

1 Abstract

a) Synopsis

Technical, economic and ecological impacts for Austria's energy system (until 2050) due to massive e-mobility penetrations are examined. The options of system related e-mobility integration in urban and rural case studies are analyzed developing active grid integration as well as new business models (e.g. loading strategies, balancing services) for Grid to Vehicle and Vehicle to Grid concepts. As key results a tailor made guideline and action plan for Austrian decision makers are derived.

b) Summary

The increase of energy consumption by the transport sector due to the steady rise of vehicle numbers and their capacities leads to further CO₂ emissions in Austria. In this context, if the climate goals of Austria are considered, an efficiency increase in the transport sector becomes essential. Among other measures, these necessary efficiency increases can be supported by a massive market integration of e-mobility in Austria. Nevertheless, such measures may often cause a change in already established market models and furthermore increase the number of market players (e.g. in the electricity & balancing market, consumer behaviour, fleet management etc.) as well as electricity grid operation and grid planning models. Hence, best practise solutions and strategies for a system driven (mainly by electricity grids) integration of e-mobility in urban and rural areas have to be identified. Furthermore, the open question needs to be clarified under which conditions a high market penetration of electric vehicles in a system supportive manner can be realised.

Thus, the core questions of this project are:

- Which technical, economic and ecological parameters enable a rising market penetration of e-mobility?
- What is the influence of different market penetration and charging strategy scenarios on electricity grids (focus on medium and low voltage grids) and the energy system?
- How can innovative business models be designed to optimize the system integration and the roles of market participants implementing Grid to Vehicle (G2V) and Vehicle to Grid (V2G) concepts?
- Which strategical decisions are to be met by policy makers, principals and market participants to enable a successful market and system integration of affordable e-mobility in Austria?

The analytical approach of this study pursues a dynamic total cost comparison of new e-mobility system integration approaches under detailed analysis of corresponding business models within several case studies. As a consequence, the technical analysis contains a dynamic load flow simulation of different rural and urban grid segments in Austria incorporating suitable battery charge strategies – derived by user traffic behaviour and the available charging infrastructure – regional grid parameters as well as the respective electricity generation mix. Based on that, parameters which allow the identification of e-mobility energy system impacts are derived for Austria. In addition, the backlash of new business models on these market penetrations is analyzed.

The main outcomes of this study can be summarised as follows:

- E-mobility development scenarios for 1 specific urban (city of Salzburg) and 3 rural regions (Salzburg, Vorarlberg, Upper Austria) as well as whole Austria until 2050
- Technology specific battery charging strategies depending on user traffic behaviour, grid conditions, charging infrastructure as well as the overall electricity generation mix
- Evaluation of technological, economical and ecological impact of e-mobility (using detailed load flow analysis) in 1 urban and 3 rural distribution grids implementing new (active) grid integration concepts for G2V and V2G applications
- A cost/benefit analysis incorporating different business models within Austria in order to derive findings on overall efficiency increases as well as future generation and demand needs
- Development of a tailor made guidebook for market actors containing all necessary steps towards a broad G2V and V2G concept implementation in Austria
- Two press conferences and international workshops (separately for each market actor) for result presentation and discussion in direct cooperation with principals

Above all, this study derives an Action Plan (aligned with the "Austrian Energy Strategy") for decision makers, which provides adequate strategies towards an optimal system integration of G2V and V2G concepts.