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REFLEX PhD Candidate

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PHD THESIS

Title Electric vehicle fleets in the local energy system under consideration of the integration of renewable energy sources and uncertainty

Abstract

Electric vehicles (EV) are one promising technology towards an improved sustainable and green transportation sector, especially when charged with electricity from renewable energy sources (RES). However, the fluctuation generation of RES as well as the changing driving patterns of EVs have the offset of an uncertain nature which make it hard to schedule the charging processes optimal.

This PhD elaborates several methods (simulation, optimization and stochastic programming) to schedule the charging process of three different EV fleets at a common charging infrastructure under uncertainty. In the setting of a car park use case, several restrictions are taken into consideration when the load shift potential of the EV fleets are evaluated – cost-wise with respect to charging-cost minimization as well as maximal utilization of generated photovoltaic (PV) for charging. A Latin hypercube based sample average approximation method is used to solve the underlying two-stage stochastic mixed-integer optimization problem efficiently. Moreover, the characteristics of the three EV fleets are models with a non-parametric probability density function (kernel density estimation) to reflect the arrival time, departure time and distance covered through the energy demand more accurately.

The benefits of reduced charging costs, even when uncertainties are considered are shown as well as an increased utilization of the PV when optimized and simpler heuristics are compared. Moreover, results indicate that the commuter fleet has the highest potential to utilize generated PV for charging which also ends up in the lowest overall charging costs of all the three EV fleets. Implications for business model concepts for a car park operator interacting as an aggregator are drawn. Moreover, a conceptual framework to enhance this demand side flexibility of EV customers with incentives through diverse service designs are outlined.
PROFESSIONAL EXPERIENCE

since 04/2017 Research Associate at the Chair of Energy Economics, Institute for Industrial Production, Karlsruhe Institute of Technology (Karlsruhe, Germany)

08/2015 – 11/2015 Research stay at Lawrence Berkeley National Laboratory (Berkeley, CA, USA)

02/2013 – 05/2017 Research Associate at the Energy Solution Center e. V. (Karlsruhe, Germany)

10/2011 – 11/2011 Intern at the Federal Ministry of Economics and Technology (Berlin, Germany)

03/2011 – 08/2011 Intern at Siemens Industry, Drive Technologies (Norwood, Ohio, USA)

10/2010 – 02/2011, 04/2008 – 08/2009 Student assistant at the Dresden University of Technology (Dresden, Germany)

EDUCATION

10/2016 – 09/2012 Studies of Industrial Engineering at the Dresden University of Technology (Dresden, Germany)
Degree: Diploma (Dipl.-Wi.-Ing.)

09/2009 – 06/2010 Studies of Economics and Finance at Heriot-Watt University (Edinburgh, Scotland)
Degree: Bachelor of Arts with distinction

RESEARCH INTERESTS

- Electric Mobility, Energy System Modelling, Stochastic Programming, System Dynamics

PUBLICATIONS AND CONFERENCE PRESENTATIONS


Seddig, K.; Jochem, P.; Fichtner, W. (2016): The impact of electric vehicle fleets on the integration of renewable energy sources and CO2 emissions under uncertainty, 14th World Conference on Transport Research, Shanghai, China.


