Philipp Bruggmann

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Topic	Environmental Engineering

Simulation of an Electrolyzer System

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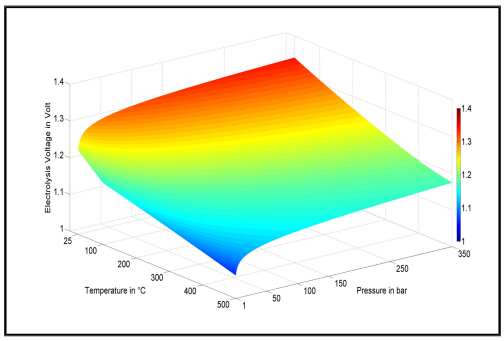
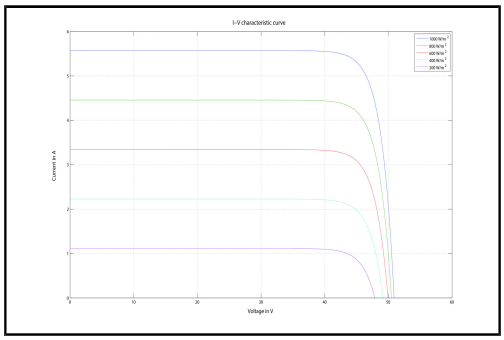
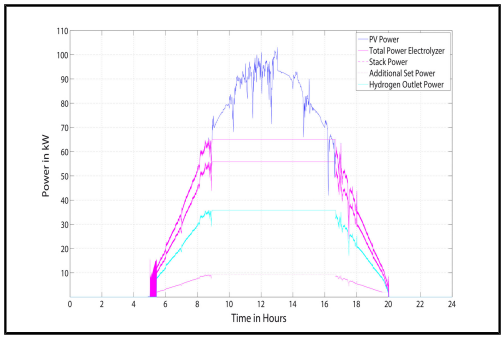


Electrolysis Voltage depending on Temperature and Pressure



I-V characteristic depending on irradiance at STC (simulation)



Power comparison on 11th July (simulation)

Introduction: The fact that more and more institutions are interested in feasibility studies about P2G energy storages and a lot of the assumptions like constant efficiencies and highly simplified controlling approaches are inaccurate without a proper model, demonstrates the need of such a model. The fact that complex models for energy supply and demand side management of bigger building projects already exist, underlines the modeling needs.

Objective: The main objective for this research project is to develop a dynamic model of a water electrolyzer. The effect of temperature, pressure as well as current changes should be seen in the simulated results. Additionally, the model should be built-up in a generic and adaptable way for the use in further projects. Second objective for this project is to include some additional components and parts of the system periphery. For modeling those systems, the software Matlab and Simulink is used.

Result: It was possible to model a PEM water electrolyzer cell by a widely used approach. Additionally, the extension from cell to stack was implemented, as well. To complete the electrolyzer model, a simple additional set and storage were introduced. Finally, the polarization as well as an efficiency curve could be presented. The used field and fact sheet data made the electrolyzer model even more applied. One more step to show the behaviour of the electrolyzer was done by developing a photovoltaic model. Using an equivalent circuit approach allowed it to simulate the characteristic current-voltage curves. Comparison with the PV panel fact sheet showed a good agreement. By adding the given irradiance model using minute basis raw data allowed to evaluate the maximal power point for each irradiance. The final integration of the PV and the electrolyzer model by introducing the control model demonstrated nicely the good approximation of the electrolyzer power to the PV power. The one day simulation at the end showed various very interesting outcomes for further research projects.