

HyCentA Research GmbH

Shaping the Sustainable Hydrogen Society

Project References Area 3: Green Mobility
Graz, August 2026

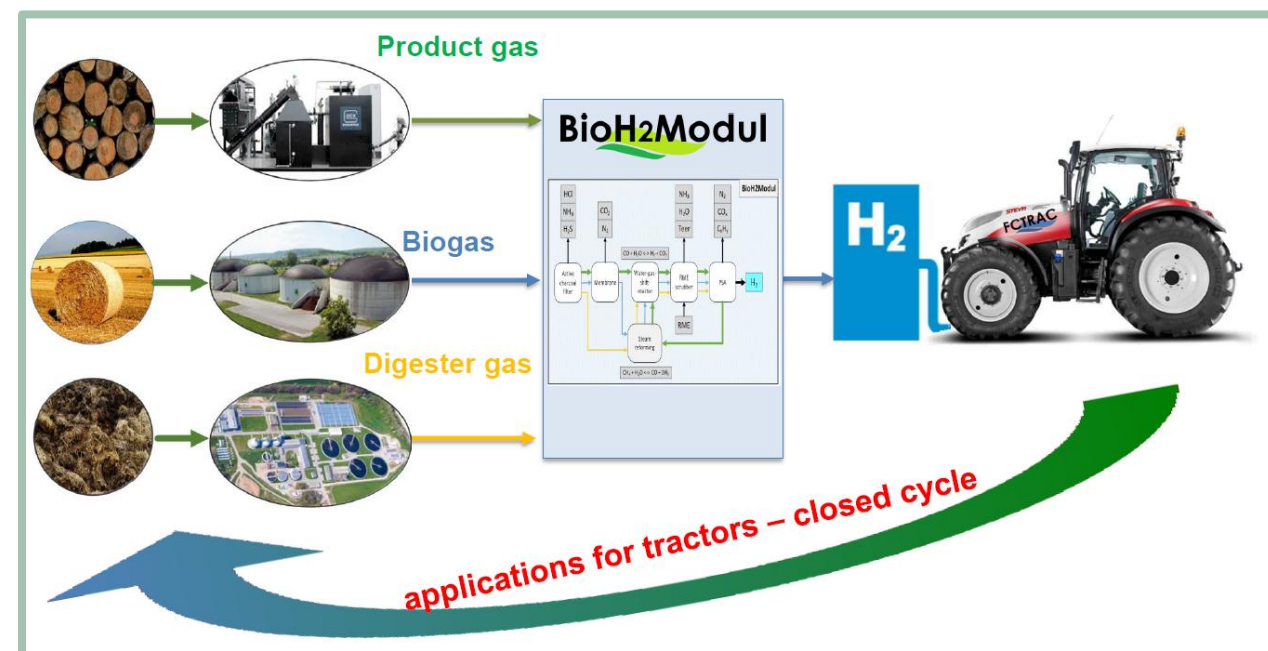


Project FCTRAC 2020-2024

The goal of the project **FCTRAC** is the development of a **fuel cell tractor**. For refueling a **hydrogen processing plant** is developed which can be connected as a **flexible system** for **local hydrogen production** by connection to block heat power plants, biogas or sewage plants.



- Development of a **Zero Emission Tractor** with fuel cell system for everyday use in agricultural enterprises
- Realization of a **modular gas treatment and hydrogen supply route** at the use of biomass synthesis gas with refueling option



Projekt HYTRAC



Energy Hub Neusiedl am See

Wind & PV

Haushalte

Wärmenetz

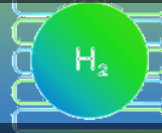
Industrie



El.-chem.
Compression

Metal Hydride
Storage

H₂ Compression and Storage



Traktor HYTRAC

- Zero Emission
- H₂ interne VKM
- 100 kW konst. Leistung
- > 25 kg onboard H₂-Speicher

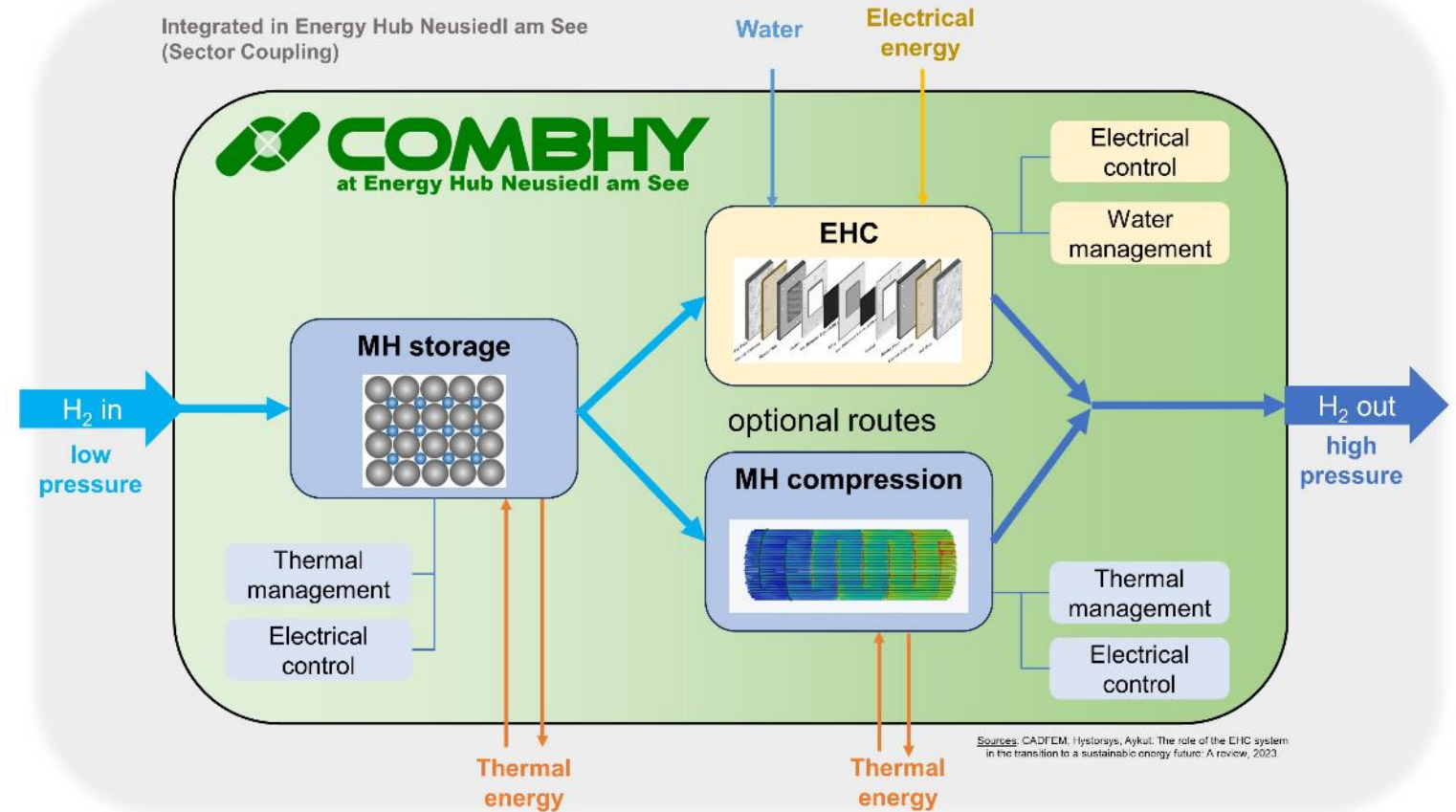


Projekt HYTRAC

- Programm: ZEM (Zero Emission Mobility)
- Laufzeit: 4 Jahre
- Projektvol.: 4 Mio € gesamt; € 1,375 Mio HyCenta

System CombHy

- „Hoftankstelle“ als Insellösung in Containerbauweise
- Aufbau am HyCentA, Test und Betankung am Energy Hub Neusiedl am See (Bgld.)
- Kombination innovativer Technologien (EHC, MHHC, MH)
- Nutzung von Wärme



- Austrian flagship project
- Replacement of industrial truck batteries by **fuel cell-range extender** and H₂-high pressure tank
- Onsite H₂ production by decentralized reforming of bio-methane
- **European's first hydrogen-indoor refuelling infrastructure**
- Winner of Energy Globe Award Fire 2014

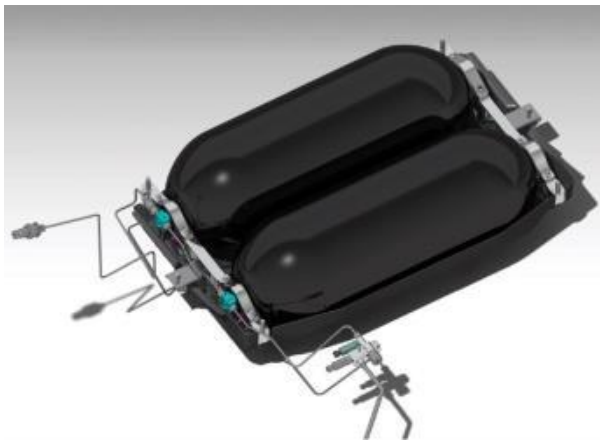




Project FC REEV 2014 – 2017

Fuel Cell Range Extended Electrical Vehicle

- Extension of a battery-powered vehicle with a **PEM fuel cell system** (25 kW)
- Zero emission
- **700 bar** hydrogen storage system
- extended driving range (> 400 km)

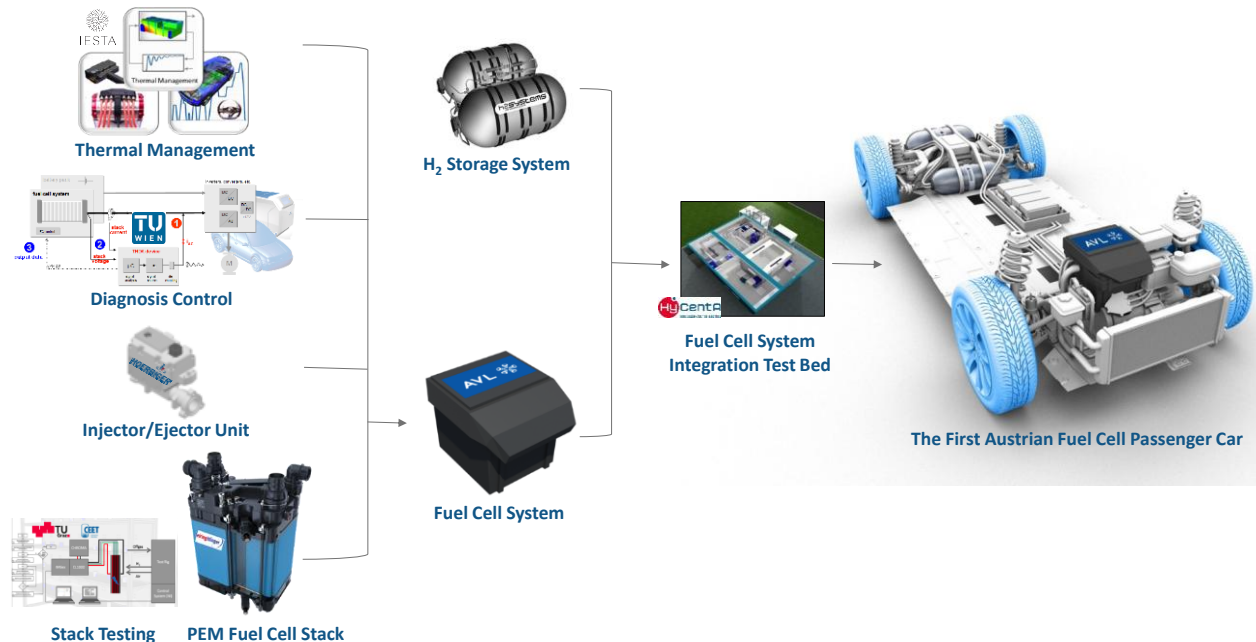




Project KEYTECH 4 EV 2017-2021

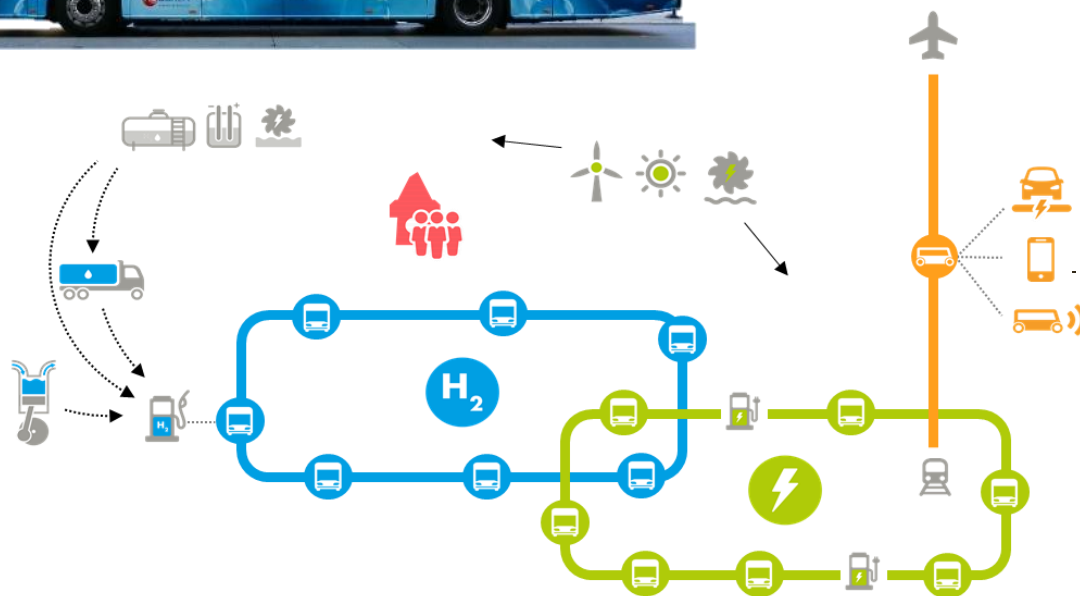
Key Technologies for Low-cost Electric Vehicle Platforms

- Innovative **key technologies** for the demonstration of green hybridized electric vehicle, with particular focus on **energy efficiency** and **costs**

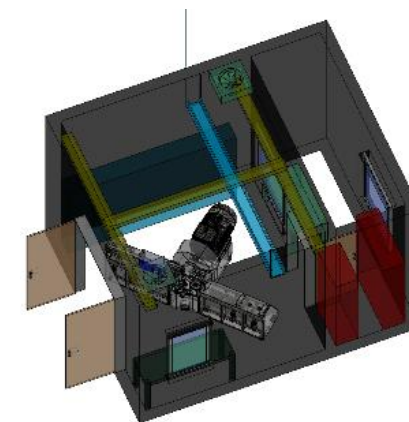




Project move2zero 2019 – 2023



- **Decarbonisation** of entire rural bus fleet of Graz
- **Demo fleet** with 7 BEV- and 7 FCEV-Busses, 350 bar refueling infrastructure at bus center
- Modelling of **ideal technology split** between BEV and FCEV busses



- Development of novel and efficient **electrochemical and mechanical hydrogen compression** technology for high output pressures



Project HyTruck 2019 – 2021

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**



- **Modular** power for different CV sizes
- **100-300 kW**
- **> 1,000 km** range
- **> 20,000 h** lifetime



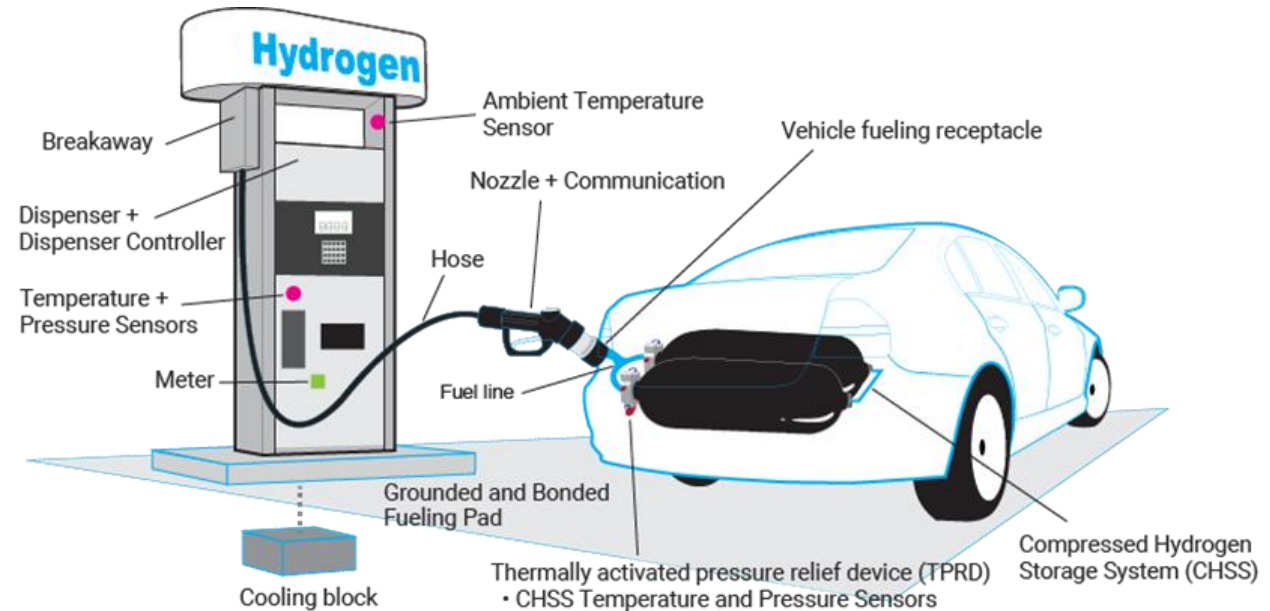


Project HERO 2020-2023

The goal of the project **HERO** is the development of a **cost-efficient, optimized and safe hydrogen refueling station**, which will also be developed for different use-cases and therefore help to represent a successful business case



- Design of new **dispenser** systems and optimization of existing **refueling strategies**
- Increased **efficiency** while maintaining highest safety standards
- Innovative, modular **cooling concepts** for optimized operation strategies for **350 and 700 bar refueling**



EDC – Anlagentechnik GmbH.





Decarbonization of Winter Tourism by Hydrogen Powered Fuel Cell Snowmobiles



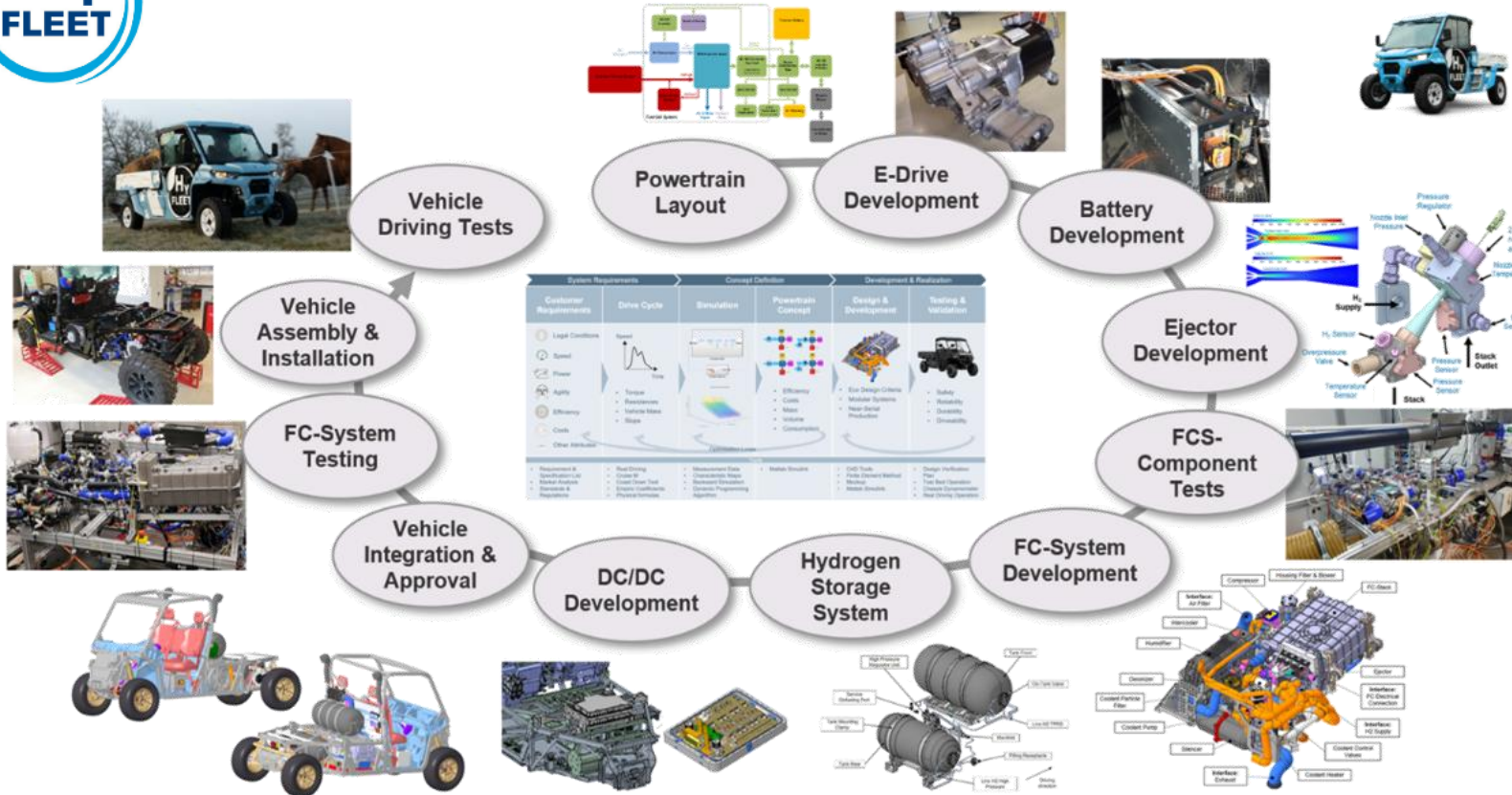
- Construction of the First **Hydrogen Filling Station** in an Alpine Environment (highest filling station in Europe)
- Direct Coupling of **Photovoltaic** and **Electrolysis** System
- Development of a **Fuel Cell System** for **Snowmobiles**
- Operation and Evaluation under **Real Operating Conditions**



Project HyFleet 2021 – 2025



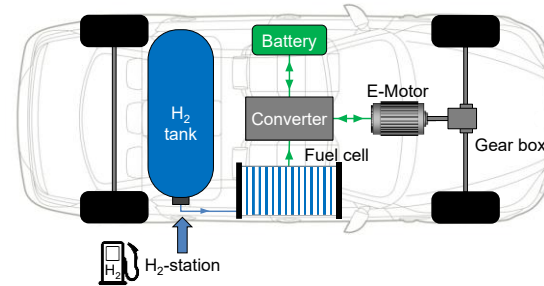
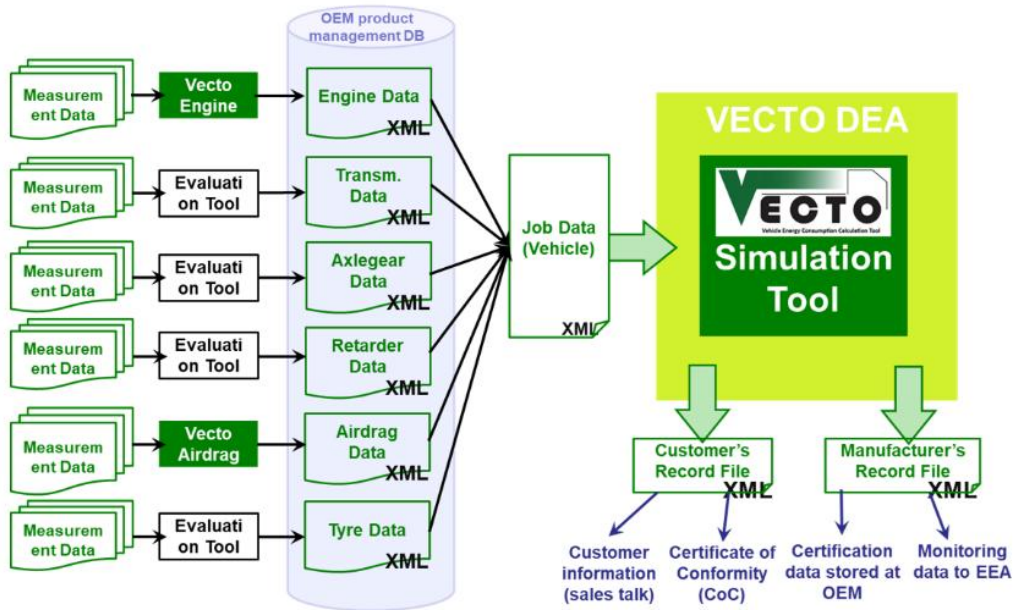
Decarbonization of Mobility by Hydrogen Powered Special Vehicle Fleets



- Development of a **FC Off-Road Vehicle**
- High-Level FC System Research to **Reduce System Complexity**
- Development of a Modular and Scalable **H₂ infrastructure**
- Development of **Supply Chain** and **Core Competences**



Further Development and update of VECTO with new technologies



- **Simulation of FC-based Powertrains in VECTO**
- Development of a **framework** and **testing procedure** for FC systems
- Rise **awareness of relevant stakeholders** for the topic
- Draft of an **annex for FC systems** to the legislation



Hydrogen Tunnel Risk Assessment



- Determination of the Effects of **H₂ Powered Vehicles** on the Tunnel Safety
- Examination of Consequences of an **Accidental Release of H₂** on the Basis of **Numerical Simulations**
- **Recommendations** for Tunnel Users and Operators to **Adjust the Infrastructure** for Future Needs



IEA AFC Annex 34 2022 – ongoing



International Energy Agency Technology Collaboration Program on Advanced Fuel Cells Annex 34

Members:



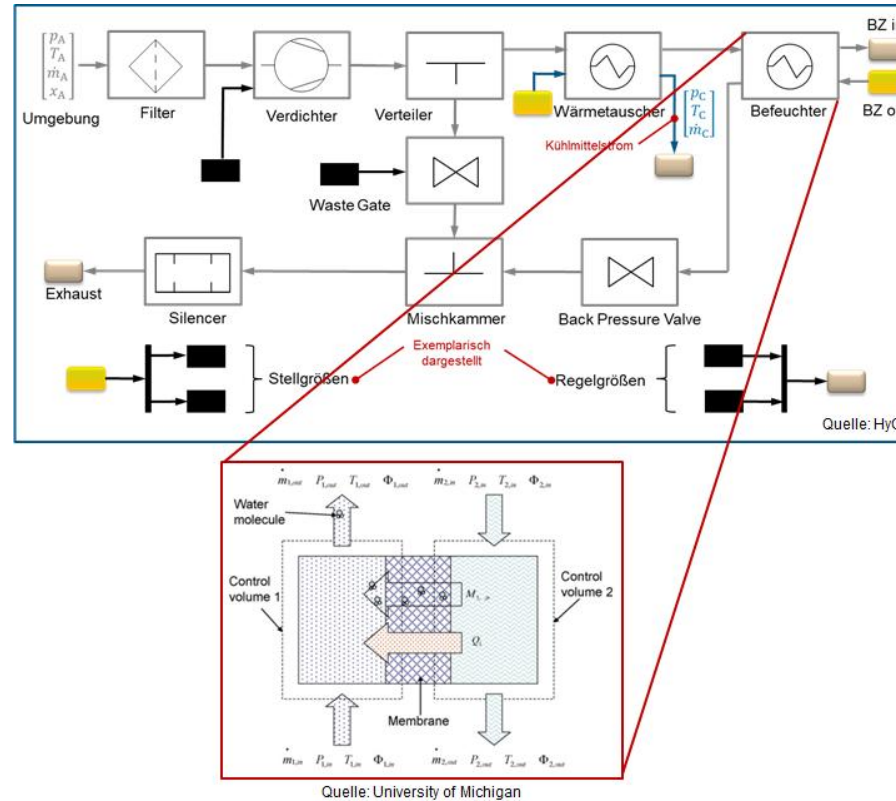
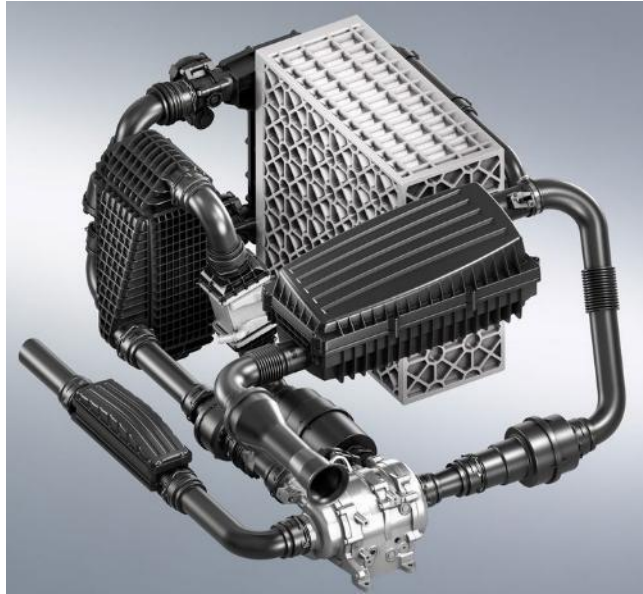
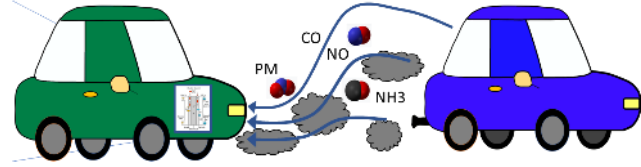
Funding institutions:



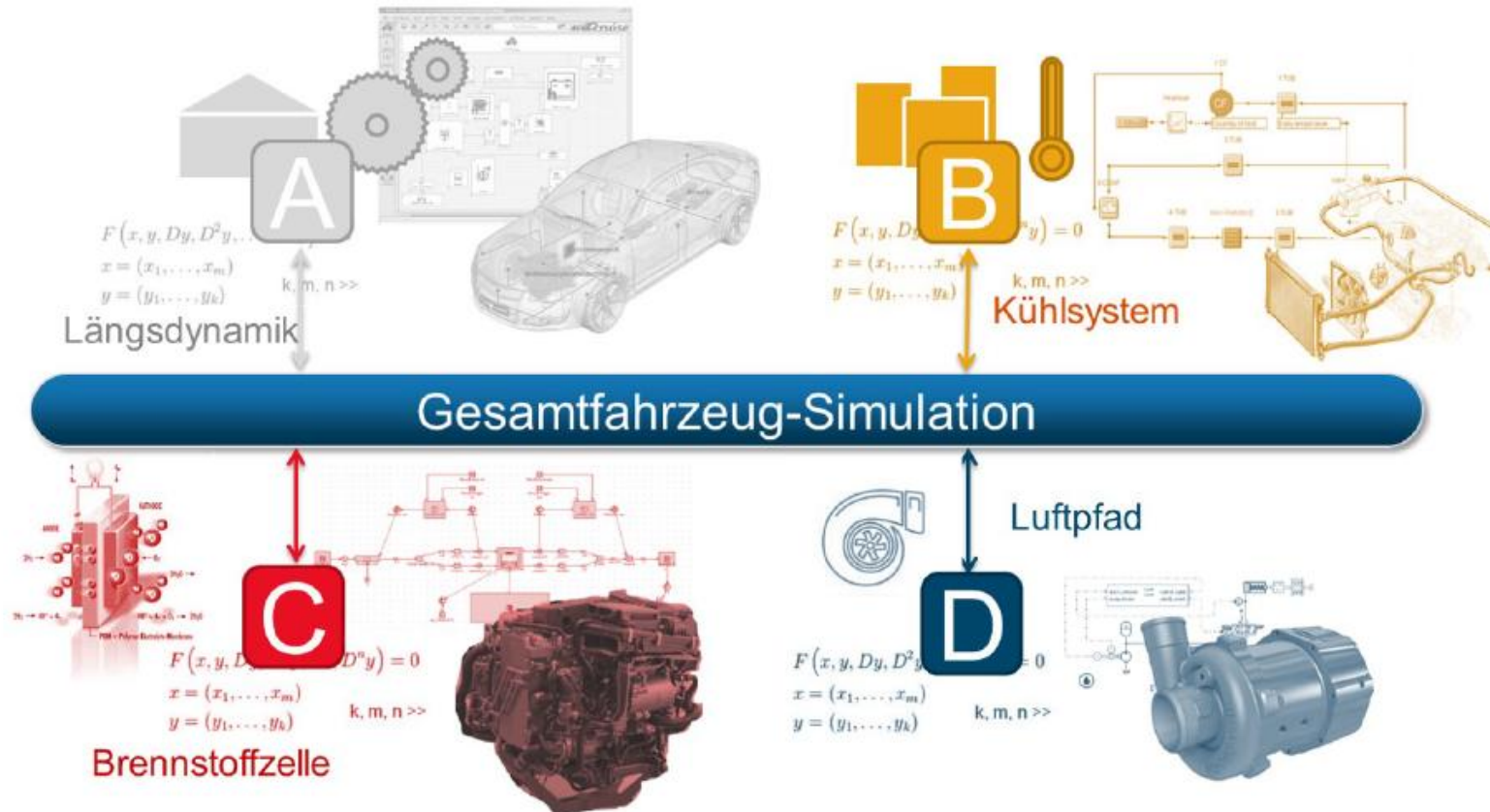
- Addressing the opportunities and barriers to **fuel cell commercialization**
- Addressing the advantages and disadvantages of fuel cells, the **further development** of storage media, the identification of **cost reduction potentials**, and the results analysis of **best practice examples**
- **Technology exchange** in an international environment
- Preparation of **recommendations for action for decision-makers**



Project B.GASUS 2021 – 2023



- **Impact of pollutant gases** on development & integration of fuel cell systems
- **Simulation** cathode sub system
- Optical accessible cathode side of a fuel cell
- Measurement methodology of locally resolved **pollutant gas determination**



- Modular **PEMFC system** for 100 - 200 kW
- **Multi-functional simulation model** for system development
- Special **focus on cathode path** (simulation, design, validation and optimization)
- **Cost analysis** of BoP components



Project FC4HD 2021 – 2024

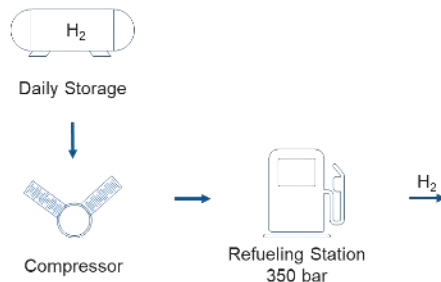


- Road demonstration of a **40 t FC truck**
- **Real-world operation** in a logistic environment
- **Validation** of technical performance & economic and ecological aspects → international market introduction

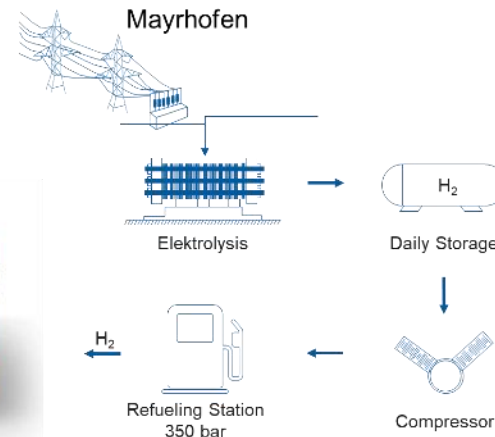


Project HyTrain 2020 – 2025

Development of the world's first hydrogen-powered narrow gauge train



Main refueling station

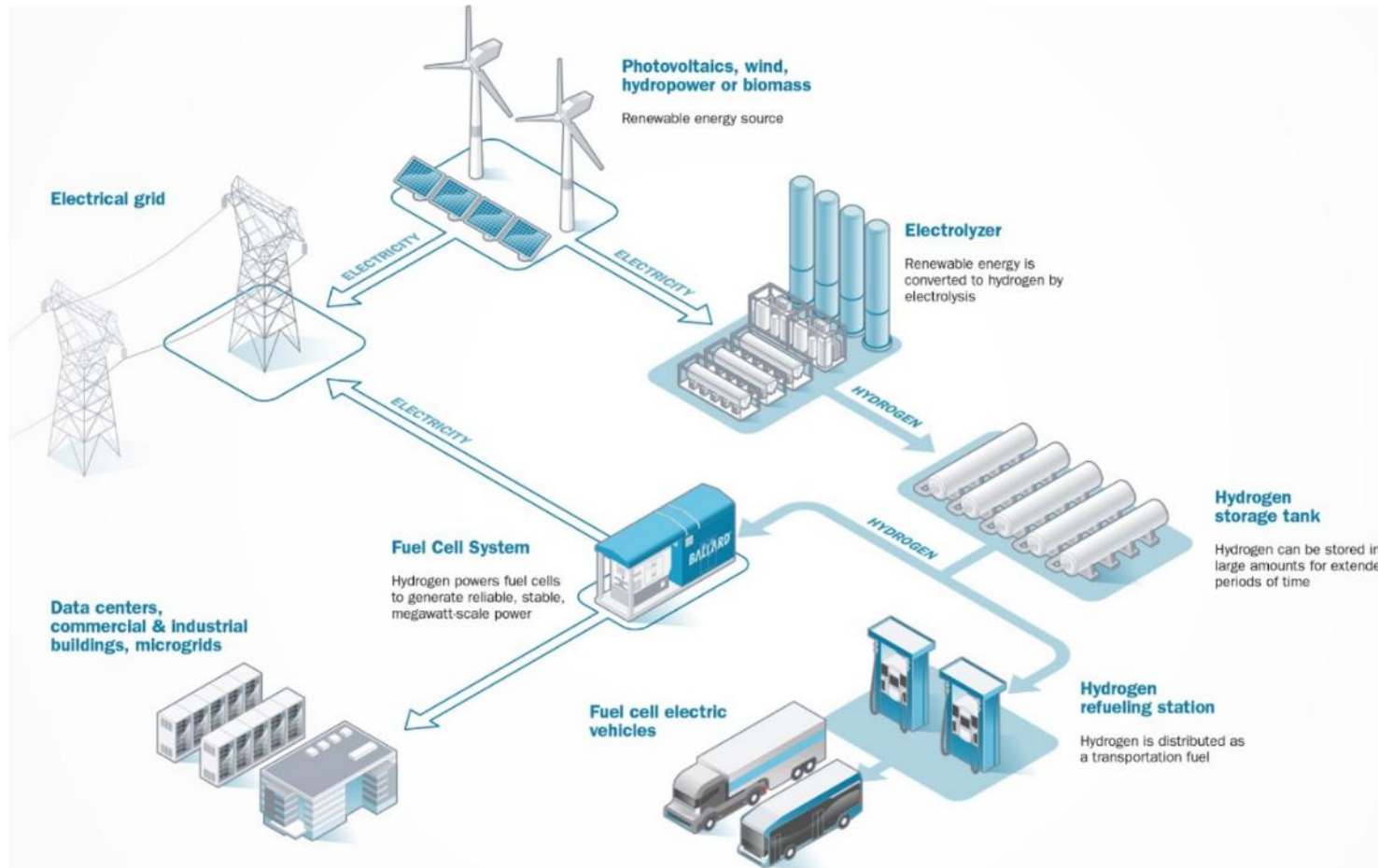


- Packaging – degradation – operation strategy
- H₂ infrastructure – production – storage - refueling
- Setup and testing of narrow gauge prototype train





Stationary PEM and SO fuel cell



- Optimization of **stationary fuel cells** (PEM and SO) for central and decentral applications regarding efficiency and costs.
- **Simulation** approach → multi-parameter optimizations (cell, stack, system)
- Improved cell **materials** and **industrialization processes**





Optimization fuel cell powertrain



- Optimization of **powertrain topology for busses**
- **Simulation** of entire powertrain and optimization based on **DOE method**
- Chassis dyno **testing**

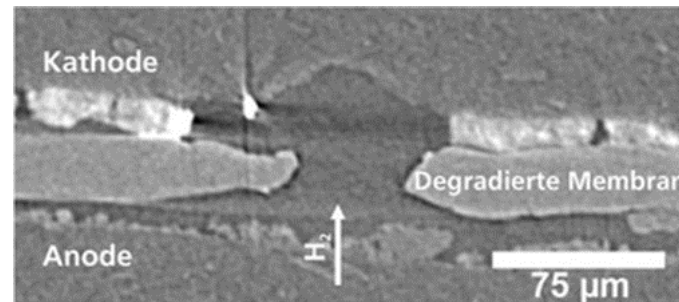
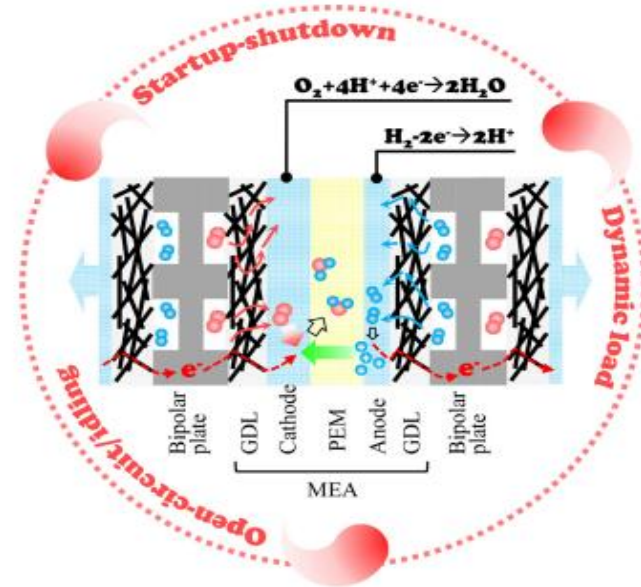
POSTBUS
Ein Unternehmen der ÖBB

itnA

HENN
CONNECTING COMPETENCE



Degradation of fuel cell systems



- Development of test methods for **accelerated stress tests**
- **Transfer of procedures/knowledge** from cell level on system testing and validation
- **Cross linking and improvement** of individual diagnostic tools into **tool chain**





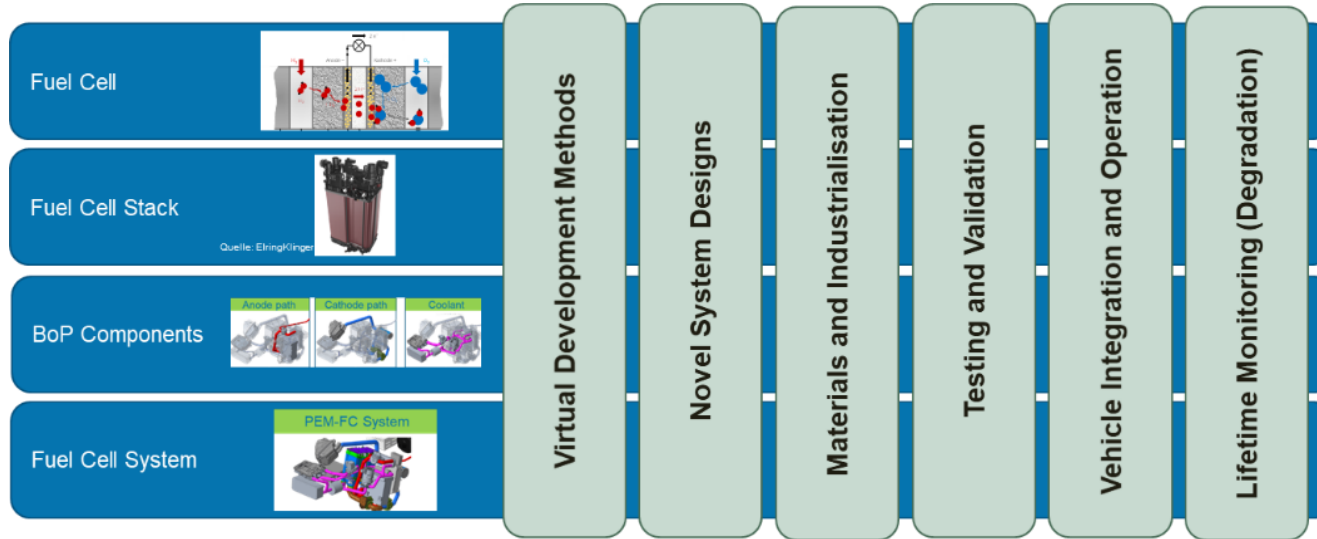
Project HyFiT 2023 – 2025



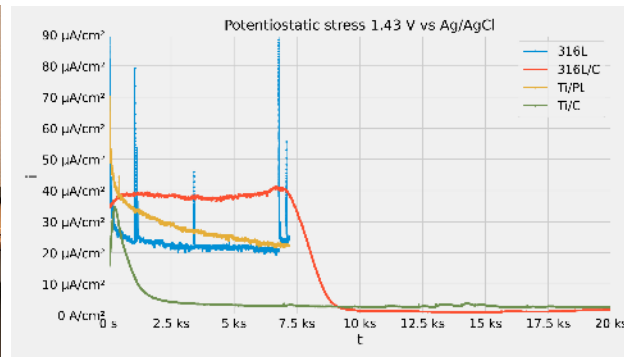
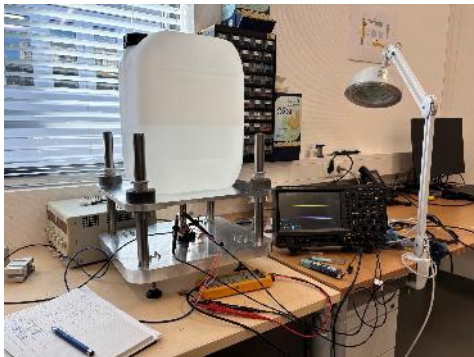
- **Thermal management** of heavy duty vehicles
- Design and testing of **novel radiator design**
- Testing of **fuel cell systems** to generate boundary conditions for **predictive thermal management**
- Cathode poisoning – filter loading
- Vehicle integration for fire fighting truck



Project GENIE 2023 – ongoing

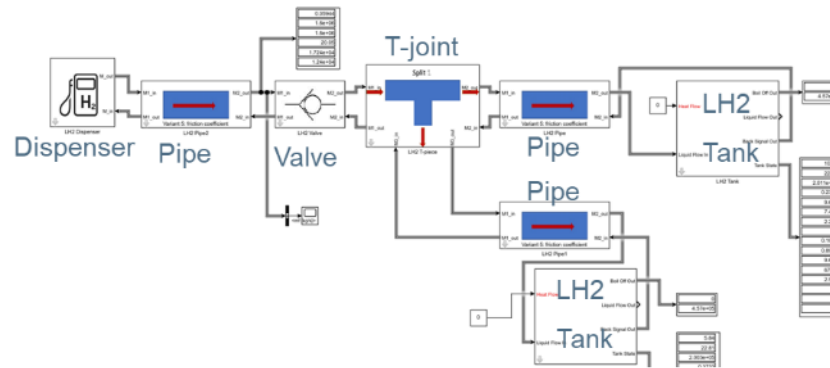
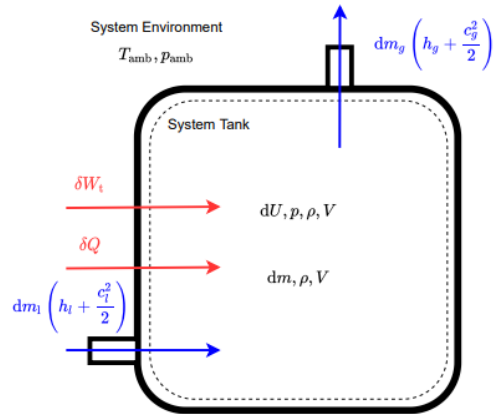
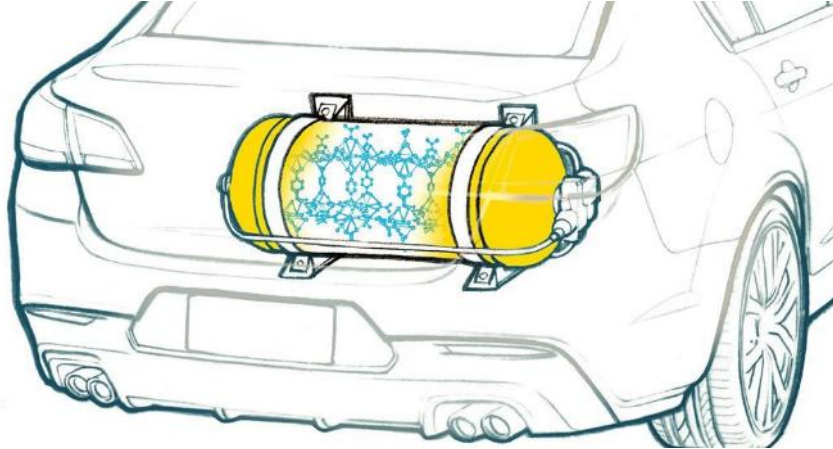


- Development of **PEM** fuel cells technology
- Minimizing the hurdles hindering broad PEMFC **commercialization** for heavy duty mobility applications
- **Simulation** of FCS technical scenarios via experimentally validated **virtual model**
- Focus on **Fluorine-free membrane**
- Optimization of **PGM** utilization
- **Bipolar plates coating** effect on durability and costs,
- **PEM degradation** phenomena and control **countermeasures**





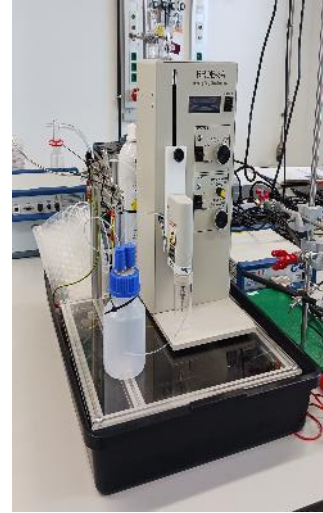
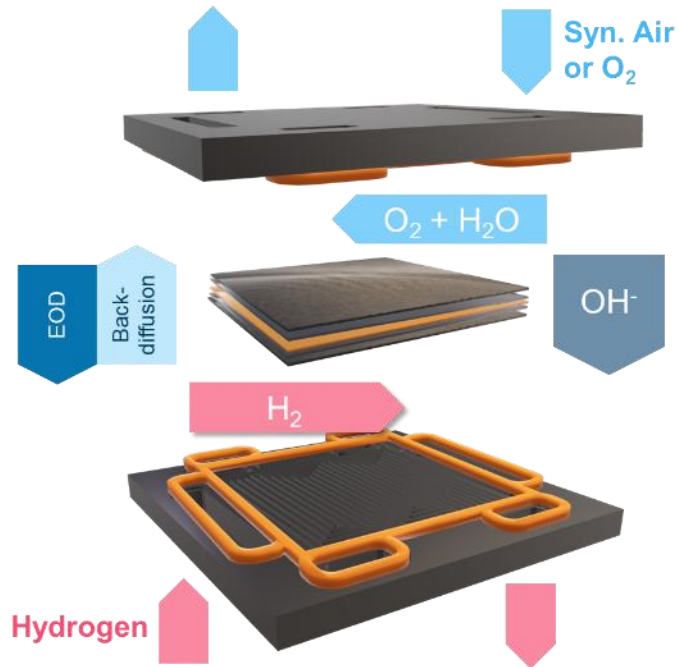
Project GHOST 2023 – ongoing



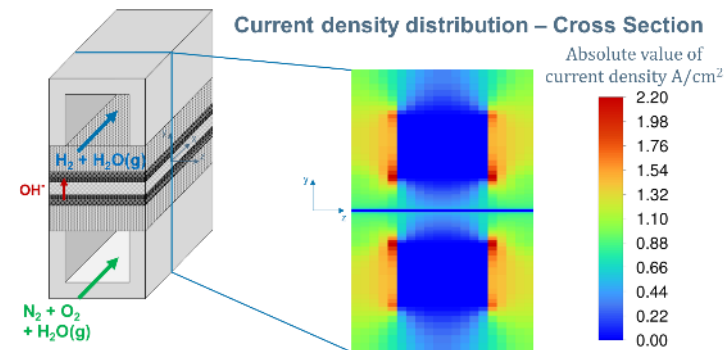
- **Improvement of hydrogen storage systems** for mobile applications and integration with hydrogen refueling infrastructure
- Decision matrix for **application-based storage type, safety/acceptance** protocol and **simulation platform** for aiding storage system development
- Research on **LH₂** and **cCh₂** storage
- Research on **metal hydride** materials
- Research on **infrastructure requirements** and refueling processes
- **Safety requirements** and **certification** of novel storage technologies



Project GAMBIT 2024 – ongoing



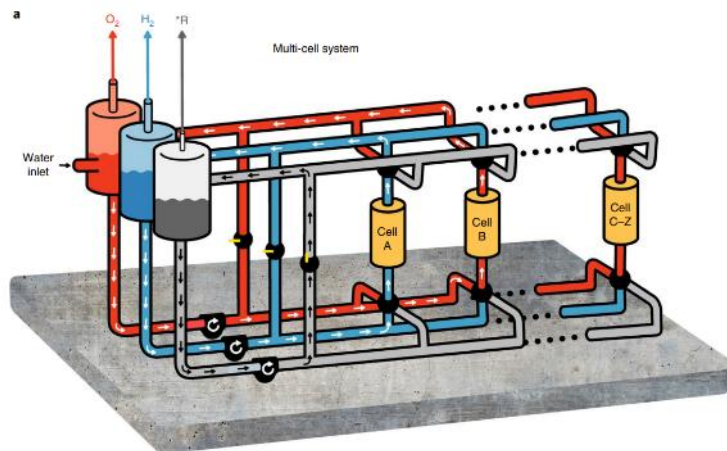
- Analysis of AEMFC key factors
 - Materials
 - components design
 - operating conditions
- Development towards higher specific performances and longer lifetime
- Assessment of AEMFC technology potential for the mobility sector
- Focus on fluorine-free reinforced membrane, low PGM loading, and degradation mitigation strategies



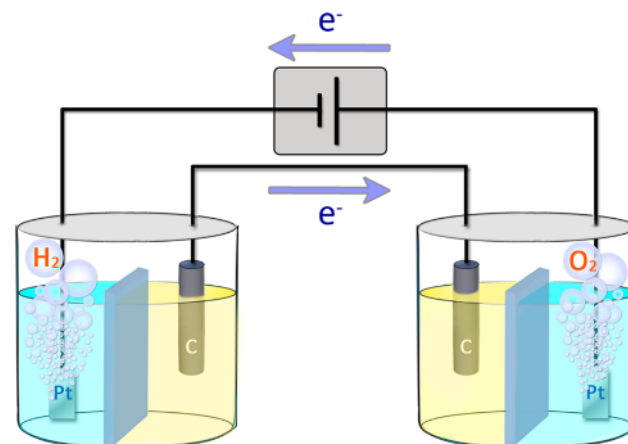


GRACE

Generation of Innovative Intermittent Half Cells



Source: H. Dotan et al.: Decoupled hydrogen and oxygen evolution by a two-step electrochemical-chemical cycle for efficient overall water splitting

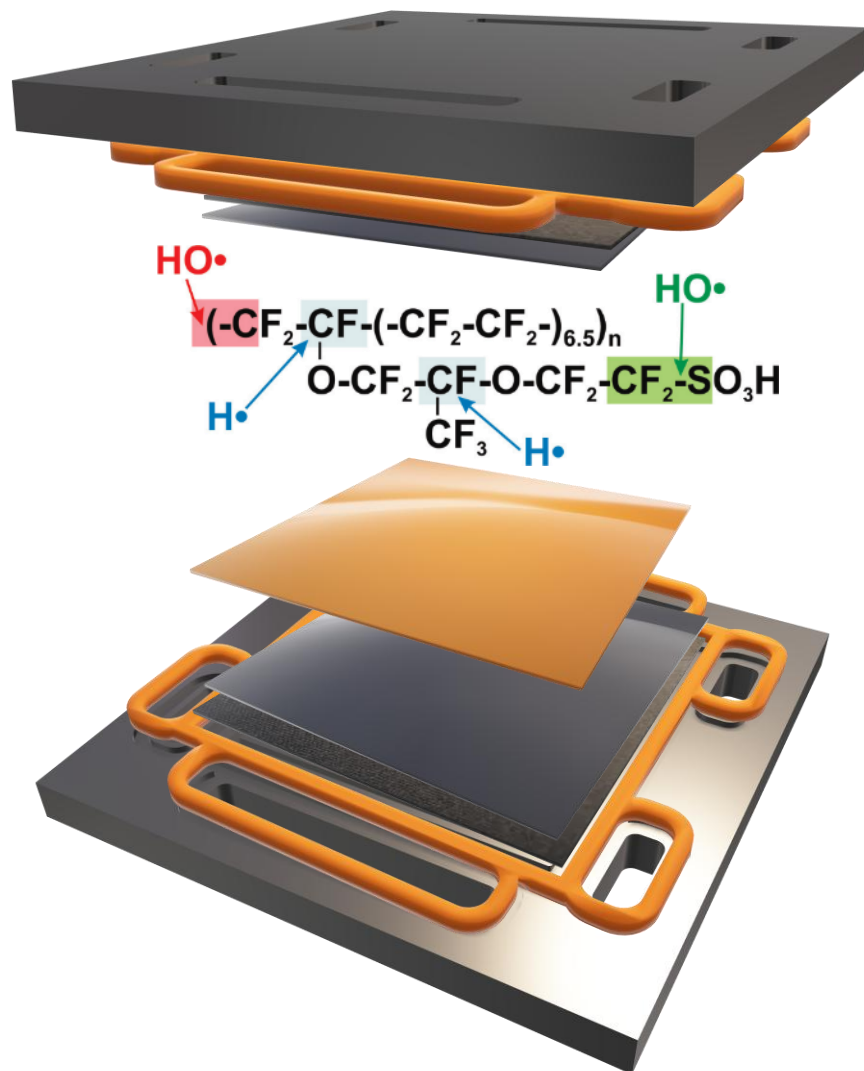


Source: S. Goodwin and D. A. Walsh, Closed Bipolar Electrodes for Spatial Separation of H2 and O2 Evolution during Water Electrolysis and the Development of High Voltage Fuel Cells

- Strategic project
- Idea based on electrolysis technology
- Generation of **innovative intermittent half cells**
- Generation of **in-depth knowledge** of intermittent half-cell technology
- Development of validated **simulation models** and tools
- Proof of functionality on the basis of **single-cell tests**
- **Material characterization** and knowledge generation



GERAS 2025 – ongoing (COMET)



- Goal: analysis of degradation mechanisms affecting the **Proton Exchange Membrane (PEM)**
 - without external humidification
 - at high operating temperatures
- Based on SoA **PFSA Membrane**
- Development of numerically efficient **degradation models** for **End-of-Life prognostics**
- Validation based on **single-cell tests** and **Fluoride Emission Rate (FER)** measurement
- Intended application within the **automotive** sector

— Project partners —



— Project logo —





Feasibility study for the conversion from fossil fuels to hydrogen

- **Technical analysis**
 - Energy supply, production, transport logistics, refueling infrastructure, safety as well as legal and regulatory framework
- **Economic and ecological analysis**
 - Cost survey and analysis concerning investment and operating costs, CO₂ reduction potentials



Project Hy.CoMM 2024 – ongoing



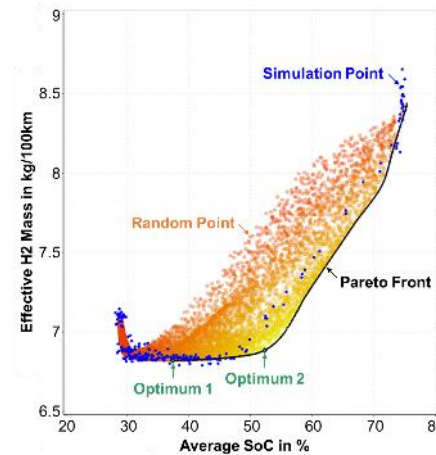
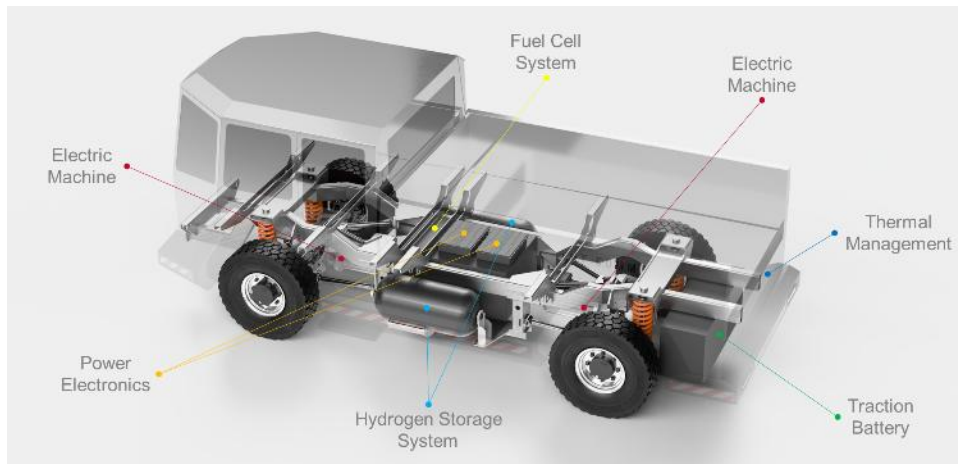
Clean Hydrogen Construction and Mining Machines



Hy.CoMM



- **Design of a fuel cell hybrid construction machine for mining applications**
- **Test operation and knowledge gain for research and industry in a real application scenario**
- **Design of a hydrogen refueling infrastructure**





Project H2ROAM 2026 – 2029

H2ROAM - HYDROGEN FOR ROBUST OFF-ROAD APPLICATION MODULES



H2ROAM



- Develop and validate **modular** building blocks
- **Flexible** integration into **different** NRMM **platforms**
- Validate system **durability** and **reliability** under representative NRMM conditions
- **State of health** monitoring for hydrogen powered drive trains

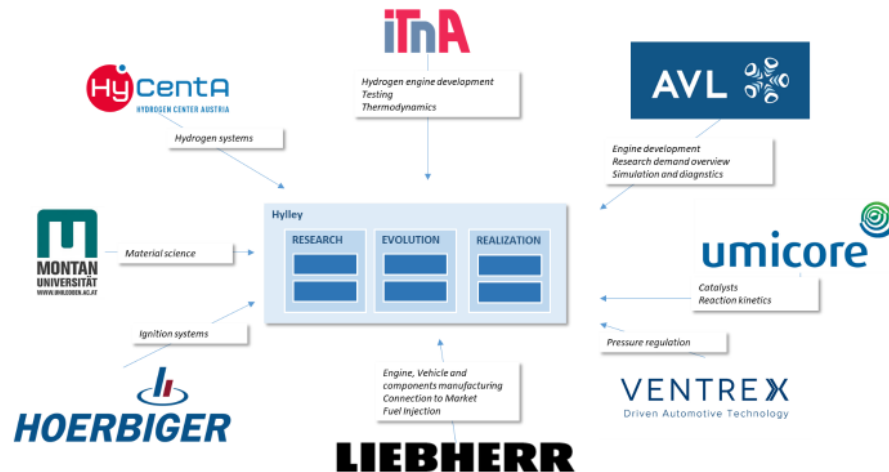


Project Hylley 2023 – ongoing

Research into Competitive and Practical Heavy Duty H₂ Engines

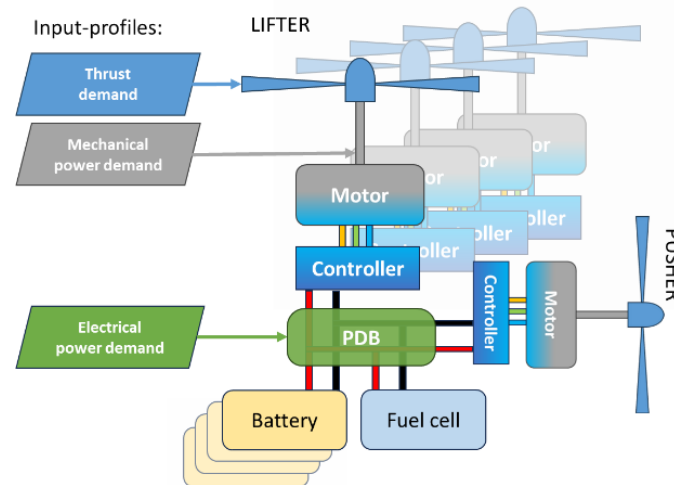
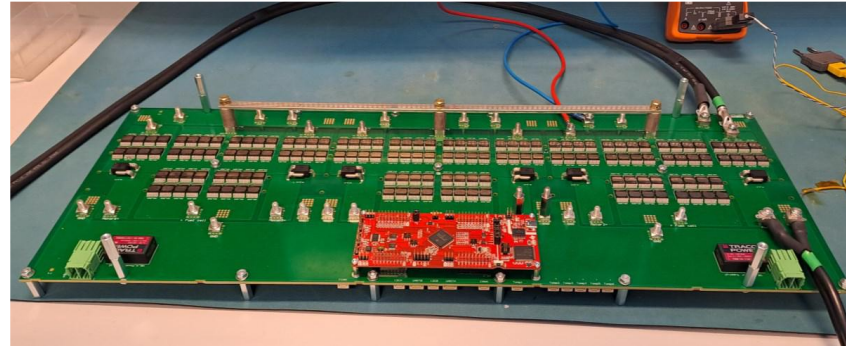


- Development of an **H₂ ICE** as a climate-neutral and sustainable power source for **heavy-duty vehicles** and **construction equipment**
- Advanced **H₂ engine optimization** workflows, **hydrogen-specific combustion simulation** tools, performance limits as well as robust and durable H₂ engine concepts
- Build-up of a **H₂ demonstrator engine** for an actual use case





Hydrogen-focused twin-engine Electrification and Digitalization Testbed



- Development of a scaled **GA-multi-engine-bench-testbed** integrating a PEM fuel cell system
- **Electrical and thermal energy management** research with special emphasis
- **Hydrogen Storage System** covering the aviation safety regulations as well as customer range requirements
- **Digital power train management** systems combining multiple sources of power generators and storage, like buffer/boost battery and fuel cell



Fly Sustainable, Innovative, and Creative

- Innovative **fuel-cell-powered propulsion concept** for short-haul aircraft
- **Integration** of FC-based **power train** and **onboard hydrogen storage** system into the aircraft design
- Research focus on **cathode path** for aviation-relevant high-altitude ambient conditions
- **Aerodynamic optimization** of the blended wing design
- **Risk minimization** of a **certifiable propulsion system** as a prerequisite for the subsequent market launch





AUTARK (2025 – ongoing)

AUTARK (Austrian liquid hydrogen tank system technologies)

Main focus:

- Decreasing weight of LH2 storage systems for aviation
- Increased hydrogen safety of the storage system (e.g. venting)
- Development of novel valve components

Role of HyCentA:

- In-depth 3D CFD simulations of venting phenomena
- Experimental validation of valves, the cold box and the tank
- Experimental assessment of venting and detonations/deflagrations

Consortium:

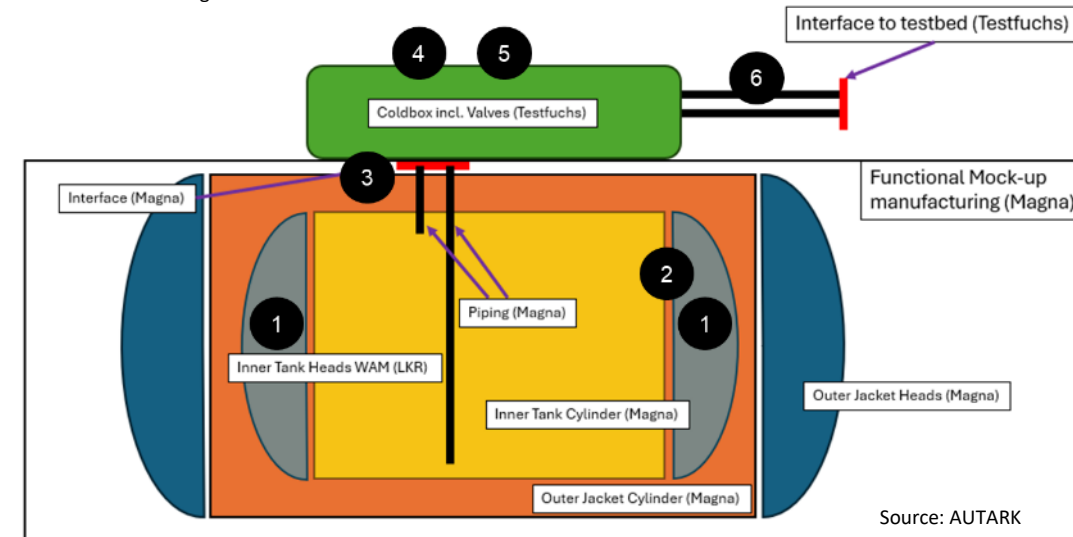


Source: Magna

Physical test articles

- 1 Inner tank (IT) dome (heads) incl. HEX
- 2 Inner tank (IT) welded assembly
- 3 Tank / Coldbox interface
- 4 Cold Box built in aluminium
- 5 Aluminium SOV+PRV in aluminium
- 6 Venting pipes with CV

HEX: heat exchanger
CV: check valve
SOV: shut of valve
PRV: pressure relief valve
OI: Outer jacket

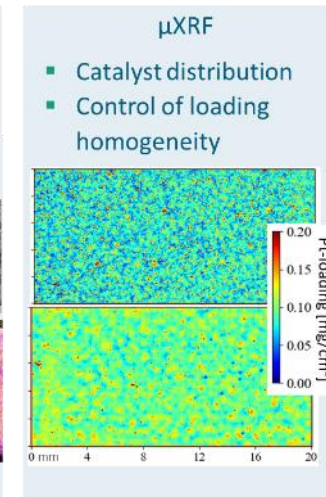
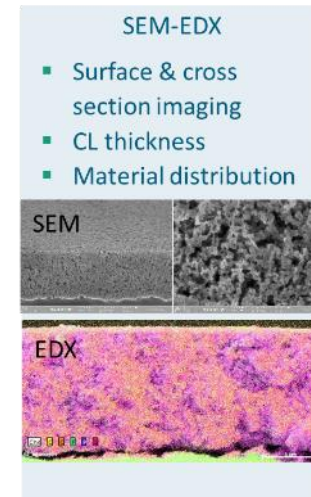
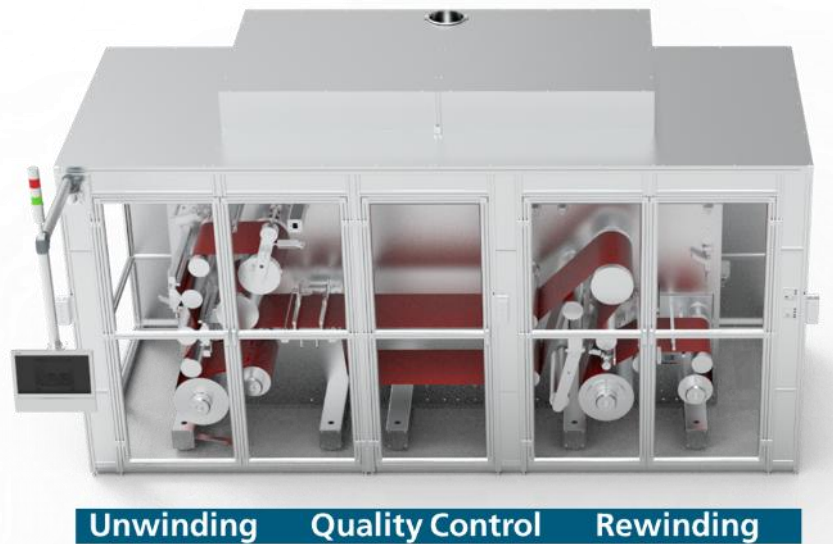


Source: AUTARK



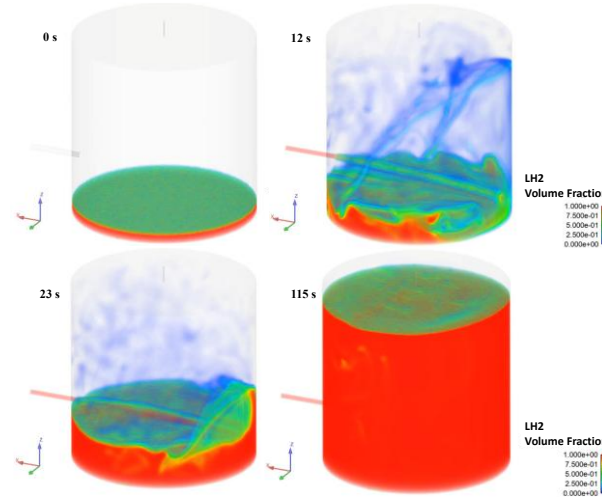
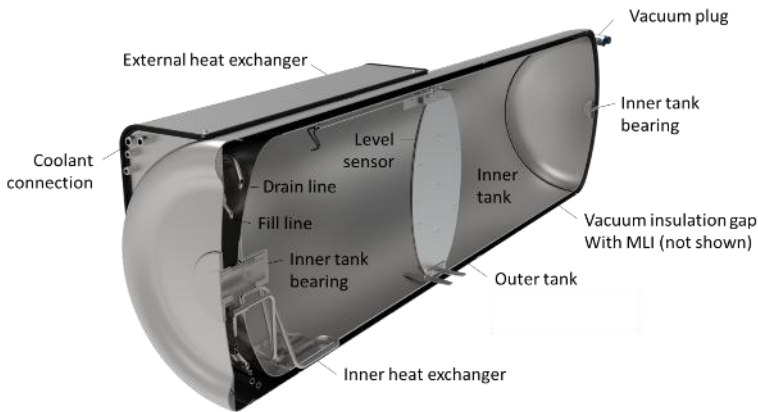
sCalable iNnovaTive pRocessEs for the Production of fuEl Cells

Development and demonstration of scalable, industrially viable processes for the manufacturing, quality control, and recycling of PEMFC components and MEAs based on an EU supply chain.





HySTA - Hydrogen Storage Tank Made in Austria



- Development of a **lightweight and safe LH₂ tank system** with improved gravimetric index through advanced materials, joining, and manufacturing technologies
- **Technical optimization** of tank performance with focus on material transitions, thermal management, and boil-off handling
- **Validation-based simulation** development including 3D CFD, reduced-order models, and a digital twin for optimization and safety assessment

Project H2 Slush - 2013

Slush production tests:

**Mixture of liquids and hard hydrogen
at extremely low temperatures**

Advantage: Higher density than LH2

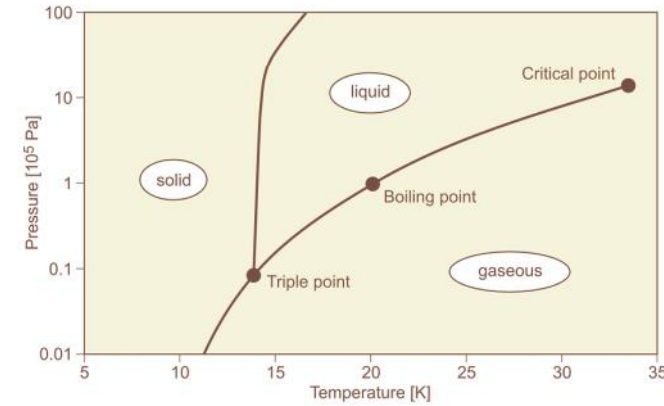


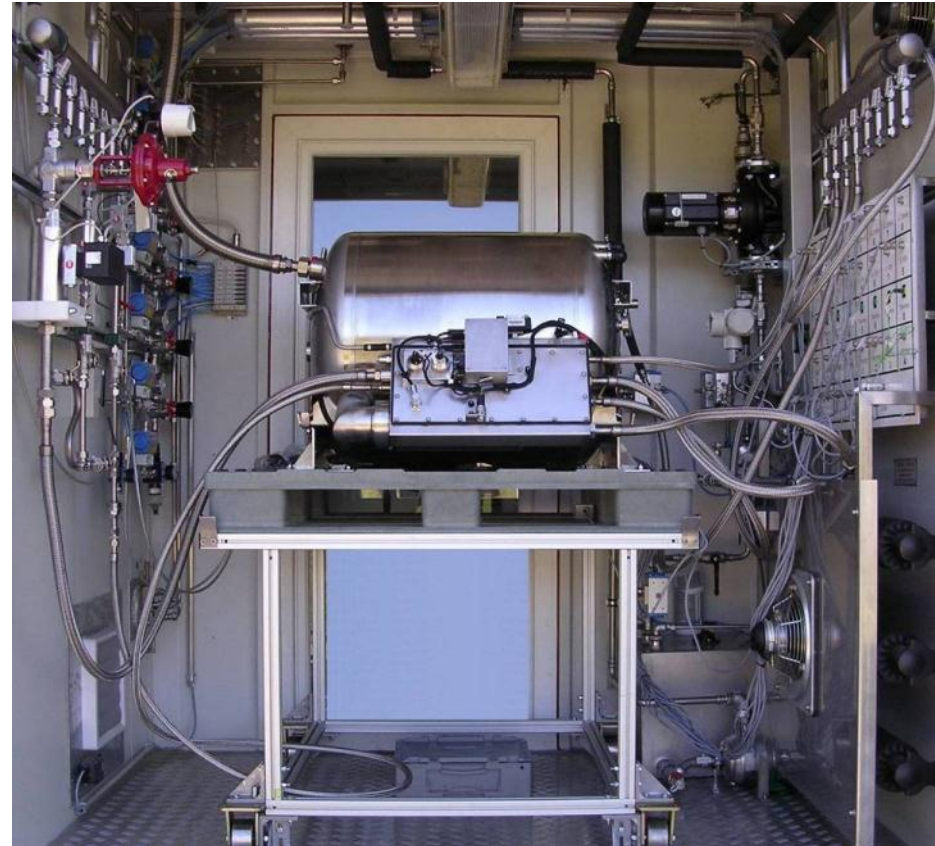
Fig. 1-1: Phase diagram of hydrogen



Project LH2 2006 - 2008

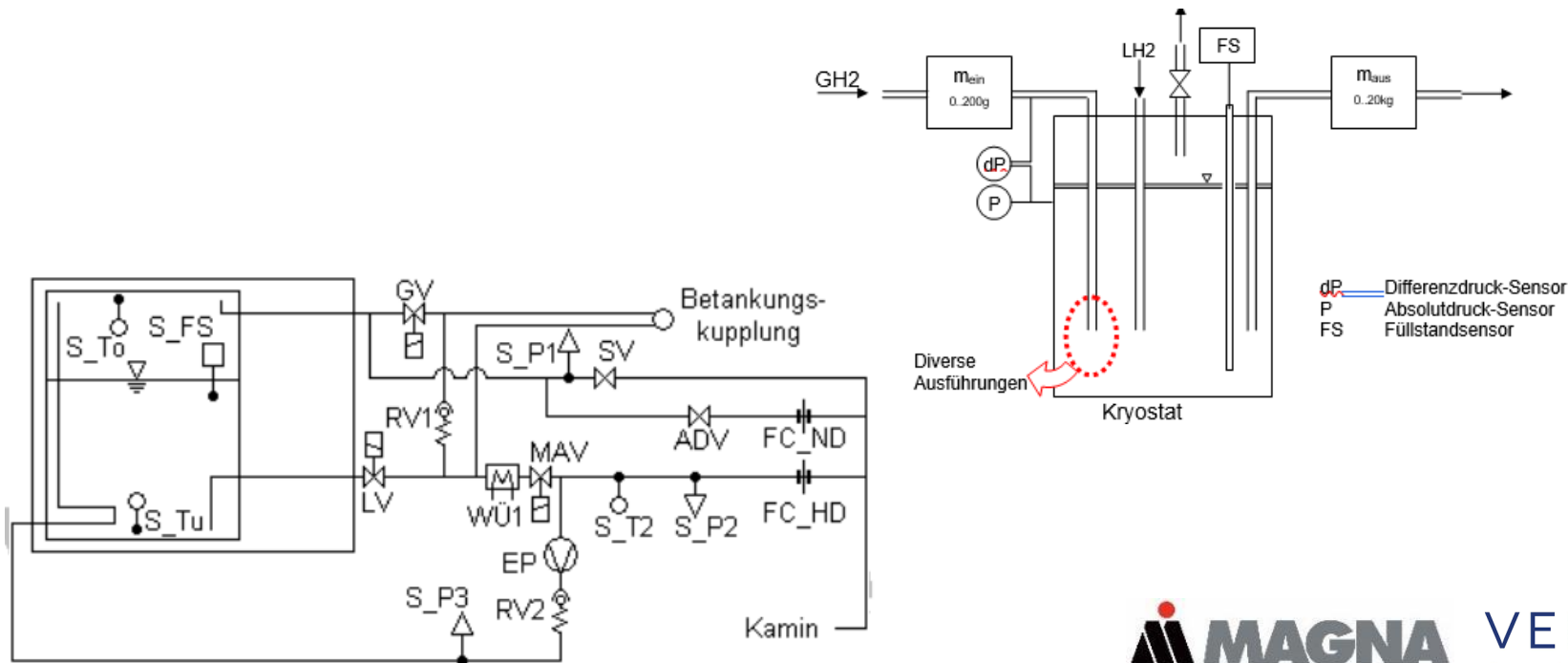
2006 – 2008:

Test runs of an LH2 – **liquid hydrogen tank** (produced by MAGNA) for an BMW Hydrogen 7



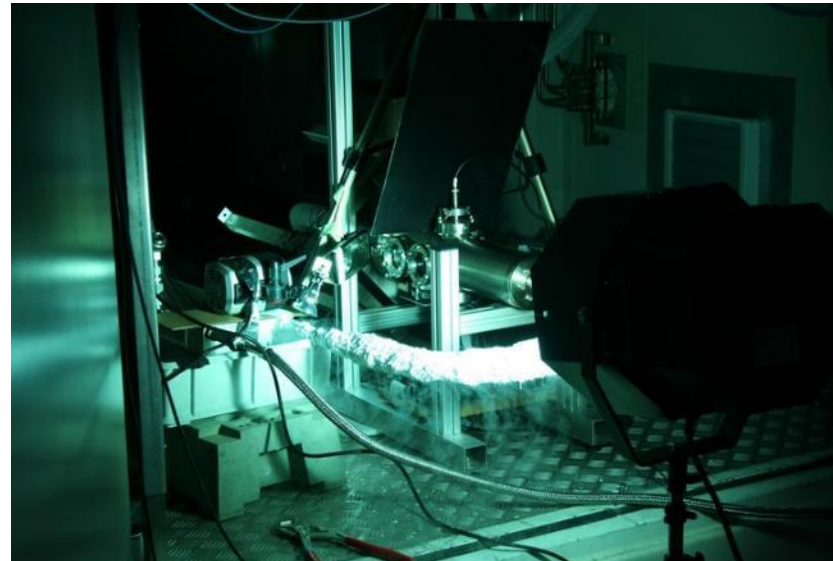
Testing at HyCentA

- Pressure build-up system with individually developed system components, functionality proven, suitably designed and build-up to a complete tank system for test purposes.
- Significant advantages of a new liquid hydrogen tank system compared to the state of the art (system dynamics and reliability)



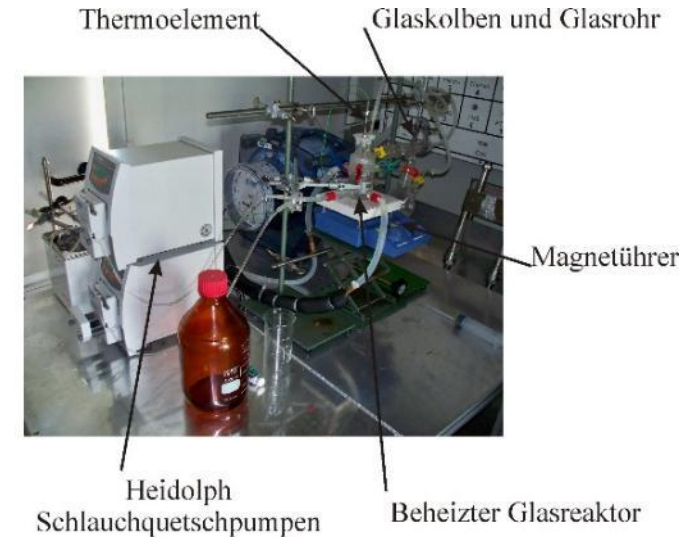
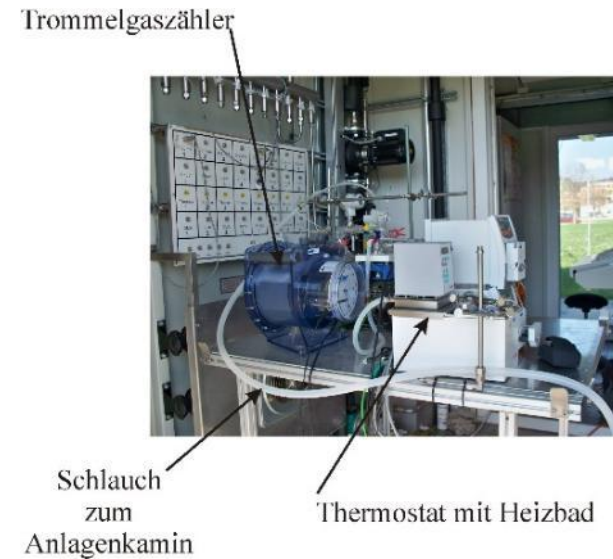
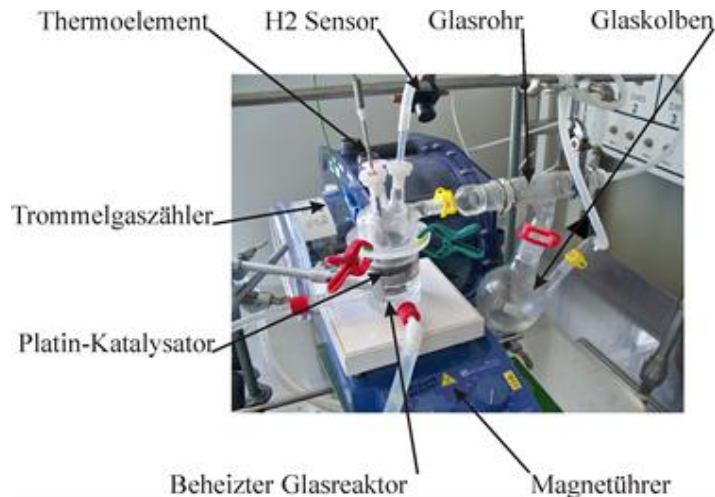
Project CryoSens (12/2006 – 11/2007)

- Investigation of a robust LH2 flow measurement for automotive applications
- Examination in both cold liquid and gaseous hydrogen for pressures up to 350 bar
- Experiments with a high degree of automation (equipment with high quality measurement and control technology)



Project Safe Hydrogen Storage (2007 – 2009)

- Storage of hydrogen at room temperature, without pressure, homogeneous and safe
- Ionic storage medium (low energy use for charging and discharging, no obvious lifetime limitation, stability compared to hydrolysis and a catalytic release of hydrogen without any heat input into the catalytic cell)
- Storage medium (physicochemical characterization), durability, optimization and ecological and toxicological impact (estimation)



Join us in shaping the future of hydrogen technology!

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 Bundesministerium
Innovation, Mobilität
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