Bundesministerium Innovation, Mobilität und Infrastruktur

Bundesministerium Wirtschaft, Energie und Tourismus

FFG Forschung wirkt.

Das Land Steiermark – Wirtschaft, Arbeit, Finanzen, Wissenschaft und Forschung

SFG – Neues denken. Neues fördern.

Tirol

UAR Innovation Network

wirtschaftsagentur wien

ober österreich

# HyCentA Research GmbH

## Shaping the Sustainable Hydrogen Society

Project References Area 1: Electrolysis & Power-to-X

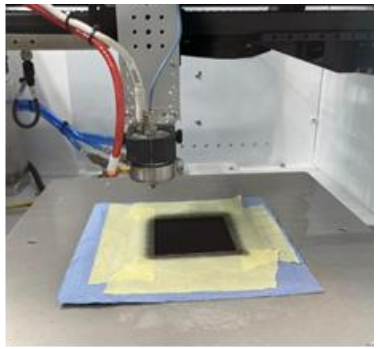
Graz, August 2026

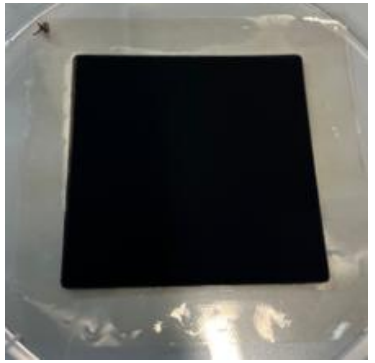
HyCentA – Hydrogen Center Austria

# Project ProGen 2023 - 2026

Development of a **new generation high-pressure PEM electrolyser stack** including an **optimized operation strategy** and most-suitable **application scenarios**

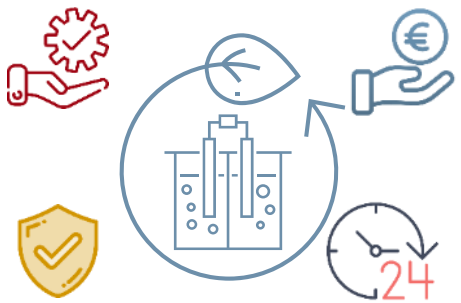
- Short stack with a power of **5 kW**
- Reduced catalyst loading of **1 $mg_{PGM}$ / $cm^2$**
- Increased stack efficiency of **> 70% (HHV)** and system efficiency of **> 80 % (HHV)**
- Stack **production cost** of **< 500 €/kW**
- Hydrogen output **pressure of 80 bar**





# Project OASES 2024 - 2026

Develop a **> 1 MW electrolyzer test system** for full-size stacks, enabling the transfer of small-scale research to large-scale applications and advancing understanding of aging, degradation, and optimization under realistic operating conditions.




Company partners

HAINZL

BOSCH

Scientific partners

ITnA

- Set up of a **megawatt stack testbench,** featuring
  - state-of-the-art **cell areas up to 1600 cm²** and higher
  - 150+ cells
- Test and **characterize** a 1.25 MW **electrolyzer stack**
- Learn how to **increase stack and system lifetime**

# Project DuraPEM

**Durability assessment** of **PEM electrolysis stacks** with focus on the **mechanical stability** of the **membrane**

01.01.2024 – 28.02.2026

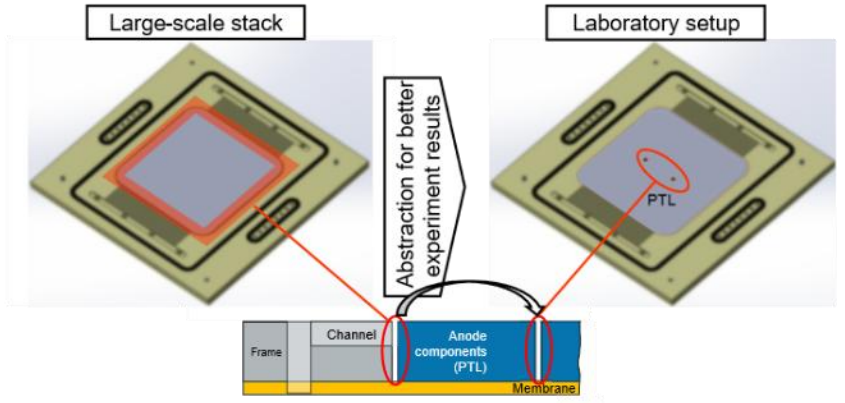
- Development of a **material model** for **membranes**
- Experimental investigation of the **mechanical failure mechanisms**
- Effect of **long-term operation** on **mechanical stability**
- **Lifetime** prediction of mechanical membrane failures

Scientific partners

LINZ CENTER OF MECHATRONICS

Company partners

BOSCH



# Project AniGen 2023 - 2026

Development of a **next generation AEM electrolyser stack** including **optimized cell components** with a focus on improved **efficiency** and increased **lifetime**

- Short stack of **3-5 cells** and **active area** of at least **50 cm²**
- Stack **production cost** of **< 300 €/kW**
- Operation with **KOH concentration** at **1 M** and below
- Achieve **current densities** of **> 2 A/cm²**
- Hydrogen output **pressure of 40 bar**

**Scientific partners**

AIT Austrian Institute of Technology

TU Graz

CEET Chemical Engineering and Environmental Technology

SFU FCReL

Montan Universität Leoben

**Company partners**

ANDRITZ

Heraeus

IONOMR Innovations

Greenerity®

Energie Netze Steiermark

OMV

# Project CoGen 2023 - 2026

HyCentA HYDROGEN CENTER AUSTRIA

Improve **efficiency, lifetime** and **performance** of HTEL in $CO_2$ and Co-electrolysis operation, as well as identification of **integration scenarios** and **business cases**

- Conduct cell, interconnect- and stack **testing** to improve **performance** and **lifetime** of SOEC-technology
- Develop **application scenarios** for the production of **chemical feedstock** and the integration into power grid and industrial waste heat
- Design a SOEC stack and integrate into **virtual system model** to improve **operation strategy** and **thermal management**
- Build a **technology matrix** to compare different **HTEL-technologies**

Company partners

Scientific partners

ANDRITZ

Institute of Thermal Engineering

ENERGIE NETZE STEIERMARK

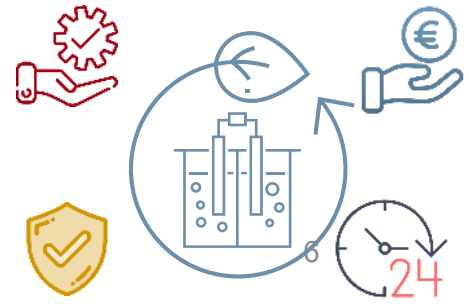
Ein Unternehmen der ENERGIE STEIERMARK

iTnA

OMV

TU Graz

Innovation in Motion Miba



# Project AltGen 2024 - 2026

Investigation and development of **new approaches** for the **production of renewable hydrogen and green chemicals**

- **New and electrode cell design** for single cell **photoelectrochemical water splitting**
- Alternative production of green $H_2O_2$ (fuel cell approach)
- Alternative, **decoupled electrolysis processes** for green hydrogen
- Proof-of-concept for **semiartificial photosynthesis**
- **Circularity** and **sustainability** of new materials

Scientific partners

AIT Austrian Institute of Technology

SFU FCReL

TU Wien

Company partners

Heraeus

IONOMR Innovations

Innovation in Motion Miba

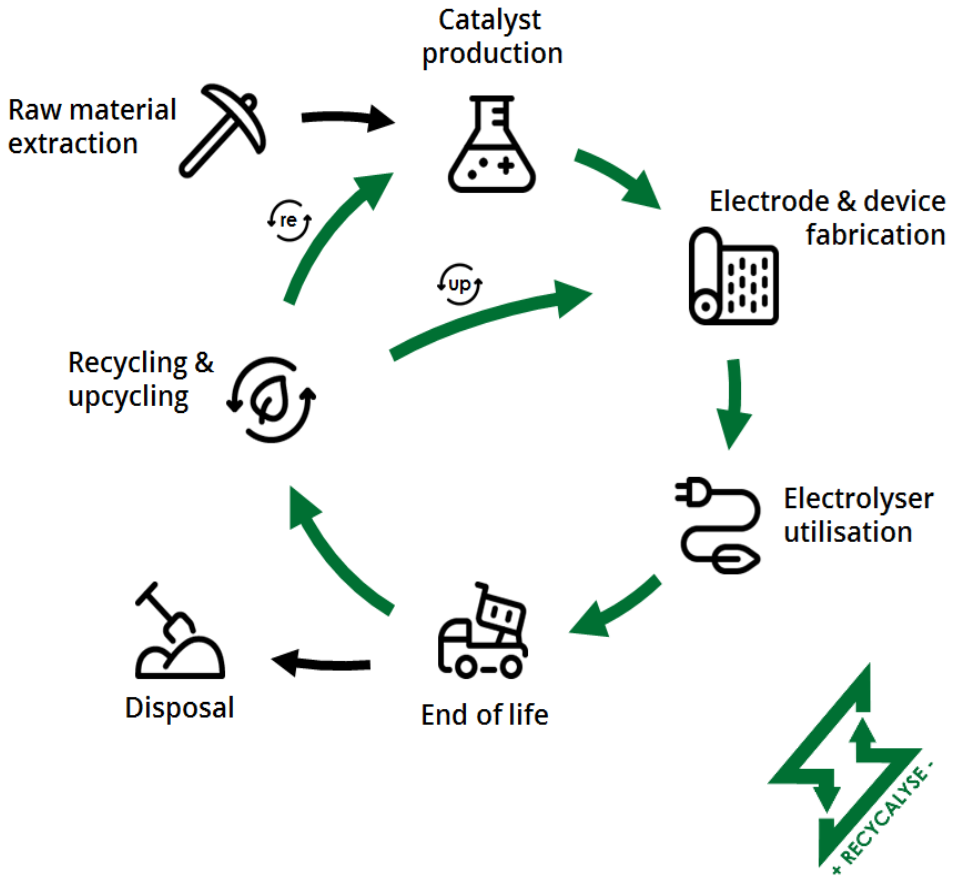
Verbund

Energie Netze Steiermark

OMV

# Project Recycalyse 2020 - 2023

Development of **new electrocatalysts** for PEM electrolyser systems with increased **performance**, reduced **critical raw material usage**, reduced **environmental footprint** and reduced **total costs**.

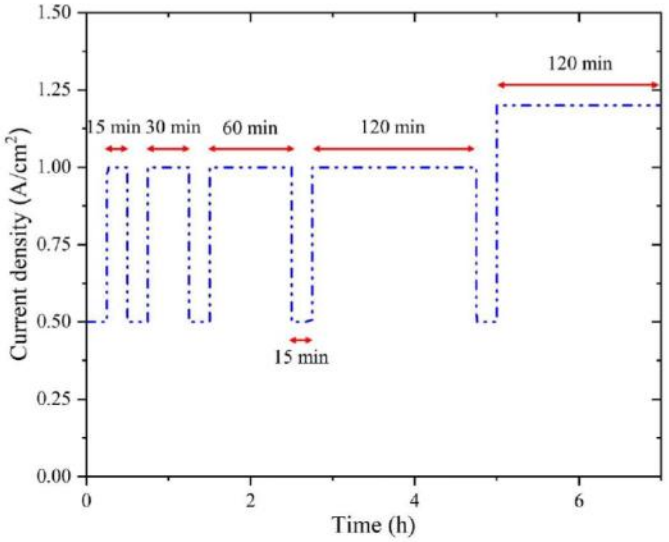


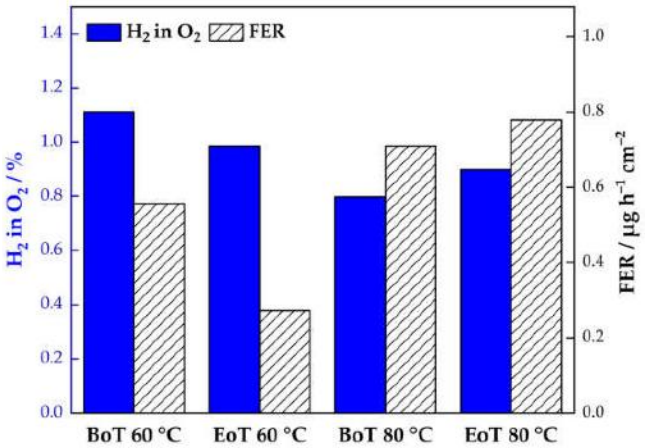

- Application of **sustainable materials and catalyst**
- Implementation of a **circular economy and large scale recycling** in which the **CRM** will be recovered and regenerated
- Analysis of **value chain** from catalyst manufacturing to system integration and demonstration, **end-of-life recycling** and supply of raw materials for catalyst manufacturing

# Project HyGen 2021 - 2025

Development and optimization of **PEM electrolysis** with a focus on investigation of **degradation** on single cell and stack level

- **Industrialization and materials research:** R&D on cell to system production & manufacturing value chain analysis
- **Test methods:** Accelerated stress test & aging correlations from cell to system
- Advancement through **simulation:** Operation strategy optimization & adaptation and further development of BoP components
- **Application Analysis:** Decentralized & centralized application and utilization $H_2$ and connection to grids




Source: Wang et al. ACS Appl. Mater. Interfaces 14(7), 9002 (2022); Kuhnert et al. Membranes 13(3), 348 (2023)

# Project wind2hydrogen 2014 – 2017

HyCentA HYDROGEN CENTER AUSTRIA

## Objective: Conversion of renewable electricity into hydrogen for storage purposes and transport into the existing natural gas grid

- Development of a dynamic high pressure PEM electrolyzer (163 bar)
- Construction of a 100 kW pilot plant
- Operative experiences of a power-to-gas plant with real life load cases of renewable energy and feed-in of $H_2$ into the natural gas grid
- Production of green hydrogen for $H_2$ mobility

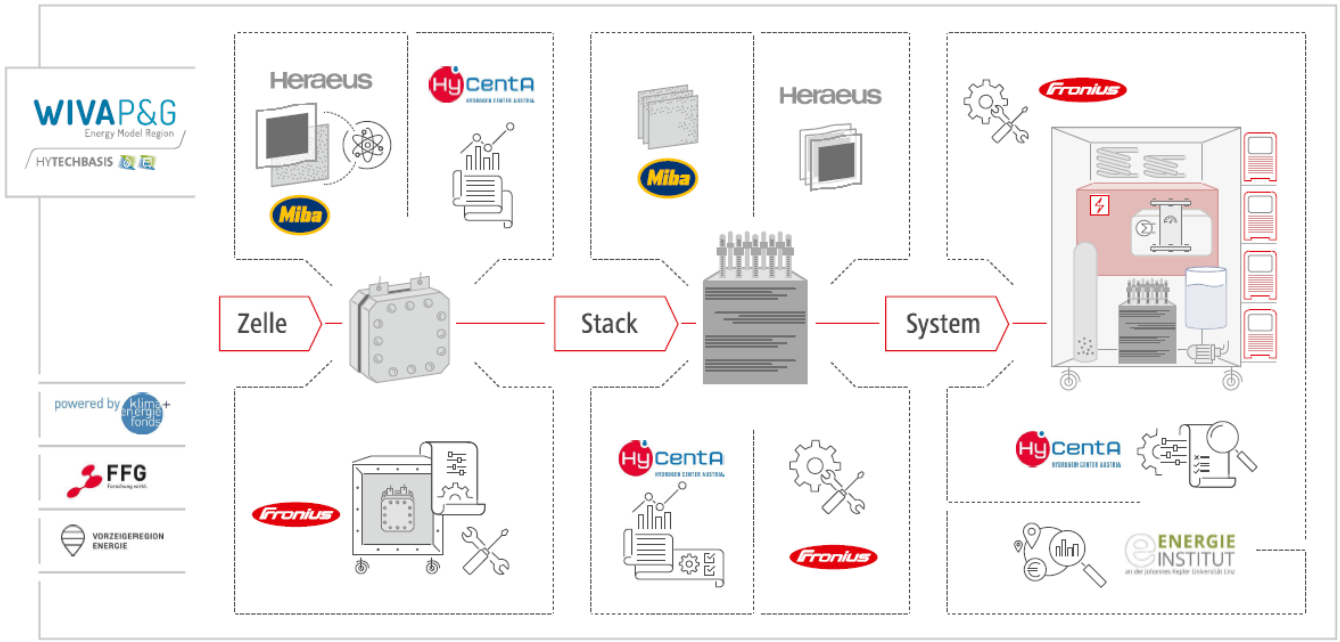
OMV EVN Fronius ENERGIE INSTITUT powered by klima+ energie fonds

# Project HYTECHBASIS 4 WIVA 2019-2022

HyCentA HYDROGEN CENTER AUSTRIA

**Objective: Achievement of a higher level of industrialization by developing the next generation of PEM fuel cell and high pressure electrolysis in an holistic approach**

- **Advanced membrane technology and development of bipolar plates to increase the overall system efficiency and reduce costs of electrolysis technology**
- **Design and optimization of a modular electrolysis system**
- **Advanced development of the fuel cell system through new, optimized BoP components**

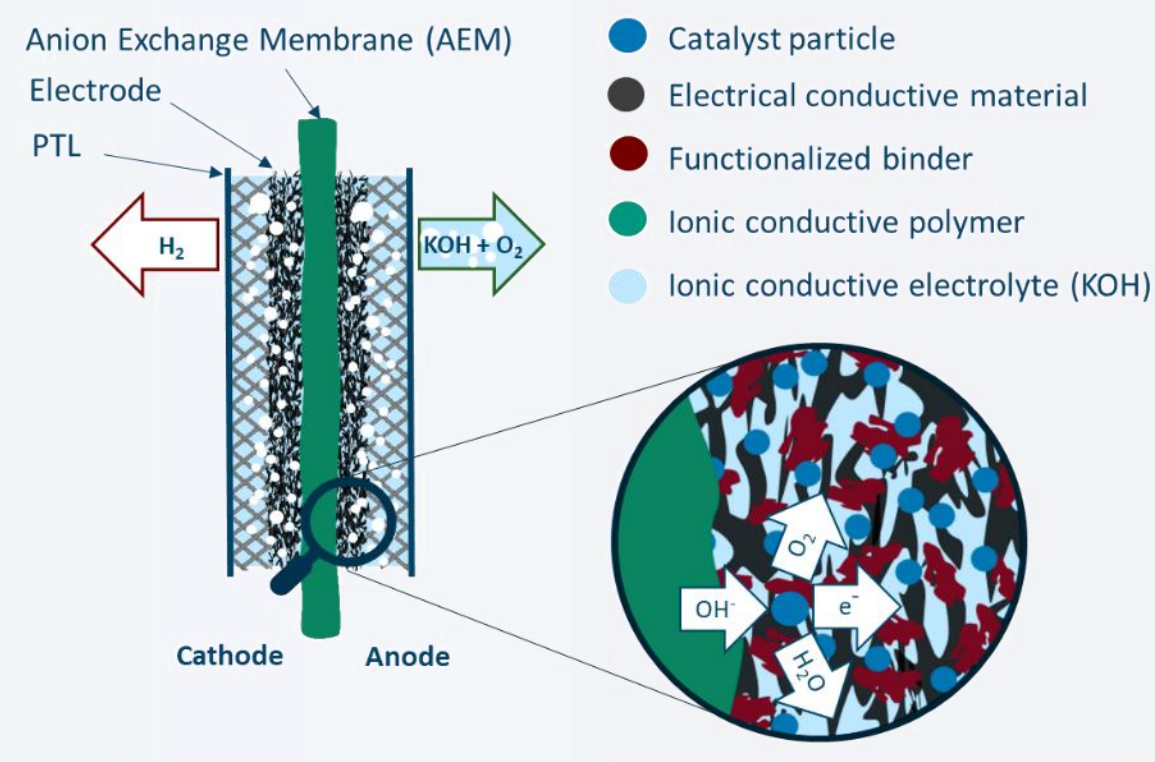



Electrolysis System

Fuel Cell System

# Project AEM Neo 2022 – 2024

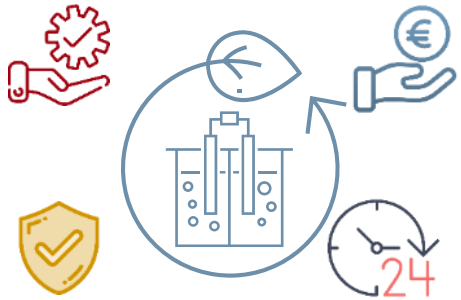
Modification of inner layer of **AEM electrolysis** cell with **ionically conductive polymers** to increase performance




- Systematic experiments generate a comprehensive understanding of the **transport mechanisms**
- **Fabrication of electrodes** with modified polymers and the subsequent characterization of the electrodes in the assembled cell
- Chemical-physical analysis of the electrode is performed to identify degradation effects and mechanisms

# Project MemGen 2023 - 2026

Gain a deep understanding of **aging and degradation mechanism of large-scale membrane electrolysis stacks** considering realistic operation conditions




Scientific partners

Institute of Thermodynamics and Sustainable Propulsion Systems

- Set up of a **full-size stack testbench**
  - Featuring state-of-the-art **cell areas up to 1600 cm²** and higher
- Develop and implement **novel diagnostic methods** on large-scale electrolyser level
- Operate stacks with moderate and stressed parameters to gain deep insight in **degradation mechanisms**
- Learn how to **increase stack and system lifetime**

# Project INGE 2025 – 2028

Highly efficient PGM-free electrodes for AEM electrolysis with increased lifetime and demonstration thereof in an innovative stack design

- Increase lifetime: Current density of 1.5 A/cm² at <2 V, Degradation rate of <0.7%/1000 h
- Increase efficiency: reduce voltage from 2.5 V to 2.1 V at 1.5 A/cm³
- PGM-free catalysts with innovative binder polymers for better interaction of catalyst and ionomer
- Reduction of production costs of CCS to 500 €/m² in role-to-role process (considering scaling effects)

Company partners

DURAMEA

Scientific partners

TU Graz

CEET Chemical Engineering and Environmental Technology

# Projekt ELYSIUM 2025 – 2028

Entwicklung der **nächsten Generation der AEM MEA**, bereit für die Skalierung der AEMEL-Technologie zur Deckung der benötigten Elektrolysekapazitäten mit **Technologien „Made in Austria“**

Charakterisierung einer mittels **Plasma-PVD-Verfahren** hergestellten AEMEL-Elektrode mit state-of-the-art (SoA) beginning-of-life (BoL) Leistung von **1 A/cm² bei ‹2 V**

Verbesserte MEA mit BoL Leistung von **2 A/cm² bei ‹2 V** in einer Elektrolyt-Konzentration von ‹1 M nach **Aktivierung** anhand des neu entwickelten Prozederes in **‹6 h**, mit **Teillastfähigkeit bis 10 %** bei **‹40 % UEG H2 in O2** und einer **Degradation von 0,7 %/1000 h** bei Konstantstrombetrieb bei 1 A/cm²

**Simulationsgestützte Skalierung** der Komponenten und Herstellungsverfahren für den Bedarf von 200 MW/a bei vergleichbarer Elektroden-Leistung und Herstellungskosten von rund **200 €/kW** auf Stapel-Ebene im Jahr 2030 mit geringeren negativen ökologischen und sozialen Auswirkungen als vergleichbare Elektrolysetechnologien

# Project Green Hydrogen for Aviation 2023-2024

HyCentA HYDROGEN CENTER AUSTRIA

Project results

- Optimized reactor design(4 g H2/m2/h)
- Validated photocatalyst performance (6 sources of hydrogens)
- Demonstrated reactor stability (200 h test)
- Scaled-up hydrogen evolution testing (1600 cm2)
- Technoeconomic analysis (3 aviation-related hydrogen applications)


REDEEM SOLAR TECHNOLOGIES

RHP GROUP

TU WIEN

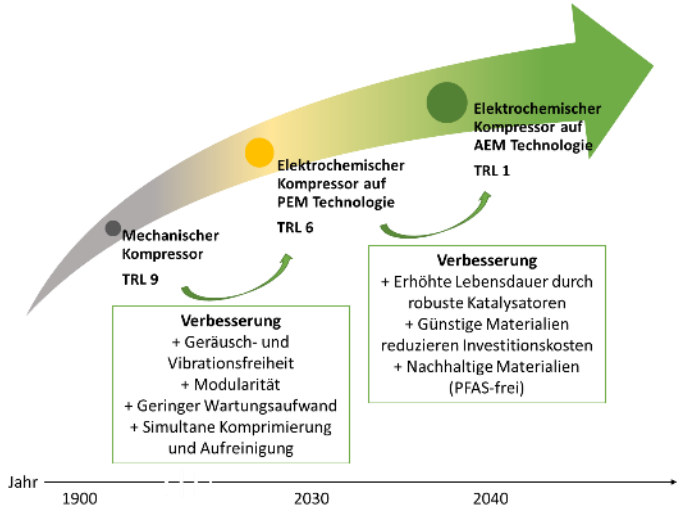
HyCentA

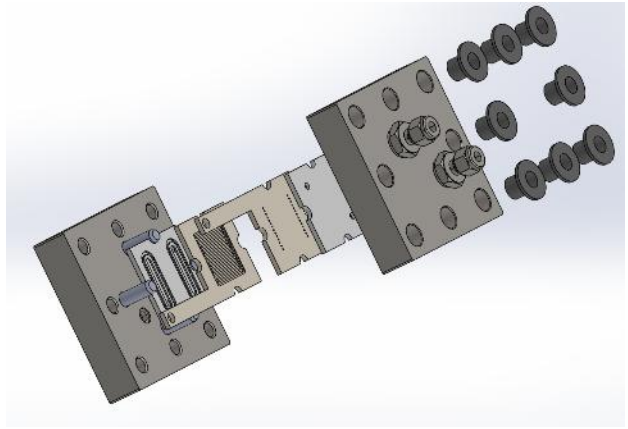
# Project AEM TECC 2024 – 2025

HyCentA HYDROGEN CENTER AUSTRIA

## Proof of concept for AEM Technology in ElectroChemical Compression

- Ziel: **Nachweis der Machbarkeit sowie Generierung von Know-how in neuartiger AEM ECC Technologie**
- Vergleich der Performance zu Standardmaterialien
- Identifikation der Prozesslimitierung
- Verbesserung der Prozessführung
- Bewertung des ökonomischen Vorteils des AEM ECC



# Project SAHARA 2024 – 2027

Development of a **photoelectrochemical water splitting (PEC) system** with focus on **scale-up**, improving **efficiency** and **stability** and enhancing **sustainability**.

- Increase **technology readiness level** (TRL) from 3 to **6**
- **PEC cell** development with **400 cm²** active area
- Photoelectrodes with **10 % efficiency** and **>100 h stability**
- Set-up of an **advanced test-rig**, proving $H_2$ production at **5 bar** and **>99 % purity**
- **Cost reduction** to hydrogen production costs **<4 €/kg $H_2$**
- Enhanced **sustainability** with **>90 % recycling efficiency** and **60 %** less **carbon footprint**

Company partners

REDEEM SOLAR TECHNOLOGIES

Scientific partners

SDU University of Southern Denmark

Fraunhofer IWS

Fraunhofer IKTS

# Projekt HELIOS 2025 – 2026

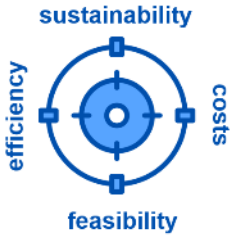
**Technologiescreening**
Entkoppelte Wasserspaltung
(Elektrolyse und thermische Wasserspaltung)

→ **Identifikation eines Zukunftsprozesses**

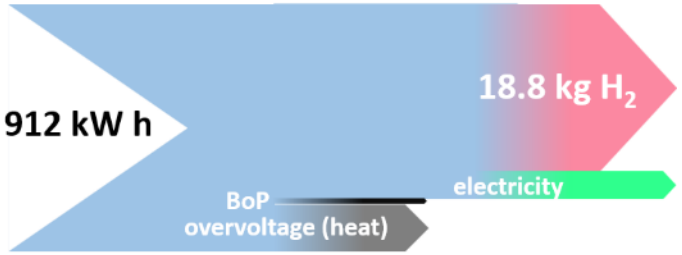
→ **Realisierung / Verifizierung**
im Labormaßstab

→ **Anwendungsanalyse** – Kosten, Effizienz, Umsetzung

**Konzepterstellung eines Nachfolgeprojekts**
zur Realisierung und Demonstration
des Zukunftsprozesses



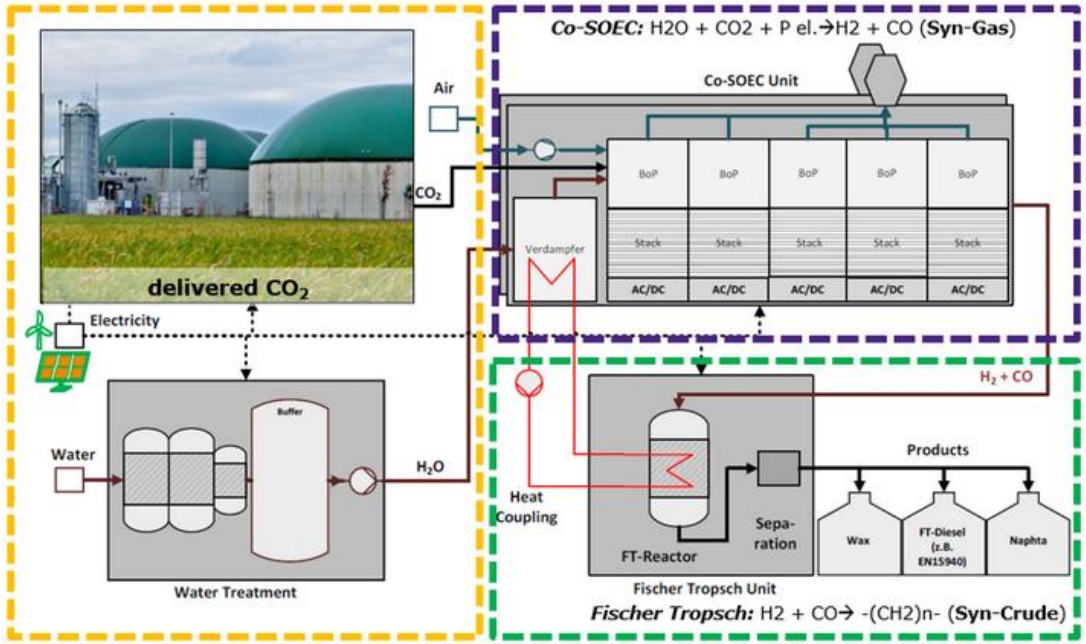

| energy balance | kW h | % |
|---|---|---|
| total demand of energy | 912.3 | 100.0 |
| total energy storage | 719.6 | 78.9 |
| electricity | 105.2 | 11.5 |
| hydrogen | 614.4 | 67.4 |
| total heat losses | 173.9 | 19.1 |
| bifunctional el.; $\eta_{act}$ [mV] HER 80 / OER 230 | 155.0 | 17.0 |
| zinc el.; $\eta_{act}$ [mV] red: 20 / ox 10 | 15.0 | 1.6 |
| Ohmic losses; gap 1 mm | 3.9 | 0.4 |
| BoP energy demand; 1 kW h / kg $H_2$ | 18.8 | 2.1 |
| energy consumtion / kg $H_2$ | 42.9 | |
| total efficiency of hydrogen production | | 76.1 |



# HiPoLiq 2024-2026

## Demonstration of highly efficient Power to Liquid plant

➢01.01.2024-31.12.2026



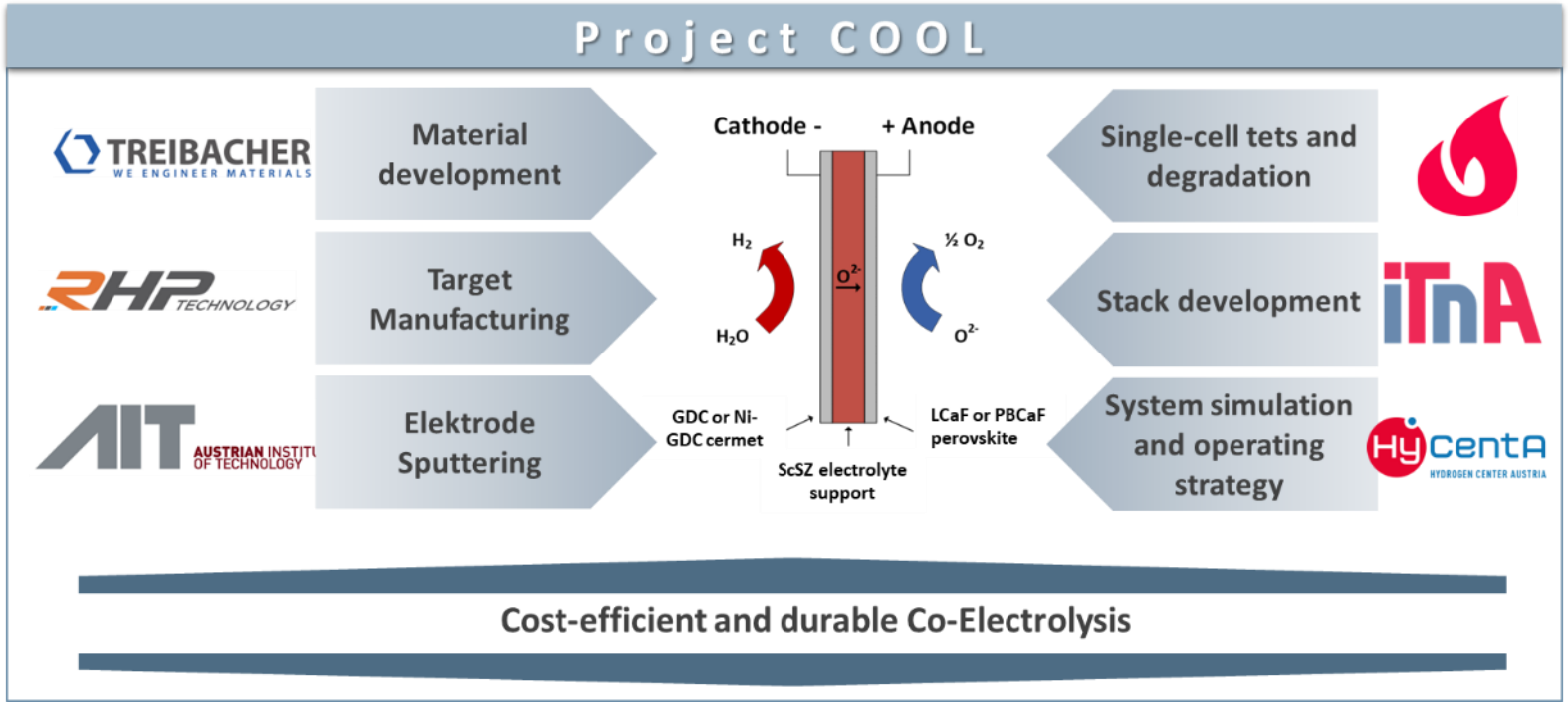

Source: https://www.wiva.at/project/hipoliq/

- **>10,000 h** operation of a **200 kW PtL demonstration plant**
- **Reduction** of overall system **energy demand by >35%** through heat integration
- **Efficiency** of **Co-SOEC unit >95%** for syngas production
- Process simulation for **optimal operation points** of the plant
- **Optimization** of the Co-SOEC unit (long-term stability, degradation rates) & FRS (conversion rates, operation)
- Methodology for FTS catalyst **lifetime prediction**
- **Multi-GW upscaling** and preparation of the roll-out of **industrial PtL plants optimized for SAF production**

# COOL 2025-2028

## New and innovative Co-Electrolysis

➢01.11.2025-31.10.2028




Innovative **electrode manufacturing** with co-sputtering

Electrodes with **reduced CRM**-share

Extended stack lifespan with **<0.5%** voltage **degradation**

Optimized **operation strategy**

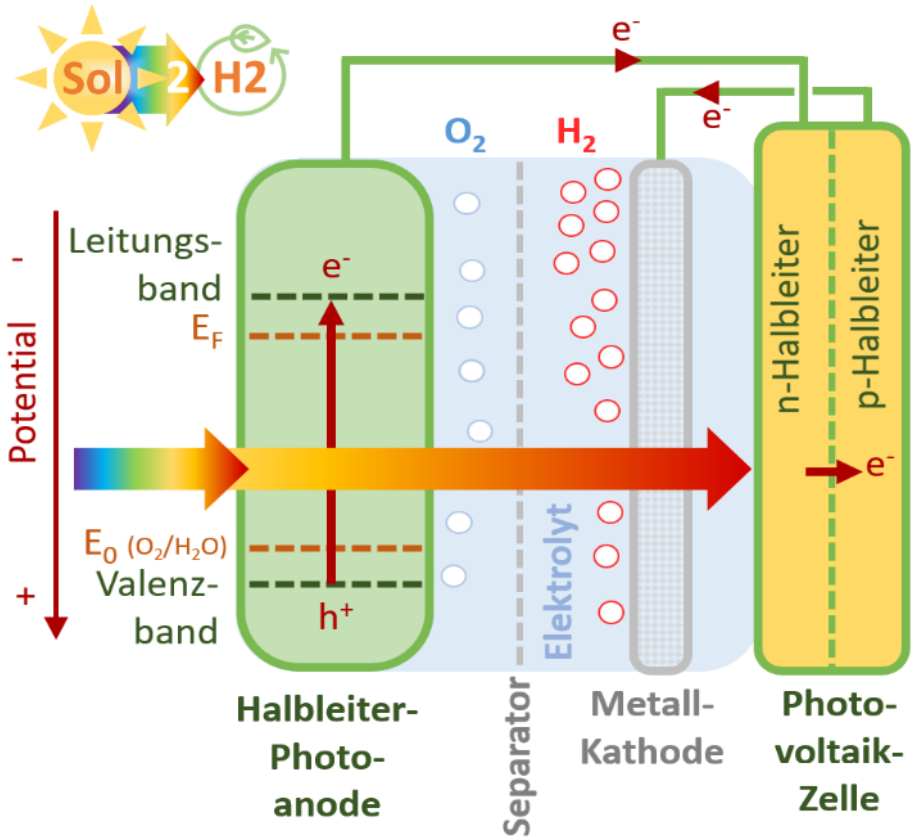
**Reduction of hydrogen production costs by >5%**

# Project Sol2H2 2026 – 2029

**Solar-to-Hydrogen: Efficient hydrogen production using solar energy / a fully stand-alone solution**

The Sol2H2 project focuses on a new generation of efficient, scalable, and sustainable hydrogen technologies by a direct solar hydrogen production. A tandem cell combines a photovoltaic (PV) cell and a photoelectrochemical (PEC) cell into a single unit, efficiently utilizing sunlight for water splitting. The incoming light is spectrally divided: the PEC cell absorbs the high-energy portion for direct hydrogen production, while the PV cell uses the remaining part to provide an external bias that supports the electrochemical reaction. This integrated approach eliminates the need for a separate PV system with an attached electrolyzer, thereby increasing efficiency while reducing material, system costs, and space requirements.

- Solar-to-hydrogen efficiency: ≥ 20%
- Material development for highly stable electrodes with a performance increase of ≥ 50%
- Reduction of production costs compared to PEM-PV systems of ≥ 80%



HyCentA
HYDROGEN CENTER AUSTRIA

# Join us in shaping the future of hydrogen technology!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Bundesministerium Innovation, Mobilität und Infrastruktur

Bundesministerium Wirtschaft, Energie und Tourismus

FFG Promoting Innovation.

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