

## Data and facts

# Hydrogen Lab Leuna – Green hydrogen in the chemical industry

The Hydrogen Lab Leuna (HLL) is one of a total of three labs being set up at Fraunhofer IWES. Each lab satisfies the same basic requirements and, in addition, has its own focus. The operation of these three Hydrogen Labs will create a digitally networked infrastructure with test and qualification capacities for the necessary electrolysis and fuel cell systems of over 25 megawatts (MW) for the very first time. This allows IWES to control the allocation of test capacities and thus the utilization optimally as well as to make customers supraregional, precisely tailored offers with optimized time availability.

In the Central German Chemical Triangle, the Fraunhofer-Gesellschaft is making a new generation of test infrastructure for hydrogen technologies available with the Hydrogen Lab Leuna (HLL) funded by the State of Saxony-Anhalt and the EU. Embedded in the materials network of the Leuna Chemical Park, the HLL boasts four separate outdoor test pads and a technical center for electrolyzers up to 5 MW, which are supplied with deionized water, steam, compressed air, nitrogen, hydrogen, and in the future also with CO<sub>2</sub>. The green hydrogen produced is analyzed on site, purified, and fed directly into the 157-km-long H<sub>2</sub> pipeline, from where it is distributed to the industrial sites in the region for use in chemical processes. Fraunhofer IWES is the owner and operator of the HLL infrastructure.

## Overview of services

- H<sub>2</sub> production: Endurance and stress testing of electrolyzer systems of any type (PEM, SOEC, AEL, AEM) up to 5 MW and electrolyzer components up to 50 kW in real-world operation with renewable energies, testing of auxiliary units such as H<sub>2</sub> compressors, storage units, etc.
- Integration in the chemical industry: Supply with media (deionized water, steam, N<sub>2</sub>, H<sub>2</sub>, CO<sub>2</sub>, compressed air) and feeding of produced H<sub>2</sub> into pipeline.
- Power-to-X technologies: Coupling of electrolyzers with processes for chemical use of H<sub>2</sub> on a pilot scale.
- Performance evaluation: Electrochemical evaluation of stacks, cells, and electrolyzer components up to 300 cm<sup>2</sup>, development of test protocols, model-based data analysis and correlation. Microstructural fault diagnostics (in cooperation with the Fraunhofer IMWS).
- Technoeconomics: Modeling of real-world operating scenarios for cost-optimized design of electrolyzers, storage units, etc., especially in operation with renewable energy sources.
- Analysis and preparation of process flows: Real-time monitoring of H<sub>2</sub> and O<sub>2</sub> purity, GC-MS trace analysis. Preparation by means of distillation, parallel process simulation and modeling for assessment and optimization of parameters possible (in cooperation with Fraunhofer CBP).

## Testing of electrolyzers on an industrial scale

The HLL offers the capacity for testing of industrial-scale electrolyzers of any type – PEM, AEL, AEM, or SOEC – in 24/7 continuous operation, with the possibility of simulating dynamic load profiles during operation with electricity from photovoltaic systems and wind turbines in order to investigate the performance, cost-efficiency, and long-term behavior in real-world operation as well as in an accelerated aging tests. The data collected will provide the basis for future certification, which will form operators with assurance about the reliability and efficiency of such plants.

The Fraunhofer IWES' competences in electrochemical analysis make it possible to trace degradation phenomena on critical components such as membranes and bipolar plates back to material properties and utilize these findings for the continuous further development of materials and components. In addition, test benches for electrolyzers up to 50 kW enable the investigation of new components and operation under particularly challenging conditions (mechanical and thermal loading).

## Commodity chemicals from green hydrogen

The green hydrogen produced in the HLL can be used on site in partnership with Fraunhofer CBP for the sustainable synthesis of commodity chemicals and fuels. The integration of the HLL into the Leuna Chemical Park and its materials network allows innovative processes for sector coupling to be demonstrated on a pilot scale and tested under realistic conditions directly at the chemical industry site.

This offers SMEs in particular an excellent, time- and cost-saving way to scale up new technologies with the aim of faster product development and market launch as well as to develop them further under Fraunhofer's scientific guidance. For example, Fraunhofer is currently developing a pilot process for the production of methanol from CO<sub>2</sub> and green hydrogen in collaboration with Sunfire and under the coordination of TotalEnergies in the e-CO<sub>2</sub>Met project. Investment volume of Hydrogen Lab: Over €10 million.



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## Further information

Fraunhofer IWES secures investments in technological developments through validation, shortens innovation cycles, accelerates certification procedures, and increases planning accuracy by means of innovative measurement methods in the wind energy and hydrogen technology sectors. At present, there are more than 300 scientists and employees as well as more than 100 students employed at the nine sites: Bochum, Bremen, Bremerhaven, Leer, Görlitz, Hamburg, Hanover, Leuna and Oldenburg.

### Supported by



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