

## Master Thesis Proposal

### Smart Charging for Electric Vehicles: An Innovative Charging and Pricing Model

Electric vehicles (EVs) represent a transformative force in urban mobility. Their environmental friendliness has always been controversial. Furthermore, prevailing charging practices, characterized by charging batteries at maximum speed upon plugging in, have elicited concerns among experts. This approach may incur unnecessary costs and emissions due to fluctuations in the marginal cost of electricity generation and associated emissions throughout the day. To address these challenges and achieve significant cost and emission reductions, researchers are increasingly focusing on smart charging methods, including battery-swapping and vehicle-to-grid (V2G) technologies, alongside innovative charging pricing models. In the battery-swapping business model, service providers lease fully charged batteries to vehicle owners through swapping them with depleted ones (Mak et al., 2013). V2G technology allows electric vehicle batteries to store power for the grid, thereby aiding in grid stability against short-term demand and generation fluctuations (Mak, 2022).

The objectives of the master thesis are to

- critically discuss the environmental friendliness of EVs,
- conduct a comprehensive review of real-world EV charging methods and charging pricing schemes, as well as existing literature on smart EV charging methods and charging pricing models,
- summarize the mechanisms, benefits, and challenges of charging methods and pricing schemes applied in both real-world business practices and proposed academic models,
- develop an innovative charging and pricing model by elaborating on its motivation, mechanism, benefits, and challenges, drawing from insights gained through existing business models,
- identify and discuss open research gaps and future trends in the field of smart charging and pricing for EVs.

#### Requirements

- OPM 781
- Good knowledge in Operations and Revenue Management
- Analytical skills and an ability to transform real-world business problems into Operations Research models

Administrative information for writing a master thesis at the Chair of Service Operations Management can be found [here](#).

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## **Selected Literature Recommendations**

Bjørndal, E., Bjørndal, M., Bøe, E. K., Dalton, J., & Guajardo, M. (2023). Smart home charging of electric vehicles using a digital platform. *Smart Energy*, 12, 100118.

Mak, H. Y. (2022). Enabling smarter cities with operations management. *Manufacturing & Service Operations Management*, 24(1), 24-39.

Ensslen, A., Ringler, P., Dörr, L., Jochem, P., Zimmermann, F., & Fichtner, W. (2018). Incentivizing smart charging: Modeling charging tariffs for electric vehicles in German and French electricity markets. *Energy research & social science*, 42, 112-126.

Hildermeier, J., Kolokathis, C., Rosenow, J., Hogan, M., Wiese, C., & Jahn, A. (2019). Smart EV charging: A global review of promising practices. *World Electric Vehicle Journal*, 10(4), 80.

Lim, M. K., Mak, H. Y., & Rong, Y. (2015). Toward mass adoption of electric vehicles: Impact of the range and resale anxieties. *Manufacturing & Service Operations Management*, 17(1), 101-119.

Mak, H. Y., Rong, Y., & Shen, Z. J. M. (2013). Infrastructure planning for electric vehicles with battery swapping. *Management science*, 59(7), 1557-1575.

Wu, O. Q., Yücel, Ş., & Zhou, Y. (2022). Smart charging of electric vehicles: An innovative business model for utility firms. *Manufacturing & Service Operations Management*, 24(5), 2481-2499.