

HyCentA Research GmbH at Graz University of Technology

Research Focus and ongoing Projects

DI Dr. Marie-Gabrielle Macherhammer

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Austria's Research Centre for Hydrogen Technologies since 2005



Extra-University Public Research Organization
at the **Graz University of Technology**



- **55 Researchers***
Mechanical Engineering, Physics, Chemistry,
Process Engineering, Electrical Engineering
- More than **70 projects** successfully finished
- More than **17 years** of expertise
- Modern testing infrastructure and HRS
- Covering all fields of hydrogen R&D
- **International Network**

* >160 Researchers in H₂-Area at TUG



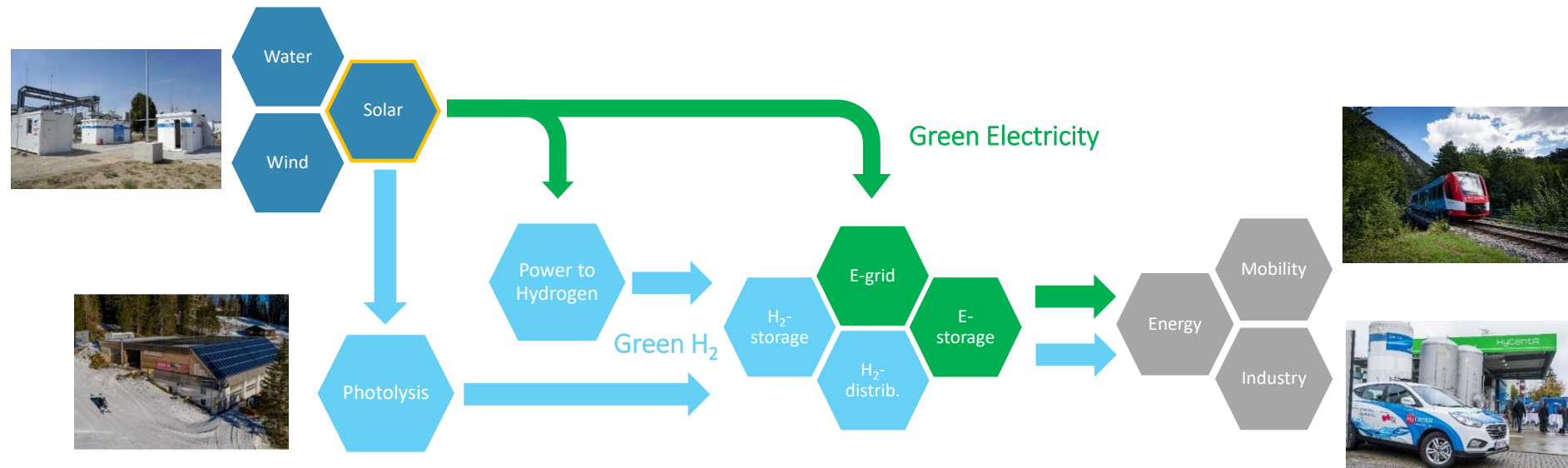
TU Graz at European Top Level

~1970 Prof. Kordesch



- **TU Graz is nucleus and core center** of technological R&D in Austria
- Research in electrochemistry and hydrogen **since the 1970s**
- **Unique** laboratory and **research infrastructure** – approx. 50 M€ value
- Various expertise provided by **160 scientists** – under Top 5 in EU
- From fundamental research to applied technologies and systemic aspects – **TU Graz is „One-Stop-Shop“ of H₂ technology research**

Driving the sustainable hydrogen society through research!



Integration of renewables

- Integrate production surpluses
- Direct water splitting

Energy conversion

- Electrolysis - compensate temporal volatility
- H₂ as secondary energy carrier – energy storage

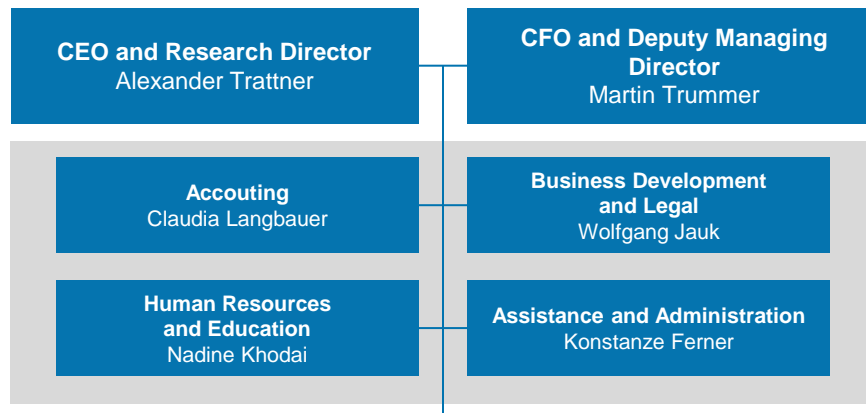
Storage and distribution

- Centralized and decentralized storage
- Long-term storage
- Efficient transport over long distances

Zero Emission Usage

- Energy Services – CHP
- Mobility with Fuel cells
- Industry and high-temperature processes

Organisational Chart



Electrochemical Technologies Head: Marie Macherhammer



Research on electrolysis technologies, from cell to stack to system, as well as on electrochemical compression and fuel cells

Infrastructure Technologies Head: Markus Sartory



Research on generation, purification, compression, storage, distribution and delivery technologies for the optimised configuration of hydrogen infrastructures and their systemic integration in industry and the energy sector

Measuring and Test Systems Head: Stefan Brandstätter



Research on measurement and test systems in the field of hydrogen technologies with specialisations in material investigations, gas analysis, electrolysis, storage systems and fuel cells

Mobility Technologies Head: Patrick Pertl



Research on fuel cell propulsion solutions for land, water and air as well as fuel cell stacks and systems for mobile and stationary applications, including on-board hydrogen storage systems

Research & Development

Simulation

Testing

Teaching

- **Electrolysis**
 - Design, testing and certification: cell, stack, system und overall facilities
 - Concept development, testing, e.g.: GH₂ compression systems
- **H₂-Infrastructures - Storage and Distribution**
 - Concept development and testing of GH₂ storage systems
 - Alternative technologies: hydride storage und LH₂ systems
- **Fuel Cells – Mobility and Stationary Power Systems**
 - Design & testing: stacks, BoP, systems & controls
 - R&D and testing of advanced fuel cell systems
- **Measurement Systems and Test Center**
 - Mass and gas quality measurements
 - Advanced R&D infrastructure – customer specific tasks



H₂-Refueling
350 & 700 bar



GH₂ test stand up to
1000 bar
with climate chamber



Two test cells for
components,
stacks & systems



Fuel cell system test
stand 160 kW
with climate chamber



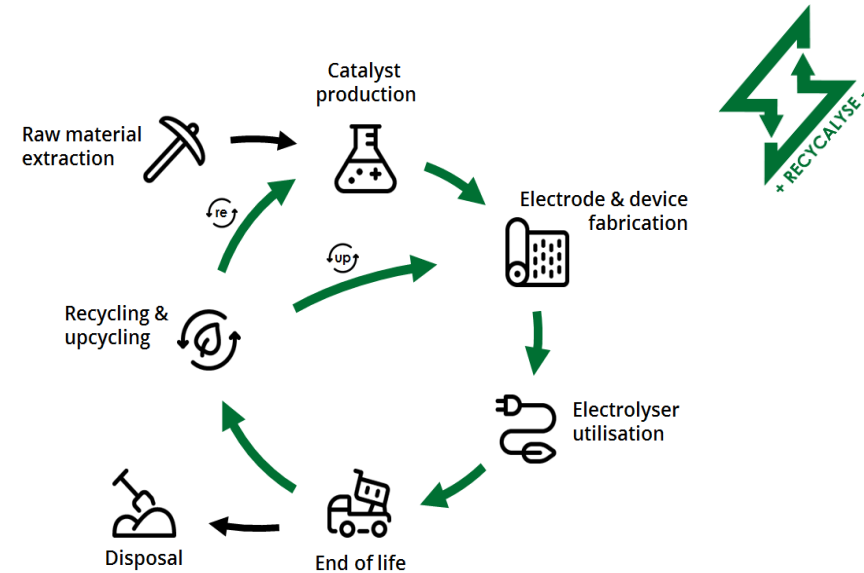
Single-cell electrolysis
lab and short-stack
testing




H₂ gas quality
laboratory

The project aims to develop new **electrocatalysts** for PEM electrolysis systems with increased **performance**, reduced consumption of **critical raw materials**, reduced **environmental footprint** and reduced total costs.

- **Upscaling** of the recycling process for critical raw materials
- Usage of **sustainable materials**
- Application of a **circular economy** in which critical raw materials are recovered and regenerated
- Analysis of the **entire value chain** from production of the catalyst to system integration and demonstration of the system

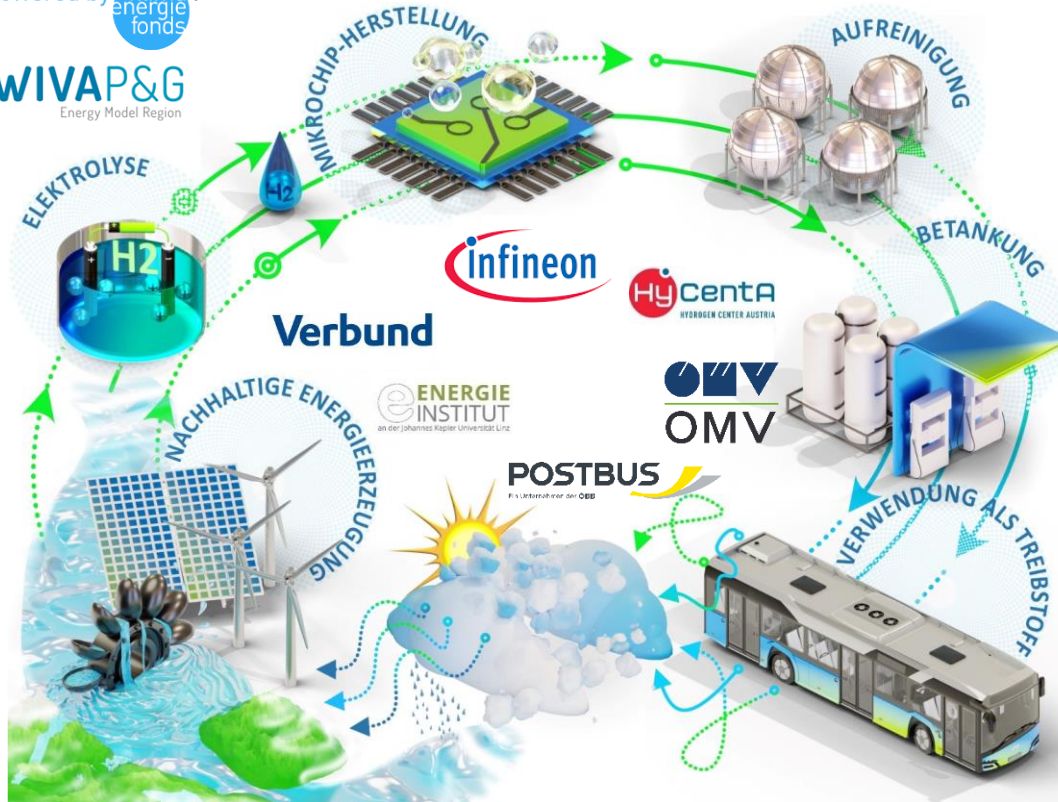


Industry – Recycling of Hydrogen

LAND  KÄRNTEN **H2Carinthia = H2Pioneer and ReHyB**

powered by 

WIVAP&G
Energy Model Region

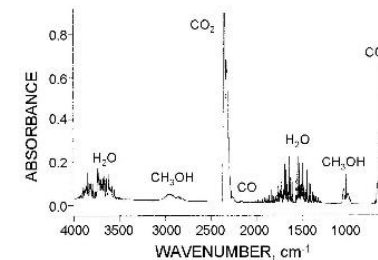


- Green H₂ produced on site instead of delivered grey H₂
- Purification to 8.0
- Usage in industry process (epitaxy)
- Purification to 5.0
- Usage in mobility
- Decoupling and bus refuelling station

See more: Richter, M., et al.: "Evaluierung von Wiederverwertungsmethoden für Wasserstoff in Halbleiterindustrieprozessen", 16th Symposium Energieinnovation, Graz/Austria, 2020.

Drive expansion of H2 refueling station network by developing solutions for the official verification of gas quality and dispensed hydrogen mass at the refueling station

- Development of modern measurement techniques for gas quality and mass – fulfill legal requirements and enable the operation of hydrogen refuelling stations
- Upscaling of green mobility in Austria – renewable produced hydrogen and improved distributions concepts
- Scenarios and concepts for the expansion of green H2 production and associated H2 logistics



Verbund



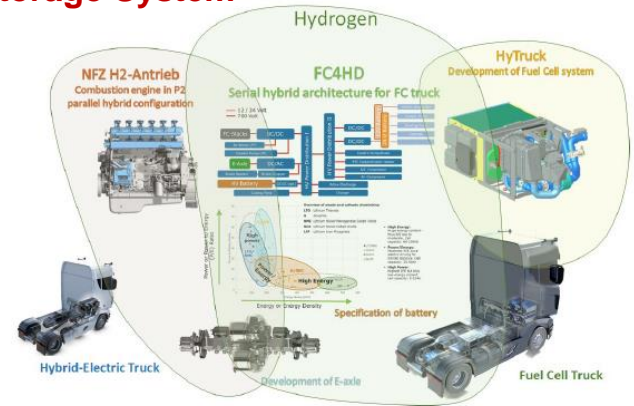
Project HyTruck (2019-2022) & FC4HD (2021 – 2024) HyCentA HYDROGEN CENTER AUSTRIA

Development, build-up, calibration and validation of a **HD fuel cell system** and its key technologies to meet **performance, efficiency, reliability and lifetime criteria** of commercial vehicles

AVL FCS:

- **Power: 156 kW**
- **Power Density: 0.33 kW/L**
- **Power/Weight Ratio: 0.46 kW/kg**
- **Efficiency @max Power: up to 50%**
- **Peak Efficiency: up to 60%**

- **Demonstration of a 40 t fuel cell truck**
- **Real-world operation** in a logistic environment
- **Validation of technical performance** and of economic and ecological aspects → **international market introduction**
- **Simulation and Design of the Hydrogen Storage System**



 rosenbauer

 cemt

 ivt
Institut für
Verbrennungskraftmaschinen
und Thermodynamik

 fen systems

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 DB SCHENKER

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POWERTRAIN TECHNOLOGIES

 PRODUCTBLOKS

 WIVAP&G
Energy Model Region

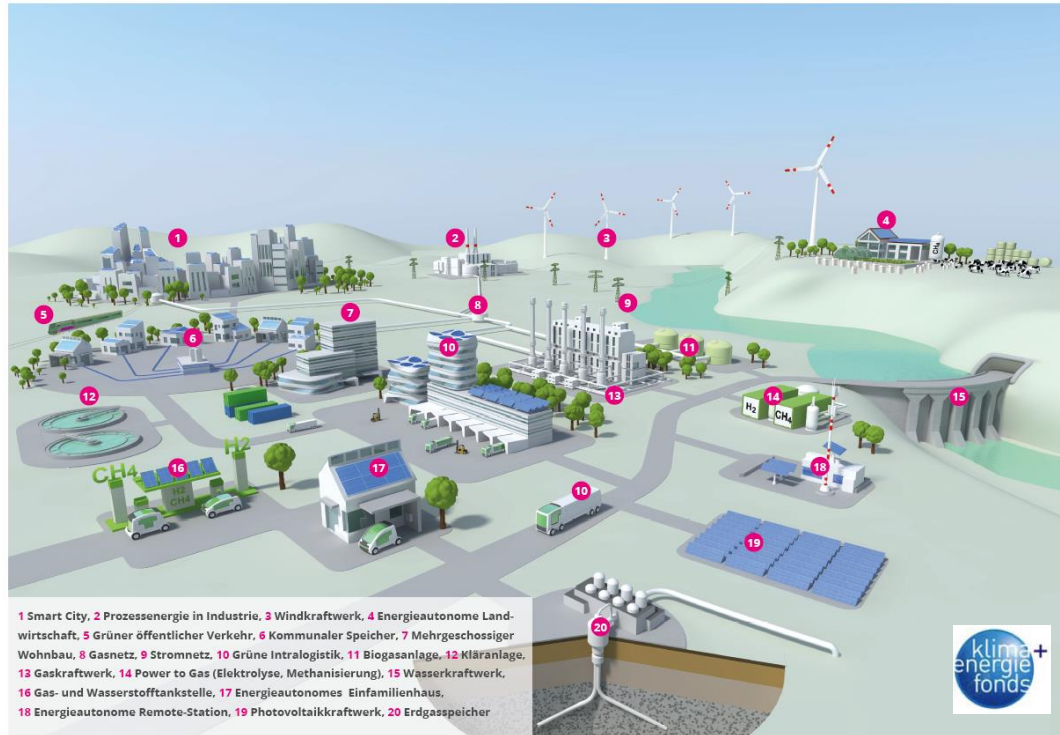
 HyCentA
HYDROGEN CENTER AUSTRIA

 MAGNA

 Hydrogen
Europe

 OMV

Development and Demonstration of Hydrogen based energy system from renewable sources for all economic sectors



Landesgesellschaft Österreich



Making our world more productive

Wir denken an morgen



Contact

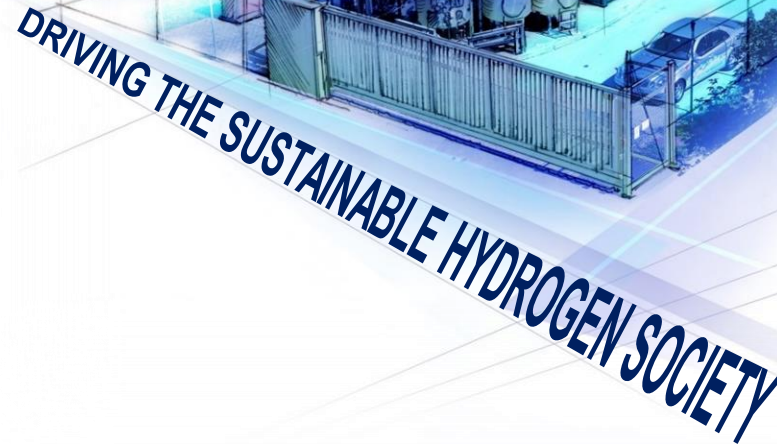
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DRIVING THE SUSTAINABLE HYDROGEN SOCIETY