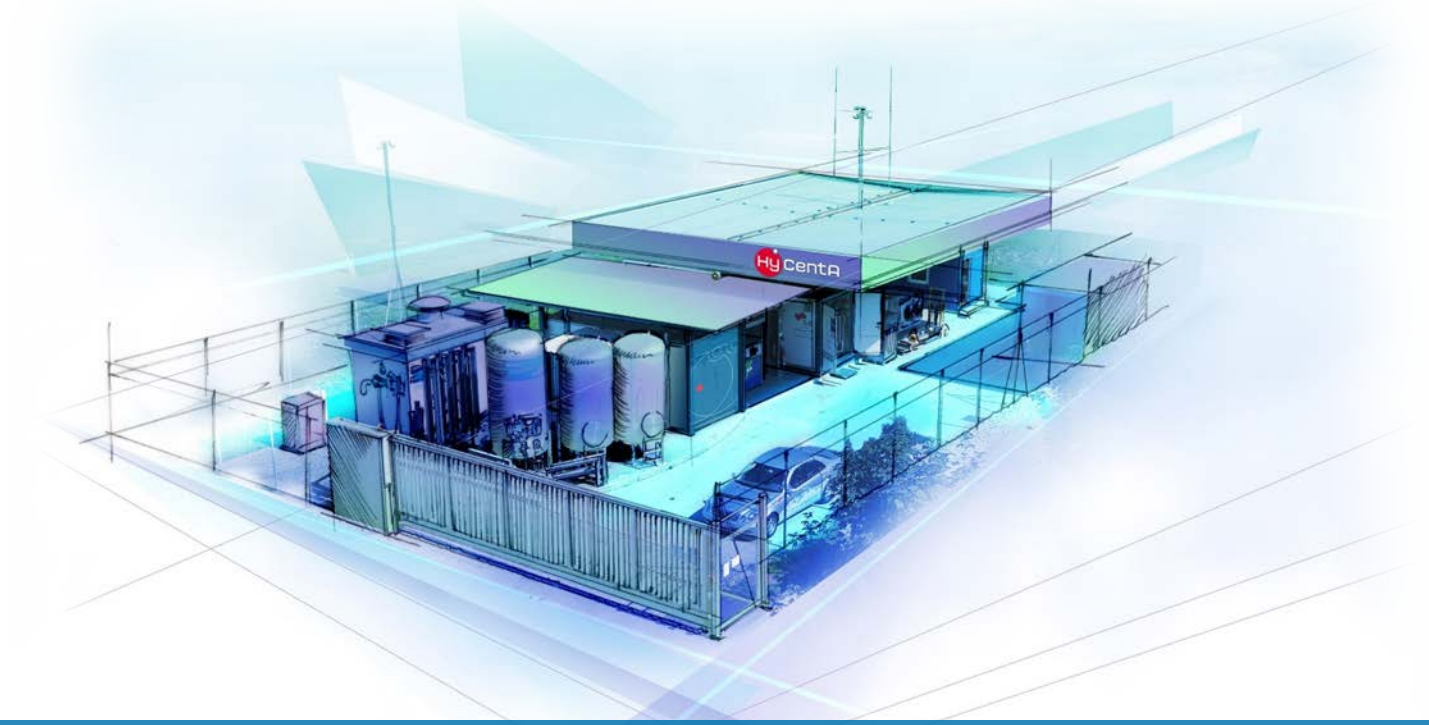


Integrated Multi-Energy Storages – coupling the power network to the transportation sector

DI Dr. Marie Macherhammer, DI Dr. Wolfgang Siegl

Vienna, November 2021

HyCentA HYDROGEN CENTER AUSTRIA

TU Graz

HyCentA Research GmbH

Austria's Research Centre for Hydrogen Technologies since 2005

Extra-University Research Organization at the Graz University of Technology

- **~50 Researchers***
  Mechanical Engineering, Physics, Chemistry, Process Engineering, Electrical Engineering
- More than **70 projects** successfully finished
- More than **16 years** of expertise
- Modern testing infrastructure and HRS
- Covering all fields of hydrogen R&D
- **International Network**

* ~160 Researchers in H_2-Area at TUG

Climate Change

©smartcitiesworld.net

Climate Goal in Austria

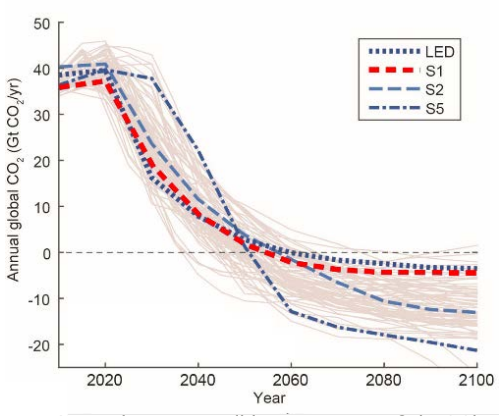
100 % Renewable Electricity until 2030*

Climate-neutral in 2040**

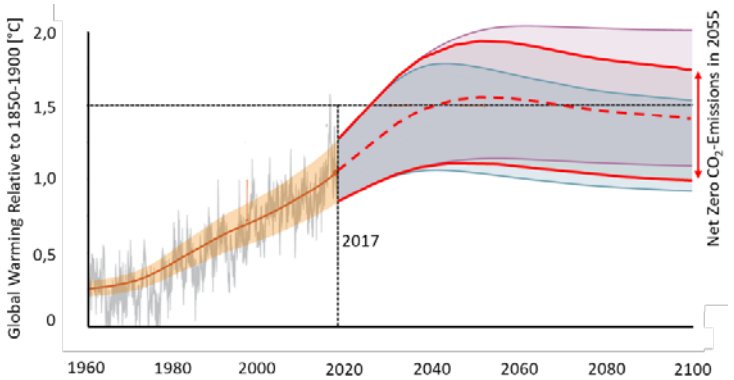
* #mission2030; **Government program Austria 2020–2024

Challenges of the energy transition

The primary goal is the reduction of greenhouse gases!



Szenarien zum Treibhausgasausstoß (IPCC)

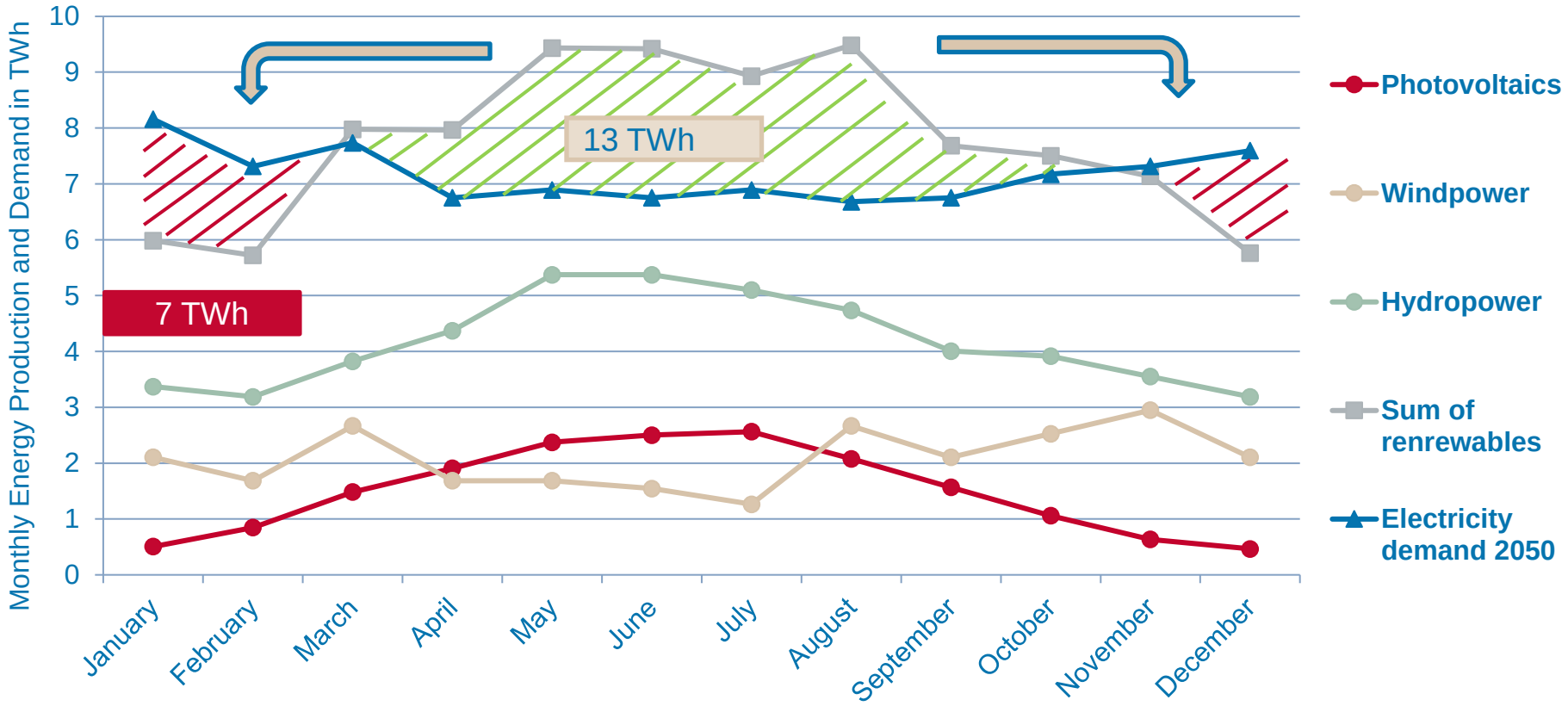


Szenarien zur globalen Erwärmung (IPCC)

Three strategies for implementing the energy transition:

1. Expansion of renewables and integration of renewables through energy storage systems
2. More efficient energy conversion - efficiency increase
3. Reduction of consumption

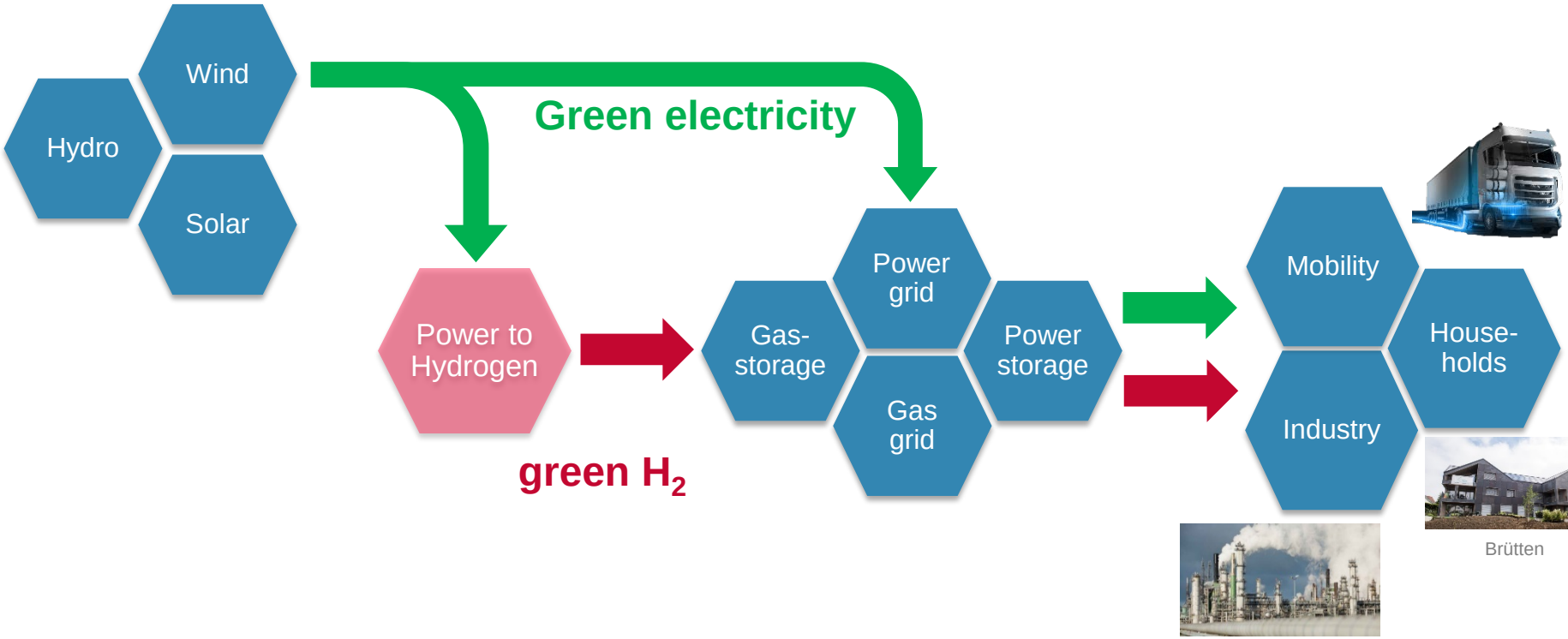
Production and Demand in 2050



Source: Klima-Zielpfade für Österreich 2050 des Umweltbundesamtes; besonders hohes Ambitionsniveau

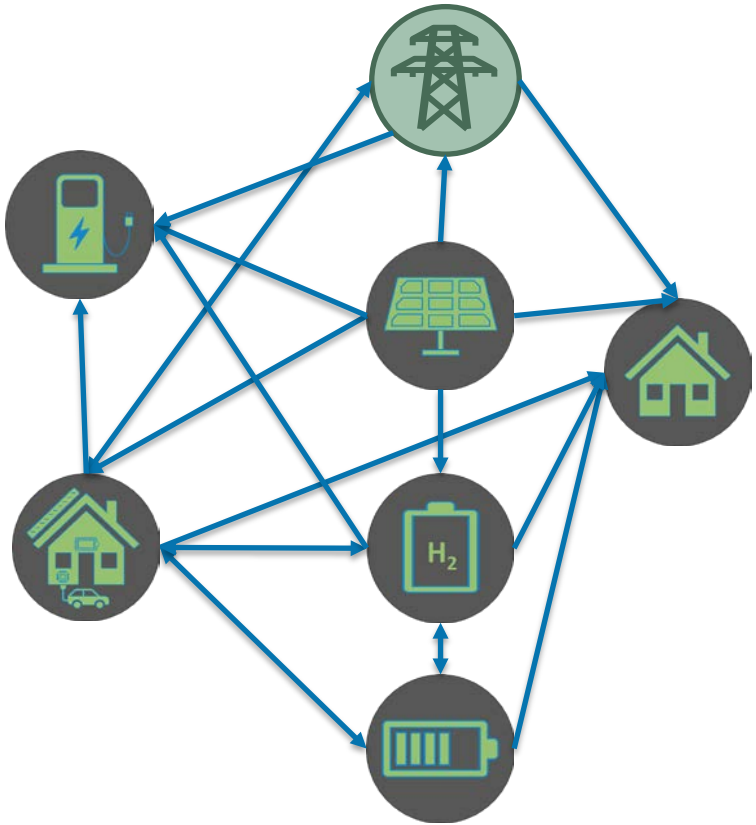
Vision Hydrogen Economy

- **Hydrogen economy as a solution for renewable energy systems**

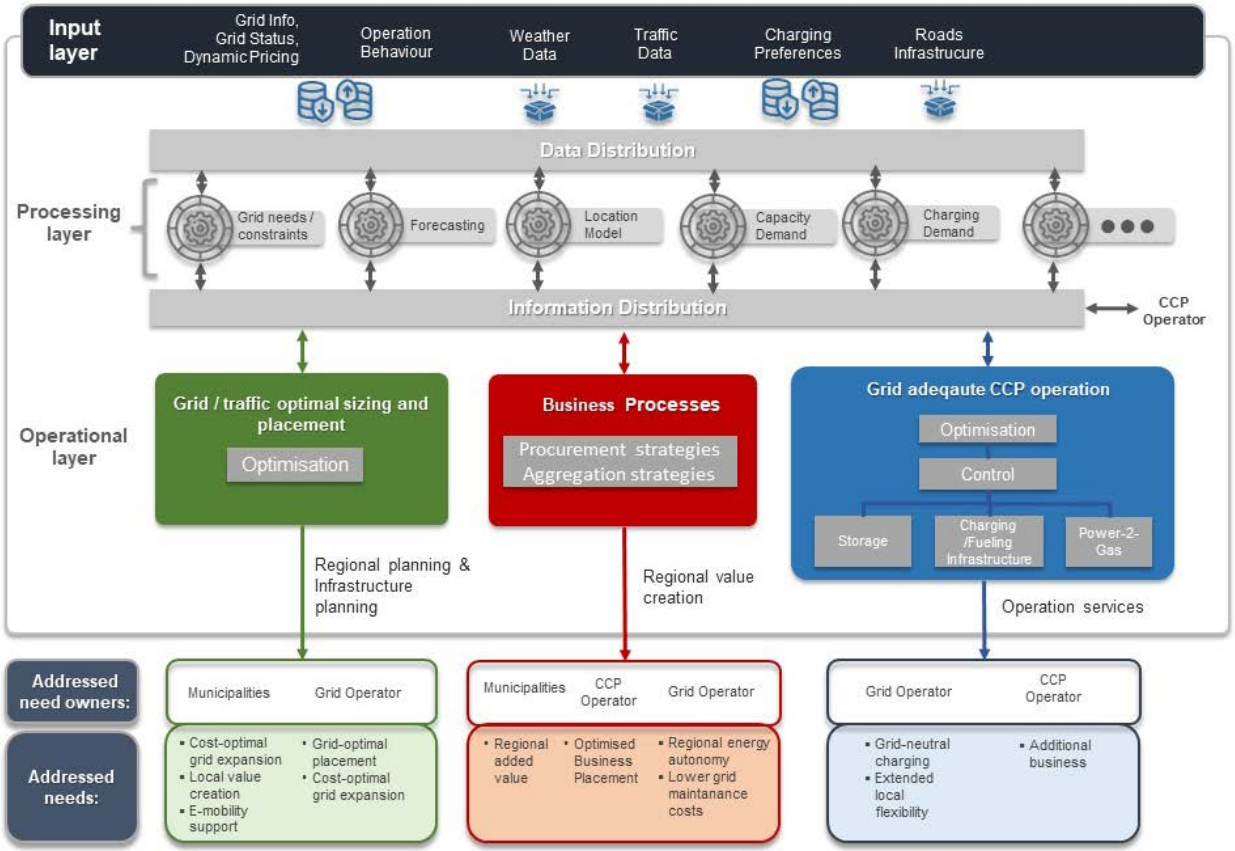


CrossChargePoint – an Overview

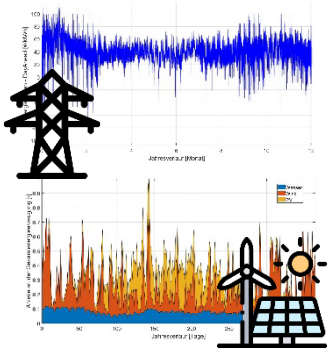
- **Virtual Power Plant** (VPP) linking energy generation/conversion/storage and charging of vehicles
- **Surplus energy** → energy **storage** (short/long-term) / **e-mobility**
- **Different regions** and local **characteristics**
- **Demand** and **production modelling** based on simulation
- Development of **regional Energy Management System** (rEMS) for controlling and monitoring the CCP infrastructure
- Integration of **energy conversion** (PtG)



Detailed Project Overview CCP

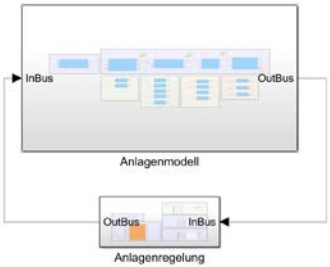


Optimization Process with Hydra



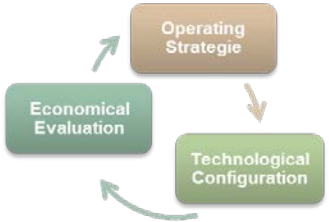
Specify local **demands**

- Energy demand (power, heat, chemical)
- Media demands (e.g. industrial demand)
- All energy sectors are implementable



Definition of **operating strategies**

- Cost-based
- Demand-based
- Grid stabilisation
- Forecast-based



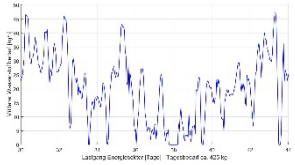
Documentation

- Graphic data analysis and documentation
- Calculation of key performance indicators

Iterative simulation process

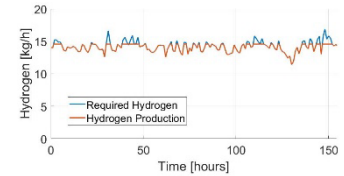
Definition of usable **potentials**

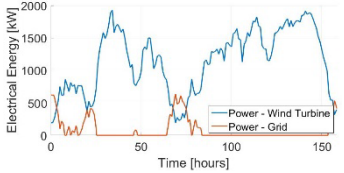
- Local renewable potential
- Electricity grids, pipelines



Design of **plant topology**

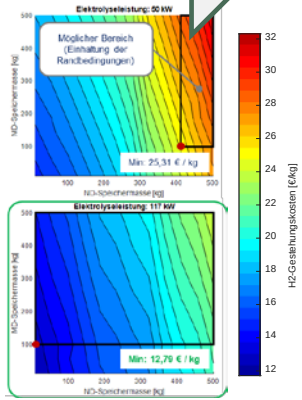
- Versatile module library
- Drag and drop
- Predefined plant layouts



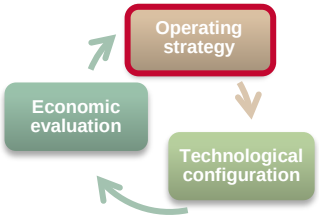


Technological & economic **optimization**

- Technology selection
- Operating strategy optimization
- Economic evaluation
- Cost-function database



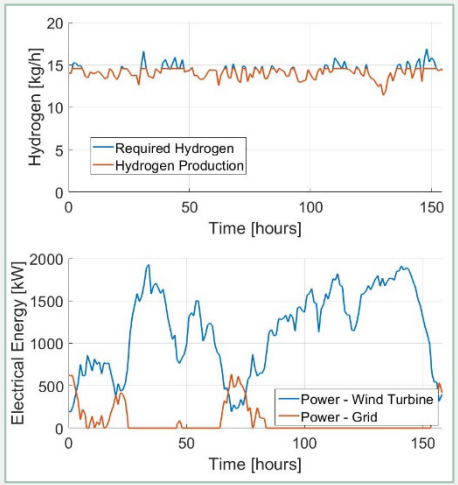
Selection of Operating Strategies



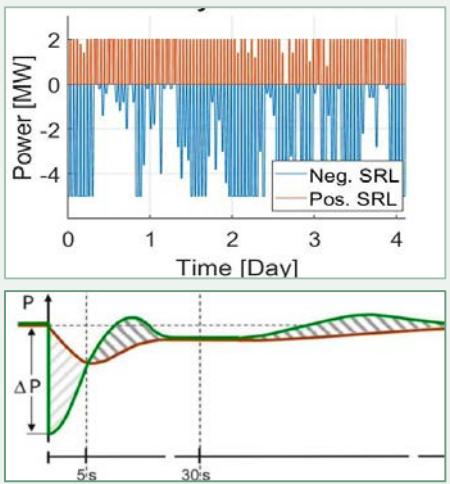
Operating Strategies, adaptable to local conditions:

- **Cost**-based, (hydrogen) **demand**-based, coupled to renewable energy **production**
- Positive and negative **balancing power** for **grid stabilisation**
- **Forecast-based** operating strategies for **electrolysis** systems
- **Combination** of operating **strategies**

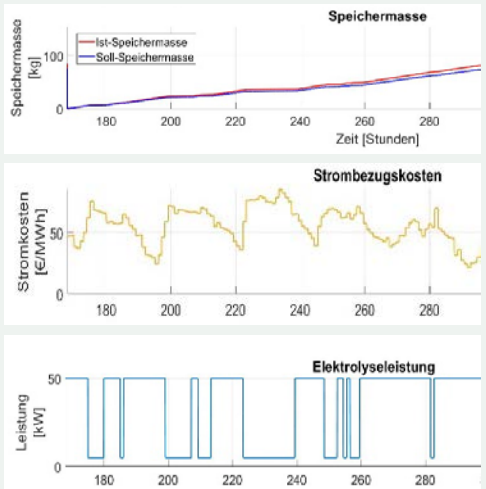
Cost/demand-based



Grid stabilisation



Forecast-based



Key Messages

Hydrogen is essential to move our energy system towards zero-emission power generation.

- **Investments need to start now –**
  the earlier hydrogen production is scaling up,
  the earlier hydrogen is available for all sectors!

- **Activities for hydrogen implementation have to be combined to increase impact – resources have to be bundled. Energy communities will support the transformation!**

- **Research and development has to be strengthened to ensure smooth and fast market introduction!**

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