SMART CHARGING AND V2G EXPERIMENTATION

EVS32 – MAY 19-22ND

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MAY 2019

GROUPE RENAULT

RENAULT - EV PIONEER & LEADER IN EUROPE

FIRST OEM WITH A FULL ELECTRIC PRODUCT LINE UP

10 YEARS
OF EV EXPERIENCE

30 000
PEOPLE TRAINED

100%
TRAINED DEALERS

CUSTOMER SATISFACTION

- New ZOE: autonomy **300 km** WLTP
- **>90%** customer recommendations
- **~200K** customers

TECHNICAL EXCELLENCE

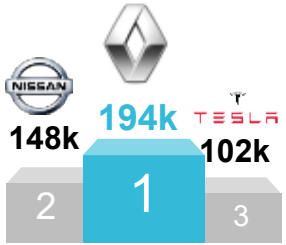
Battery Pack
TECHNOCENTRE

e-Motor CLEON

ZOE FLINS

Kangoo ZE
MAUBEUGE

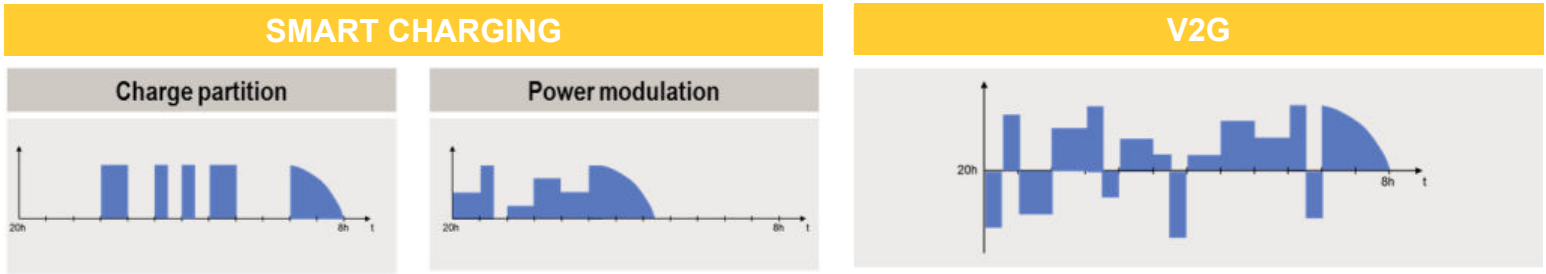
LEADER IN EUROPE



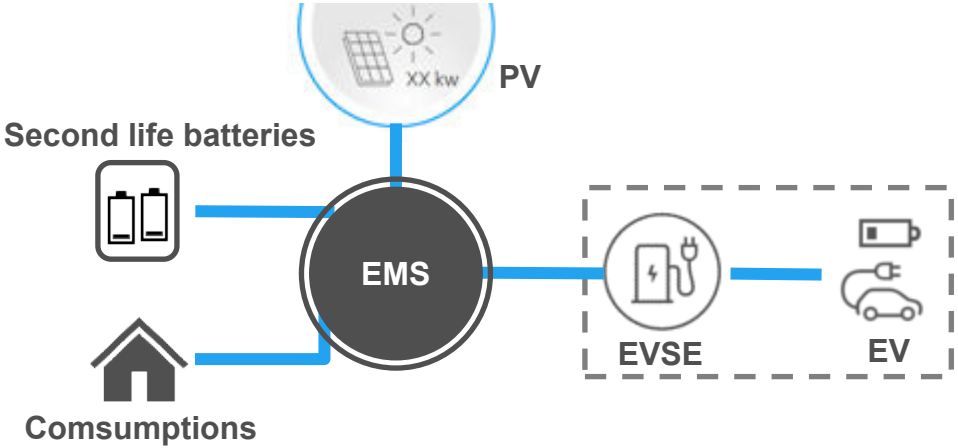
Total cumulated EV sales
(@end 2018)

FROM SMARTCHARGING TO V2X AC: RENAULT STRATEGY

Goal: generate value from energy & mobility sectors



EVS32:
End to end experimentations



EVS30 & EVS31:
- ISO 15118
- Function allocation
- Grid codes

ON GOING PROJECTS

EV Smart Energy Station

- Focus on communication protocols
- Smart charging and V2G use cases
- Second life EV batteries
- In house EMS

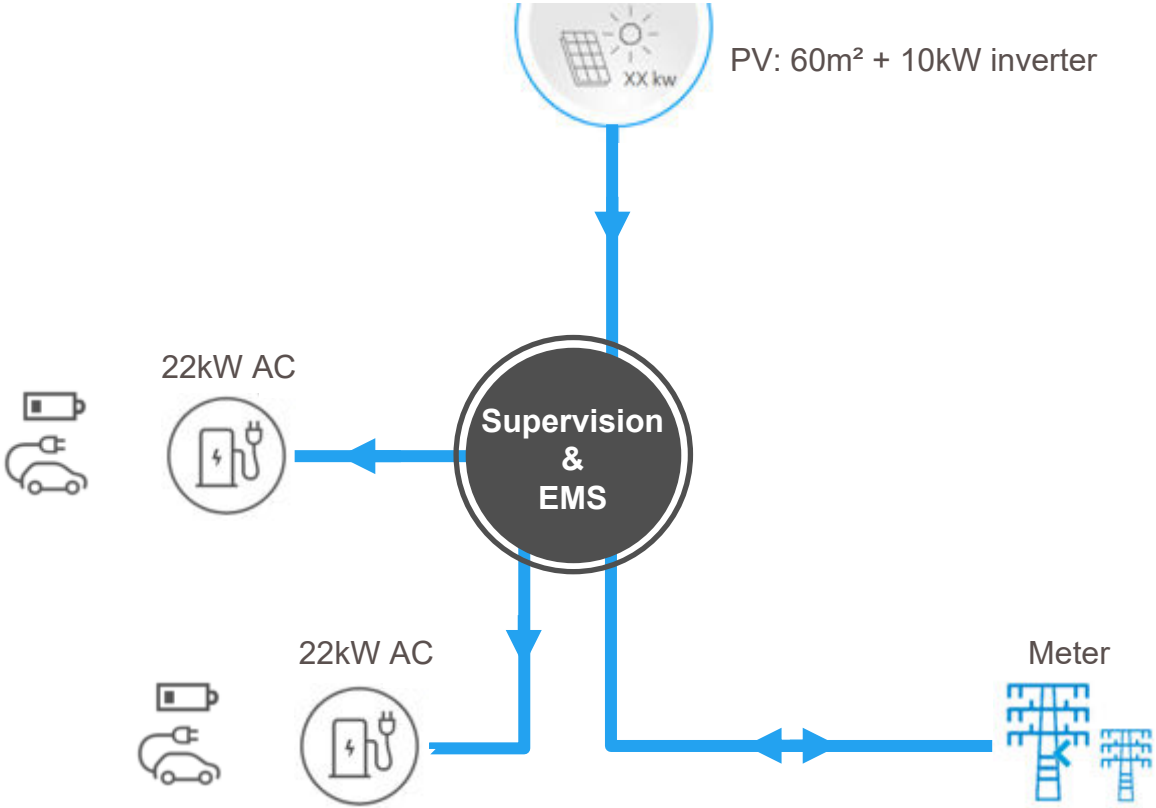
Europe V2G experimentations

- Focus on business case
- V2G – dynamic mode
- Usage profiles
- Work with DSO

EV SMART ENERGY STATION

- Focus on communication protocols
- Smart charging and V2G use cases
- Second life EV batteries
- In house EMS

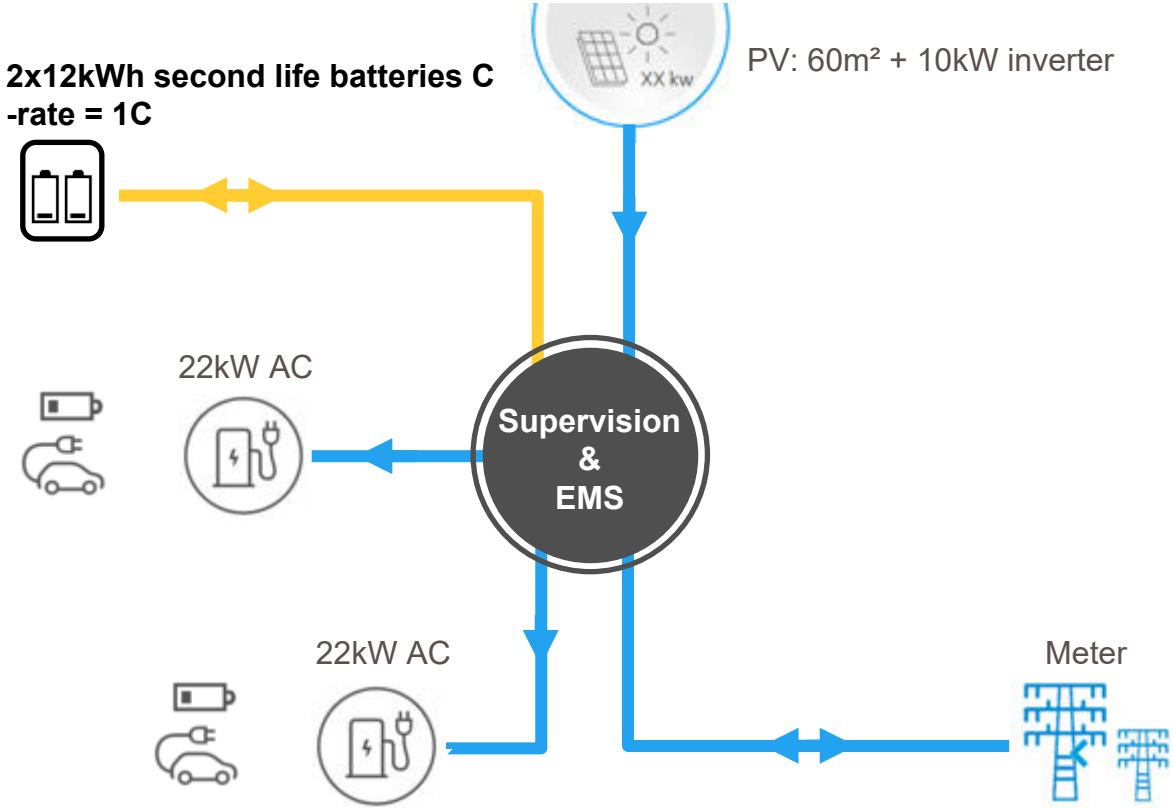
SYSTEM DESIGN AND USE CASES



First configuration:

- Base scenario for comparison of future configurations
- Objectives:
  - Self consumption
  - Smart charging peak / off peak (w/o mobility needs)
  - Power repartition between EVs
- Limitations:
  - Self consumption limited
  - Mobility needs not communicated to the EMS

SYSTEM DESIGN AND USE CASES

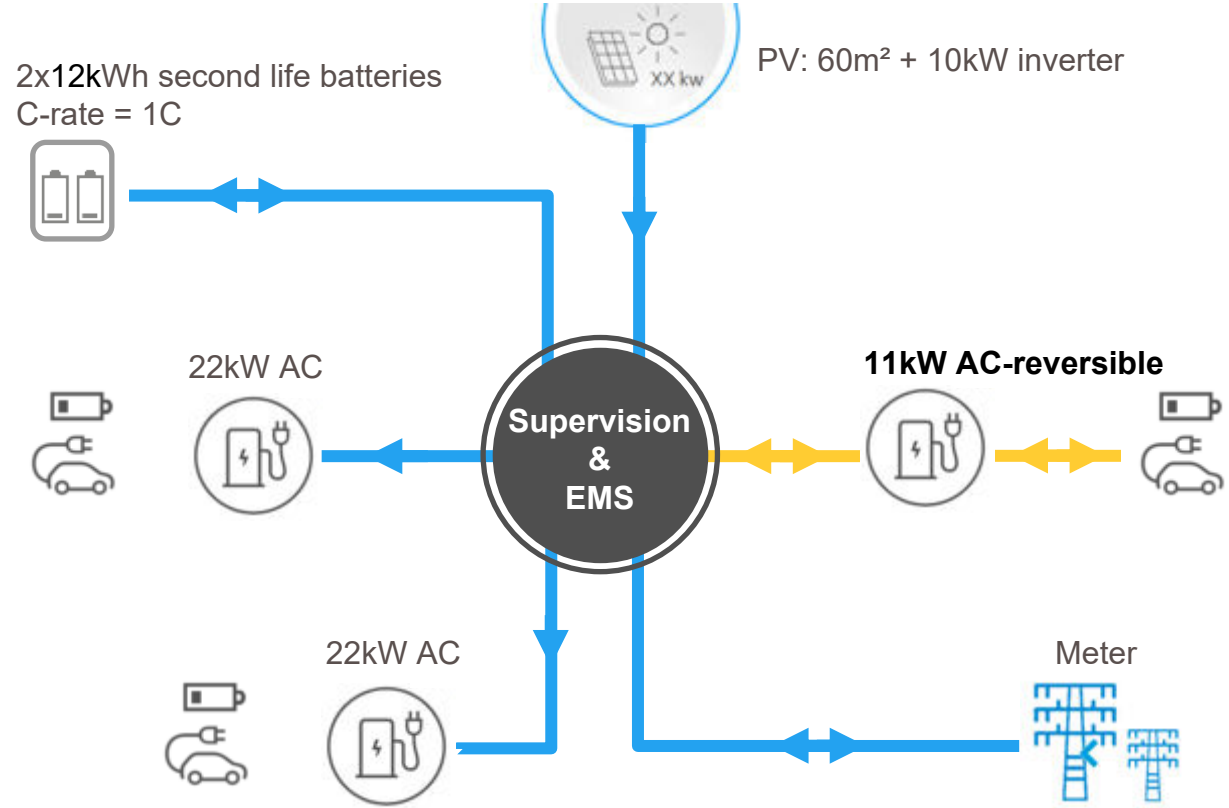


Second configuration:

- Ensure self consumption when no EV is charging
  - At least 50% self consumption
  - Increase from 10 to 34kW maximum available charging power for EVs (grid neutral)
- Evaluate the value of stationary storage

- Limitations:
  - Mobility needs not communicated to the EMS

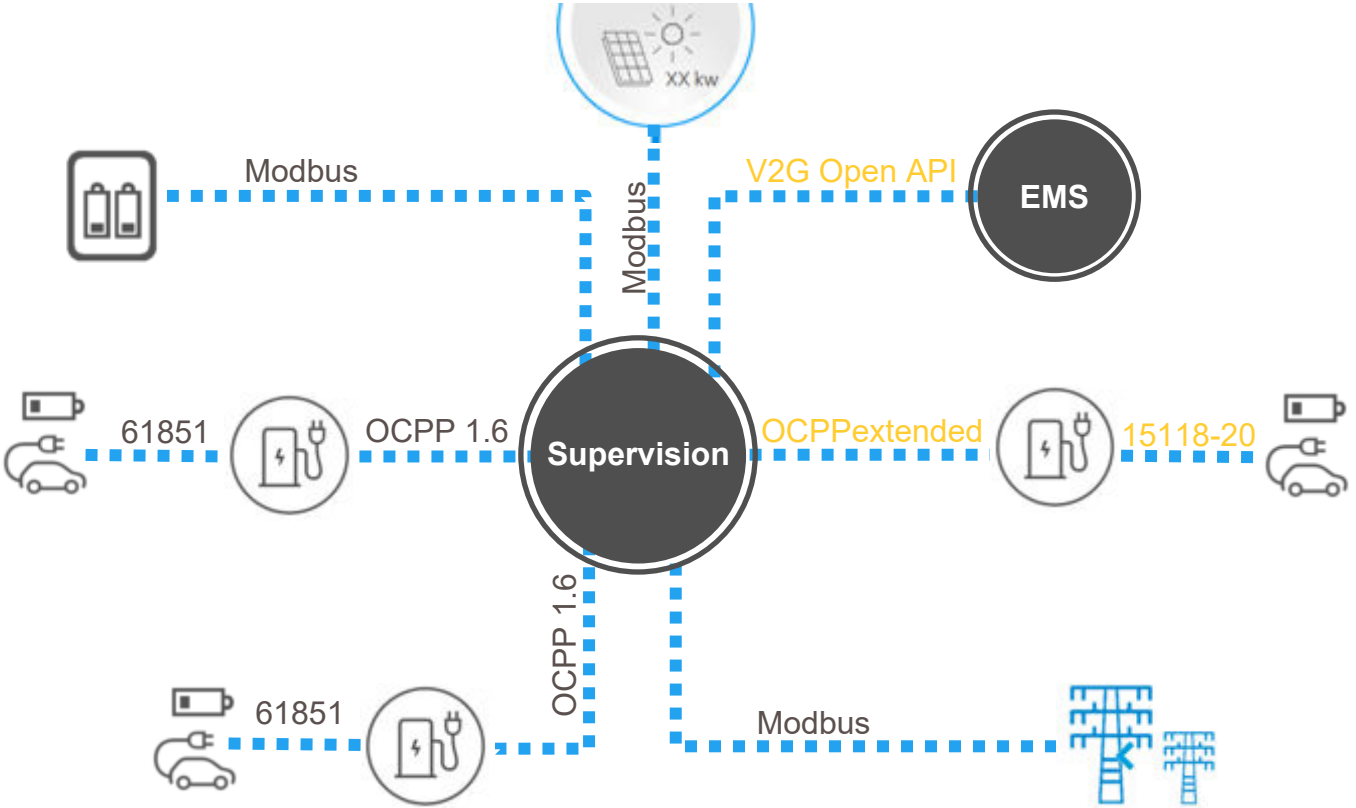
SYSTEM DESIGN AND USE CASES



Third configuration:

- Smart charging schedule and dynamic modes
- V2G schedule and dynamic modes
- Mobility needs retrieved by EMS

COMMUNICATION PROTOCOLS



EV SMART ENERGY STATION

ISO 15118-20

Communication between **EV** and **EVSE**

61851

- Basic communication based on PWM signal
- Exchange only current limitations and state

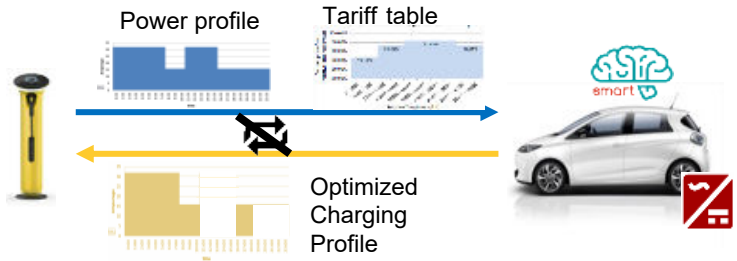
15118-2 (2014)

- Digital communication for AC and DC charges
- Smart charging (schedule mode)

15118-20 (2020)

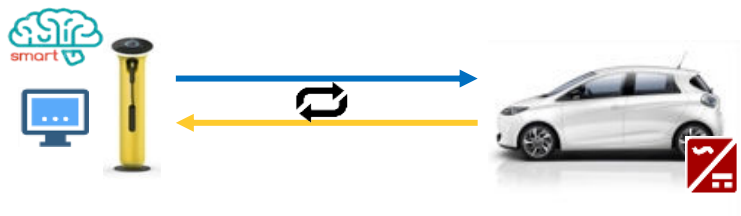
- Bidirectional power transfer
- Fast responding services V2G/V2H (dynamic mode)

Schedule mode



- EVSE communicates grid constraints (power & price)
- EV calculates optimized charge profile ensuring mobility need

Dynamic mode



- EVSE calculates power setpoint based on mobility needs
- EV follow power setpoint and updates physical limitations (AC bidirectional)

OCPP EXTENDED

Communication between **EVSE** and **Supervision**

OCPP 1.6

- Smart charging for load balancing and charge profiles (no electricity prices)

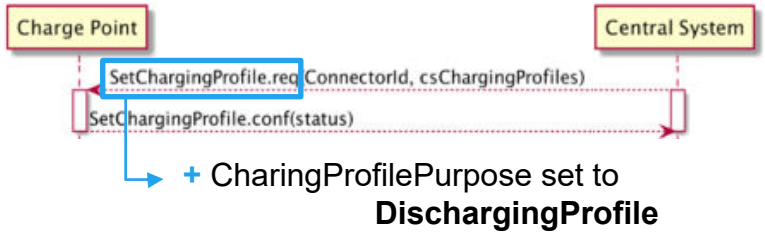
OCPP 2.0

- Compliant with 15118-2 for Smart charging (schedule mode)

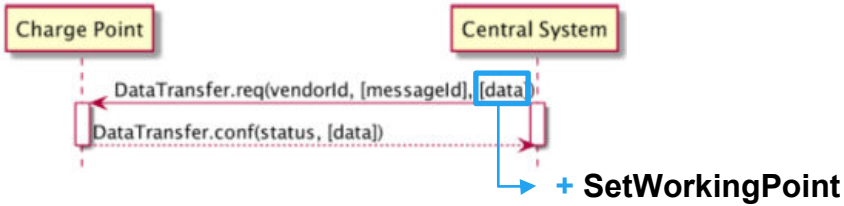
OCPP Extended

- Proprietary modification of OCPP 1.6 to include V2G (compliant 15118-20)

Modified message example:



New message example (DataTransfer):



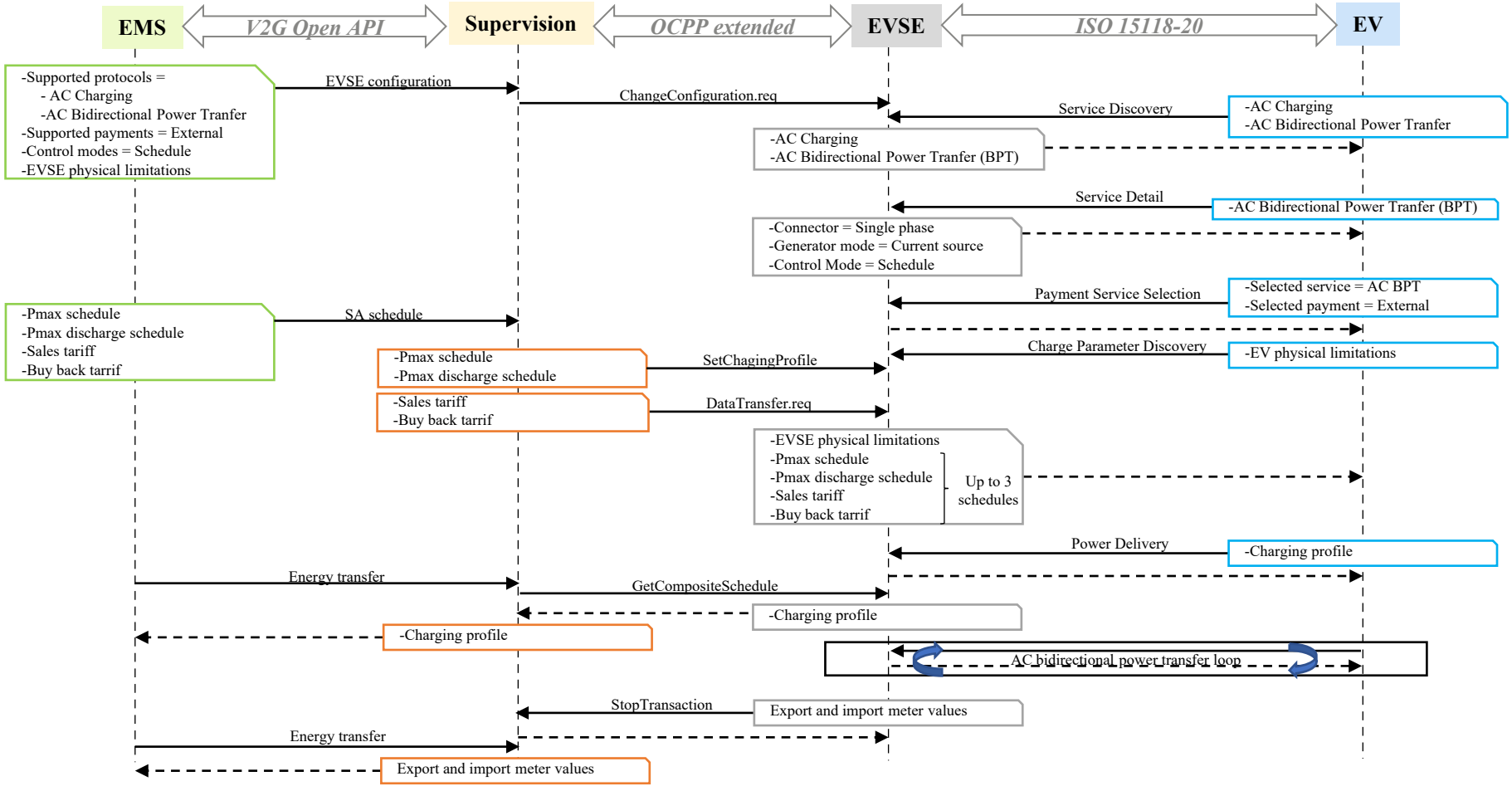
V2G Open API

Communication between **Supervision** and **EMS**

- Proprietary JSON API to make transparent the OCPP extended language for the EMS/Aggregator

EV SMART ENERGY STATION

SCHEDULE MODE DATA FLOW



EUROPE V2G EXPERIMENTATIONS

- Focus on business case
- V2G – dynamic mode
- Usage profiles
- Work with DSO

ON GOING PROJECTS

Porto Santo – Smart Island

- 80% EV and 80% RES by 2020
- Use cases: V2G for frequency and voltage regulation

Electricidade da Madeira

The Mobility House

Utrecht - Eco district

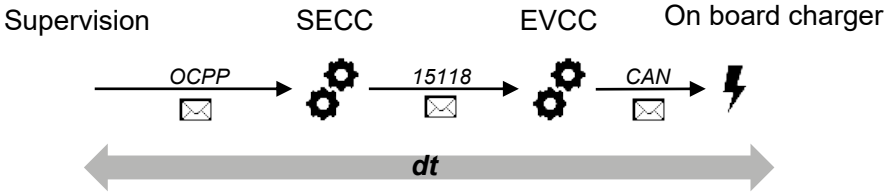
- Solar power car sharing program
- Use cases: V2G for collective self-consumption and local congestion management

WE DRIVE SOLAR

Elaad nl

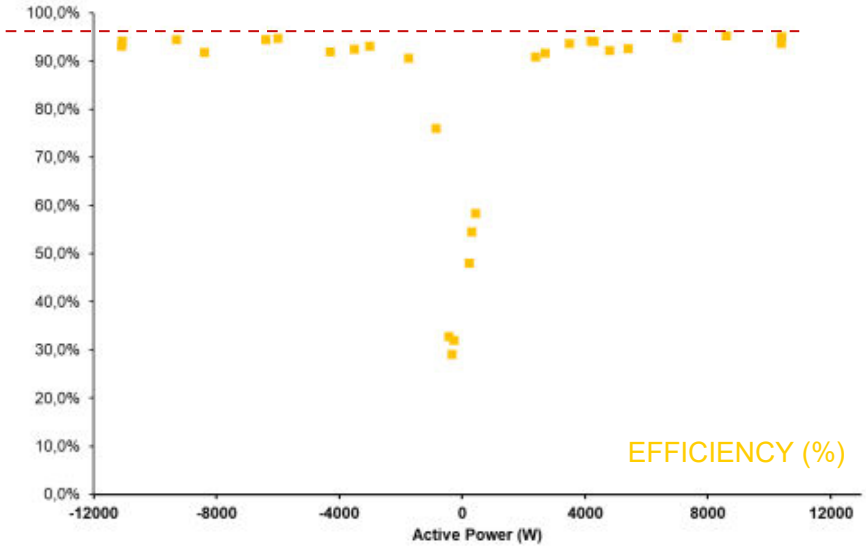
SYSTEM PERFORMANCE

Step response



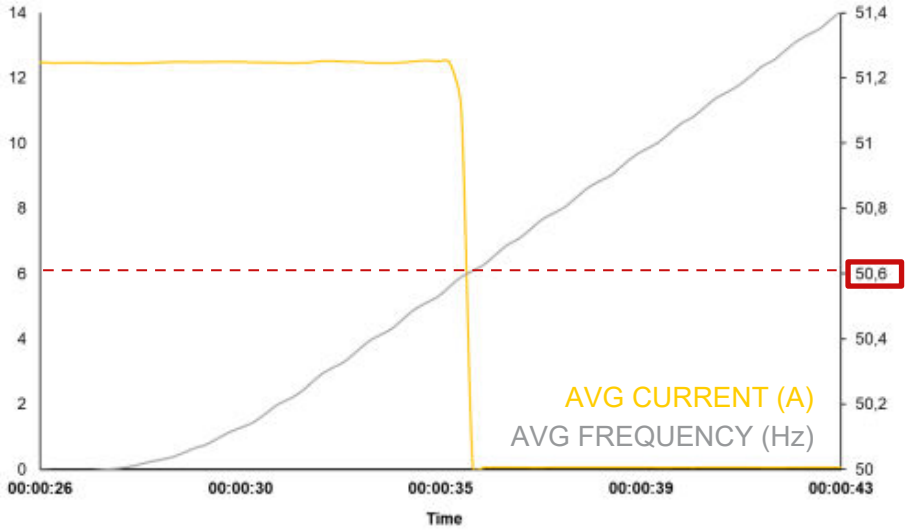
Power step	dt
-7kW to 5kW	2,1s
5kW to 7kW	1,0s
7kW to 11kW	1,1
11kW to 8,5kW	0,8s
8,5kW to -3kW	1,7s

Efficiency

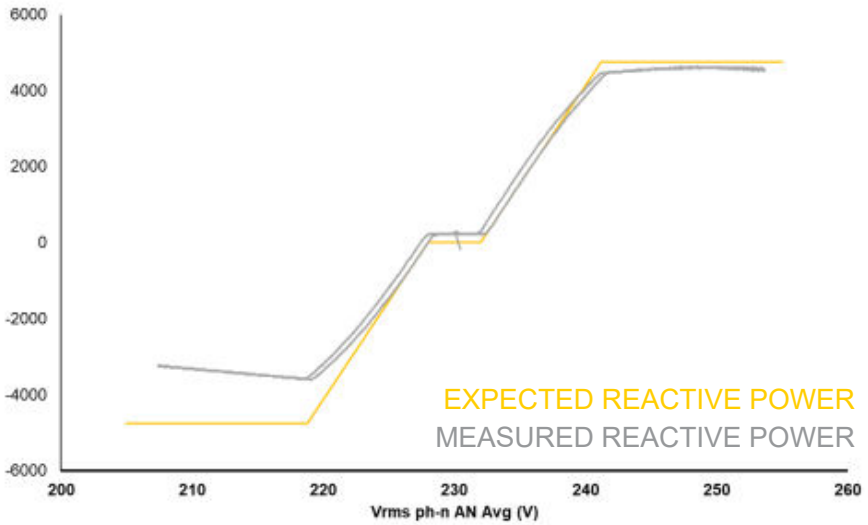


SYSTEM PERFORMANCE

Interface protection

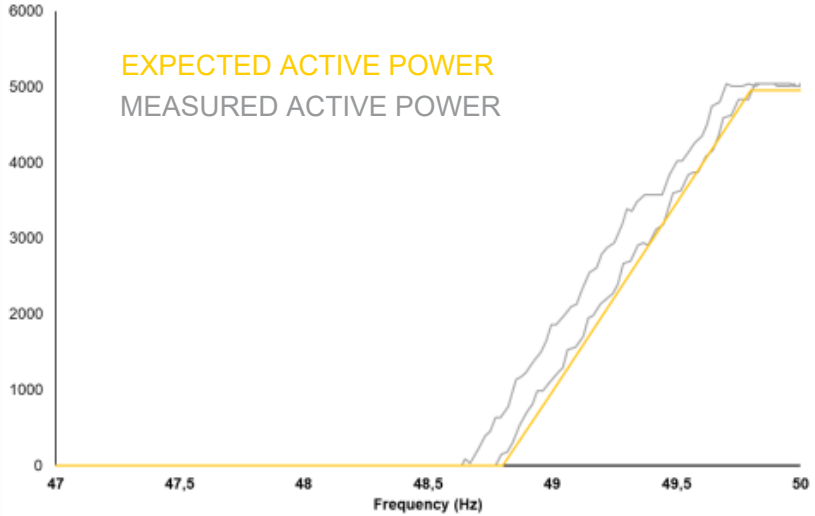


Voltage regulation Q=f(U)



SYSTEM PERFORMANCE

Under Frequency response



CONCLUSION

EXPERIMENTATIONS

- A ready to use platform to plugin and test new technologies and optimization strategies (EMS)
- Several experimentations in place to learn usage profiles for different use cases

COMMUNICATION PROTOCOLS

- OCPP 2.0 not yet compatible with reversibility → proprietary changes are required for experimentations

PERFORMANCES

- Grid codes compliance feasibility of an AC bidirectional on board charger proven

COME VISIT US!

V2G and Plug&Charge demo

at the Renault booth

THANK YOU