



Power to Gas and Hydrogen Supply Chains

Techno-Economic Assessments of Hydrogen Infrastructure

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The efficient and economically viable utilization of green hydrogen in various sectors requires a comprehensive understanding of all individual elements in the hydrogen supply chain. In our techno-economic analyses, we develop and evaluate tailor-made solutions for the production of clean hydrogen from renewable energy, its efficient storage and demand-oriented distribution.

Our Offer

We support our customers in understanding hydrogen projects through:

- dynamic system simulation of electrolysis plants and hydrogen infrastructure with our modeling tool H2ProSim
- plant concepts, monitoring and component testing for hydrogen production, mobility and gas networks
- assessment and optimization of operational management and deployment strategies
- hydrogen yield forecasts and evaluation of business models
- Geographic Information Systems (GIS)-based techno-economic studies on the integration of hydrogen in the energy system
- life cycle assessment of hydrogen production plants and supply chains
- technological and market studies

Operating our own Hydrogen Refueling Station and Feed-in Plant

Fraunhofer ISE has been operating a hydrogen refueling station since 2012 and a hydrogen feed-in plant since 2017 as part of the respective public infrastructure. They provide us a broad database and many years of experience in the field of construction and operation of hydrogen plants.

Component Tests and Development of Operational Management

Due to the open interfaces and operation of our installations as a research platform, we can carry out component tests and examine operational management strategies and targeted measurement programs under real conditions.

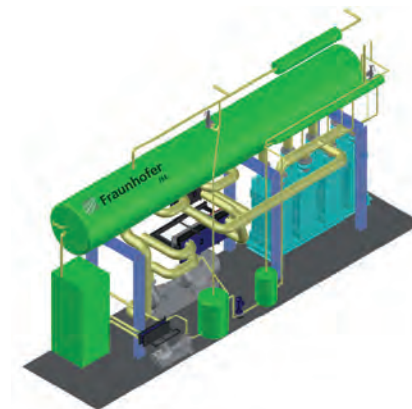
Dynamic System Modeling with our Toolbox H2ProSim

The toolbox H2ProSim developed at Fraunhofer ISE is an extensive tool for the simulation-based, techno-economic evaluation of hydrogen plants and supply chains using the simulation environment "Matlab/Simulink/Stateflow". The toolbox has a modular structure and is constantly being updated. The comprehensive data validation derived from our R&D projects and own research platforms guarantees high accuracy, and hydrogen production costs can also be calculated.

Techno-Economic Assessments of Power to Gas Plants and Hydrogen Infrastructure

We deploy our toolbox H2ProSim along the entire hydrogen value chain:

- feasibility analyses: Using standard models and parameters, we estimate hydrogen production and supply costs and assess the benefit of different plant configurations. The model easily analyzes different scenarios and variations of business models.
- plant design and optimization: With in-depth modeling, a plant design can be developed up to the rough concept level with techno-economic plant optimization. The impact of different electrolyzer types and locations on the operation and performance of the plant can be evaluated. Typical tasks are minimization of operational expenditures (OPEX), possibilities of heat extraction and oxygen utilization. Selected parameters can be optimized for specific techno-economic targets.
- hydrogen yield forecasts: Yield forecasts for submission to lenders can be made for existing plant concepts and locations.

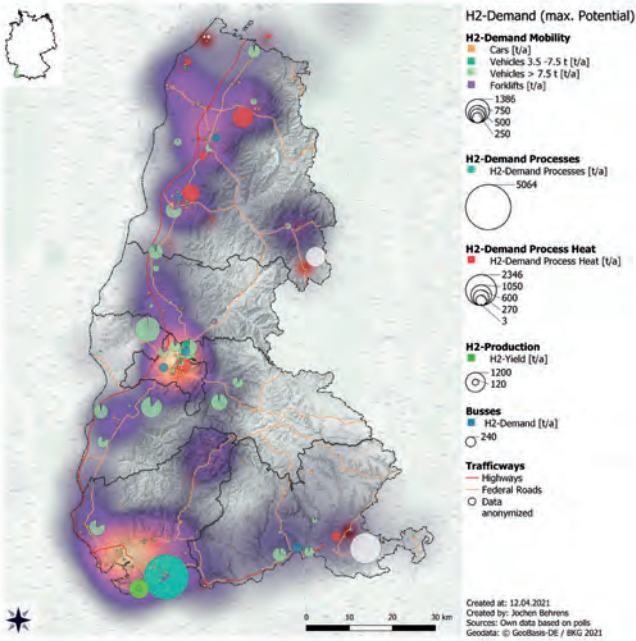


Technical design of a 10MW PEM electrolysis system: Fraunhofer ISE designs plants according to customer specifications. © Fraunhofer ISE

Application of Hydrogen-Based Synthesis Products

We use Geographic Information Systems (GIS) independently or in combination with H2ProSim to identify suitable locations for hydrogen installations and plants and to determine where hydrogen can be produced most economically.

Thus, we enable a spatial representation of both demand and production potential. By linking this data, we can use our process expertise to develop a cost-efficient and spatially optimized placement of a hydrogen landscape, such as the best location for electrolyzers or hydrogen refueling stations under given constraints, such as transportation costs. Special focus lies on the transformation of the existing infrastructure (electricity, heat and gas grids) and the integration of the analyzed regions into the higher-level energy system, with roadmaps to build up hydrogen regions.



Geographically distributed H₂ demands for different sectors in mobility and industry. The heatmap indicates demand hotspots. © Fraunhofer ISE

For Further Information



Virtual Tour of Fraunhofer ISE's Hydrogen Refueling Station



Contacts

Hydrogen Technologies – Hydrogen Production by Water Electrolysis

Dr. Tom Smolinka

Phone +49 761 4588-5212

h2fc.electrolysis@ise.fraunhofer.de

Power to Gas and Hydrogen Infrastructure

Christopher Voglstätter

Phone +49 761 4588-5357

Fraunhofer ISE
Heidenhofstr. 2
79110 Freiburg, Germany
www.ise.fraunhofer.de

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