

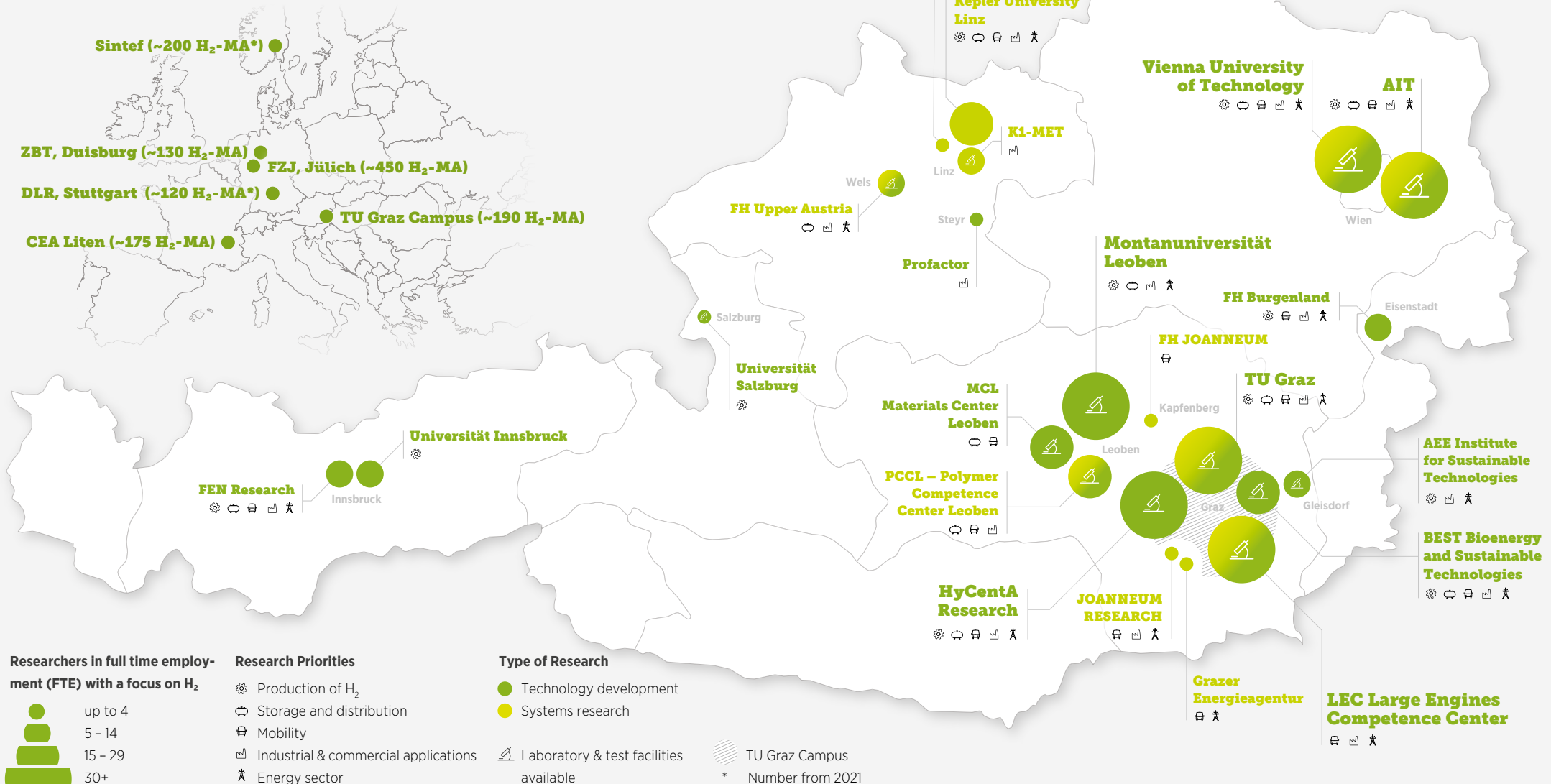
H₂ Research Austria



Academic and non-academic hydrogen research in Austria: Survey of June 2023

Cutting-Edge H₂ Research in Europe

The map shows 6 of the largest research institutions in Europe in the field of H₂.
With about 190 H₂-researchers on campus, TU Graz is among the top 3.



STEIERMARK

HyCentA

Graz / NOE: H₂ researchers in FTE: **30+**

The Hydrogen Research Center Austria is the leading non-university research institution in Austria exclusively conducting research into hydrogen technology and electrochemical systems. The KI COMET Center carries out research and development projects into the generation, distribution, storage and use of hydrogen, as part of an international science and industry network.

Research Priorities



The comprehensive areas of research include simulation and systemic analysis of the application of H₂ technology, improved testing methods and the circular economy, covering production, industrialisation and recycling of components and materials.

Research Facilities

Test benches and laboratories for electrolysis (PEM/AEM), 2 multifunctional test benches (supply up to 300 bar), a high-pressure multifunctional test bench with climate chamber (up to 1,000 bar), PEM stack test bench, 160 kW fuel cell system test bench with climate chamber, gas analysis and materials laboratory, compressor and filling station facilities (-1,200 m²).

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LEC GmbH – Large Engines Competence Center

Graz / NOE: H₂ researchers in FTE: **30+**

LEC GmbH is a global innovation hub for sustainable energy and transport systems. The research institution has built a reputation for excellence in the development of environmentally friendly, efficient and robust solutions to drastically reduce greenhouse gases and pollutant emissions and to increase flexibility and reliability. Research activities include the use of renewable energy and overall system optimisation by closing resource cycles.

Research Priorities



Storage and distribution of hydrogen; specific research priorities include marine transport and power generation, mining vehicles and rail traction and other off-road applications.

Research Facilities

Laboratory and test facilities, to the value of € 35m for the areas mentioned above, cover 1,500 m² and feature 7 test stands.

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Montanuniversität Leoben

NOE: H₂ researchers in FTE: **30+**

As part of the (Strategic Core Research Area) SCoRe A+ Hydrogen and Carbon, the University of Leoben brings together all the innovation activities involved in the production of high-quality carbon, CO₂-neutral hydrogen, and other synthetic, renewable energy sources, in particular green gas and fuels.

Research Priorities



Core technology processes being developed within the scope of the HY-CARE Center are the pyrolysis of biogas and natural gas, as the basis for blue, CO₂-neutral or CO₂-negative hydrogen and high-purity carbon. Synthesis processes for the production of renewable natural gas and fuels based on hydrogen and CO₂ from industrial processes are also being developed.

Research Facilities

Systems for further development of methane pyrolysis, separation of solid carbon and gas processing; additional testing facilities in other laboratories also cover the characterisation of carbon worth approx. € 14m.

Contact Person

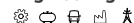
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TU Graz

NOE: H₂ researchers in FTE: **30+**

The (TU) Graz University of Technology incorporates 5 Fields of Expertise in H₂ Research at the following institutes:

Research Priorities – Institute of Thermal Engineering



The goals of the institute are to develop innovative energy technology, to use resources in an energy-efficient manner and to develop local and global solutions for a cost-effective and ecologically sustainable energy industry. In addition to energy conversion technology and efficient heat generation methods, the Thermal Energy Systems and Biomass Utilisation working group is involved in the experimental investigation of both solid oxide fuel cells (SOFC) and solid oxide electrolysis cells (SOEC), as well as the development of processes to reduce degradation. Joint Research Projects: Combustion simulation of crucible and annealing furnaces, thermal management of a variety of systems using numerical simulation methods.

Research Facilities

Semi- to full technical scale test systems as well as tailor-made simulation tools. Test Facilities: fuel cell laboratory, reforming test bench, model combustion system, including flue system, up to 1.2MW, climate chamber(s) for temperatures from -20 to +40 °C. Measurement technology: typical sensors for flow, temperature, pressure, humidity etc., flame ionization detector (FID), gas analysers (GA), gas chromatographs (GC), infra-red spectrometers.

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Research Priorities – Institute for Chemical Engineering and Environmental Technology



Teaching and research in the fields of electrochemical technology, hydrogen and reaction technology, development of fuel cells and electrolysis cells, lifespan studies, hydrogen production from renewable hydrocarbons, chemical looping hydrogen and e-fuels. The developments in materials and processes range from basic research to pilot plant operation.

Research Facilities

Fuel cell and hydrogen laboratory, covering 400 m² over 15 test stands, for R&D of low-temperature fuel cells.

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Research Priorities – Institute of Thermodynamics and Sustainable Propulsion Systems



Teaching and research in the field of energy, propulsion systems, transport and the environment, with a focus on environmental issues. With specific respect to H₂, the institute is dedicated to hydrogen for mobility, with a focus on the hydrogen ICE and fuel cells.

Research Facilities

€ 18m investment in test stands for propulsion systems with combustion engines and fuel cells as well as truck roller test stands for complete vehicles.

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PCCL – Polymer Competence Center Leoben

NOE: H₂ researchers in FTE: **15 – 29**

The leading Austrian centre of excellence for cooperative research in the field of plastics technology and polymer science. Basic and applied research activities cover the complete value chain, from starting stock through to processing and on to material behavioural properties, against various scales of measurement.

Research Priorities



In addition to the research priorities mentioned above, PCCL primarily conducts research into plastics and fibre composites for application to hydrogen technology.

Research Facilities

Facilities for the optical, chemical, thermal, mechanical and fracture mechanics analysis of plastics and fibre composite materials. There is also a permeation measuring cell (up to 80 MPa pressure, 0 °C to +85 °C) to evaluate the barrier properties of polymers to hydrogen gas.

Contact Person

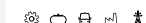
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BEST – Bioenergy and Sustainable Technologies

Graz / NOE: H₂ researchers in FTE: **15 – 29**

BEST is a K1 Competence Center within the COMET program. Acting as a bridge between academic research and development of industrial technology, the vision is to develop and demonstrate sustainable and circular biorefinery processes and technology for the production of green gases, green liquid fuels and green products.

Research Priorities



- Thermochemical production of hydrogen from syngas of biomass and waste fractions
- Use of hydrogen-rich syngas in industry (natural gas replacement)
- Chemical storage of hydrogen in synthesis products
- Biochemical production of hydrogen, for example, from industrial wastewater
- Use of hydrogen as energy storage in microgrids

Research Facilities

MW-DFB syngas generation plant from biomass and (assorted) waste materials; barrel/day FT pilot plant; FT system, Aqueous Phase Reformer (APR) and pilot scale mixed alcohol synthesis; pilot scale syngas generator (fixed bed).

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MCL Materials Center Leoben

NOE: H₂ researchers in FTE: **15 – 29**

The Materials Center Leoben (MCL) is the leading national research company specialized in materials, manufacturing and processing methods and innovative material applications. The focus is on metallic and ceramic materials and their composites. The MCL offers cooperative research and development as well as a comprehensive range of services.

Research Priorities



Interaction of materials with hydrogen by means of simulations and experiments on length scales from the atom to the component. From this profound understanding, we derive innovative and safe material solutions and design methods for hydrogen transportation and -storage (rededication and construction) and hydrogen use (combustion chambers and fuel cells).

Research Facilities

Characterization of material structure, structure, residual stress and cause of damage (e.g. scanning electron microscopy, computed tomography, X-ray diffraction), Determination of the influence of hydrogen on material properties (e.g. slow strain rate and constant load tests, fracture mechanics, diffusion), methods for modeling hydrogen uptake, distribution and damage (e.g. FEM, atomistic modeling).

Contact person

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AEE – Institute for Sustainable Technologies

Gleisdorf/NOE: H₂ researchers in FTE: **5 – 14**

AEE INTEC is one of the leading European institutes for applied research in renewable energy and resource efficiency. Within the scope of the target groups of Buildings, Cities & Networks and Industrial Systems, and the technology groups of Renewable Energy, Thermal Storage and Water and Process Technology, a range of R&D projects are conducted, from basic research right up to implementation of demonstration plants.

Research Priorities



New reactors for photocatalytic and photo-electrochemical processes through direct use of sunlight: reactor development for efficient

production and separation of H₂ from water and wastewater streams (e.g. microplastics), using novel rheology for ideal mass and energy transfer and optimisation of process parameters; systems integration of H₂ by the coupling of sectors for industrial applications.

Research Facilities

Solar Reactor for the production of H₂ from different water fractions (measuring instruments for water analysis) consisting of concentrating collectors and oscillating reactor tubes and the necessary measuring instruments for radiation measurement, pH, flow properties, energy consumption and gas yield (quantitative and qualitative).

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JOANNEUM RESEARCH

Graz/NOE: H₂ researchers in FTE: **1 – 4**

LIFE – the Institute for Climate, Energy Systems and Society at JOANNEUM RESEARCH – is one of the leading research institutes for fundamental issues on climate change, climate risks and energy transformation research, in the transition to a climate-neutral society.

Research Priorities



Industrial, commercial and mobility applications: development and evaluation of transformation pathways, for the industry and transport sector, in the transition to climate neutrality, where hydrogen applications have the potential to play a critical role. Commercial and economic feasibility studies of hydrogen-based technology as well as business modelling of the hydrogen economy and volatility of renewable electricity production, including forecast models and scenario planning systems.

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FH JOANNEUM

Kapfenberg/NOE: researchers, FTE: **1 – 4**

The Institute for Energy, Traffic and Environmental Management is primarily concerned with issues relating to technological protection of the environment, energy efficiency and intelligent mobility. The critical challenges to be faced include urban planning that is sustainable, with respect to both transport and energy, and new regional and state-wide energy strategies.

Research Priorities



Use of H₂ in fuel cells. Research under the theme of “Fuel cell production – development of core competences” as part of the DFC-Core research project (in cooperation with Graz University of Technology). Based on technical developments at TU Graz, electrodes are being produced where the amount of platinum used in the systems is reduced even further through the use of a novel, inexpensive catalyst. Using the combination of simulation and experimental research, cell components are being developed and dimensioned, and subsequently produced, tested and evaluated on a regional basis.

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Grazer Energieagentur

NOE: H₂ researchers in FTE: **1 – 4**

The Graz Energy Agency advises and conducts research into saving energy, increasing energy efficiency and using renewable energies.

Research Priorities



The focus is on the survey, evaluation and dimensioning of efficient hydrogen production plants based on renewable energies and taking into account renewable energy production and storage by means of intelligent energy management. Different fields of application in industry and mobility are considered and evaluated through economic and ecological analyses. In the lighthouse project move2zero, we are looking at the optimal use of hydrogen-powered buses, including infrastructure, in urban transportation.

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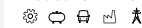
WIEN

Vienna University of Technology

NOE: H₂ researchers in FTE: **30+**

The Vienna University of Technology is Austria's largest research and educational institution within the field of natural sciences and applied technology. More than 4,000 scientists conduct research on Technology for People, covering five main research areas and eight faculties. As a driver of innovation, Vienna University of Technology facilitates cooperation, both strengthening the business location and contributing to the prosperity of society.

Research Priorities



Selected technology development and projects include, for example: pure hydrogen from the natural gas network using a new and efficient filter and compressor system HylyPure®; green fuels from biogenic waste – flexible production of valuable energy sources from various residues; investigation into the Sorption Enhanced Reforming process (calcium looping) for the generation of a hydrogen-rich gas or hythane; digital twins for Energy 4.0 – to reduce total energy consumption, CO₂ emissions and costs, taking into account different energy sources (electricity, heat, H₂) and enabling optimum cross-sector coupling (industry, buildings, mobility); materials engineering and chemical processes for the use of H₂; Energy Economics Group concerned with developing economic models and scenarios for energy.

Research Facilities

A comprehensive range of laboratory and test facilities are available.

Contact Persons

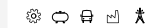
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AIT

Vienna/NOE: H₂ researchers in FTE: **30+**

The AIT Austrian Institute of Technology is Austria's largest non-academic research institution and in Europe the foremost authority on the “Grand Challenges” of central infrastructure. The Center for Energy covers a portfolio of topics based on three central systems: Public Energy Supply Systems, Industrial Energy Systems and Cities & the Built Environment.

Research Priorities



Under the topic of hydrogen, research is focused on the following: Integration of hydrogen technology in the energy infrastructure for effective cross-sector coupling, taking into account energy management aspects. Application of hydrogen feedstock and energy in industrial processes to decarbonise industry.

Research Facilities

Laboratory facilities for the development of materials and processes in electrolysis technology (PEM, AEM, SOE, PEC) for water splitting and/or CO₂ reduction. AIT SmartEST laboratory for (EN ISO/IEC 17025 accredited) testing of components and systems with simulated networks and primary energy sources. AIT H₂LAB test and development infrastructure for hydrogen and hybrid power plant technology up to 1.5 MW connected load (from 2024).

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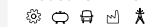
OBERÖSTERREICH

Energy Institute at the Johannes Kepler University

LinZ/NOE: H₂ researchers in FTE: **15 – 29**

With around 80 R&D projects each year, the Energy Institute conducts activities, under the three departments of Energy Industry, Energy Law and Energy Technology, into further development of an energy infrastructure that has a positive influence on living, economic and environmental spaces, thus strengthening European economies and reducing fossil fuel use as far as possible.

Research Priorities



In addition to techno-economic and ecological analyses of the range of Power-to-X pathways, the Energy Institute at the JKU Linz also analyses the socio-technical and legal challenges for the production and use of Power-to-X products

Contact Person

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WIVA P&G

Linz/NOE: H₂ researchers in FTE: **1–4**

Association for the promotion of technology R&D in the field of hydrogen and renewable gases.

Research Priorities

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WIVA P&G conducts R&D into all the key issues related to hydrogen. Over the next few years, the association will demonstrate how Austrian technology, already tried and tested in the domestic market, can actively reduce greenhouse gas emissions and, therefore, not only serve the Austrian economy as an export hit, but also make a significant contribution to reducing greenhouse gas emissions worldwide.

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K1-MET

Linz/NOE: H₂ researchers in FTE: **5–14**

K1-MET GmbH is one of the leading international metallurgical centres of excellence for ferrous and non-ferrous metallurgy based in Austria. Funded under the Austrian COMET Competence Centers for Excellent Technologies program, research work is conducted under four research areas: 1) Raw Materials and Recycling; 2) Metallurgical Processes; 3) Low Carbon Energy Systems and 4) Simulation and Analyses.

Research Priorities

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Direct use of H₂ as a substitute for fossil energy sources (carbon direct avoidance) or as a reaction medium with CO₂ for conversion into usable materials as a CO₂ reduction option (carbon capture and utilisation).

Research Facilities

Pilot plant for hydrogen plasma reduction smelting for production of CO₂ emission-free steel, CO₂ capture plant and catalytic methanation plant.

Contact Person

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FH Upper Austria

Wels/NOE: H₂ researchers in FTE: **5–14**

Since 2003, the University of Applied Sciences (FH) Upper Austria has been conducting innovative R&D oriented towards application, covering 10 centres of excellence and areas of focus: Computer Science, Communication, Media, Health & Social Affairs, Management, Energy, Food, Technology and Environmental Science. The FH Upper Austria offers a total of 7 energy degree programs: Applied Energy Technology, Electrical Engineering, Sustainable Energy Systems, Energy Informatics and, from autumn 2023, the BA course in Sustainable Solutions.

The Wels Campus of the FH Upper Austria supports industry in the implementation of H₂ technology. A dedicated Professor of Hydrogen Technology has been active at the Wels campus since October 2022.

Research Priorities

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Materials and components for H₂. H₂ for use in CO₂-intensive industrial processes. Components relevant to H₂, such as sensors, valves or fuel cell systems and materials, in particular metals and plastics (wear, brittleness, gas-tightness). Energy storage for H₂ and storage systems.

Research Facilities

Laboratory scale H₂ electrolysis plant, facilities for testing components relevant to H₂, such as sensors, valves or fuel cell systems and materials, in particular metals and plastics (wear, brittleness, gas-tightness), operational simulation methods for evaluating energy storage with H₂ and other energy storage processes

Contact Person

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Profactor

Steyr/NOE: H₂ researchers in FTE: **1–4**

Research has been conducted, under the H₂Desorb FFG project, into the improvement of (stationary) H₂ storage systems, along the full value chain from generation to storage and application. Profactor has been responsible for nano-structuring of magnesium wire pellets, used in the project.

Research Priorities

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Production Improvement. Support to improve the production and quality control of the individual components of the fuel and electrolyser

systems (surface inspection and projection-based assistance in assembly) as well as in the final inspection of the overall systems (machine learning during operation and the end-of-line test).

Contact Person

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TIROL

University of Innsbruck

NOE: H₂ researchers in FTE: **5–14**

With a focus on promoting green chemistry and sustainable technology, the Institute of Physical Chemistry conducts innovative research in catalysis, electrochemical processes and batteries.

Research Priorities

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Basic Research. Study of interfacial processes to determine the reaction pathways and mechanisms that occur at the solid-liquid interface during electrochemical energy conversion and storage processes. The research approach is based on the development and application of in-situ and ex-situ analysis techniques applied to systems of increasing complexity (from single crystal model electrodes to more complex nano structured materials).

Research Facilities

Several multi- and single-channel potentiostats with modules for electrochemical impedance spectroscopy (EIS), a bipotentiostat with a configuration for rotating ring electrodes (RRDE); Scanning probe microscopy systems (SPM). Annealing furnaces; FT-IR spectrometer with an additional ATR unit; DEMS instrument NAP-XPS with manipulator for electrochemistry XPS/UPS, XRD, SEM.

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FEN Research

Innsbruck/NOE: H₂ researchers in FTE: **5–14**

FEN Research is an independent research company for basic and industrial research and experimental development, as well as knowledge transfer through teaching & publications.

Research Priorities

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Research activities are focused on multi- and interdisciplinary issues and tasks related to business cases, whereby the emphasis is on systems and logistics research to build a green hydrogen economy.

Research Facilities

The EWest and HyWest research centres, set up at the Green Energy Center Europe location in Innsbruck, specialise in Power on Demand and Power to Hydrogen processes, which are critical for the conversion of energy systems.

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SALZBURG

University of Salzburg

NOE: H₂ researchers in FTE: **1–4**

Research Priorities

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Within the topics of research, energy storage and conversion are currently the most relevant. The long-term goal is to contribute to the development of solutions in the field of energy storage using batteries or fuels such as hydrogen. This is being pursued both through the development of functional materials, with the assistance of (scalable) solid-state chemical syntheses and simple deposition techniques, and through the development of basic scientific understanding related to the structure-property relationships of energy storage materials, subsequently leading to improved properties and durability of these materials.

Research Facilities

Equipment for determination of the photo current in a photoelectrochemical test apparatus, determination of the Faraday efficiency in electrochemical hydrogen production, and determination of the hydrogen production rate of photo catalysts.

Contact Person

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BURGENLAND

FH Burgenland

Pinkafeld/NOE: H₂ researchers in FTE: **5–14**

Research Priorities

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A whole-system, holistic R&D approach is taken, including passive efficiency measures for building physics, research into decentralised energy supply solutions, which integrate regenerative energy and the necessary intelligent communication between energy generation, distribution and consumers. A particular focus of the R&D activities is the development of scalable load and storage management solutions that take into account sector coupling technology (heat pumps, PV, battery storage, electromobility, electrolysis, fuel cells, etc.).

Research Facilities

HiL environment for electrolysis and fuel cell system development, test building for SOFC and rSOC system integration and for the development of holistic energy management solutions, a range of gas supply and analysis systems, PEM & AEL field test systems, and monitoring systems.

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