Power and energy support of wind through IEC 61851 EV/EVSEs

M. Kristiansen and C. Lund

DTU Electrical Engineering, Technical University of Denmark

ABSTRACT

Wind power is becoming a larger part of the total energy production as Denmark strives to achieve its energy goals by 2050. Since wind is not a controllable source of energy such as a power factory is, it becomes increasingly important to use the energy when it is available. Energy consumption follows approximately the same weekly pattern over the whole year and has a daily peak in the time interval 17:00-20:00, resulting in higher prices and more polluting energy production. Typically, a electrical vehicle (EV) owner will charge the car in this interval. It is not typically necessary for the car to charge at this time and it would therefore be desirable to move the charging to less congested hours. This could help prevent further increases in price and CO2 production.

This project seeks to design and implement an intelligent charging solution to charge an EV according to wind power production and energy consumption. To make intelligent EV integration a reality, it is necessary to understand the relevant areas of interest, which the program will affect or be affected by. Therefore, analysis of the connection between wind, consumption, price and CO2 have been conducted. Furthermore, we have investigated the energy system in order to understand how a synergistic relationship between the system and an EV can be approached. This research includes frequency behaviour, the day-ahead market and auxiliary services.

Based on the analyses, the algorithm has been designed to find the most optimal charging times, according to data, such as wind, consumption or CO2, while also providing some auxiliary services. User-friendliness has been focus throughout the project and implementation of deadline securities, ensure that the car is available and charged (if possible) when the owner plans to use it again. A minimum state of charge is also ensured in case of unplanned trips.

As expected, the project has shown, that using the algorithm results in significantly lower price per charge and a lower CO2 production per accumulated kilowatt-hour when compared to non-intelligent charging, without largely affecting the car's primary function.