

**Austrian Strategic Technology Programs:
Implementation and Current Research
Activities in the Field of Hydrogen and Fuel
Cells for the Transport Sector**

Fuel Cell Seminar
16. – 19. Nov. 2009 Palm Springs

Content

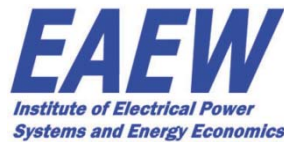
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A3PS – Austrian Agency for Alternative Propulsion Systems

PPP between industry, research and technology policy as strategic cooperation for the development and market introduction of alternative propulsion systems and fuels

- Stimulating the cooperation of complimentary partners, building up interdisciplinary research co-operations and trans-sectoral demonstration projects.
- Providing, compiling and analyzing information (technology foresight and assessment, studies, lectures, workshops, conferences, travel reports,...).
- Creating innovation friendly framework conditions (regulatory- and fiscal policy, fuel taxation, endowment of research programs, 7. FP, codes and standards, emission limits, access to sensitive areas,...).
- International networking and marketing for Austrian R&D competence and the product and engineering know how of A3PS members

27 A3PS - Members



Industry

- AVL List
- Fronius International
- KTM Powersports
- Magna Steyr
- OMV
- Plansee
- AustriaTech

University Institutes

- TU Graz - Institute for ICE and Thermodynamics
- TU Graz - Inst. of Chemical Engineering and Environmental Technology - Laboratory for Fuel Cell Systems
- TU Graz - Institute of Electrical Measurement and Measurement Signal Processing
- TU Vienna - Institute for ICE and Automotive Engineering
- TU Vienna - Institute of Chemical Technologies and Analytics / Research Division Electrochemistry
- TU Vienna - Institute of Chemical Engineering
- TU Vienna - Institute of Electrical Power Systems and Energy Economics
- University of Natural Resources and Applied Life Sciences

SMEs and Research Institutes

- Austrian Institute of Technology
- Austrian Hydrogen Association
- Bioenergy 2020+
- Biovest Consulting
- Bitter Group
- Competence Centre for Electrochemical Surface Technology
- Hydrogen Center Austria
- Joanneum Research
- MBtech Austria
- Profactor Group
- RIC - Regional Innovation Centre

International Cooperation and Networking

- EU-JTI “Fuel Cells and Hydrogen” (Scientific Committee)
- EU-Technology Platform BIOFUELS (Chairman of Mirror Group of National Delegates)
- EU-Technology Platform ERTRAC: Plenary, Steering Group, Financing & Governance Group
- EU-R&D-Framework Program 7: Program Committee
- ERA-NET TRANSPORT (Work Package Leader)
- IEA-Implementing Agreement “Hybrid & Electric Vehicles”
- IEA-Implementing Agreement “Advanced Motor Fuels”
- IEA-Implementing Agreement “Advanced Fuel Cells”

Automotive Industry in Austria

- Automotive industry represents a key sector of Austrian economy
 - 700 companies
 - Approx. 175.000 employees (total population of 8 Mio.)
 - Turnover of 30 Bio. €/a
 - One of the most successful branches in Austria
 - High competence on the drive train

Automotive Industry in Austria

- Key players:
 - High competence on the drive train
 - ▶ Subsidiaries of German vehicle producers (BMW, Opel, Daimler)
 - ▶ AVL List (optimization of drive trains, simulation tools, test systems)
 - ▶ KTM (world leader of off-road motorcycles)
 - ▶ MAGNA Steyr (global supplier of advanced automotive components, systems and modules)
 - Others:
 - ▶ OMV (Central Europe's leading fuel company)
 - ▶ Plansee (SOFC components)

European / Austrian Policy Goals



- Reduction of greenhouse gases (as of 1990) by at least 20% by 2020
- Increasing energy efficiency by 20% until 2020
- 20% renewable energy by 2020 (**34% in Austria**)

Transport sector

- Reduction of fleet emissions to 130 - 120 - 95 g CO₂/km
- Further tightening emission standards for emissions of pollutants (EURO 4, 5, 6,...)
- 5.75 % biofuels by 2010 and 10% by 2020 (**5.75% since 2008 in Austria**)

Supporting instruments of the Austrian Federal Ministry for Transport, Innovation and Technology

- A3 and A3plus Technology Program: funding cooperative R&D projects developing alternative propulsion systems and fuels
- Program Energy 2020: ICE-optimization, light weight structures, electronics
- Lighthouse Projects: demonstration for market introduction
- FFG basic program: bottom-up product optimization
- Headquarter Program
- Research Infrastructure (e.g. Hydrogen Center Austria)
- Competence Centers (e.g. K2-Mobility)
- International Cooperation (FP7, ETPs, ERA-NETs, IEA)
- Austrian Agency for Alternative Propulsion Systems (A3PS)

A3 program (Austrian Advanced Automotive Technology Program) |

- Funding program launched by the Federal Ministry for Transport, Innovation and Technology (BMVIT) in 2001
- Concentrates on highly innovative research projects and covers the entire innovation cycle
- Funding from basic research to demonstration projects
- Research topics are:
 - Alternative propulsion systems development
 - Vehicle electronics
 - Material research
 - Production technologies

A3 program



- 4 calls for proposals (2002-2006)
 - 152 Proposals
 - 78 projects approved (international evaluation)
 - Total project volume 39.6 Mio. €
 - Promotion of 20.4 Mio. €

- 2 calls for Lighthouse Projects (2005 and 2006)
 - 25 Proposals
 - 8 projects approved (international evaluation)
 - Total project volume 7.4 Mio. €
 - Promotion of 3.4 Mio. €

A3plus program



Goal:

Achieve real technological breakthroughs in the fields of

- Alternative drive systems and their components
- Alternative fuels
- Innovative storage concepts
- Development and promotion of necessary supplying infrastructures for refueling and the use of alternative drive systems
- Concepts for embedding alternative drives in the total vehicle design

A3plus program



- **4 calls from 2007 to 2009:**
 - 89 proposals received
 - 64 funded projects (including 3 lighthouse projects)
 - Funding volume: 19 Mio. €

Lighthouse Projects - Demonstration and Pilot Projects



- Funding instrument of the BMVIT to support the market introduction of new technologies.
- Goals:
 - Optimization of alternative propulsion systems and fuels under real life conditions through a close cooperation of developers and users
 - Preparation of the public for technological change
- Call 2009 with funding of 11 Mio. € in evaluation

Lighthouse Projects – Demonstration and Pilot Projects

II

- In 2005 and 2006 8 projects out of 25 proposals were selected and funded with 3.3 Mio. €
- In 2007 the funding for 3 lighthouse projects accounted for 2 Mio. €
 - **HYCART:** Demonstration of fuel cell vehicles with a decentralized hydrogen infrastructure under real conditions to achieve maturity for series manufacture
 - ▶ **Arsenal Research Vienna**

The HyLOG Project - Hydrogen Power Logistic System



Demonstration and investigation of the total system for an emission-free industrial transport logistic solution.

- Specific goals:
 - Developing a 2,5 kW range extender propulsion system with a 26 litre, 350 bar compressed hydrogen tank system and its certifiable integration into a series-production logistics traction vehicle
 - Construction and demonstration of operation of an autonomous filling infrastructure with local production of H₂ from solar power
 - Developing and estimating market potential of the overall system

The HyLOG Project



Source: Fronius International

The HyLOG Project



Source: Fronius International

The HyLOG Project - Results

IV

- Since May 2009: 5 days/week 2-shift operation
- 4-5 shift / cartridge exchange
- Key advantages:
 - Fast refueling increases system flexibility and availability
 - Increased productivity through constant power, reduced maintenance
 - No emissions
- Improvement potentials / Critical aspects
 - Minimum vehicle size for economic operation required
 - Competitive price for hydrogen as an energy carrier
 - Replacement of cartridge by indoor / onboard refuelling
 - System cost reduction through volume manufacturing
 - Limited freeze start capability

Source: Fronius International

The HyLOG Project

V

- Project Management
 - Fronius International
 - Contact: DI Dr. Ewald Wahlmüller
- Project Partners
 - HyCentA Research Graz
 - Bitter Group Steyr
 - Biovest Consulting Vienna
 - Clusterland Oberösterreich



BIOVEST CONSULTING



CLUSTERLAND
OBERÖSTERREICH GmbH

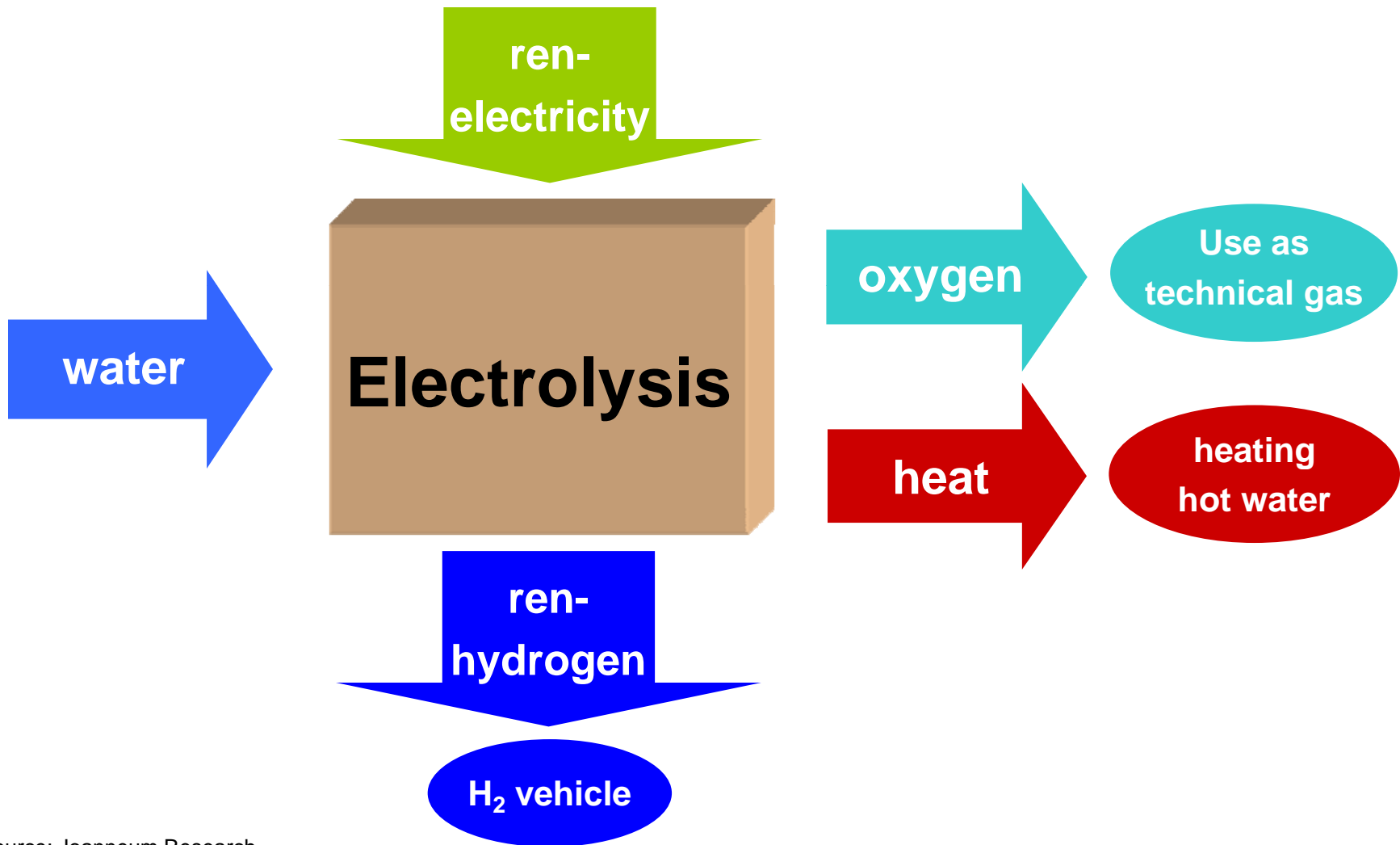
Lighthouse Project - Renewable Hydrogen Filling Station



- **Goals:**
 - Demonstration of combined electrolytic hydrogen production from renewable-electricity using the byproducts oxygen and heat
 - Energy-efficient production of hydrogen from renewable and regional available energy sources
 - Demonstration of the “Renewable Hydrogen Filling Station” during driving events at the HyCentA in Graz (Hydrogen Center Austria)

Renewable Hydrogen Filling Station – Scheme

II



Source: Joanneum Research

Renewable Hydrogen Filling Station - at HyCentA in Graz



HyCentA (Hydrogen Center Austria)



Supply infrastructure

Source: HycentA Research

Renewable Hydrogen Filling Station - Outlook

IV

- Start-up of the Renewable Hydrogen Filling Station by the end of 2009
- Evaluation of the operation by measurements until September 2010
- Driving event with H₂-vehicles at the HyCentA in summer 2010



Source: Joanneum Research

Renewable Hydrogen Filling Station

IV

- Project Management
 - Joanneum Research Graz
 - Contact: DI Dr. Gerfried Jungmeier
- Project Partners
 - HyCentA Research Graz
 - OMV
 - Linde Gas
 - Weizer Naturenergie
 - Region of Styria



BIOVEST CONSULTING



Relevant A3plus R&D Projects in 2008

I

Project	Project Partners
<p>THDA ADVANCED Advanced new fuel cell monitoring technology</p>	<ul style="list-style-type: none"> ● AVL List GmbH ● PSA Peugeot Citroën (PSA) ● Graz University of Technology – Institute of Chemical Engineering and Environmental Technology
<p>H2CPI Efficient and low emission hydrogen-ICE with cryogenic inlet manifold injection as high power drive train</p>	<ul style="list-style-type: none"> ● Graz University of Technology – Institute for Internal Combustion engines and Thermodynamics ● BMW Forschung und Technik ● AFT Atlas Fahrzeugtechnik ● Hoerbiger ValveTEC ● Ensinger Sintimid ● Forschungsgesellschaft für Verbrennungskraftmaschinen und Thermodynamik

Relevant A3plus R&D Projects in 2008

II

Project	Project Partners
CryoComp Principles and components for cryogenic pressure tank systems for hydrogen	<ul style="list-style-type: none">● Alvatec Alkali Vacuum Technologies● MT Aerospace● Austrian Aerospace● Dresden University of Technology – Chair for Refrigeration and Cryo-Engineering● Rotarex Automotive● BMW
H₂ProFerm Fermentative production of hydrogen from bio-residues and innovative processing to fuel quality	<ul style="list-style-type: none">● Profactor● Bitter● Prosolve Muttenthaler

Outlook

- Funding budget for the automotive sector provided by the Federal Ministry for Transport, Innovation and Technology increased from 40 Mio. € in 2008 to **60 Mio. €** in **2009** and **2010**.
- Elaboration of an Electromobility Introduction Plan
 - First draft by the end of 2009
 - Reduction of environmental and social impact of transport
 - Increase energy efficiency
 - Shift to renewable fuels/energy sources
- The Electromobility Introduction Plan considers various aspects
 - ▶ Vehicle availability
 - ▶ Infrastructure
 - ▶ Customers
 - ▶ Governmental incentives and activities

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Thank you for your attention!