

Master Thesis / Semester Thesis

# Optimized Charge Point Management for On-Route Truck Charging with Reservation and Dynamic Pricing

## Motivation:

Commercial vehicles are significant contributors to greenhouse gas emissions within European road transport. Transitioning to battery-electric commercial vehicles offers one of the most effective pathways to achieving meaningful and sustainable emission reductions. This transformation aligns with the European Commission's ambitious goal to cut CO<sub>2</sub> emissions from heavy-duty vehicles by 90% by 2040. Additionally, the increasing number of companies requiring environmentally responsible supply chains reinforce the urgency of this shift. Especially long-haul electric trucks will have high demands on the public charging infrastructure and its availability. As charging stops on the route will be inevitable, precise scheduling and reliability in operation are of high interest for the freight forwarders. To meet those requirements, smart route planning and charge stop integration including reservation of charge points are promising ideas.

## Thesis topic:

To enable smooth and reliable on-route charging for electric trucks, Charge Point Operators (CPOs) must efficiently plan and operate their charging infrastructure while considering charging slot reservations. This includes allocating charging power and energy to trucks in a way that respects the site's grid connection limits and fulfills all energy and power demands. In addition, increasing electricity price volatility and new charging contract models for trucks make time-dependent pricing strategies highly relevant.

Therefore, there is a strong need for an optimized energy and charge point management system that jointly considers reservation times, charging power, energy demand, grid constraints, and dynamic electricity prices.

The objective of this thesis is to design and implement an optimized charge point management system (CPMS) with reservation and scheduling capabilities. The system will be integrated and evaluated within an existing agent-based simulation framework to analyze the interactions between trucks and CPOs under different operational and pricing scenarios. To keep computational effort low in the simulation, reasonable assumptions and simplifications must be done in the optimization.



## Work packages:

1. Literature review on charge point management systems (CPMS) and optimization methods
2. Analysis and selection of a suitable optimization approach
3. Conceptualization of an optimized charge point management approach
4. Implementation of the optimized CPMS with reservations and dynamic pricing
5. Transfer and simplification for the application in an agent based simulation
6. Evaluation of the CPMS in an agent-based simulation framework with truck and CPO agents

## Requirements:

- Passion for e-mobility and energy-transition technologies
- Good programming skills in Python, Basics in Git
- Ideally initial experience with Operations Research
- Independent and strategic way of working
- Enjoy working in a team
- Very good German or English language skills

I look forward to receiving your application with a CV, current overview of grades (+ any other documents) and a brief motivation. I'm happy to discuss the topic with you in detail in a personal meeting. **The thesis can be written either in German or English.**

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## Start date:

From now on

## Workplace:

FTM, Garching Forschungszentrum. The thesis can be done on site or remotely.