SYNERG-E
managed batteries

SYNERG-E Project
Local Stationary Buffer Storage for High Power Charging Stations

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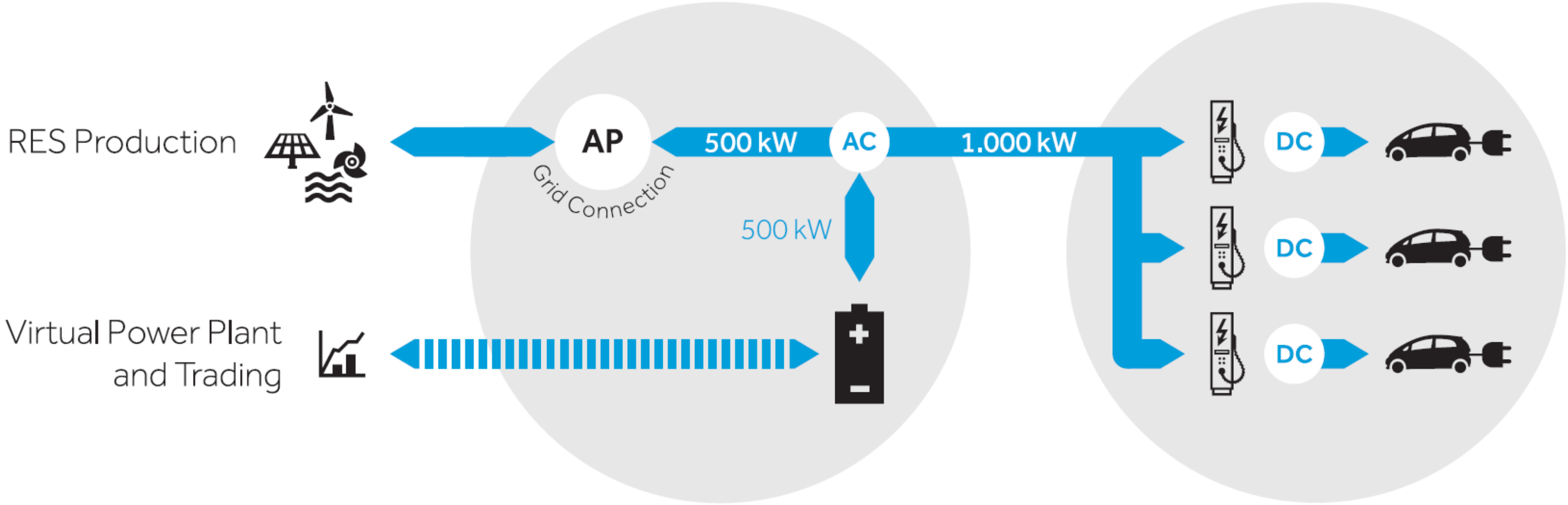
Connecting Europe Facility

SYNERG-E: Local Stationary Buffer Storage Systems for Ultra-fast Charging Stations

SYNERG-E managed batteries



SYNERG-E Project - Overview

SYNERG-E managed batteries

- Deployment of 10 stationary Batteries in Austria and Germany to connect Transport Infrastructure and Energy Infrastructure
- Synergies with High Power Charging (HPC) Stations: More Power, reduced Costs due to Peak-Shaving
- Synergies with Electricity Infrastructure: Additional Flexibility from combination with Hydro Power Plant; Grid Services for Transmission Grid

Facts

Project Volume:

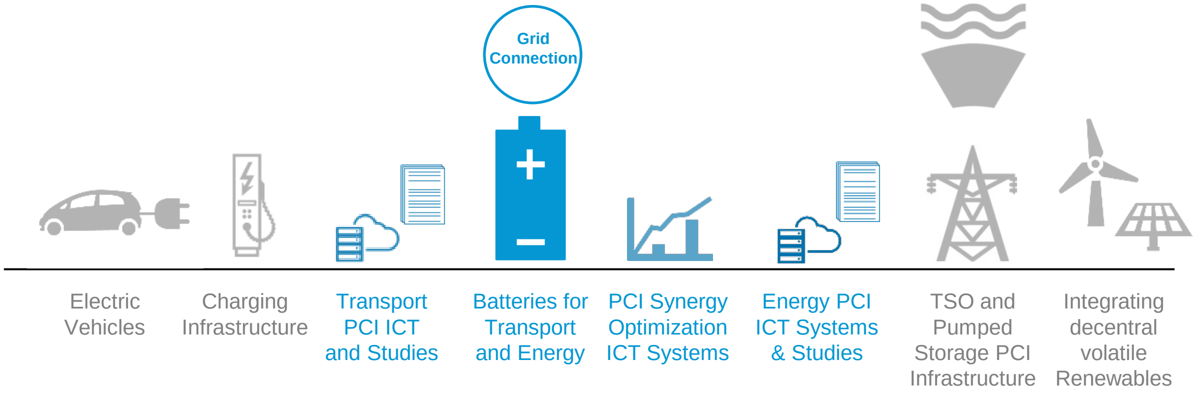
8,712 Mio. EUR, 60 % Funding

Project Duration:

01.01.2017 - 31.12.2019

Project Partners:

- VERBUND AG
- Allego GmbH



SYNERG-E Locations

Status Quo

GERMANY
(allego)

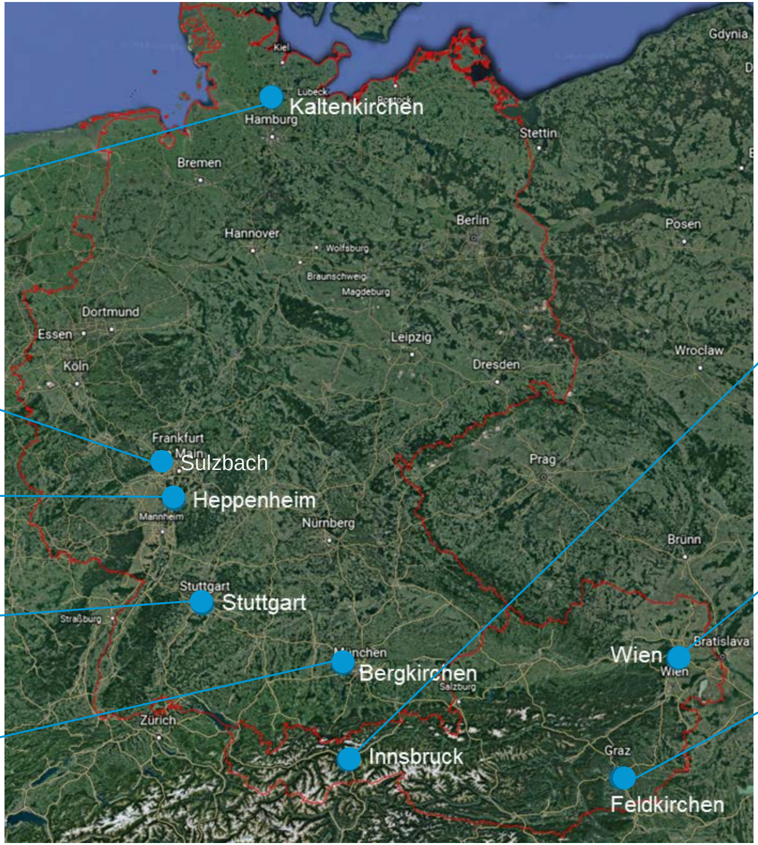
Kaltenkirchen
(advanced)

Sulzbach
(techn. planning)

Heppenheim
(under construction)

Stuttgart
(advanced)

Bergkirchen
(under construction)



AUSTRIA
(SMATRICS)

Innsbruck
(techn. planning)

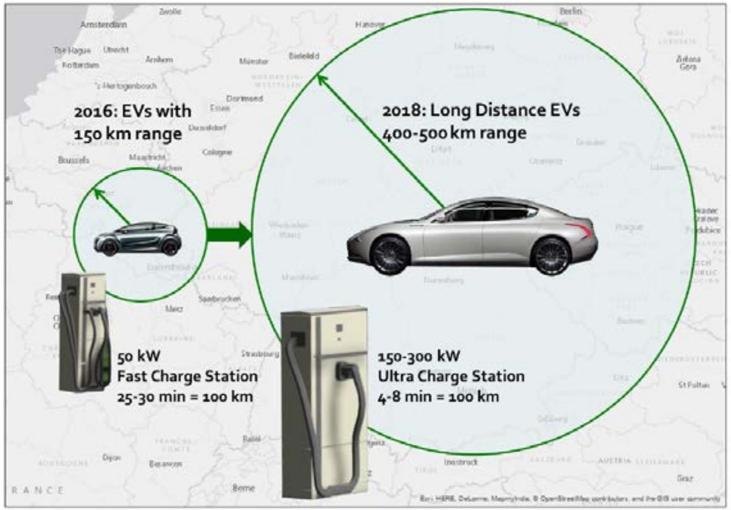
Vienna
(installed)

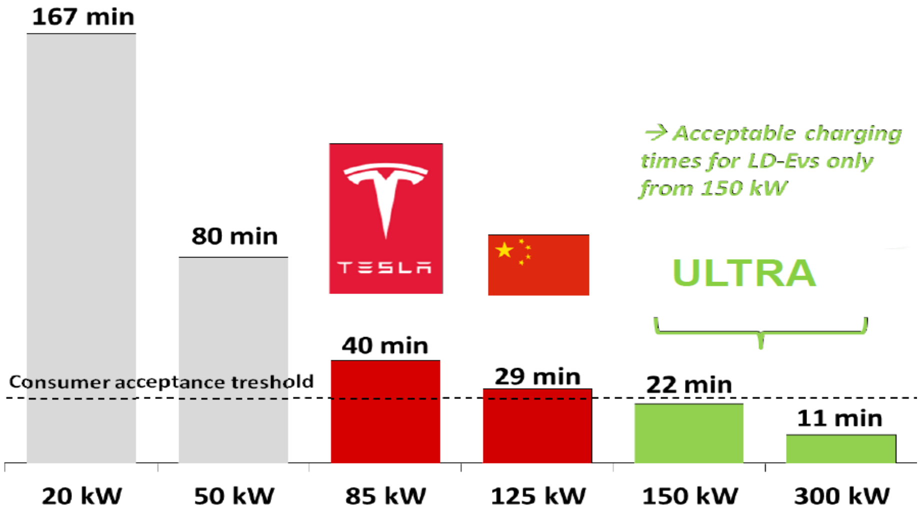
Feldkirchen bei Graz
(under construction)

With the Introduction of new BEV Models the European Car Industry needs a ultra-high Power Network in place

Driven by success of Tesla models, all brands line up BEV with higher battery capacity and drive range who need **Ultra High Power charging;**

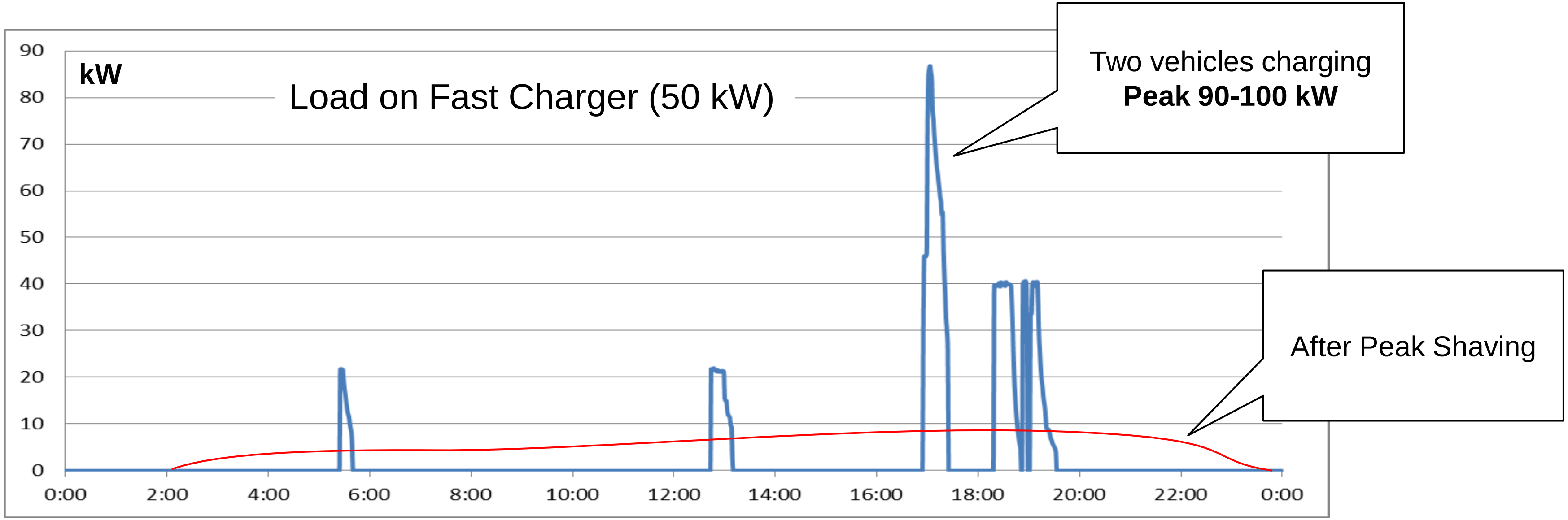
Ultra high power charging (150-350kW) requires extremely professional operation and is capex intensive while few cars will be around for some time;





Ultra-High Power Charging leads to increased Demand on the Electricity Grid

Experience from 50 kW fast chargers show that load on the grids comes with very high peaks and no load between charging events. Based on grid access tariffs this also places a burden on fast charging business cases.

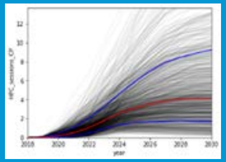
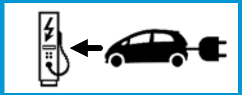
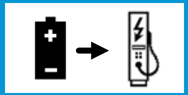


Overview of Use Cases of Battery Energy Storage Systems at HPC Infrastructure

SYNERG-E managed batteries

- Provision of Grid Services (stand-alone / with other power plants)
- Imbalance Reduction
- Peak-Load Shaving
- Intraday Commercialisation / Trading
- Uninterruptable Power Supply / Power Quality
- Integration of local (renewable) Electricity Generation
- Enabling of Locations
- …

Electrical Model & Simulation
Approach

EV Uptake Forecast	Charging Simulation	Battery Simulation	Financial Simulation
			
Number of charging sessions per day	Electricity demand at charging location	Battery operation and resulting load profile	Financial balance sheets per actor

EV Uptake Forecast

- EV market development
- HPC share
- Charging behavior

Charging Simulation

- Location layout
- Session size
- Temporal distribution of charging events

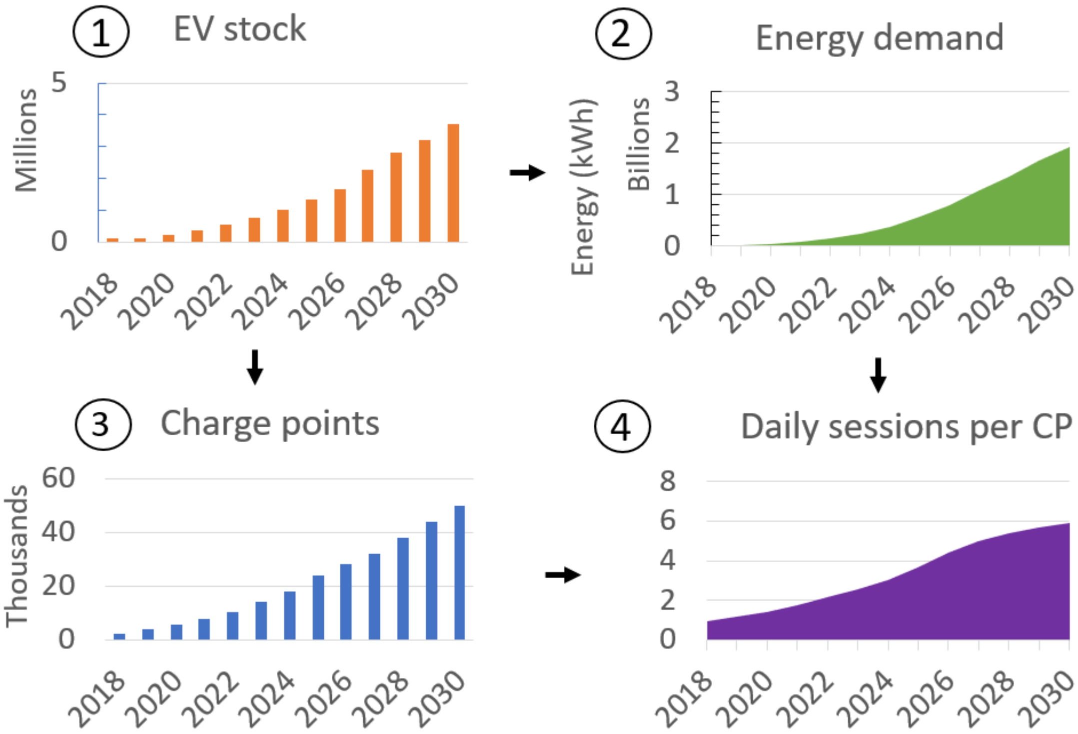
Battery Simulation

- Focus on 15-min peak-shaving
- Optimize battery operation

Financial Simulation

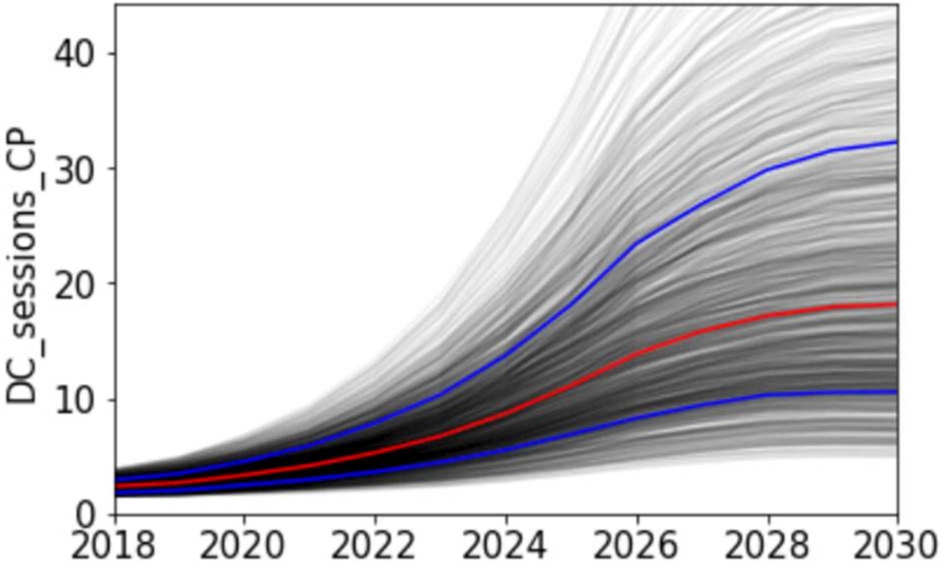
- SYNERG-E benefit
- Allocation of costs depending on business relation

EV Uptake Forecast (I)
Approach



1. Calculate the total number of EVs on the road by estimating the yearly car sales and predicting the market share of EVs
2. Estimate total energy demand for fast charging of this EV fleet, which is determined by the average mileage of the EV fleet and the consumption per kilometer
3. Calculate the number of charge points that is expected to serve the demand based on a certain ratio of EVs per charge point
4. To get to the total number of sessions, the energy demand is divided by the average session size and then divided over the total number of charge points to arrive at the **numbers of sessions per CP**

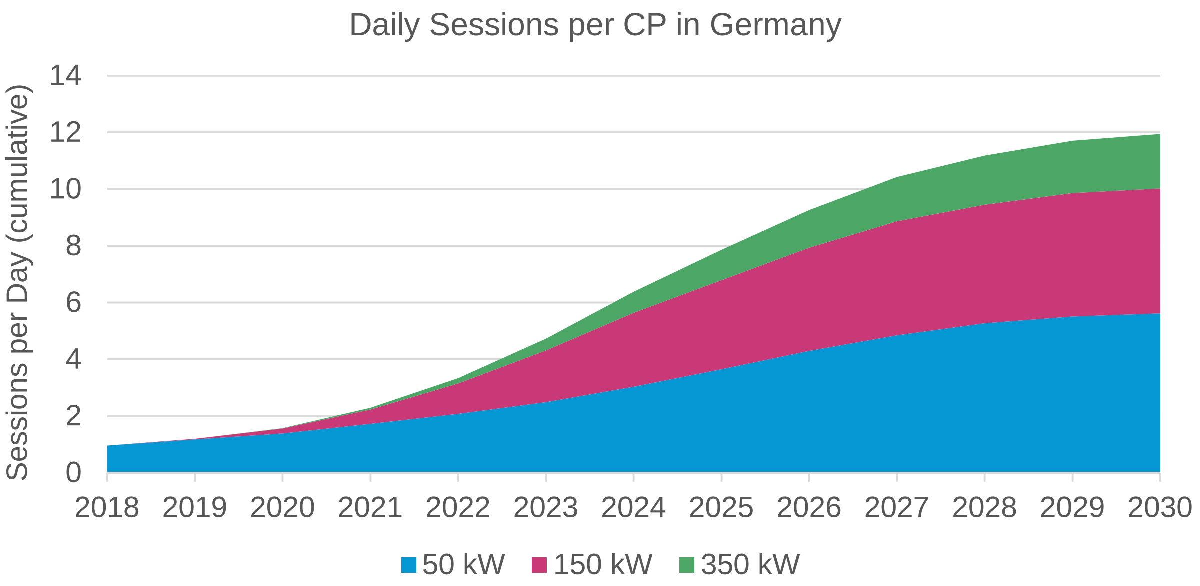
EV Uptake Forecast (II)
Number of Charging Sessions per Day



- A set of seven different scenarios for the market share of EVs is chosen
- For all other input variables, a worst (min) and best case (max) scenario is estimated, as well as a realistic (mean) scenario
- Using these input values, over 100,000 unique combinations are created
- The median and the standard deviation of this distribution are set as central and low / high scenarios

EV Uptake Forecast (III)

Number of Charging Sessions per Day

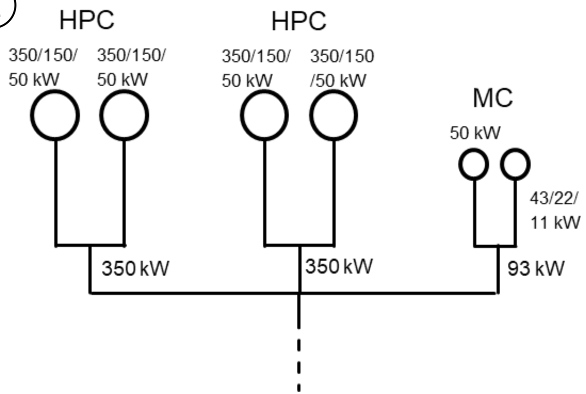


Average number of charging sessions per charge point per day in Germany (median scenario)

Charging Simulation (I)

Input Data

1



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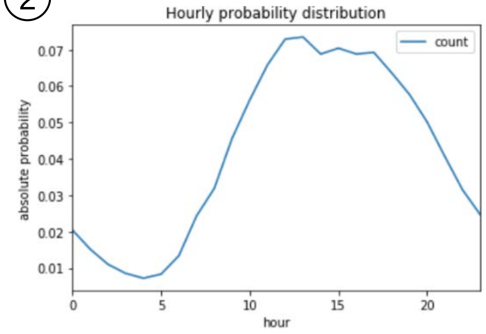

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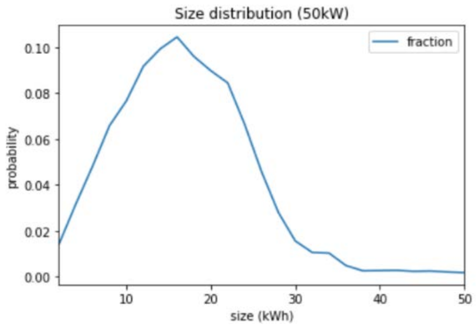

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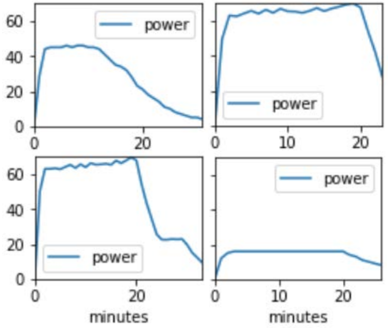
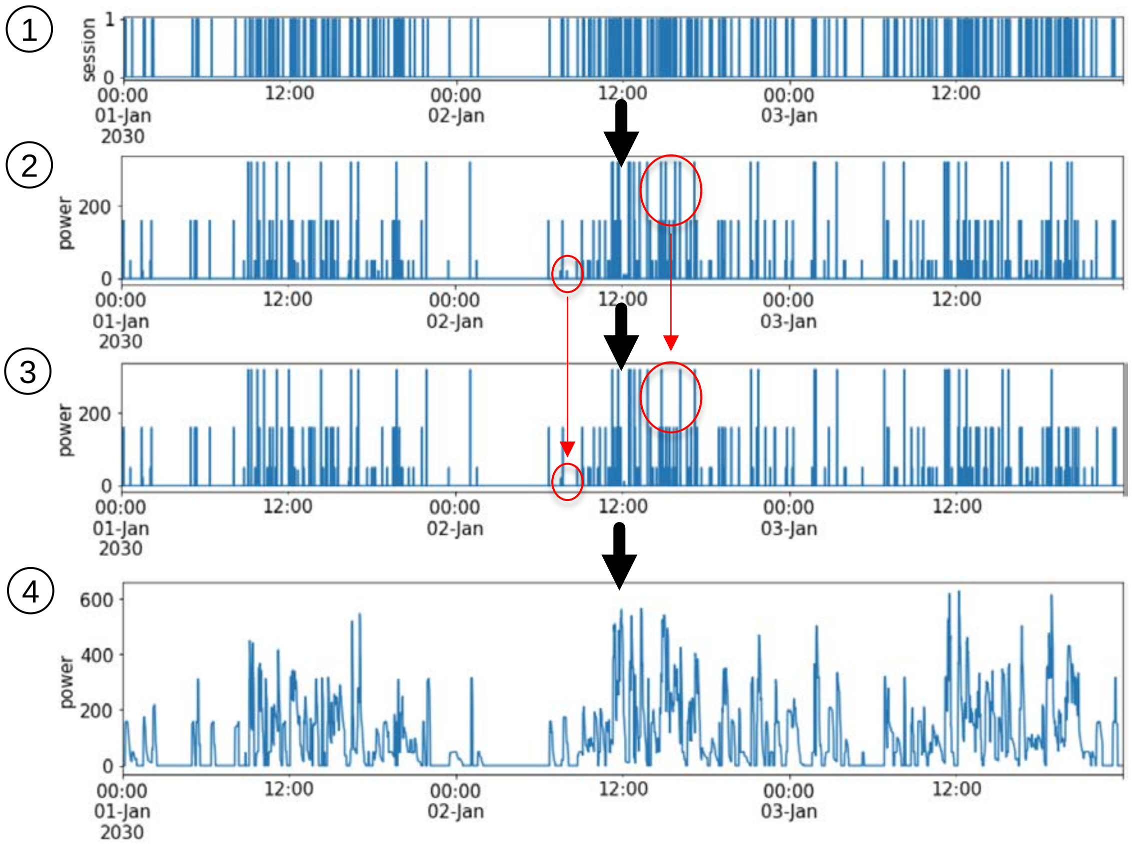


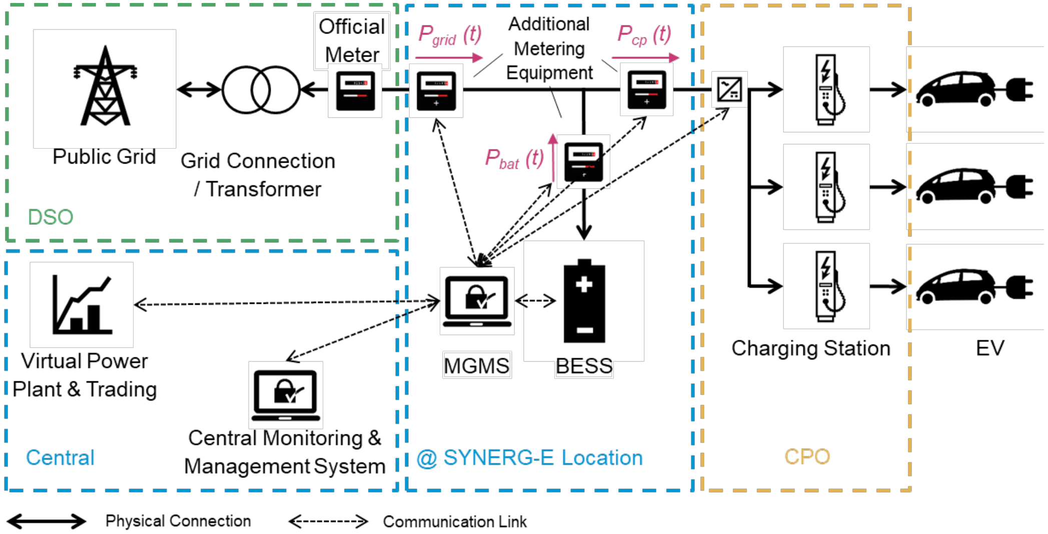
1. Location lay-out: Number of charge points and capacity (limiting the number of simultaneous sessions)
2. Temporal distributions of sessions per day, per week and per month – different probabilities of EVs arriving at CP
3. Session size distributions (duration of charging events) are generated for different charging speeds
4. Different types of load curves from actual EV charging sessions are established

Charging Simulation (II)
Electricity Demand at Charging Location



1. Step 1 is creating a timeframe of events
2. Step 2 assigns characteristics to these events (size, power, length)
3. Step 3 applies location constraints to the generated sessions
4. Step 4 gives each session a custom load curve

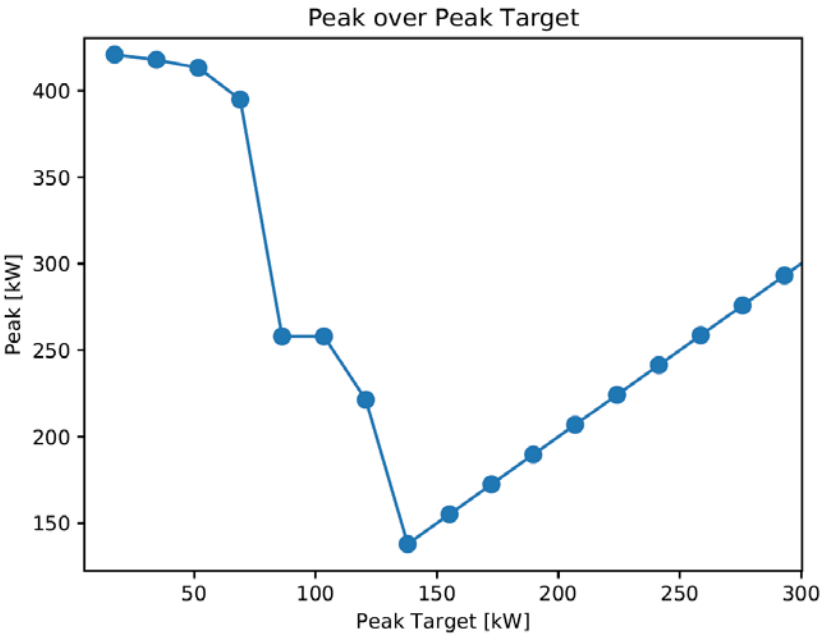
Battery Simulation (I)
Micro-Grid Management System



- Simulation uses same decision algorithm as the actual Micro-Grid Management System (MGMS) – no perfect foresight
- Emulated battery with parameters storage capacity, power capacity and cycle-efficiency
- Emulated MGMS with settings for state-of-charge (SOC) limits & targets, peak-shaving target, grid limit,

Multiple simulation runs with varying parameters and settings have been conducted

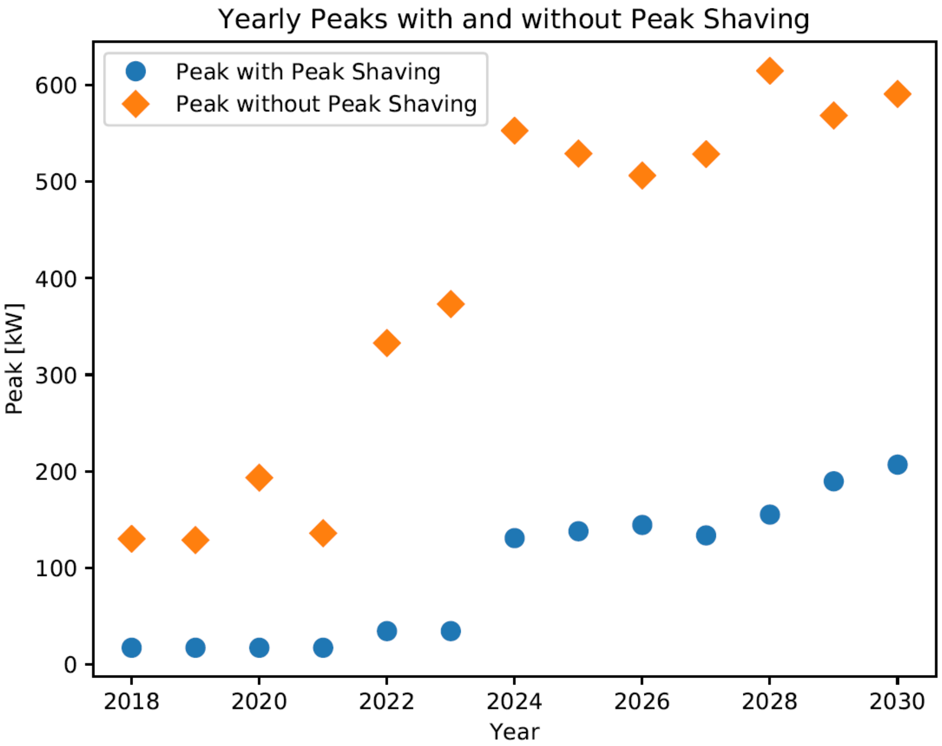
Battery Simulation (II)
Results



- CP load curve of 2025
- Battery parameters
  - 500 kW / 500 kWh
  - η = 90%
- MGMS settings
  - SOC limits = 10% - 90%
  - SOC target = 90%
  - grid limit = 450 kW

Battery Simulation (III)

Results



- CP load curve of 2025
- Battery parameters
    - 500 kW / 500 kWh
    - η = 90%
- MGMS settings
    - SOC limits = 10% - 90%
    - SOC target = 90%
    - grid limit = 450 kW

Conclusions

- High uptake of HPC infrastructure roll-out
- Power demand of HPC infrastructure can have a big impact on the electricity grid infrastructure and grid balancing
- Local buffer batteries at HPC infrastructure help
    - the energy infrastructure (TSOs/DSOs) to mitigate large fluctuations, to lower peak-demand at HPC Stations and additionally provide grid services to TSOs
    - the transport sector (charge point operators) to lower CAPEX of the grid connection and OPEX due to peak-load shaving and access additional revenue streams

Thank you for your Attention!

Contact

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