#### **Grid Integration Levels**

2018-11-19 Version 4



#### **Grid-compliant Charging**

- EV and EVSE are compliant with the local requirements, guidelines and regulations.
- This level only considers charging events from grid to EV.

Description

Technical requirements:

 The charging power is below thresholds, requiring controllability / load management by the DSO.

### Level 1 - V1G Controlled Charging

- The charging event can be influenced regarding the charging power and can be shifted in time remotely by DSO (with highest priority), CPO, EV user, EV or home energy management (HEM).
- The EV is capable to wake up for defined start/stops.
- Reaction timings are defined.
- EV/EVSE, HEM consider variable power settings.

### Level 2 - V1G/H Cooperative Charging

- EV and EVSE negotiate a charging profile based on various drivers (monetary incentives or grid constraints) mainly w/o user interaction (also aggregation); tariff tables etc; mobility need taken into account
- Aggregation(local, per charging spot)

## Level 3 – V2H **Bidirectional Charging**

- battery and the home / customer system.
- Energy transfers are motivated by sustainability or economical reasons (storage and usage of power, generated by local PV panels or similar).
- Supports behind the meter (BTM) use cases

# Level 4 – V2G Aggregated (bidirectional) charging

- The EV and the EVSE fulfil functions that go beyond the customer's own energy system (bidirectional energy transfers, aggregators qualification, full balancing market services, economic interests of the EV owner).
- Supports in front of the meter (FTM) use cases
- Swarm qualification/ aggregation across larger area (entire state or country)

 Various local regulations per country (e.g. grid codes, IEC61851-1, IEC 60364 series, ...) Local regulations EV and EVSE

- PWM signal, IEC 61851
- DIN-SPEC 70121 (for DC) EVSE and grid (Utility, CPO, ...)
- OCPP 1.6
- Demand-response
- Opt-out possibilities

Local regulations
EV and EVSE

- ISO/IEC15118 Ed1
- Telematics

EVSE and grid

- OCPP 1.6f
- See level 1
- ToU

Local regulations EV and EVSE

- See level 2
- ISO/IEC15118 Ed2 EVSE and grid
- See level 2
- EEBus
- Many requirements still missing

Local regulations EV and EVSE

- See level 2 EVSE and grid
- See level 3
- Many requirements still missing

today till 2020 till 2020 till 2025 around 2025

Grid connection Grid integratio