SE-6.2 The Energy Lab 2.0 – Real-life laboratory and simulation platform contributing to the successful implementation of the energy transition (A)

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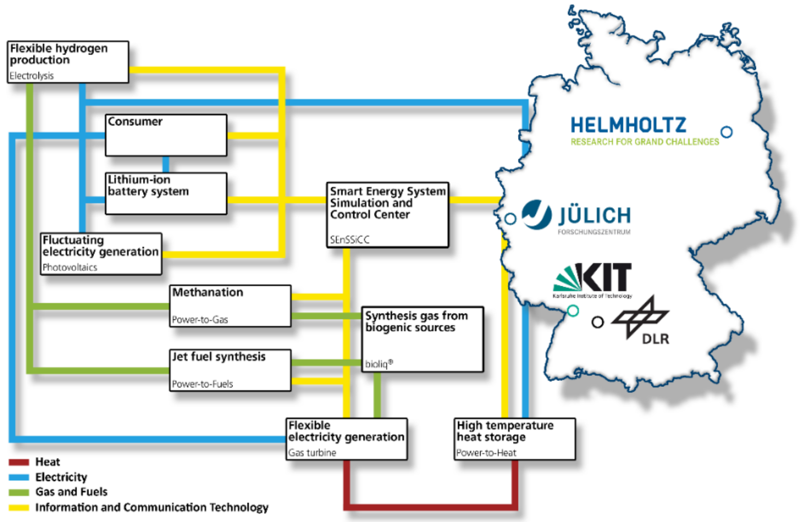
The global energy industry currently is undergoing a dynamic change. In the frame of the "Energiewende" Germany aims to reach a share of renewable energies of at least 80 percent of the gross electricity production until 2050 in order to achieve the goal of the reduction of carbon dioxide emissions by up to 95% compared with 1990 levels. This target demands continued buildup of wind and photovoltaic plants – though, wind and sun do not deliver a constant level of electricity over daytime and season, and the electricity consumption also shows considerable fluctuations. Furthermore, the most effective sites for wind energy generation are often not located where electricity is needed. These considerations demand a paradigm shift in society, research and industry to successfully develop and implement an integrated energy system based on local, small scale plants of energy generation from renewable sources combined with decentralized energy conversion and storage in a smart, interlinked manner. In particular, transport, distribution, storage, and usage of electricity have to be improved, which requires a new grid architecture, the integration of different storage technologies, new grid hardware, and control strategies as well as a smart linkage of electricity, heat, and chemical energy carriers by efficient transformation technologies. In order to answer the questions posed here, a large-scale research infrastructure is currently being built by the Helmholtz Centers Karlsruhe Institute of Technology (KIT), German Aerospace Center (DLR), and Forschungszentrum Jülich (FZJ) – the Energy Lab 2.0!

In the Energy Lab 2.0 researchers will be able to investigate the coupling of fluctuating electricity from renewables with different conversion and storage technologies and optimized energy utilization in a scale comparable to realistic scenarios: from a 1 MW(peak) photovoltaic field over a 1.3 MWh Li-ion battery system, large scale electrolyzers and Power-to-X conversion units (X=methane, liquid fuels, heat) to three micro gas turbines flexible to load and fuels with an output of 100 kW each, a broad variety of different key components of future energy systems will be available and coupled for testing in various modes. Besides the plant network representing the aspects of the process technologies of future energy systems, the Smart Energy System Simulation and Control Center (SEnSSiCC) [1] focusses on the understanding and control of such complex interacting systems. Therefore, hardware and software infrastructures for simulation, visualization, analysis and optimization are being developed, implemented and tested. In addition, a 1 MVA power hardware in the loop laboratory will allow for the testing of new power grid components, topologies and technologies which will play a major role in future energy systems with a large share of distributed renewable energy generation.

In this contribution the Energy Lab 2.0 with special focus on Power-to-X [2,3] will be presented.



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