Abstract

Due to climate change, an energy transition is indispensable. In the area of mobility, this means switching to alternative drives. With the help of e-mobility, a high degree of efficiency can be achieved in making use of primary energy. This efficiency can be mapped well by electricity prices. A cost-optimized wallbox control software could do just that and is therefore of high relevance. The energy generation of renewable energies is day-time-dependent. This is why the flexibility of the charging loads of electric vehicles can help to optimize the efficient use of primary energy.

In this thesis, a cost-optimized wallbox control software is implemented, which is embedded in the EVerest Project. This project is about developing an open hardware and software stack for commercial use.

The charging strategy is controlled by setting a goal for a minimal energy charged and a maximal duration of the charging session. Inputs like photovoltaic energy production forecast and energy price forecast are combined to calculate when energy can be drawn from the power grid as cheap as possible. A PI-controller is used to reach an efficient use of self-produced energy.

This implemented charging strategy and its connection components are tested by several tests and two simulations that show the strategy's behavior in several situations. The simulation of a complete charging session has shown that the user could save about 20% of the electricity costs and could use 85% of the remaining self-produced energy, which can increase the household's annual self-consumed energy substantially.

Nevertheless, future work is required to reduce delays and overshoots in the PI-controller and to extend the energy manager's feature set by adding a non tech-savvy friendly user interface and several automatic routines that allow to waive as much user inputs as possible.

Projects, as the EVerest Project that work on energy management solutions that provide better grid stabilization, should be continued and expanded in the future, because they decide of success or failure of a transition to renewable energy.

Keywords: EVSE, EV, Smart Charging, EVerest, PV, Grid, ICT, Energy