VORZEIGEREGION
ENERGIE

WIVAP&G
Energy Model Region

Hydrogen Initiative Energy Model Region Austria Power & Gas

Challenges for the transition of the energy system

WIVA P&G
Energy Model Region

- **Challenge 1: reduction of greenhouse gas emissions puts every economic sector under pressure to generate new solutions for substituting fossil by renewable resources.**

  >> as one consequence, volatile renewables like wind- or solar-power get strengthened and expanded in huge amounts, leading to a significant **necessity for new energy storage solutions and coupling of energy sectors**

- **Challenge 2: The dependency of the EU on imports of fossil (energy) sources – and therefore also on geopolitical problematic regions - is still very high, leading also to enormous losses of added value**

An increased integration and implementation of green hydrogen and other (therefrom generated) hydrocarbons such as methane is necessary for a manifold of both ecological and economic reasons (such as decarbonization, necessity of long-term energy storage, alternative energy transmission solutions,…)

Objectives of the energy model regions

The Energy Model Region program of the Austrian Climate and Energy Fund focuses on developing and demonstrating showcase solutions for intelligent, safe and affordable energy and transport systems of the future with innovative energy technologies from Austria.

Objective 1: **Development and model application of domestic energy and energy-related transport technologies for large-scale field trials of intelligent system solutions in real operation**

- Significant technology and system development, numerous pilot plants, development of new processes production of green energy, sector coupling

Objective 2: **Strengthening and expanding Austria as a leading market for innovative energy and energy related transport technologies and services**

- Leading Austrian enterprises as partners with establishes markets, positioning as lead providers, marketing for international visibility, developing of standards and laws, creation of a unique R&D consortium, networking with other areas

Objective 3: **Involvement and active participation of users and operators**

- Guided tours, virtual visitations, events, social media, conventions / events / workshops, congresses, publications

Partner

WIVA P&G
Energy Model Region

Fronius

Wiener Stadtwerke

rag AUSTRIA AG

AVL

Energie Steiermark

voestalpine
ONE STEP AHEAD.

Verbund

OMV

ENERGIE AG
Vertrieb
Wir denken an morgen

EVN

ENERGIE INSTITUT
an der Johannes Kepler Universität Linz

K1 MET
metallurgical competence center

HyCentA
HYDROGEN CENTER AUSTRIA

fen research

powered by klima+ energie fonds

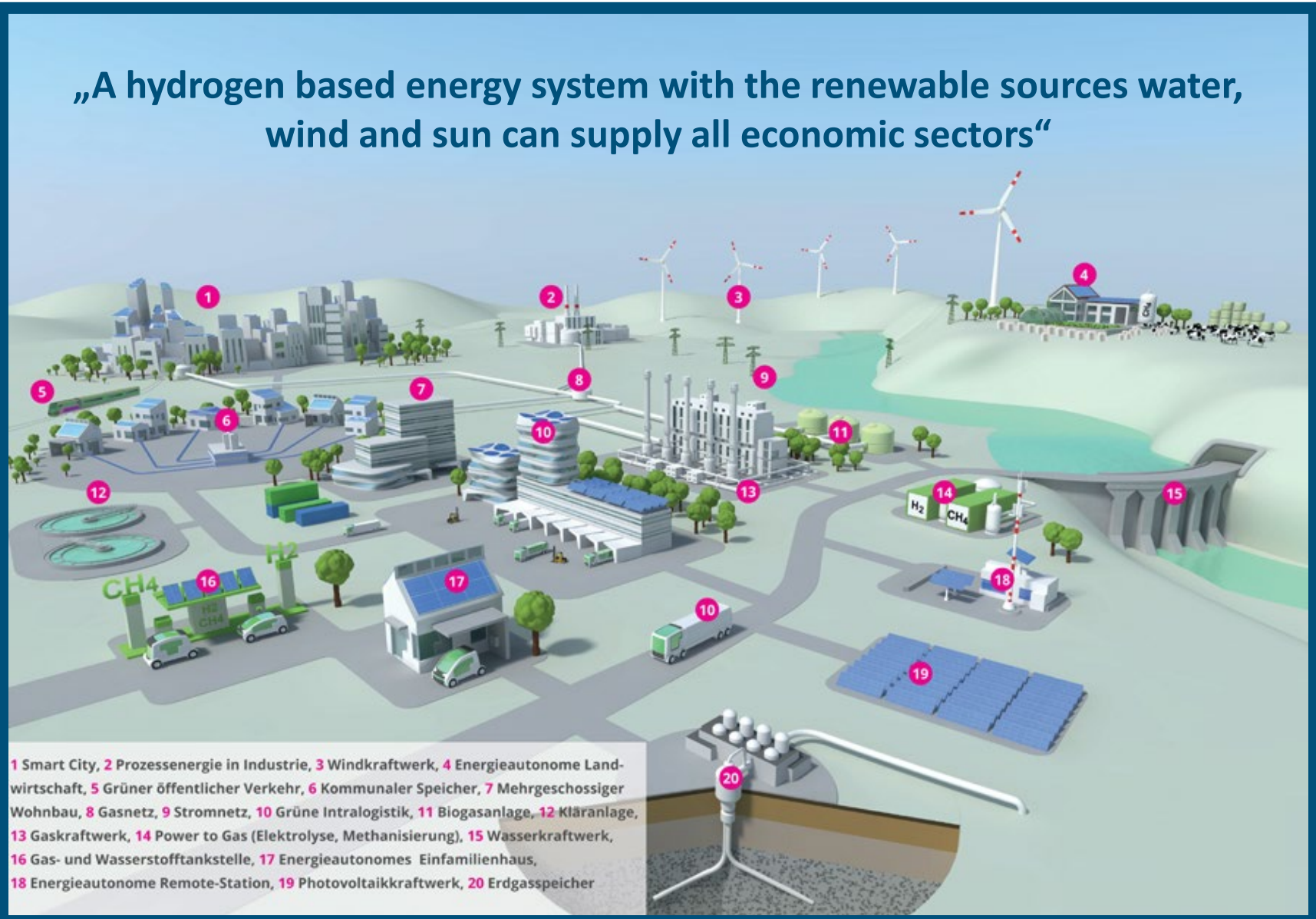
VORZEIGEREGION ENERGIE

FFG
Promoting Innovation.

VORZEIGEREGION
ENERGIE

WIVAP&G
Energy Model Region

„A hydrogen based energy system with the renewable sources water, wind and sun can supply all economic sectors“



Benefits of a transition to a hydrogen-based energy system

WIVA P&G
Energy Model Region

Power-to-gas
(H2 and SNG)

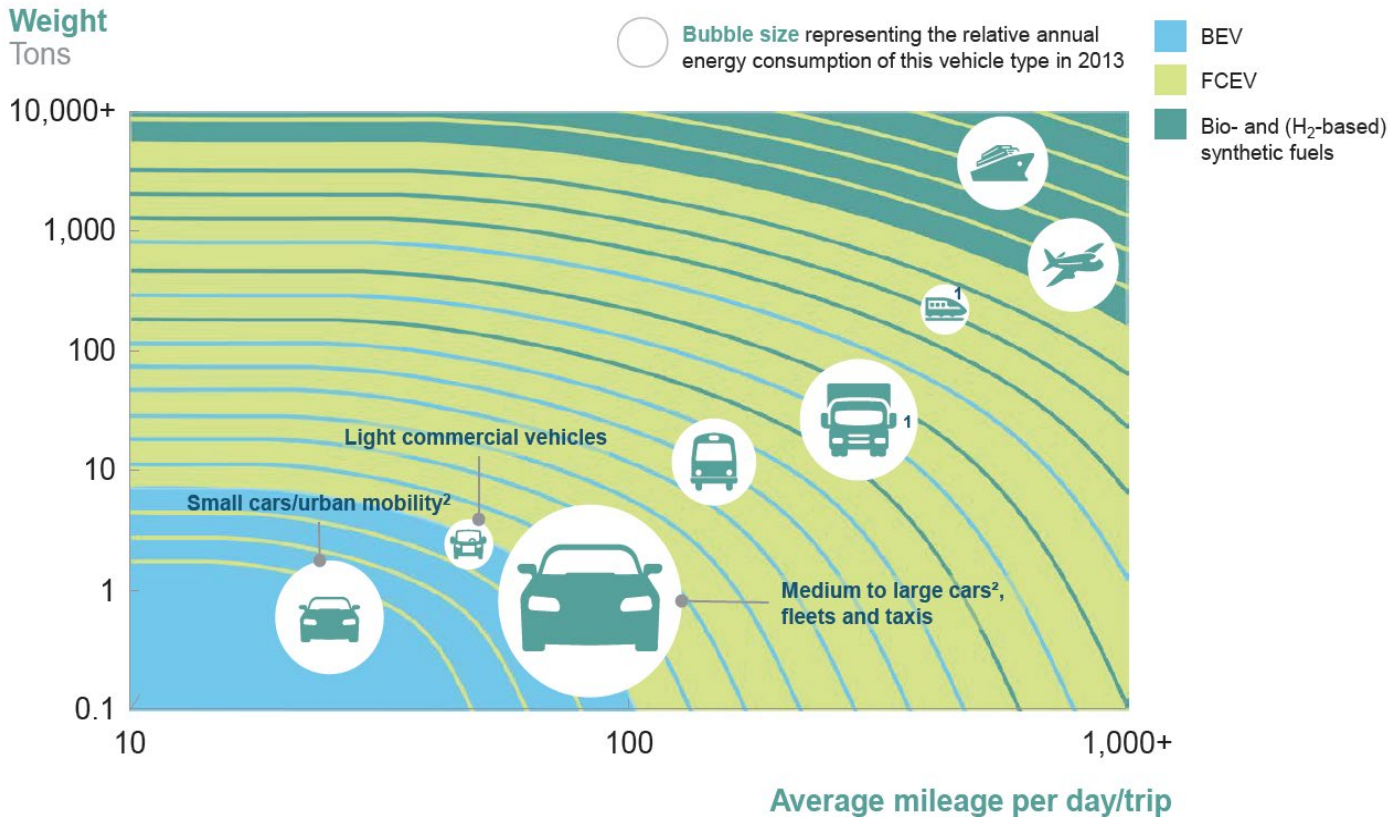
- Coupling of the power grid and the gas grid
- Long term chemical storage of fluctuating energy carriers
- Production of new green energy sources
- Decarbonisation of specific industrial processes

Reduction of greenhouse gases and of air pollutants

- Higher share of renewables
- Sustainable usage of existing gas infrastructure
- Higher resource efficiency of the energy sector
- Reduction of energy imports – high added value
- Increased security of supply

powered by klima+ energie fonds
VORZEIGEREGION ENERGIE
FFG Promoting Innovation.

Green Mobility Background



Source: Hydrogen Council 2017

- Long Driving Range
- Short Fueling Time
- High Effici-ency

Selection of Austrian R&D projects in the transport sector

WIVAP&G Energy Model Region

WIVAP&G Energy Model Region HYTRUCK

HYTRUCK
2018/07 – 2021/06

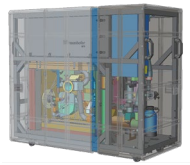
The main project goal of HyTruck is to develop, build, calibrate and validate a heavy-duty Fuel Cell System including its key technologies that fulfills the requirements of commercial vehicles regarding power, efficiency, reliability, and lifetime.

WIVAP&G Energy Model Region UPHY

UpHy
2018/05 – 2022/05

Upscaling of green hydrogen for mobility and industry (UpHy I) objectives are also the development of modern analytical methods to determine the required quality parameters directly at the pump and a mobile mass and gas quality measurement of the hydrogen to enable the calibration of all H2 filling stations on site.

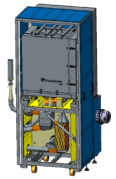
FFG



SOFC5-60
2016/11 – 2019/10

The project aims towards the development of a 5 kWel Solid Oxide Fuel Cell Combined Heat and Power system for residential and non-residential applications such as hotels, small industries and multi-family homes with an electrical efficiency of 60 % and a total efficiency of 95 % (based on hot water production and/or space heating).

FFG
WIVAP&G Energy Model Region



HYDROMETHA
2018/01 – 2021/12

With the flagship project a novel, fully integrated system of CO2+H2O high-temperature co-electrolysis (Co-SOEC) and catalytic methanation will be developed. The interconnection of these processes, as well as component and operational optimization will allow a significant increase in conversion efficiencies above 80%el.

WIVA P&G
Energy Model Region

HYTRUCK

WIVA P&G
Energy Model Region

Development, construction, calibration and validation of a heavy-duty fuel cell system including key technologies

AVL · FPT Powertrain Technologies · HyCentA Hydrogen Center Austria · emt · TU Wien Institut für Mechanik und Mechatronik Mechanics & Mechatronics · fen systems · PRODUCTBLOKS

IVECO · DB SCHENKER · TU Graz · IVT · Energie Institut an der Johannes Kepler Universität Linz · rosenbauer · EVN

powered by klima+ energie fonds · VORZEIGEREGION ENERGIE · FFG Promoting Innovation.

WIVA P&G Energy Model Region

UPHY

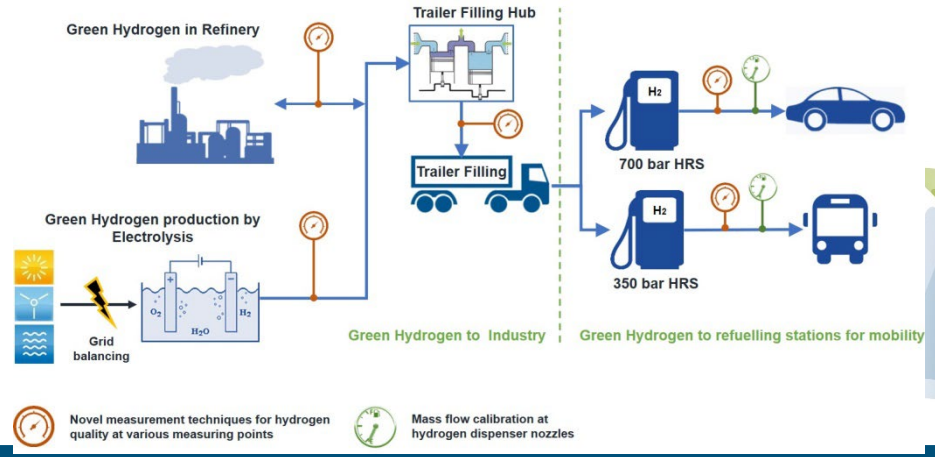
WIVA P&G Energy Model Region

CO2 reduction by green H2 mobility
(Phase 1: 4,600 t CO2/a reduction / extension to up to 15,000 t CO2/a)

Demonstration and **optimization of value chain for real life H2-mobility** application (commercial bus and taxi fleet)

Sector coupling of green power production, refining and mobility with green hydrogen

Development of **novel metering techniques to enable roll-out of H2** refilling stations (validation of H2 quality acc. ISO 14687-2 and official calibration of H2 mass at HRS)



OMV Verbund HyCentA HYDROGEN CENTER AUSTRIA V&F Analyse- und Messtechnik GmbH

ENERGIE INSTITUT WIVA P&G Energy Model Region

powered by klima+ energie fonds

VORZEIGEREGION ENERGIE

FFG Promoting Innovation.

Research and Development Needs

- Hydrogen fuel cell components and systems for affordable FC-electric vehicles
- Hydrogen fuel cell for electrified heavy-duty mobility sector
- Hydrogen in fleet use
- CO2-free Logistics
- Hydrogen refueling infrastructure

Green Industry

WIVA P&G
Energy Model Region

CO_2 reduction in industry by integration of renewables

- Favorable position of AUT in RES production BUT with increased deployment of wind energy we will see the same effects as in Germany (shut down of wind turbines)
- Large production sites in worldwide competition
- Integration of renewable gases necessary
- ETS: a global level playing field is needed
- Low-price H_2 from steam reformers vs green H_2: business models not viable
- Certification of green hydrogen needed

Selection of Austrian R&D projects in the industry sector

WIVAP&G Energy Model Region

H2Pioneer
2018/07 – 2021/06

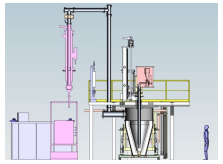
H2Pioneer replaces the current external production and supply, which is based on the intensive use of fossil energy sources and rich in greenhouse gases, with an electrolysis and cleaning plant at the industrial partner with a "green power" supply, together with further concepts for the recovery and reuse of the hydrogen used in the process or for power generation.

UpHy
2018/05 – 2022/05

Upscaling of green hydrogen for mobility and industry (UpHy I) objectives are also the development of modern analytical methods to determine the required quality parameters directly at the pump and a mobile mass and gas quality measurement of the hydrogen to enable the calibration of all H2 filling stations on site.

H2Future
2017-2021

Production of green hydrogen via water electrolysis out of electricity coming from renewable energy sources. Design and installation of one of the world`s largest PEM electrolyser unit (6 MW, 1200 m^3/hSTP hydrogen). Industrial integration of renewable hydrogen production in steelmaking processes, Demand Side Management (www.h2future-project.eu)

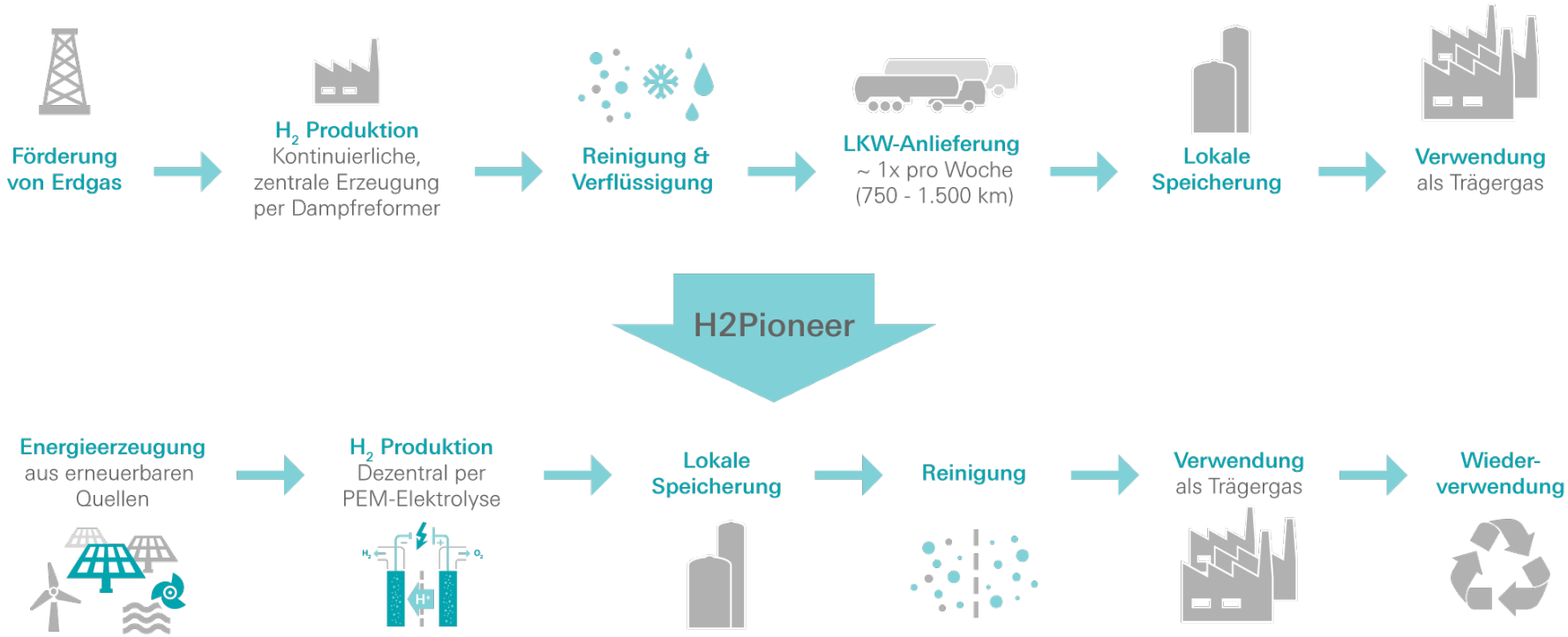


SuSteel
2016/09 – 2019/08

Direct transformation process from iron oxides to „steel“ with H_2 plasma smelting reduction process. Upscaling of the reactor (former MUL projects) from 100g to 50 kg batch operation with power consumption of approx. 250 kW. Location of the reactor is the new research melting plant at voestalpine Donawitz site. Follow-up K1-MET project 2020 to 2023.

WIVAP&G
Energy Model Region
H2PIONEER

WIVAP&G
Energy Model Region



Use of green hydrogen in the semiconductor industry

Verbund · ENERGIE INSTITUT an der Johannes Kepler Universität Linz · HyCentA HYDROGEN CENTER AUSTRIA · infineon

Research and Development Needs

- Green hydrogen in (current) industrial processes
- Carbon cycle economy
- New technology for the use of hydrogen
- Stationary fuel cells for households

Green Energy Background

WIVA P&G
Energy Model Region

Additional approach: Upgrading Hydrogen to Methane by linking with Carbon

- Seasonal balancing – security of supply
- Increasing energy density
- Utilization of existing infrastructure – no stranded investments
- Copying nature – all natural forms of energy storage contain H and C
- Sector coupling – carrier to all economic sectors

Selection of Austrian R&D projects in the energy sector

WIVA P&G Energy Model Region

WIVA P&G Energy Model Region RENEWABLE GASFIELD

Renewable Gasfield
2018/12 – 2021/11

Holistic approach for coupling hydrogen production from renewable energies by electrolysis with load-flexible methanisation including storage and distribution of renewable hydrogen and synthetically produced natural gas. Development of the versatile plant infrastructure under consideration of regional conditions. Large scale demonstration with direct coupling to an existing biogas plant.

WIVA P&G Energy Model Region HYTECHBASIS

HyTechbasis
2019/04 – 2022/03

By applying advanced catalyst coated membrane technology and the usage of sophisticated technology in bipolar plate manufacturing HYTECHBASIS improves state-of-the-art electrolysis technology. A generic PEM fuel cell system platform based on next generation low-cost metal bipolar plates stack architecture and highly function integrated peripheral components paves the way for a broader range of marketable applications.

UNDERGROUND SUN.STORAGE

Underground Sun Storage
09/2013 – 02/2017

Storage of hydrogen produced using solar energy is being trialled at a small depleted gas reservoir in Pilsbach, Upper Austria. Energy from renewable sources that can be retained thanks to storage offers the only straight replacement for conventional energy – and Austria's gas storage facilities provide the necessary infrastructure.

powered by klima+ energie fonds

FFG

UNDERGROUND SUN.CONVERSION

Underground Sun. Conversion
09/2013 – 02/2017

Hydrogen is produced from solar/wind power and water and then injected with carbon dioxide into an existing (porous) natural gas reservoir. At a depth of over 1,000 metres, in a relatively short time naturally occurring micro-organisms convert these substances into renewable gas which can be stored in the same reservoir, withdrawn as needed at any time, and transported to consumers via the existing pipeline network.

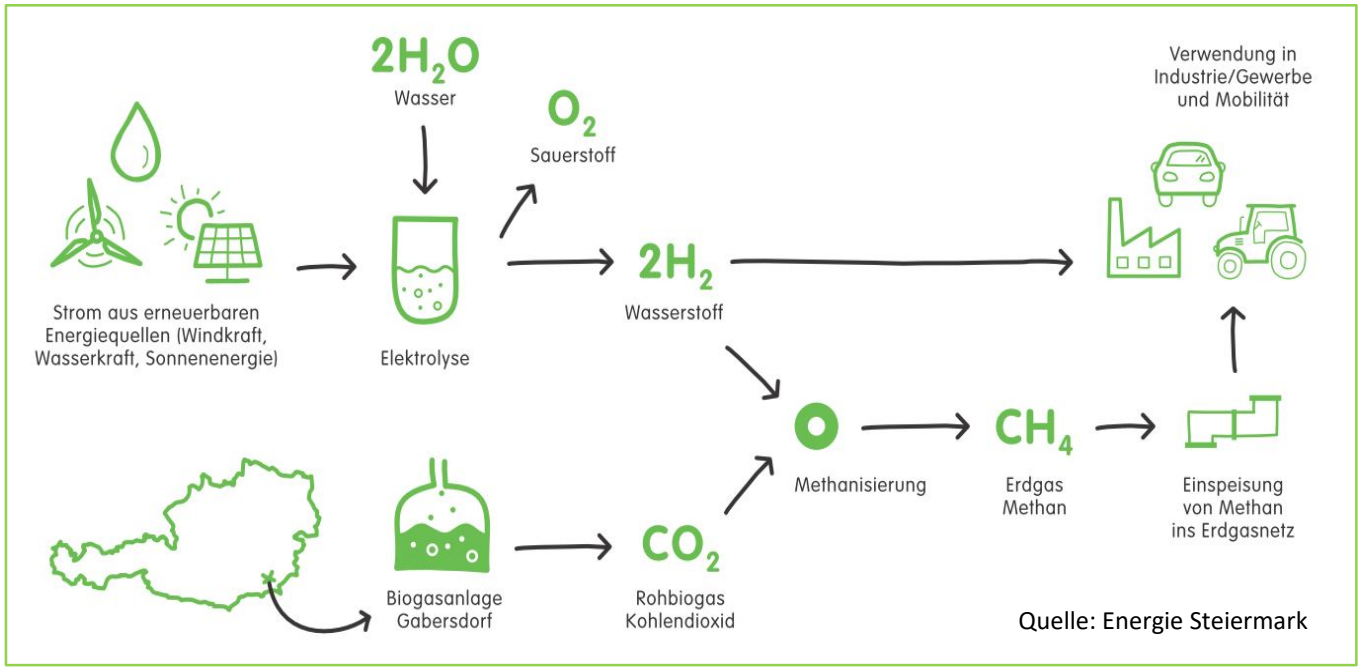
FFG

WIVAP&G Energy Model Region

RENEWABLE GASFIELD

WIVAP&G Energy Model Region

Production of green hydrogen with PEM electrolysis



Quelle: Energie Steiermark

Konsortialführer: ENERGIE STEIERMARK

ENERGIE NETZE STEIERMARK · HyCentA HYDROGEN CENTER AUSTRIA · ENERGIEAGENTUR Steiermark · VTiU Verfahrenstechnik · ENERGIE INSTITUT an der Johannes Kepler Universität Linz · WIVAP&G Energy Model Region · Das Land Steiermark

powered by klima+ energie fonds · VORZEIGEREGION ENERGIE · FFG Promoting Innovation. · KOMMUNAL KREDIT PUBLIC CONSULTING

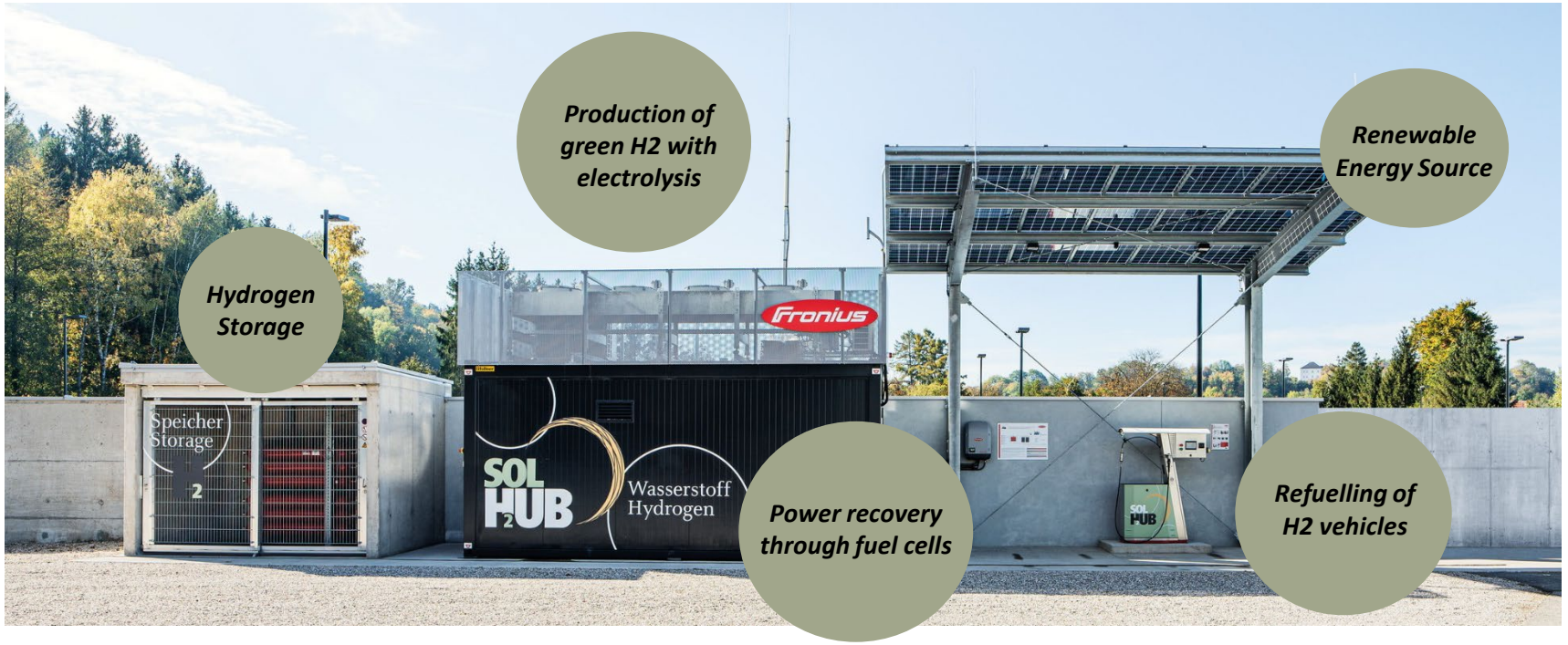
WIVA P&G Energy Model Region

HYTECHBASIS

WIVA P&G Energy Model Region

ENERGIE STAR 2019

staatspreis 2018 Clean Technology Austria



Advancing industrialization with the development of the next generation of PEM electrolysis stacks and systems and fuel cell systems

Fronius Innovation in Motion Miba Heraeus HyCentA Hydrogen Center Austria ENERGIE INSTITUT WIVA P&G Energy Model Region

powered by klima+ energie fonds

VORZEIGEREGION ENERGIE

FFG Promoting Innovation.

Research and Development Needs

- Feed-in and feed-out of green hydrogen
- Methanation of renewable gases
- Seasonal gas storage for renewable gases
- Use and adaption of existing gas and electricity infrastructure
- Green hydrogen production
- Central and de-centralized sector linkage

Top 3 findings

- WIVA P&G deals in its core activities with comprehensive research, development and implementation of a hydrogen-based system. The changeover is not comparable with, for example, increasing energy efficiency or a pure change of energy source from fossil to renewable. **The implentation also includes the optimized integration into the national and international legal system.**
- In accordance with the vision that WIVA P&G has set itself to demonstrate the possibilities of converting the economic system to a hydrogen-based system, **research projects must also be as broad and comprehensive as possible**. This is the reason why it is so important that all existing funding instruments of the entire R&D chain must continue to be available. This is particularly so because it can be assumed that there will still be major developments in many areas of technology. It can be expected that there will be a demand for technologies that are only available today on a laboratory scale.
- An essential advantage of the model region is the **joint cooperation** towards our vision **beyond project borders**. This enables us to shorten paths, accelarate exchange and optimize the utilization of results.

VORZEIGEREGION
ENERGIE

WIVA P&G
Energy Model Region

Thank you for your attention!

Martina Ammer-Grausgruber
ammer@wiva.at
www.wiva.at