DIW BERLIN

Webinar and Do-A-Thon

emobpy, an open-source tool for time-series generation of battery electric vehicles

Organizers: DIW Berlin, Department of Energy, Transportation, Environment

Online event 25.03.2022, 10:00 CET

Webinar

10:00 Opening and welcome

10:10 Introduction to emobpy

Carlos Gaete, Ph.D.

10:30 Why does aggregating single-unit data results in overestimating flexibility potentials

Jarusch Müßel

10:50 Optimizing investment and operation of an electrical company fleet

Dr. Lukas Gnam

11:10 Pause

11:15 Comparing energy supply costs for electric vehicles and low carbon fuels

Dr. William Lilley

11: 35 Modeling Electric Vehicles from the Perspective of the German Electrical Power System

Dr.-Ing. Jonas Schlund

11: 55 Discussion about limitations, potential improvements, and community-building

Moderator Dr. Wolf-Peter Schill

12:25- 12:30 Closing remarks

Do-A-Thon

14:00 - 16:00 Installation; Jupyter notebook: time-series generation, plots and export functions

Carlos Gaete, Ph.D.

See the documentation https://emobpy.readthedocs.io/ for use and functionalities

Tickets for free

Eventbrite

www.eventbrite.com/e/265898719227

ABSTRACTS

Why does aggregating single-unit data results in overestimating flexibility potentials

Jarusch Müßel

Besides introducing volatility, electric vehicles can potentially balance the power system and market prices by providing flexibility through specific charging strategies. One example for this considers load shifting via smart charging or providing physical storage capacity via bidirectional charging.

As empirical charging profiles are scarce, the scientific community currently derives representative charging profiles based on mobility data. The prime source of uncertainty when following this driving data-driven approach is the aggregation of individual profiles. This aggregation of charging and consumption profiles is necessary to model the overall flexibility potential in broader energy system models.

Recent research has shown that the aggregation of single-unit profiles might result in an overestimation of the flexibility. Therefore, in my presentation, I will compare different models that derive charging profiles, and I will analyze different aggregation methods using emobpy, which generates single unit profiles in contrast to other driving data-driven models.

Optimizing investment and operation of an electrical company fleet

Dr Lukas Gnam
Fachhochschule Burgenland, Department of Energy and Environmental Technology, Austria

Within the project Car2Flex, we show to what extent the increasing share of electrical vehicles (EVs) can be integrated into a holistic systemic approach. Company EVs can be utilized to increase the company’s photovoltaic (PV) self-consumption, while simultaneously, decrease the mobility costs. The latter can be further optimized by implementing different smart charging strategies in combination with suitable forecasting methods for PV production, weather, and the number and distances of planned trips. Utilizing the emobpy tool time series for electrical vehicles are obtained which serve as input for a mixed-integer linear optimization model. The optimization model aims at minimizing the total net costs of an EV company fleet including necessary infrastructure, e.g., charging stations. Besides the technical and economic evaluations, one major focus of the Car2Flex project is the analysis of employees driving behavior and mobility needs. These social aspects are then fed into the optimization model as well as into emobpy to derive better suitable initial time series. Eventually, the simulated input data for the optimization model are compared to monitoring data after the installment of the EV company fleet, to compare the accuracy of the model data to the real-word use case.

Comparing energy supply costs for electric vehicles and low carbon fuels

Dr William Lilley
Saudi Aramco Fuel Research Centre, France

Policy aimed at decarbonizing road transport has focused on the use of electric vehicles due in part to their high energy conversion efficiency. In this study, focus is given to the economic efficiency of electric vehicle charging against alternative supply such as low carbon fuels under identical policy settings. A custom mixed integer linear program is used to examine the total incremental costs for fully renewable based energy supply to light duty road vehicles in Germany. Fifteen minute demand profiles from the emobpy model provide the basis for BEV charging. The default test case and charging regimes of emopby employing German mobility statistics are used as the basis for comparison. Total costs include the costs of renewable generation, in-grid storage, transmission, distribution and charging infrastructure. These costs are compared with the total costs of producing fully renewable synthetic fuels considering the impacts of renewable intermittency and the requirements on generation, storage, transmission and transport.

Modeling Electric Vehicles from the Perspective of the German Electrical Power System

Dr.-Ing. Jonas Schlund
FAU Erlangen; Ampcontrol.io, Germany

In this talk I will present parts of my PhD thesis on “Electric Vehicle Charging Flexibility for Ancillary Services in the German Electrical Power System”. The talk focuses on the developed stochastic mobility behavior model of electric vehicles.

I will outline the results of my literature review, in particular considering emobpy. I will reason why I chose to develop an own model and I will introduce my modeling approach, which is based on a directed acyclic graph and the MiD2017 dataset. The stochastic model can represent patterns of different user groups, takes the interdependencies between different variables into account, does not rely on rules and magic numbers and achieves to model overnight stays accurately. It is thus a strong foundation for my analyses on large scale electric vehicle charging flexibility potential.