Technical University of Munich
TUM School of Engineering and Design
Chair of Automotive Technology

Master's Thesis, Semester Thesis or IDP

Potential Analysis of Smart Energy System Integration of Electric and Autonomous Trucks

Motivation

Increasing climate protection requirements and a worsening shortage of drivers pose major challenges for logistics. One concept that addresses both problems simultaneously is a transfer hub-based freight transport, in which highway sections are handled autonomously, but drivers continue to transport goods to and from hubs near highways. By swapping trailers at the hubs, conflicting objectives with regard to range, payload and charging capacity of battery-electric tractor units can also be handled.

The decoupling from legally binding driving time regulations significantly increases flexibility and opens up new opportunities for vehicle-to-grid (V2G) applications. While existing research mainly considers bidirectional charging at individual sites, a hub-based system allows for coordinated, country-wide use of V2G potentials. This broader perspective may unlock additional economic value for a sector that operates under strong cost pressure.

Thesis topic

The aim of this thesis is to assess the potential of a smart energy system integration of the mentioned charging hubs. For that, an existing simulation of load profiles and mobility patterns at the hubs can be used. Special emphasis should be given on country-wide use cases that are not feasible on local sites and the additional potential through automation.

Work packages

- Literature research on and analysis of large-scale V2G use cases
- Identification of suitable modeling frameworks
- Development of an energy system model based on given load profiles and mobility patterns
- Validation of the approach
- Evaluation of different scenarios and quantification of the economic potential of smart grid integration of partly automated trucks

What you get

- Contribute to scientific research in a highly future-oriented field of commercial transport mobility
- In case of excellent working performance: Opportunity for a follow-up thesis work (master's thesis) and co-authorship in a scientific paper
- Close supervision with weekly meetings

Requirements

- High level of interest and motivation to drive the electrification and automation of the transport sector
- Ideally initial experience in energy system modeling
- Proficiency in Python is required
- Independent and structured way of working
- Very good German or English language skills

I am looking forward to receive your complete application with a CV, current overview of grades, a brief motivation, and any other documents. **The thesis can be written either in German or English.**

Contact
Fabian Bussieweke, M.Sc.
E-Mail: fabian.bussieweke@tum.de
Tel.: +49 (0) 89 289 10410

Start date
From now

Workplace
FTM (Garching Forschungszentrum) or remote