Electric mobility in Switzerland: how many Teslas can the system deal with?

Ali Darudi, Carla Mendes, Hannes Weigt

University of Basel

carla.mendes@unibas.ch

Abstract

As envisaged by the Energy Strategy 2050, Switzerland aims to reduce the greenhouse gas (GHG) emissions by 80-90% until 2050. This ambitious goal presupposes a decarbonization of the transportation sector which was responsible for 32% of the total GHG emissions in Switzerland in 2018. A suitable approach is to increase the share of electric vehicles (EVs) in the transportation sector. However, deployment of EVs and corresponding additional electricity demand will affect electricity markets and particularly, GHG emissions and market prices. The main goal of this paper is to quantify the interactions between electric mobility and electricity markets in Switzerland. In this paper, we extend Swissmod, a customized dispatch model for Switzerland and Central European electricity markets, with an electric mobility model that takes into account the particular characteristics of electric vehicles and the resulting new demand patterns. In order to obtain customized data on Swiss reality, two other models were linked to our model framework. Data regarding electricity generation mix and consumption developments are provided by Swiss TIMES energy system model (STEM), while detailed transportation patterns of EVs are developed by BedDeM. Different charging scenarios are also considered, namely, instant charging and smart charging. By considering different charging methods, we can quantify the benefits of using smart charging systems over instant charging. We believe, this integrated model framework will allow us to analyze the impacts of electrifying the mobility sector on the electricity market, network infrastructure and CO_2 emissions. Preliminary results show a clear benefit of using smart charging system in terms of reduction of CO_2 costs and electricity prices.

Keywords: Electric mobility, Electricity markets, Smart charging, Instant charging, GHG emissions