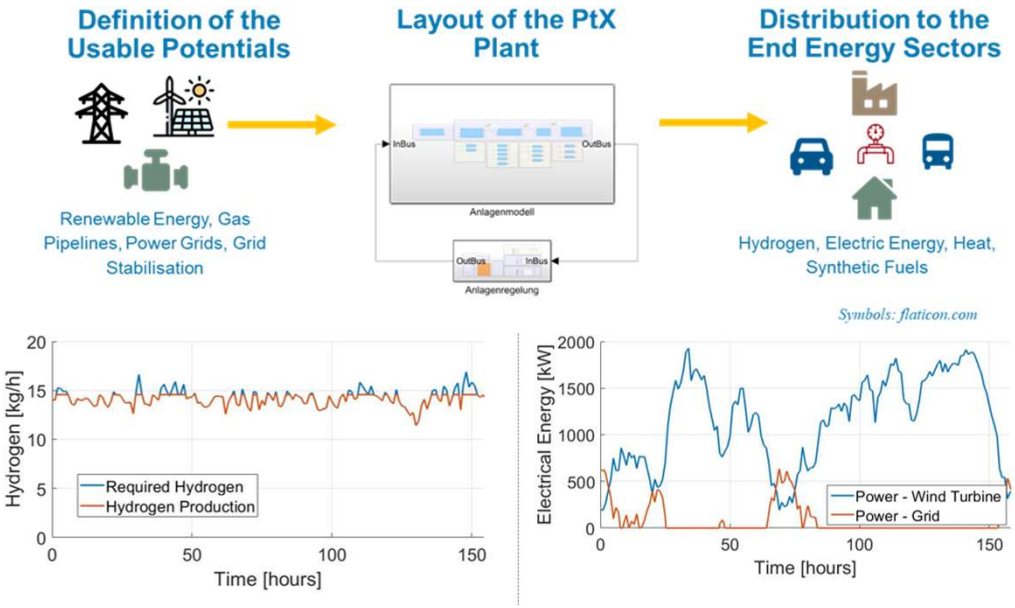
# Comparative study on use cases for AEM and PEM water electrolysis

**Description:**

Power-to-X (PtX) plants convert electrical power to chemically stored energy. They offer a variety of solutions to enable the complete integration of renewable energy into the current and future energy system by means of hydrogen. This thesis aims to conduct a comprehensive comparative analysis of Proton Exchange Membrane (PEM) and Anion Exchange Membrane (AEM) electrolysis technologies, focusing on their respective applications in industry and the energy sector. Electrolysis plays a critical role in hydrogen production, a pivotal component of sustainable energy strategies. PEM and AEM electrolysis technologies offer distinct advantages and challenges, influencing their adoption across different sectors. This thesis will evaluate efficiency, scalability, cost-effectiveness, environmental impact, and technological maturity to provide insights into optimal use cases for each technology. The findings will contribute to strategic decision-making for hydrogen production applications, aiming to foster a more sustainable and efficient energy landscape.

The HYDRA simulation tool enables the optimal design of the plant topology and the operating mode of PtX plants, individually adapted to the local conditions and potentials. Renewable energy sources, public electricity grids, gas pipelines and services such as balancing electricity grids are integrated into the PtX system to supply the mobility, industry and household sectors.




Work flow for optimizing PtX plants using HYDRA (top) and exemplary operating behavior of an electrolysis system in demand-controlled operation (bottom); Source: HyCentA

**Content / Time table:**

- Literature research and internal research on electrolysis technologies, their characteristics and operation strategies; survey of the objectives and simulation demands of industry partners (2 months)
- Development of strategic simulation plan for evaluating the potential effect of parameter variation and conduct simulation incl. data evaluation (3 months)
- Documentation of results and thesis writing (1 month)

**Start:** as of now

**Duration:** approx. 6 months

**Paid Master Thesis**

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