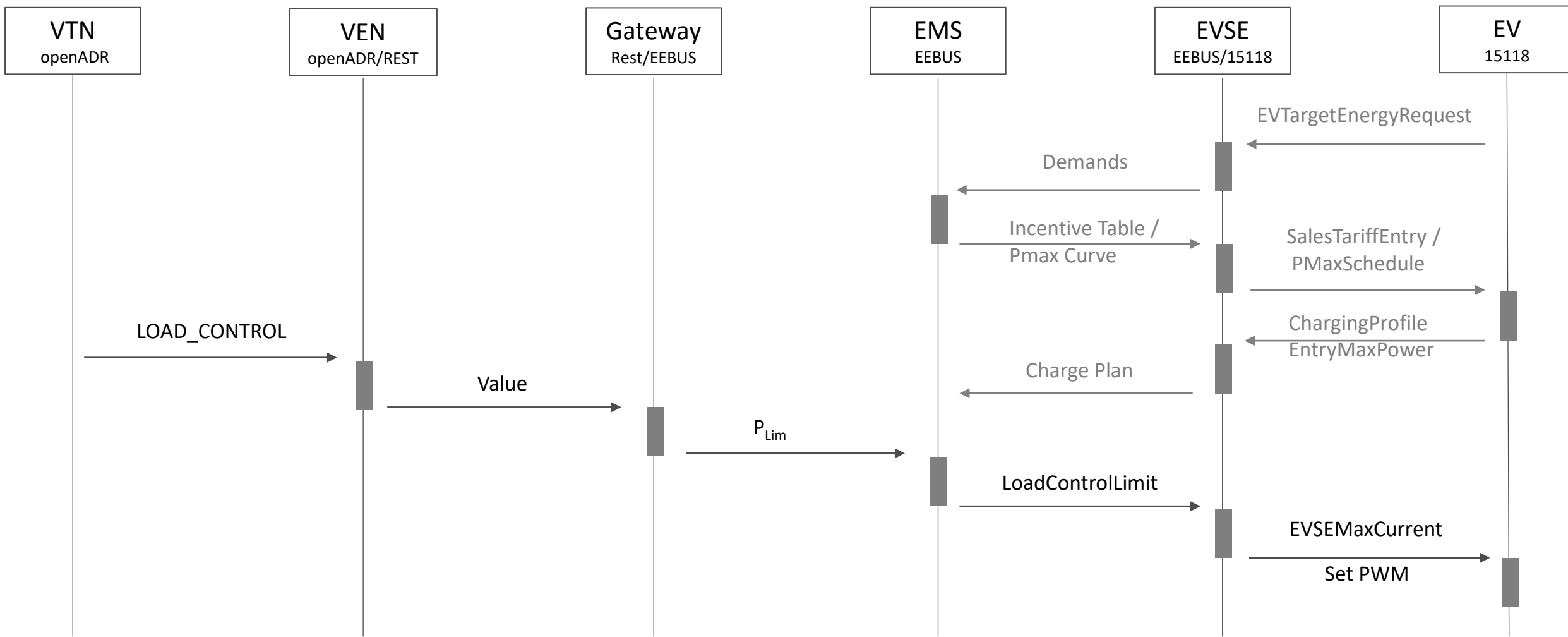
- Living lab for bidirectional communication and control from the backend of various active external market participants up to end device level in the customer system
- All applications and system architectures will be realised: partially as well as fully flexible loads, prosumer, control box, EMS....
- All relevant market roles will be represented, especially service providers, electricity sales and grid control
- The exploitation of flexibilities by grid control, electricity sales or aggregators will be demonstrated: the interplay of curative and preventive interventions will be tested
- All relevant devices of various manufacturers will participate
- The interplay of different ICT protocols will be tested
- The end-to-end functionality from DSO/Backend to end device will be demonstrated



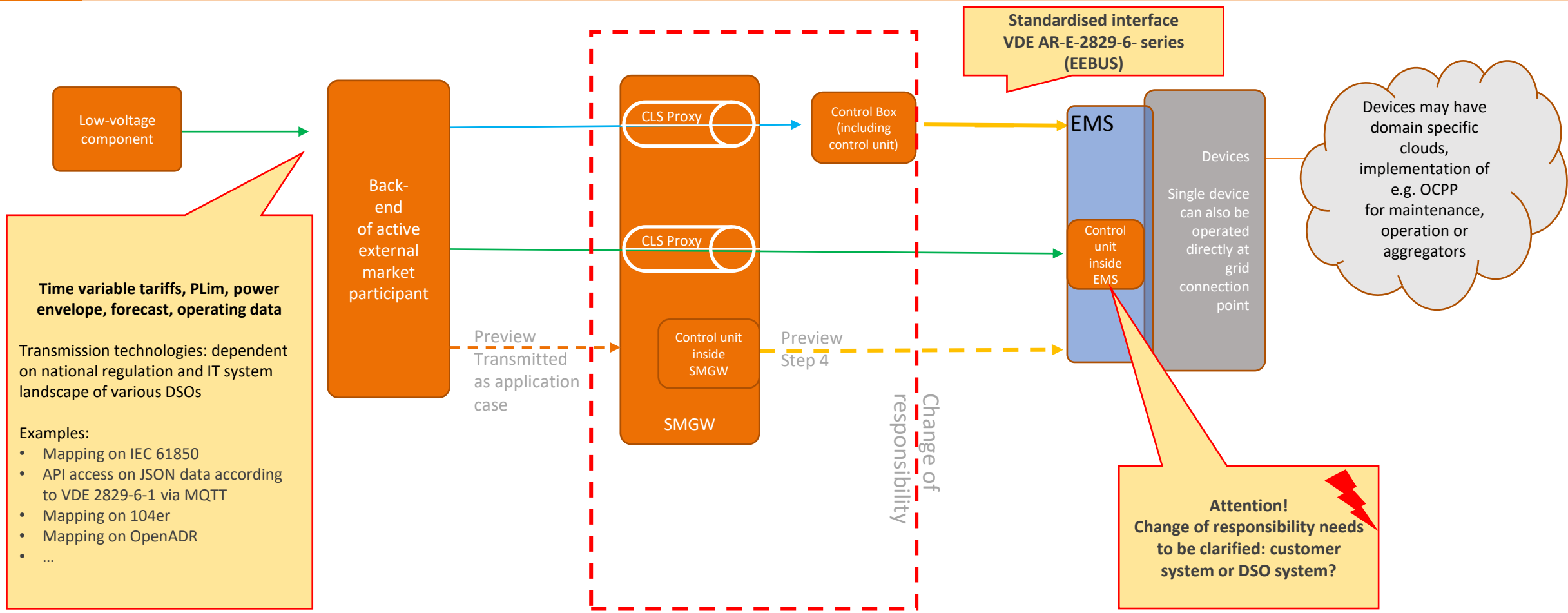




SEQUENCE DIAGRAM



CURRENT IMPLEMENTATION VARIANTS

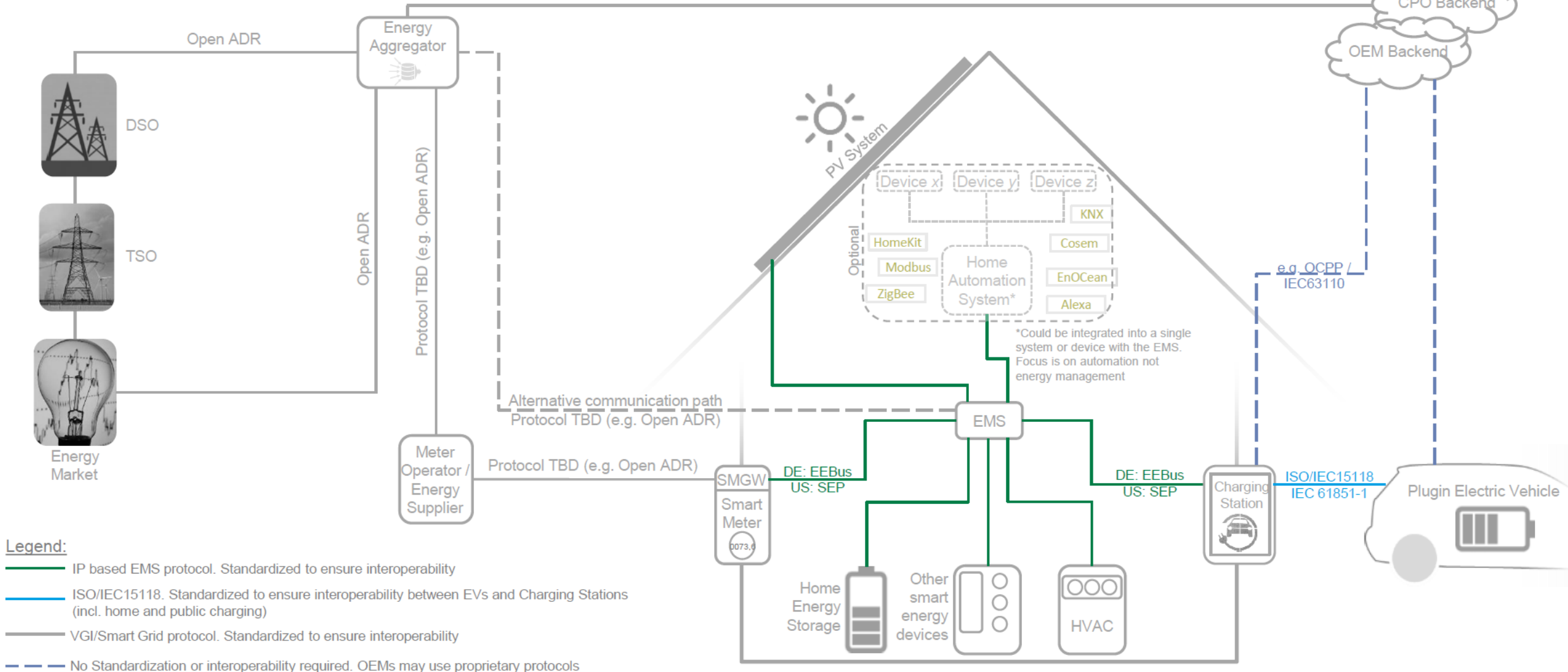


Consistent use case application of VDE 2829-6-1 (IEC 62746-2) from DSO to EMS (end device)

Customer Energy Management System

Communication Protocols in 2020

Focused on DE & US



Source: VDA homepage