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European Union
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PROSPECT2030

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Online Meeting

July 05.2021



E-mobility as Service Operation



PROSPECT2030 | Fraunhofer IFF | Prof. P. Komarnicki, Dr. P. Lombardi, Dr. S. Balischewski

Need for change
in energy sectors:

EVs are coming

Challenges of
grid integration:

Overloads and
voltage range
deviation

EVs as service
provider:

Concepts of
smarter charging
services

Technical
realisation:

EV integration in
intelligent energy
infrastructure



NEED OF CHANGING ENERGY SOURCES

particulate matter

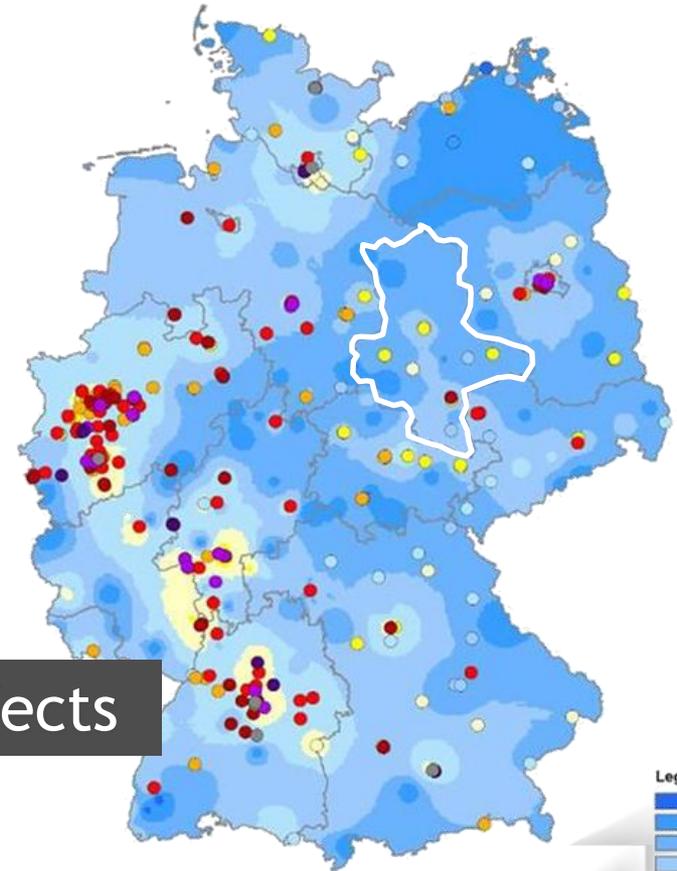
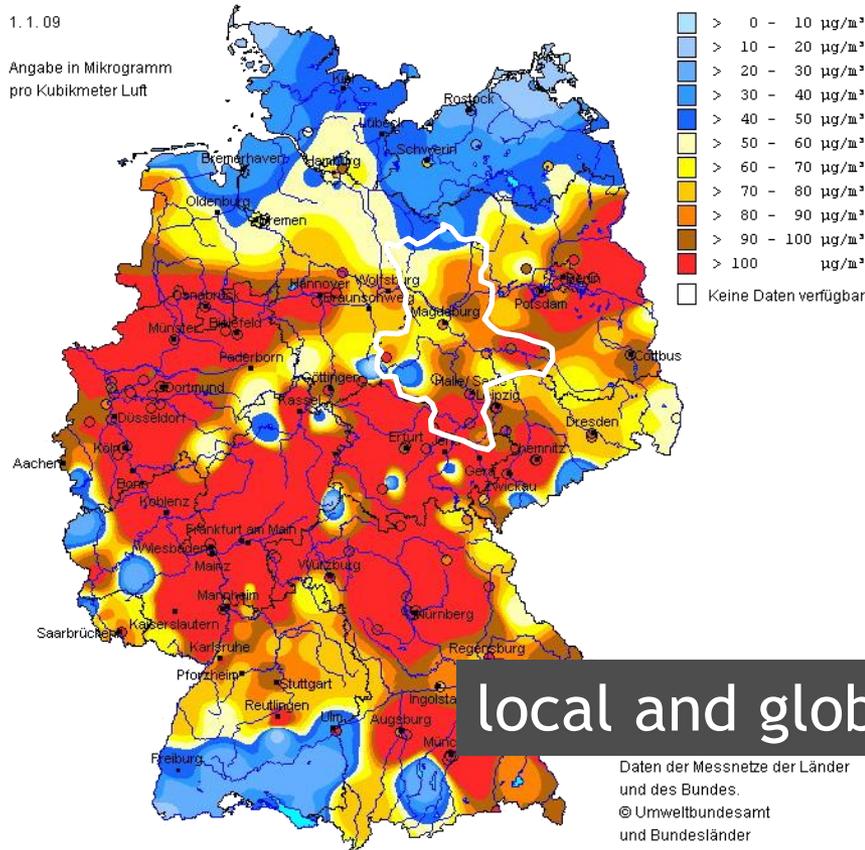
NO_x

CO₂

Tagesmittelwerte der Partikelkonzentration

1. 1. 09

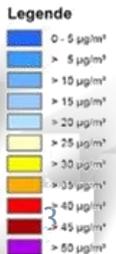
Angabe in Mikrogramm
pro Kubikmeter Luft



local and global effects

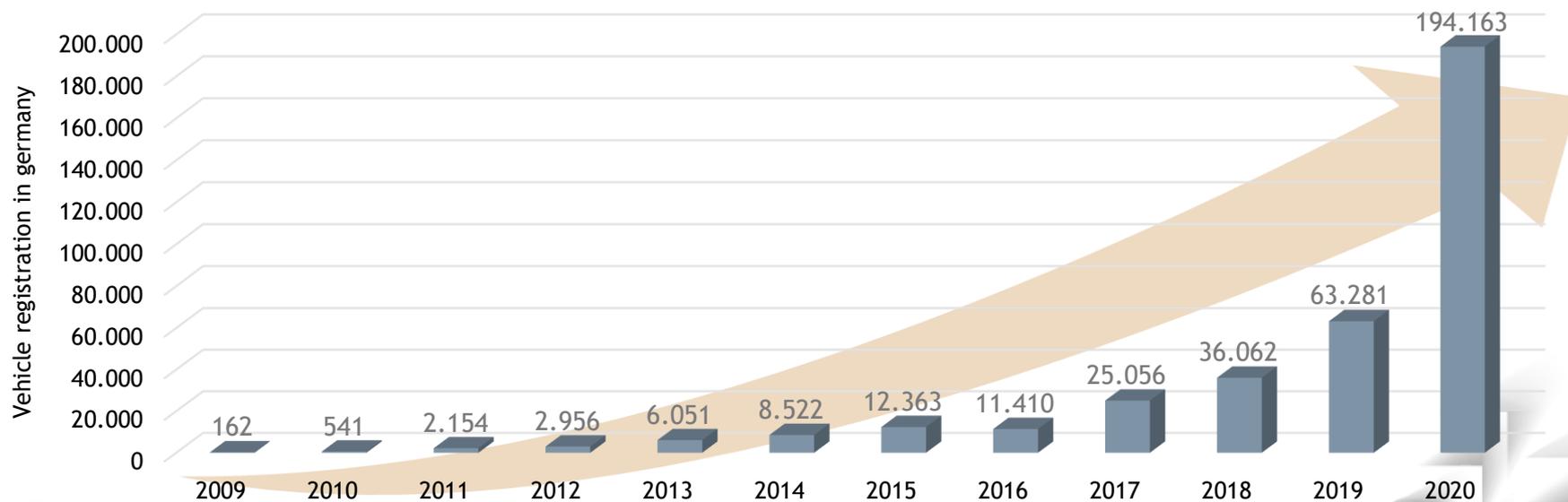
Daten der Messnetze der Länder
und des Bundes.
© Umweltbundesamt
und Bundesländer

Die vom Umweltbundesamt zusammengestellten Karten und Daten zur aktuellen Immissionsituation dienen der orientierenden Information der Bevölkerung. Auf Grund der weiträumigen Betrachtung ist eine kleinräumige Interpretation nicht zulässig.



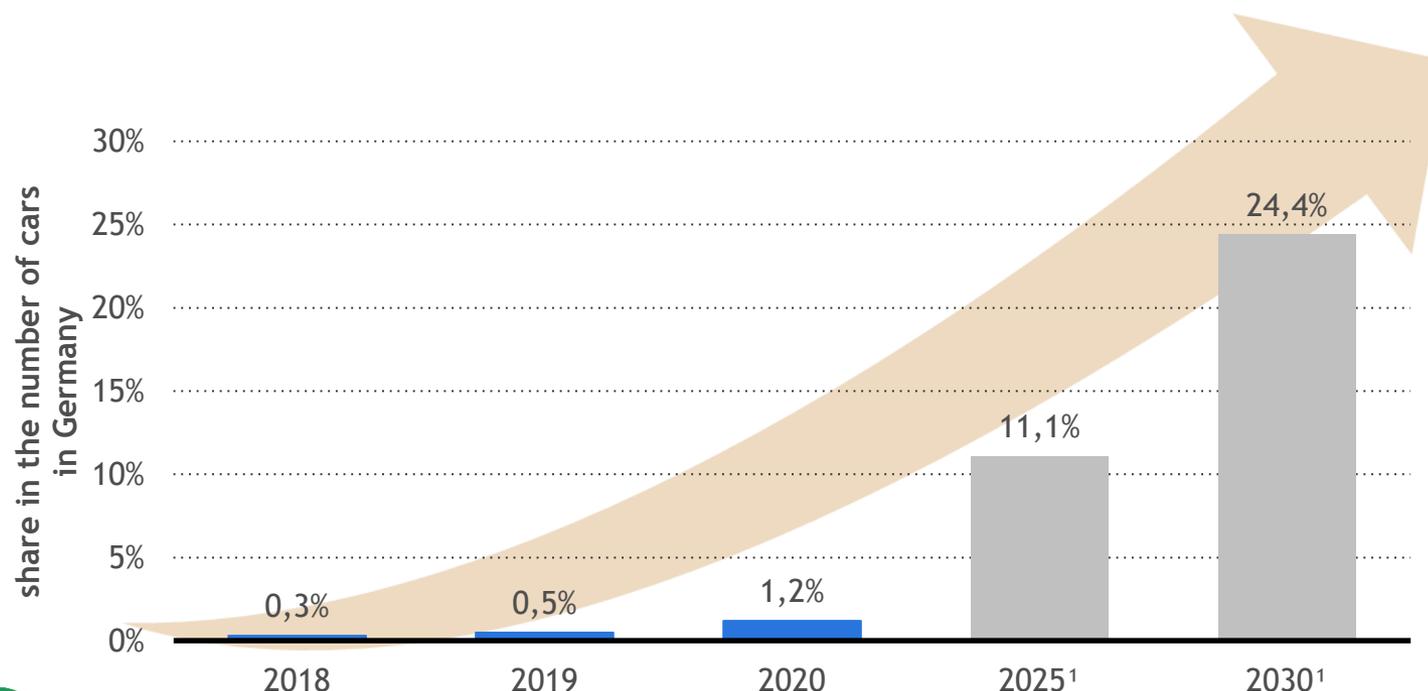
ELECTRIFICATION OF MOBILITY STARTED

- Global change in energy sectors - use of RES
- Expansion to renewable energies and electrification of mobility sector
- Change to green mobility; electric vehicles driven with RES
- Number of EV-Models increases rapidly every year

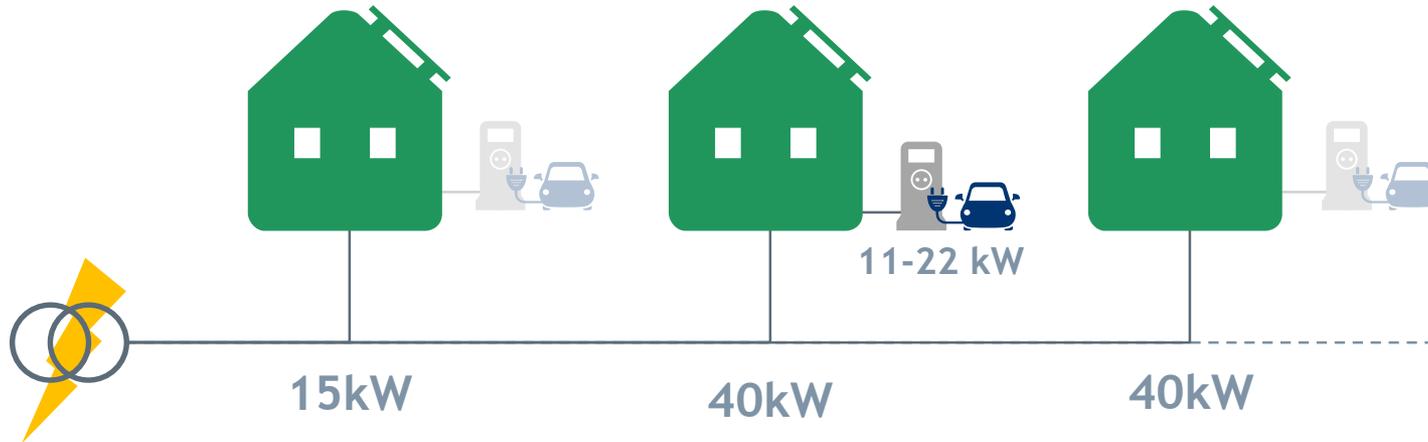


ELECTRIFICATION OF MOBILITY STARTED

- Integration in existing infrastructure - challenge or benefit
- How much do EVs change the local energy demand?
- How many charging stations are needed and where?
- Does charging station needs match with existing infrastructure?



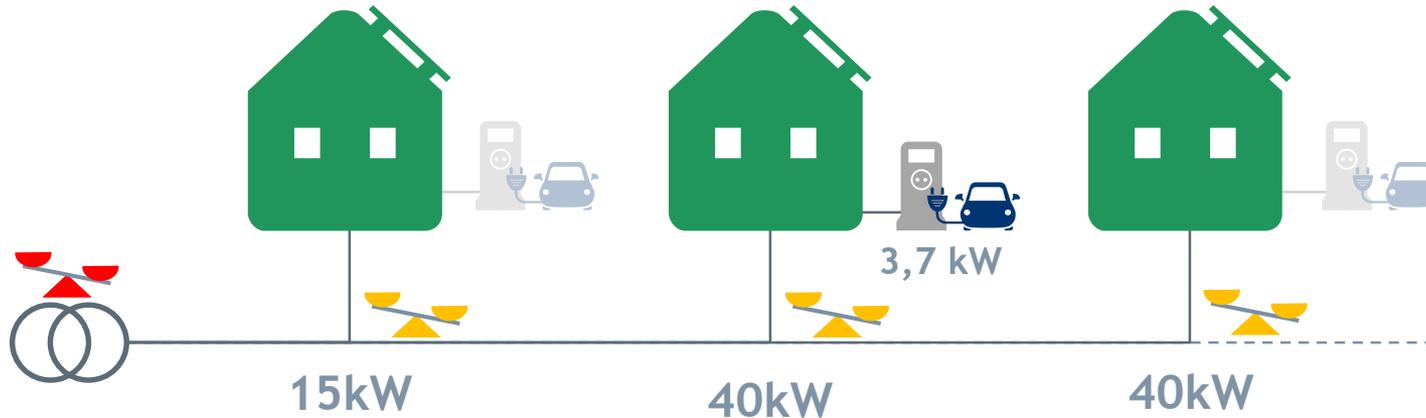
CHALLENGES OF GRID INTEGRATION



- High charging power preferred by EV customers
- High energy demand (rising capacities)
- Infrastructure is mostly not ready to cover those needs
- Big potential for overloads, especially in rural grids
- Tentially increasing requirements



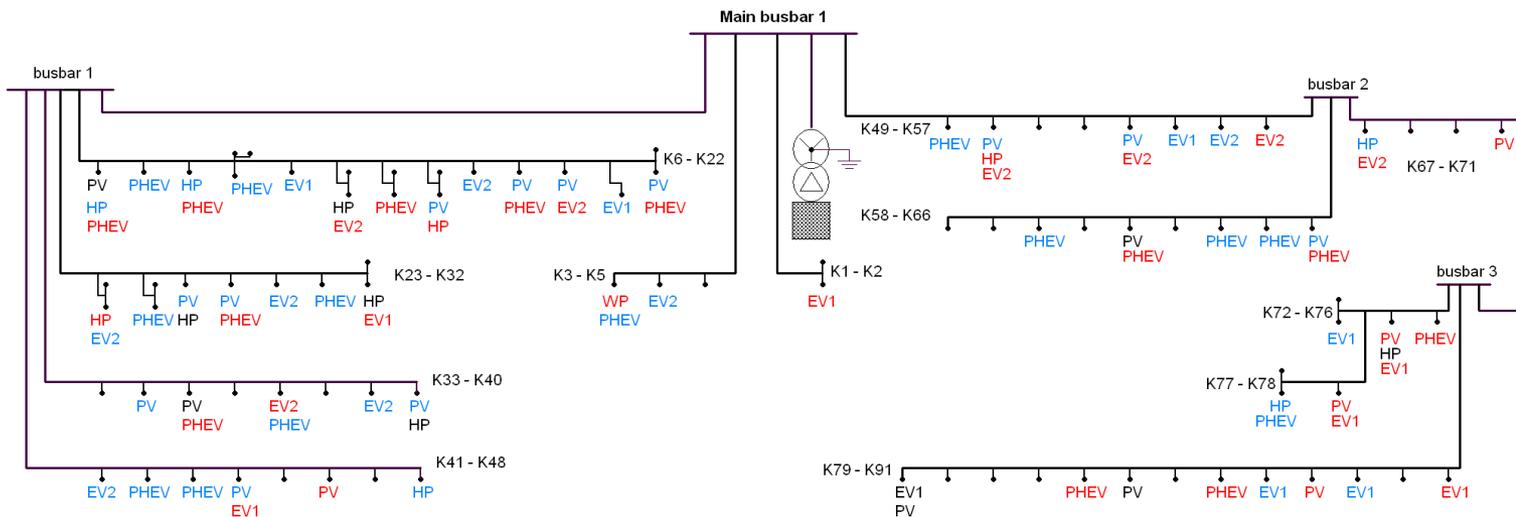
Single-Phase Charging



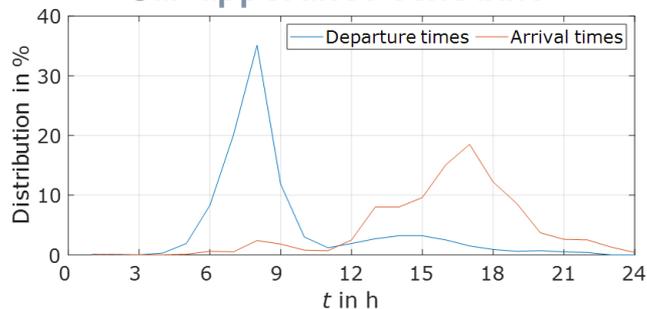
- Even single-phase charging must be considered
- Multiple single-phase charger lead to unbalanced grid
- Decreasing grid utilization
- Big potential for voltage range deviations, especially in rural grids



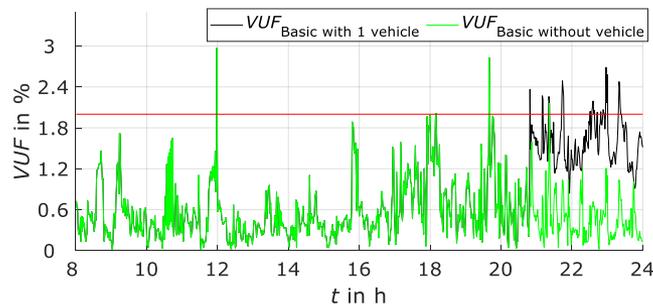
Single-Phase Charging: simulation study

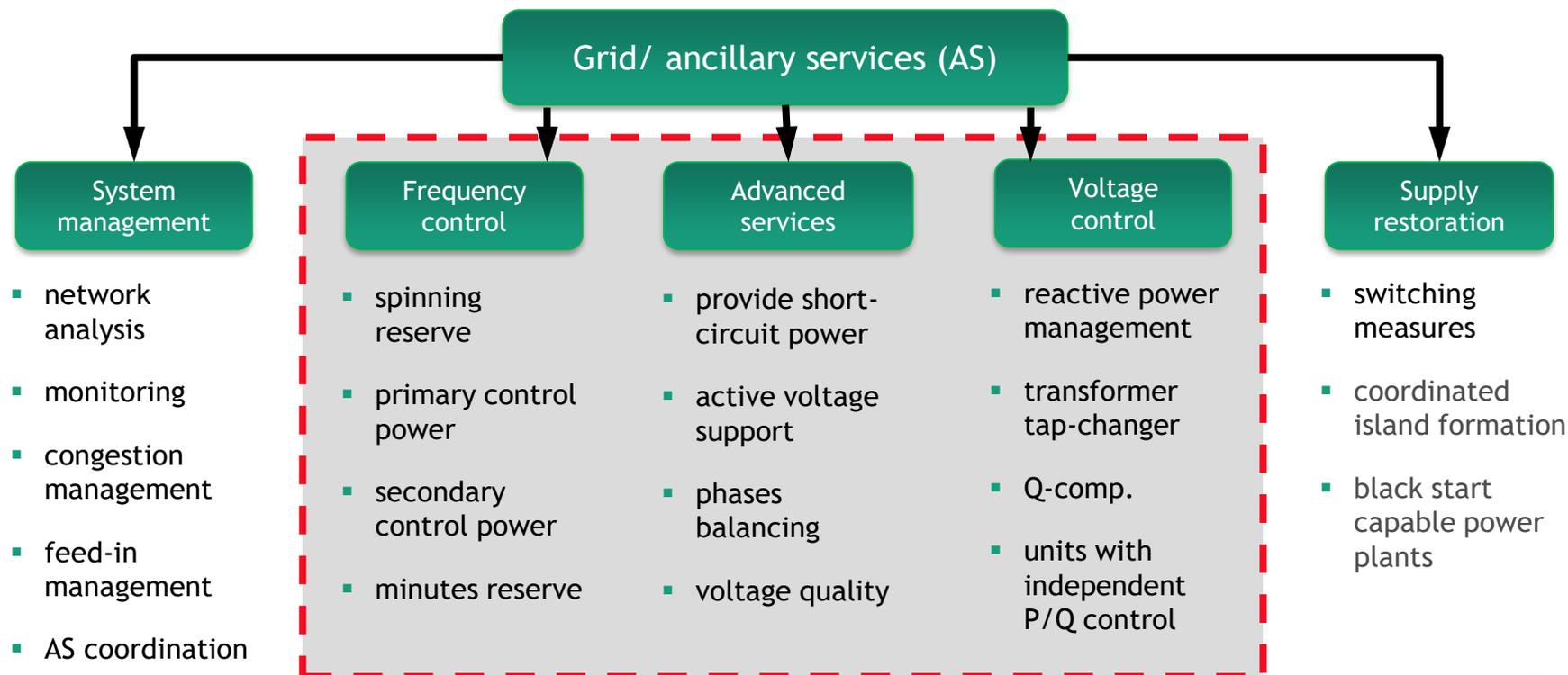


Car appearance schedule



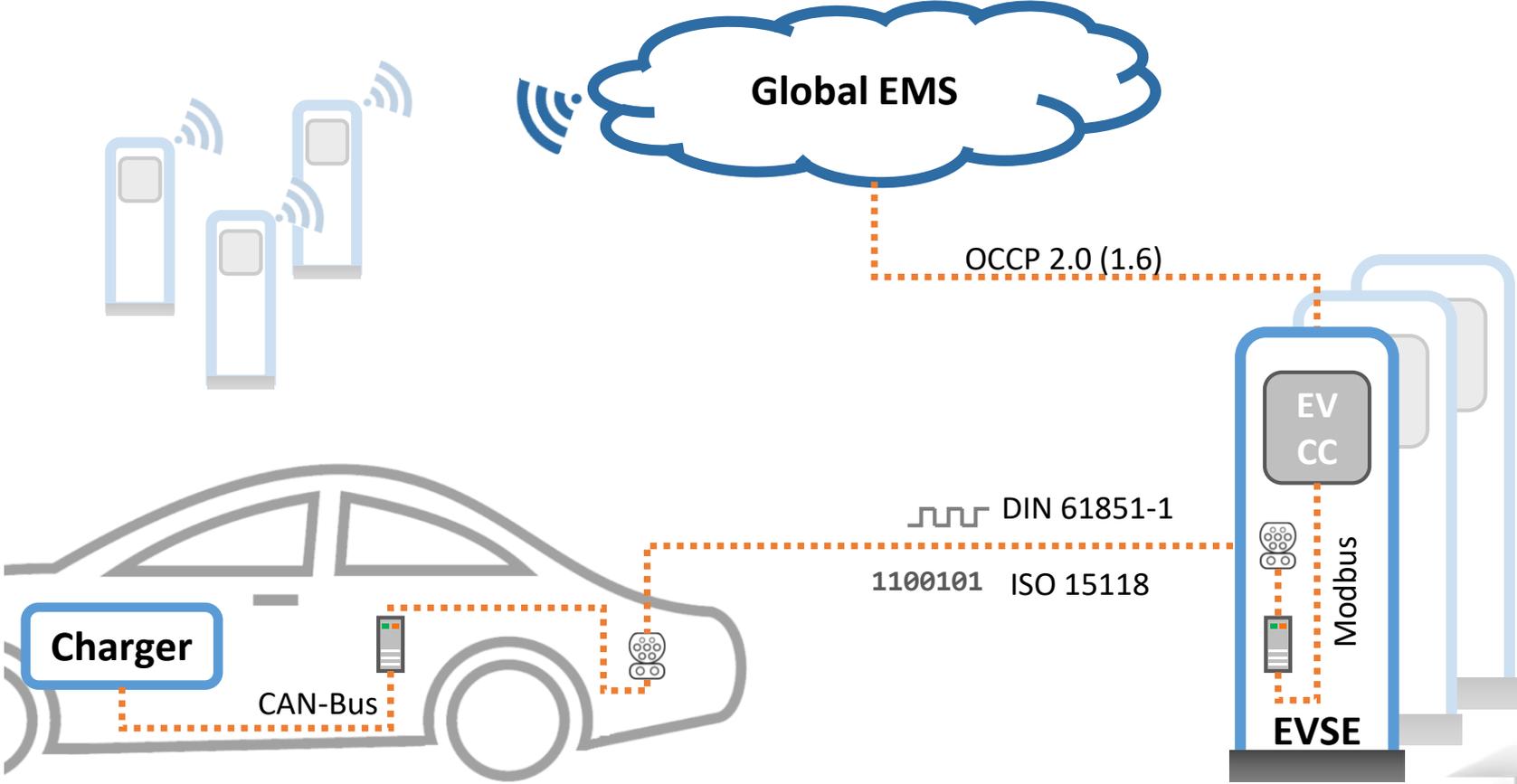
Nodale voltage unbalance



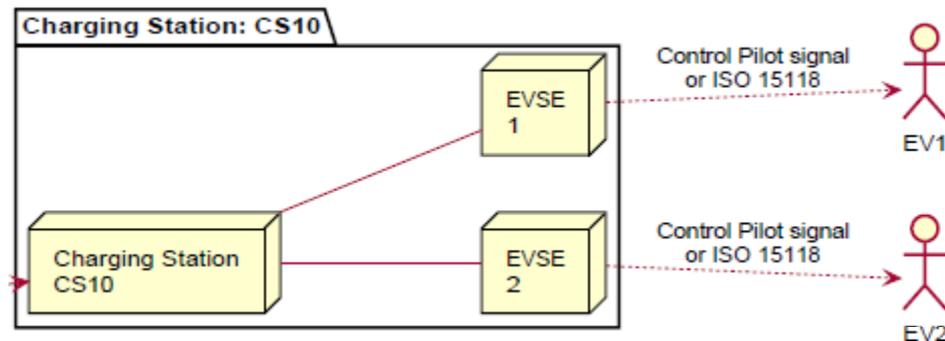
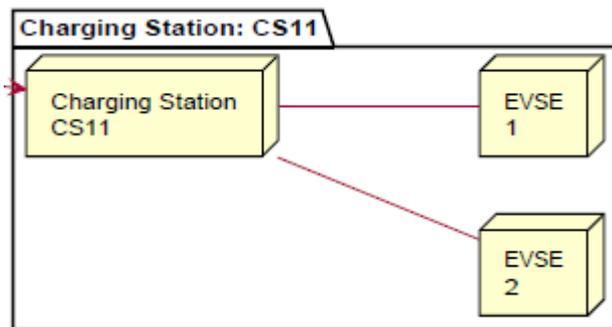


EVS AS SERVICE PROVIDER

Information side



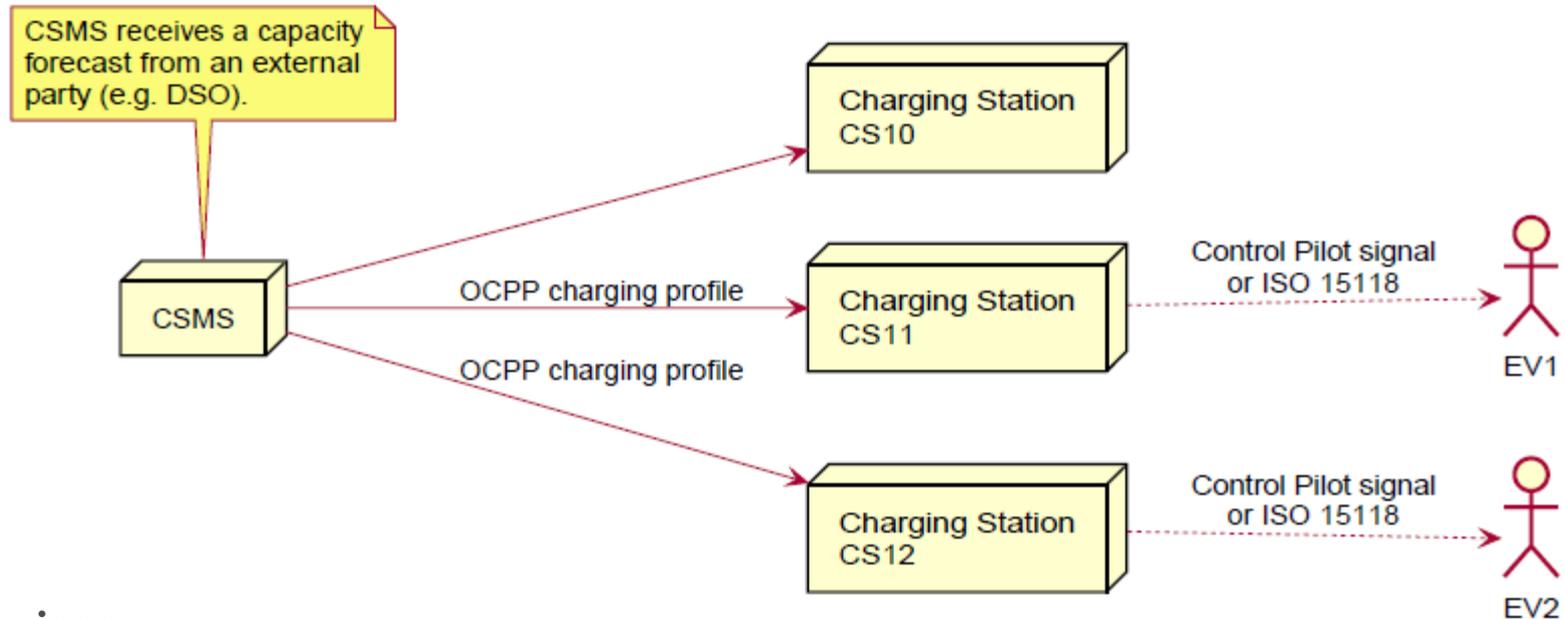
EVSE - electric vehicle supply equipment
EVCC - electric vehicle charging controller



integrated services

- Providing local services based on metering information inside the EVSE
- No external communication needed (Resilience)
- Limited to information located in the EVSE
- Potential service: load balancing, phase shifting, voltage stabilization

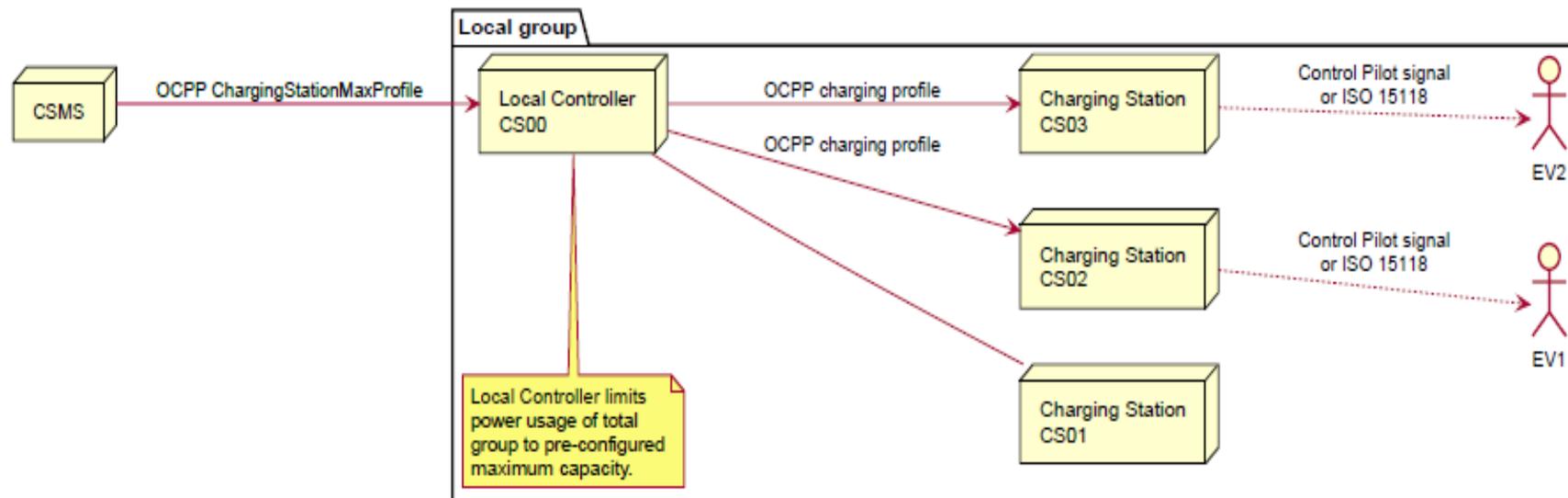




Local services

- Providing local services based on metering information on substation range
- Additional basic information needed (e.g. for Pooling)
- Limited to information located in the EVSE
- Potential service: load balancing, phase shifting, voltage stabilization



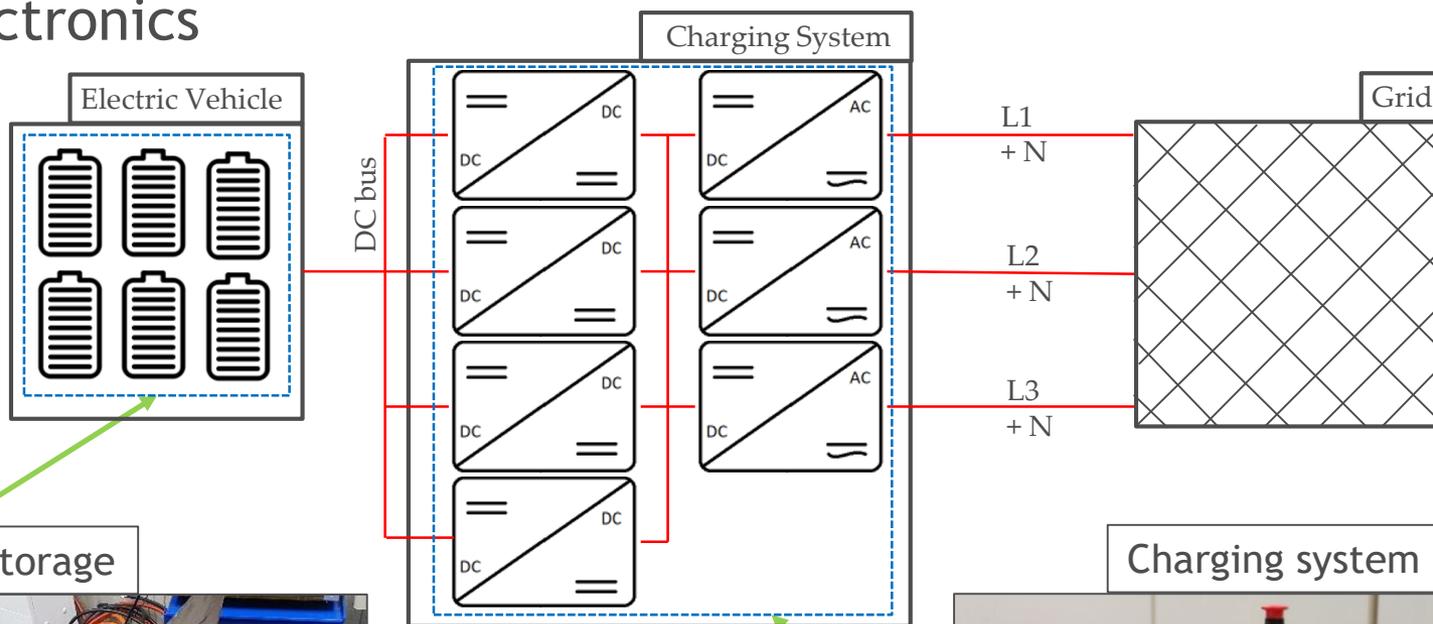


Centralized services

- Providing grid-wide services based on all information in control centre
- Local pooling is possible to boost grid influence
- Additional error handling (interruption of communication)
- Wide range of services



Power electronics



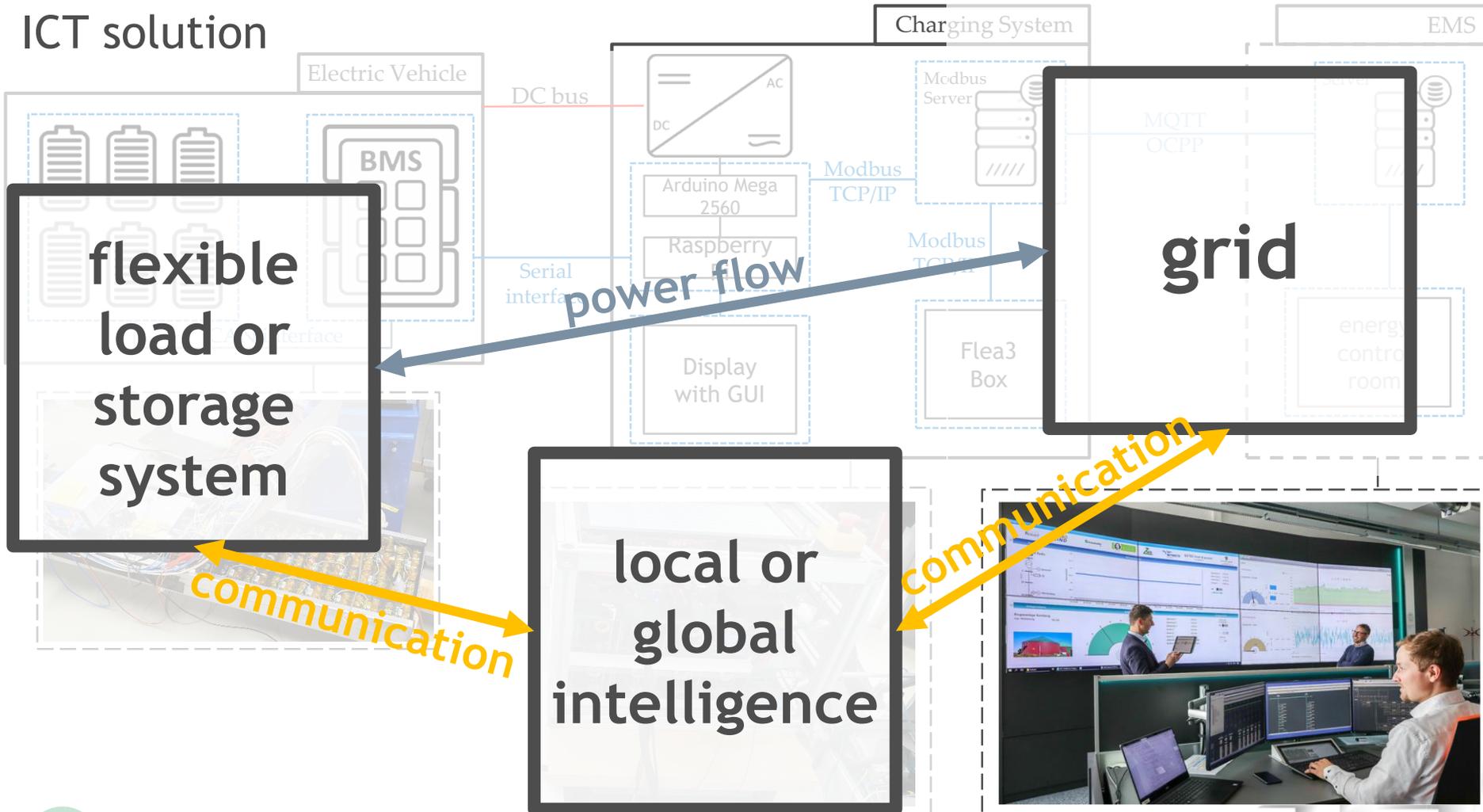
EV battery storage



Charging system



ICT solution



- EVs will change mobility and transportation sector
- EV will have significant impact on infrastructure
- EV needs to be coupled to RES to fully use benefits
- EV could be utilized for grid/ ancillary services
 - Standards for ICT and charger is needed
 - regulations for grid/ ancillary services is needed
- ICT is needed to fully use potential of EV's

Green energy supply means smart energy management with sector coupling



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Thank you for attention