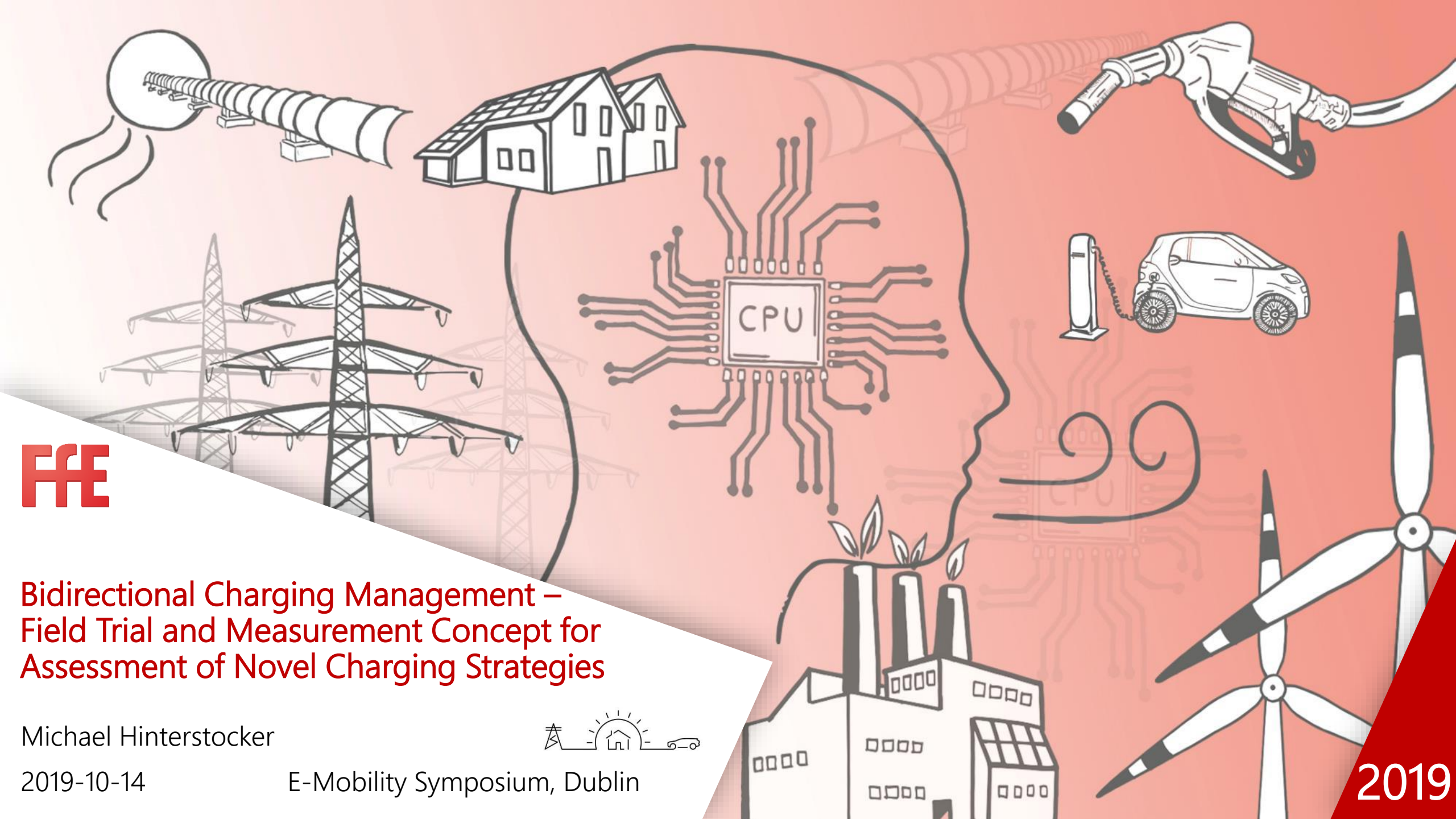


Bidirectional Charging Management – Field Trial and Measurement Concept for Assessment of Novel Charging Strategies

Michael Hinterstocker

2019-10-14 E-Mobility Symposium, Dublin

2019

Overview

Key facts

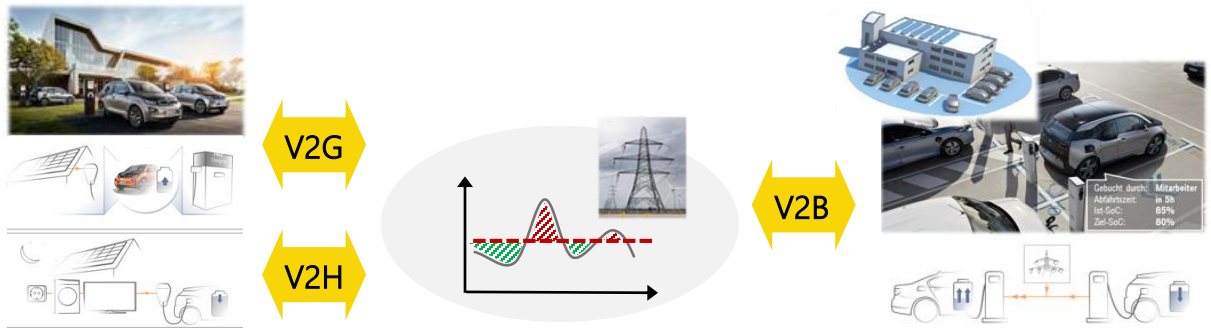
- Project duration: 05/2019–04/2022
- Funded by German Federal Ministry for Economic Affairs and Energy
- Lead: BMW

Focus of research

- Development of bidirectional charging technology
- Integration of regenerative electric vehicles into the energy system
- Design of the value chain V2G/V2H/V2B
- Piloting of the overall system

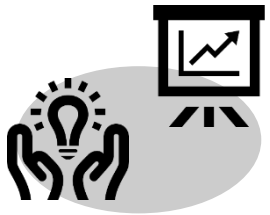
Consortium

- OEM
- OEM KOSTAL
- TSO TenneT
- DSO bayernwerk
- Scientific support FfE FfE
- Scientific support KIT
- Customer research UNIVERSITÄT PASSAU



Project objectives – EVs support the electricity grid

Use cases for beneficial application of flexibilities



Economical implementation of technical solution concepts for the use cases

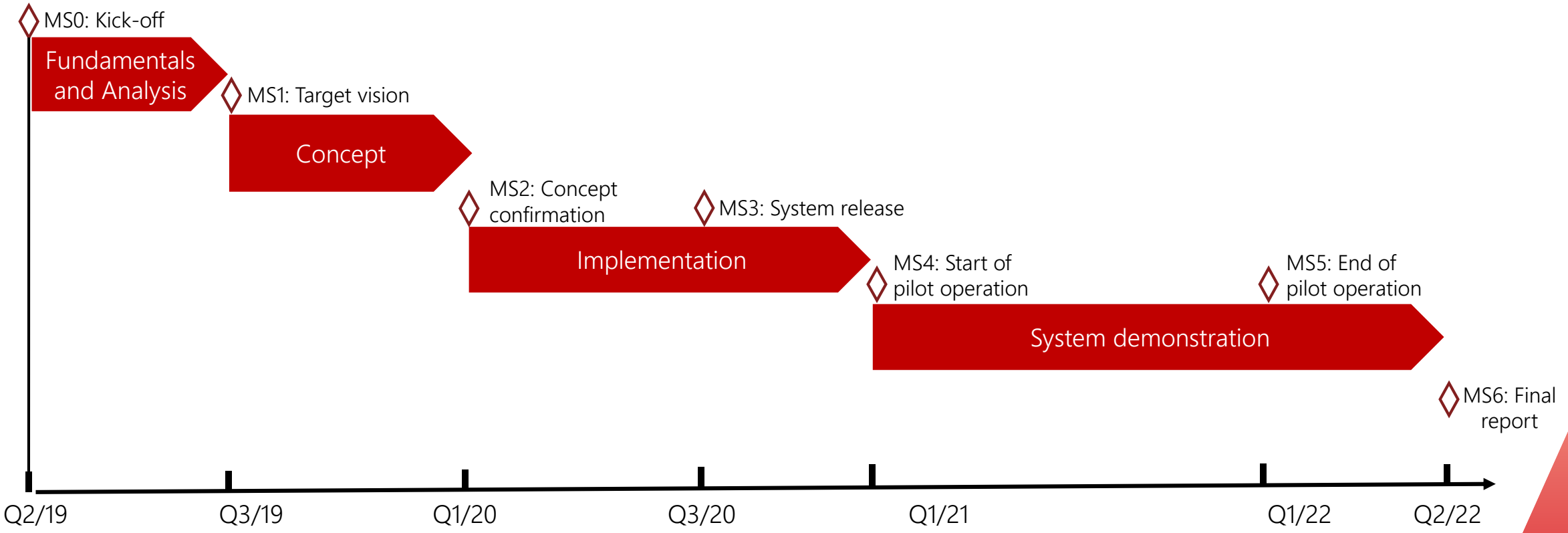
Regulatory check for feasibility of use cases/ Compatibility with GDEW

Demonstration of customer value, as well as system serviceability

Proof of economic efficiency and CO_2 advantage

Creation of the basis for a comprehensive "win-win" situation for customers, manufacturers (OEM and charging infrastructure), grid and energy industry

Project schedule



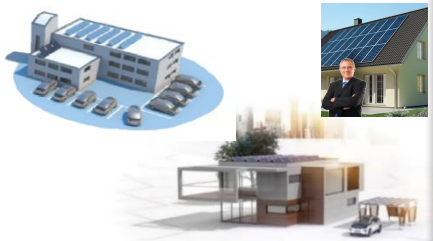
Project structure.

TP1
Vehicle development

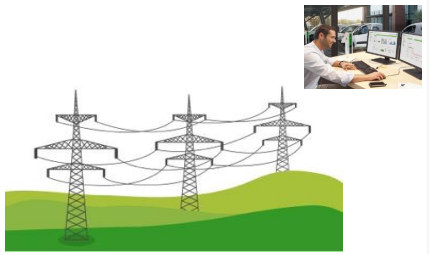
TP2
EVSE development

Hardware Basis

TP4
Behind the meter



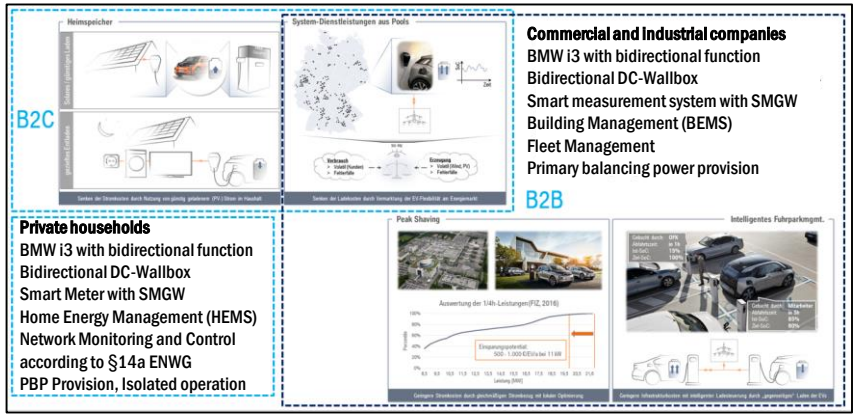
TP5
System services



Requirements & Communication

TP6
User research

TP7
Pilot operations



Field tests, Measurement & Evaluation

TP3
Background, regulatory framework, system analysis and recommendation

Development, selection and evaluation of use cases

Definition of relevant use cases

- Methodology development
- Creation of an overview of relevant actors
- Description and visualization of use cases

Deduction and evaluation of business models

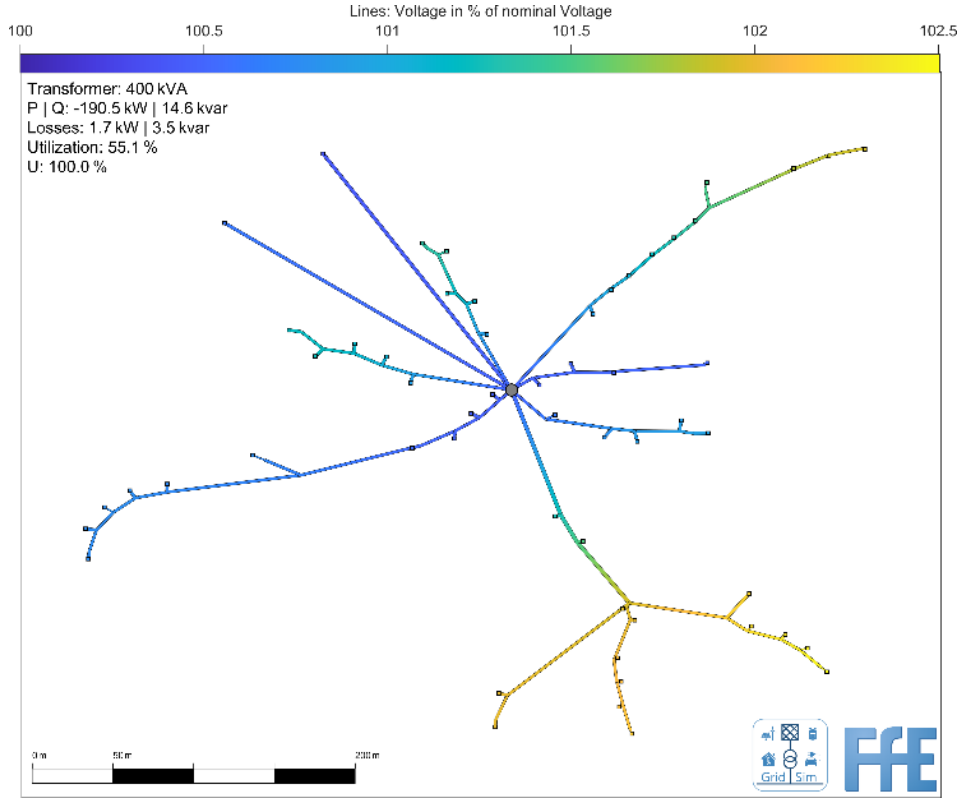
- Deduction of business models from the point of perspective of different stakeholders
- Further development in workshops with the partners
- Evaluation of business models

Economic feasibility study

- Estimation of possible revenues
- Consideration of the expected availability of the EV

Use case	Revenue creation	Customer group	Project aim
Time arbitrage (intraday)	Vehicle-to-grid	Private and commercial	Trial operation
Increased self-consumption	Vehicle-to-home	Private	Trial operation
Peak-shaving	Vehicle-to-business	Commercial	Trial operation
Primary control provision	Vehicle-to-grid	Private and commercial	Lab operation
Time arbitrage (day-ahead)	Vehicle-to-grid	Private and commercial	Lab operation
Local network service	Vehicle-to-grid	Private and commercial	Lab operation
Redispatch	Vehicle-to-grid	Private and commercial	Lab operation
Provision of reactive power	Vehicle-to-grid	Private and commercial	Lab operation
Tariff optimized charging	Vehicle-to-home	Private	Lab operation
"Real" green electricity (PPA)	Vehicle-to-business	Commercial	Lab operation
Fleet management	Vehicle-to-business	Commercial	Lab operation
Emergency power supply	Vehicle-to-home	Private and commercial	Simulation
"Real" green electricity (CO_2-optimized)	Vehicle-to-business	Commercial	Simulation

Comprehensive analysis of effects on the distribution grid



Simulation environment

- Further development of the simulation model GridSim for the analysis of different use cases
- Data acquisition: grid data, load profiles, flexibility of electric vehicles

Grid simulation

- Definition of case studies for assessment of use cases of bidirectional charging
- Simulation of these case studies for relevant use cases

Evaluation of results

- Evaluation of grid effects
- Analysis of the benefits of bidirectional charging and assessment of useful operation strategies
- Deduction of recommendations

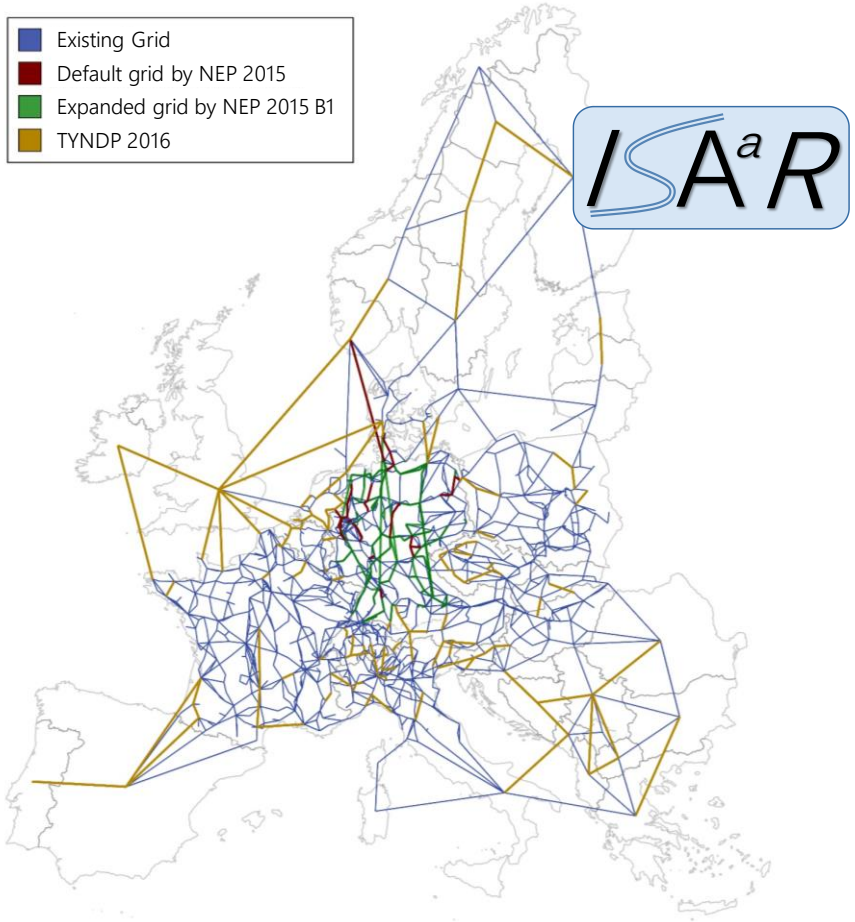
Extensive simulation of effects on the transmission grid level

Simulation environment

- Further development of the simulation model ISAaR for the analysis of the effects of on the electricity market and on the transmission grid
- Data acquisition: European grid data, demand data, parameterization of electric vehicles

Energy system simulation

- Modelling of bidirectional units with price- and emission-optimized charging strategies
- Evaluation of the feedback effects on the energy system:
  - Electricity market (emissions, prices)
  - Transmission grid
- Deduction of recommendations



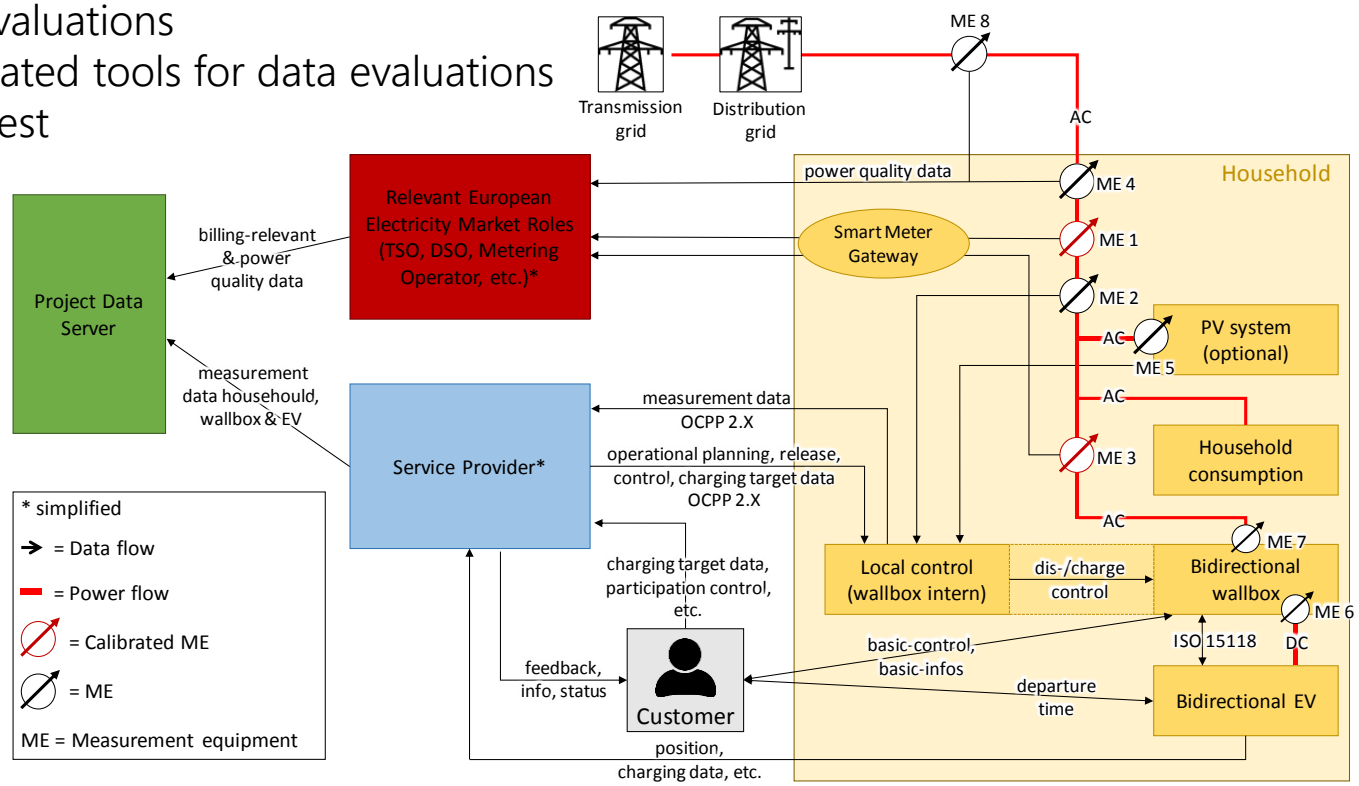
Data acquisition, processing and evaluation in the field test

Data acquisition

- Measurement concepts for relevant use cases
- Analysis of required data for evaluation
- Design and operation of a centralized data acquisition system for all partners

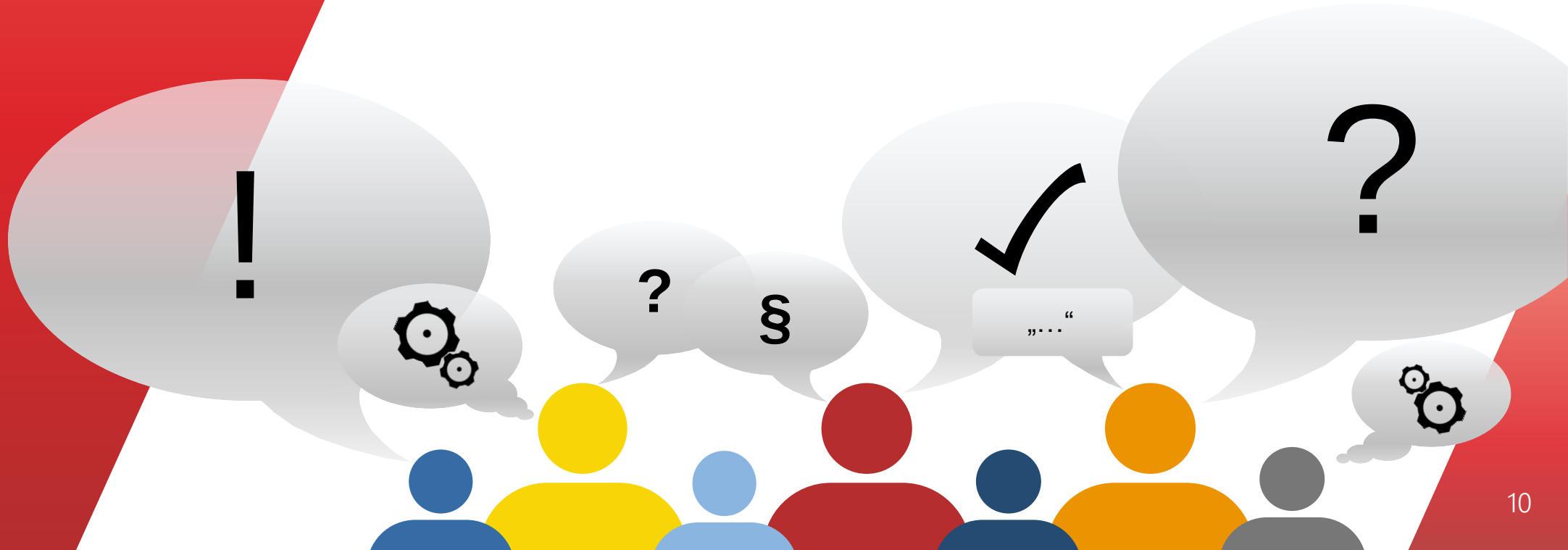
Data analysis

- Collection and fusion of measurement data
- Data preparation and synchronization
- Definition of relevant evaluations
- Development of automated tools for data evaluations
- Evaluation of the field test



Discussion

Questions? Remarks?



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