RWTH AACHEN UNIVERSITY

E.ON Energy Research Center
ACS | Institute for Automation of Complex Power Systems

# Master/Bachelor-Thesis:

## An online approach to optimize the charging plans of electric vehicles in fast-charging stations

**Context:**

The convenience, availability and speed of charging electric vehicles (EVs) are key enablers for its widespread public acceptance for passenger transport. Fast-charging stations in urban areas will allow passengers to charge their vehicles significantly in commercial and recreational urban spaces such as cinemas, shopping places, sports facilities or leisure facilities. With fast charging, the range anxieties related to the use of electric vehicles will be reduced.

The objective of this thesis is to use an online approach to coordinate and optimize charging plans for fast-charging stations in such urban spaces. Without coordination, fast charging of EVs will lead to violations in the voltage and loading constraints of the grid. Furthermore, the optimization of charging plans will maximize the benefits of fast-charging stations for different players in the e-mobility sector. These actors may include EV users, EV aggregators (i.e. an entity that manages a fleet of EVs), or the distribution system operators. This thesis will focus on the benefits of the EV users or EV aggregators.

Furthermore, the optimization problem will consider different constraints, which may include the maximum allowed charging levels and the user preferences with respect to charging time and location. The robustness of the optimization approach will also be evaluated (e.g. robustness in handling missing information, uncertainties in RES supply, or electricity price).

**Your tasks:**
The list below summarizes the main tasks of the student under this work:

1. Literature review of charging models for fast-charging stations.
2. Selection of the objective function (e.g. maximize aggregators' profits, maximize state-of-charge of EVs) and constraints to be considered.
3. Implementation of an approach to optimize the charging schedule online, that is, the station or aggregator receives charging requests at different time intervals.
4. Investigation of how parameters such as data availability, uncertainties and planning horizon affect the performance of the optimization approach.

The student and his/her supervisor will develop the detailed thesis scope and timeline in their initial meetings.

**Students profile:**

We are looking for a Masters or a Bachelors student with a good background in Python or MATLAB. The student should also have, at least, a basic knowledge of power system modeling.

**Thesis Language:**

The thesis will be done and supervised in English.

If you are interested, please contact me via email or in person.

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