Evaluation of the Flexibility Provision Behaviour of Different Charging Strategies for Electric Vehicles (Paper 0166)

Henrik Wissel Sharon Müller Krzysztof Rudion
Institute of Power Transmission and High Voltage Technology, University of Stuttgart, Germany

Introduction

- Load in the LV grid can be reduced by using the flexibility of EV charging
- Focus of this work is the observation of different real-world charging processes for the flexibility provision
- Simulation approaches often assume ideal conditions

Methodology

- Use of a 10 kW DC-Charging Station (CS) with CCS and CHAdeMO plug, bidirectional charging is supported
- ISO 15118 (CCS) and DIN SPEC 70121 (CHAdeMO) are used for communication with the EV
- Evaluation of charging for 6 EV (different manufactures)

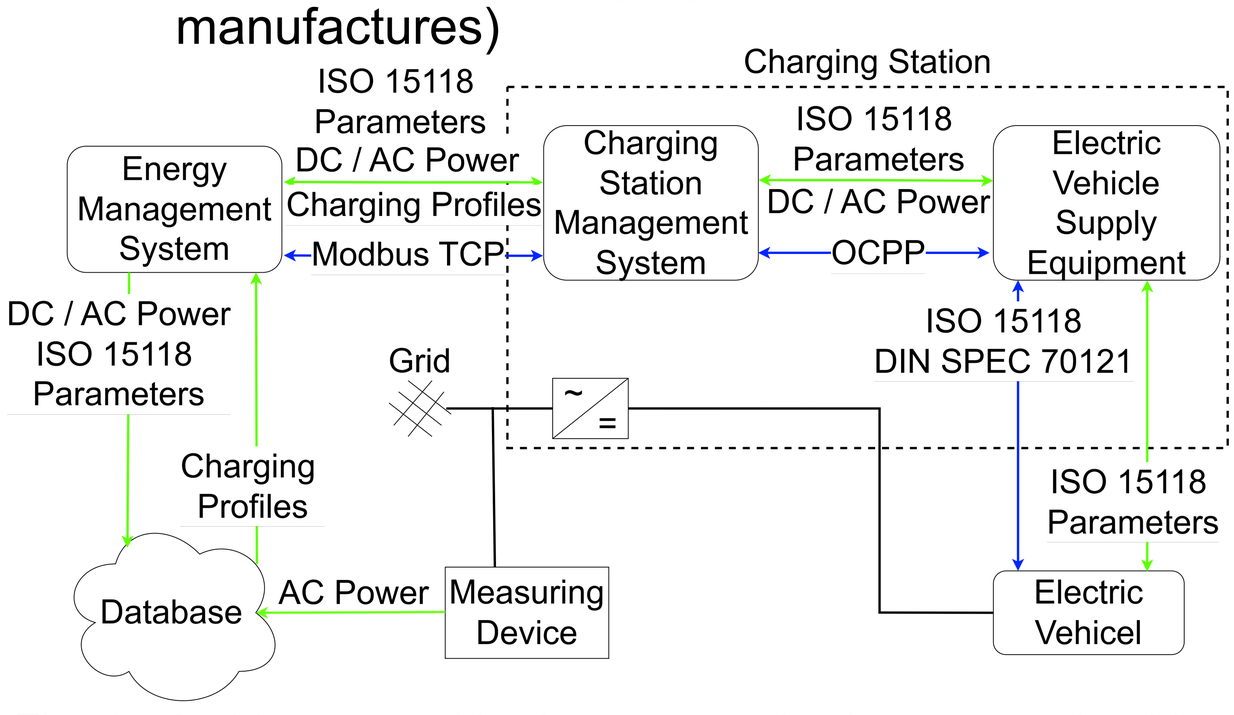

Fig 1: Architecture with the communication protocols (blue) implemented to retrieve the parameters (green) measured by the charging station

- The results are compared regarding response times, reliability, charging efficiency and the plausibility

Results

- Default charging depends on the EV
- With SOCs below 20 %, the difference between the assumed and the resulting maximum power is up to 1 kW
- With an increasing SOC, the charging behaviour of the EVs is becoming more harmonized
- Final SOCs vary between 94 % and 100 %
- If the actual charging time of the vehicles is compared with an ideal assumption of a constant charging power of 10 kW, the charging times can differ by up to 21 minutes

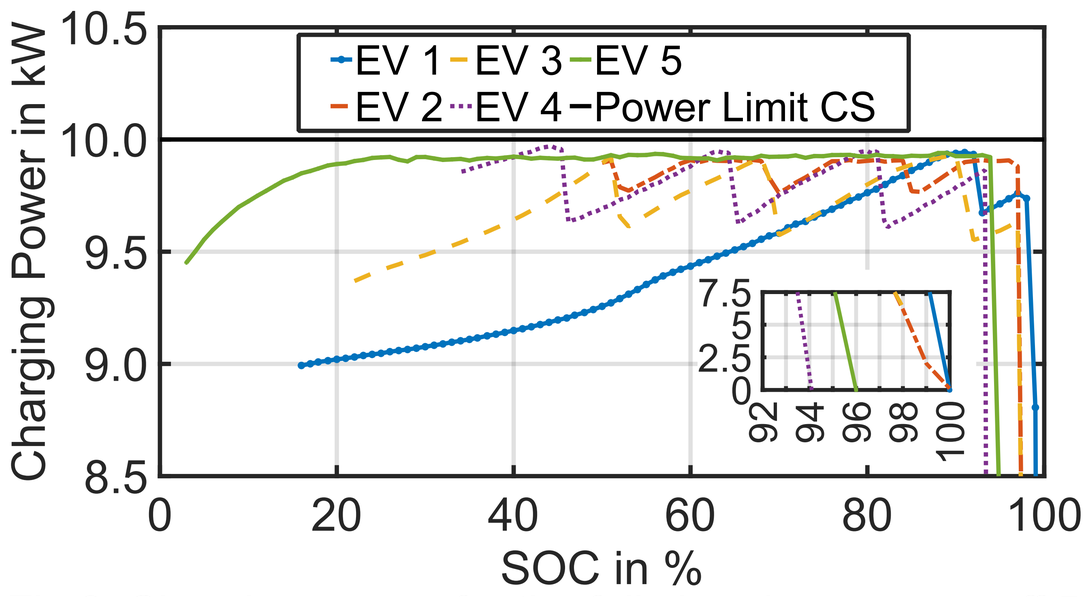

Fig 2: Charging curves for the full charging process off 5 EVs in the as fast as possible scenario

- Average response time during the charging is 1.32 s with a minimum time of 0.86 s and a maximum time of 1.94 s
- For 2 vehicles, continuation of the charging is not possible once the charging was paused
- To prevent the suspended status, a constant charging with the minimal charging power per EV (90 W – 4.4 kW) is necessary
- The communication of the maximum charging power (all EVs) and total battery capacity (3 EVs) via ISO15118 is erroneous

Conclusions

- The examined version of the ISO 15118 was not able to provide correct information and can lead to significant over or underestimating of the available flexibility potential
- Considering the power limits of the EVs, the reported power can be set precisely within seconds
- As pausing and postponing charging of EVs is the basic idea of flexibility provision, the suspended status poses a major challenge