

Accelerating market entry:

The NRW Hydrogen HyWay Program

Fuel Cell and Hydrogen Network NRW



Outline

1

The Fuel Cell and Hydrogen Network North Rhine-Westphalia

2

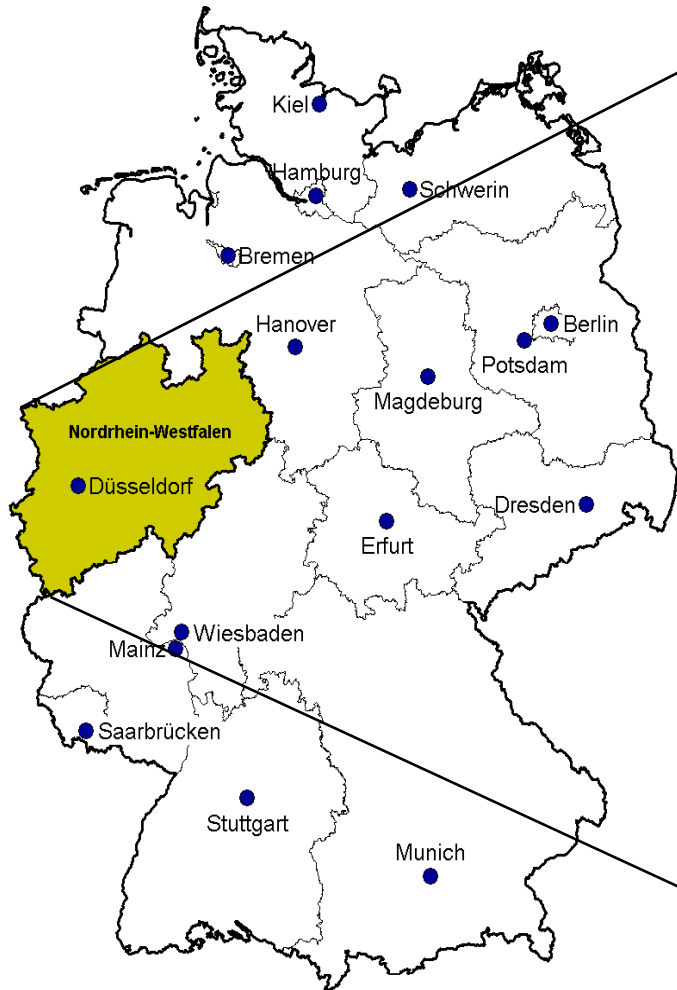
The Hydrogen Situation in NRW

3

The NRW Hydrogen HyWay-Programme

4

The World Hydrogen Energy Conference 2010



+H₂- Fuel Cell
and Hydrogen
Network NRW

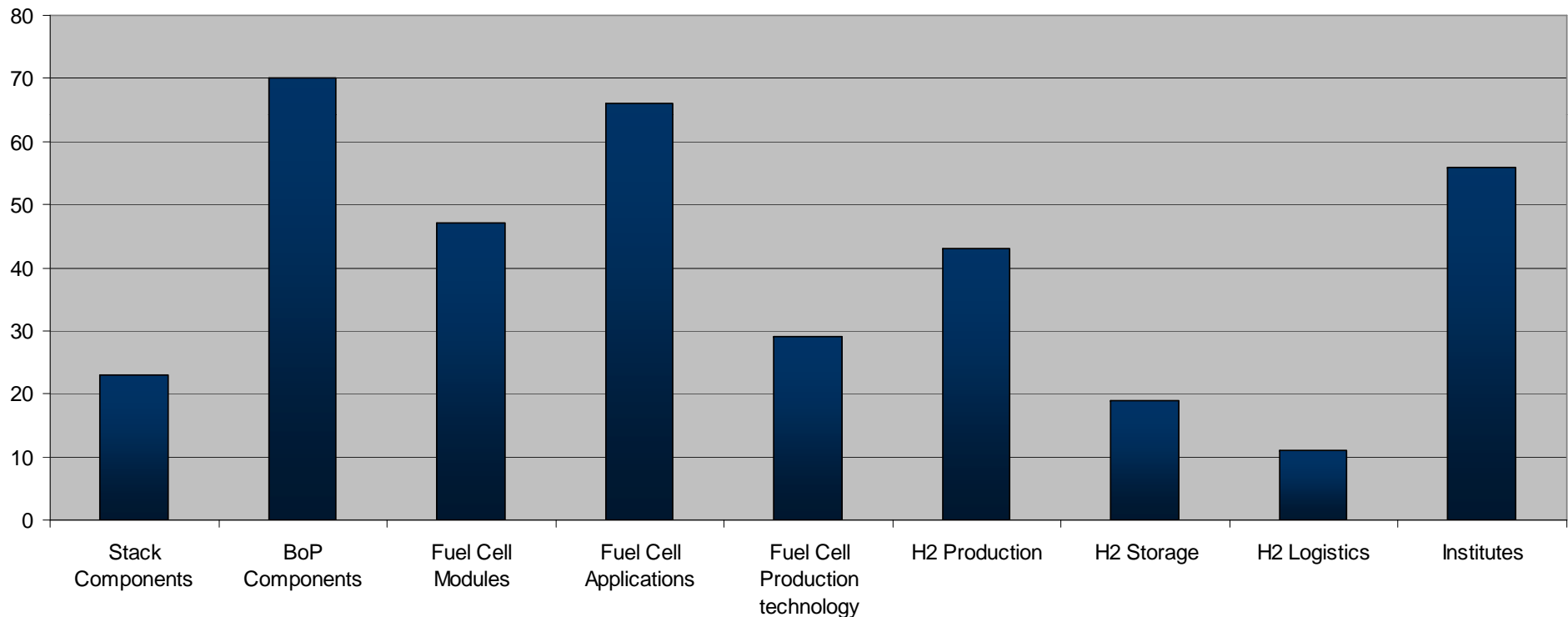
- Non-profit organization, working on behalf of the Government of North Rhine-Westphalia (Germany)
- Regional Technology Platform to develop and commercialize fuel cell and hydrogen technology
- Founded in April 2000

Objectives of the Network

- The establishment of a new industrial sector through the targeted marketing of the fuel cell in appropriate pilot markets,
- Support for development work in the field of fuel cell technology and the related system components,
- Setting up a sustainable hydrogen infrastructure based for the long term on renewable energies and
- The positioning of North Rhine-Westphalia as an internationally recognised hub for fuel cell and hydrogen technology.

Membership structure

350 members from industry and science



Database: www.fuelcell-nrw.de

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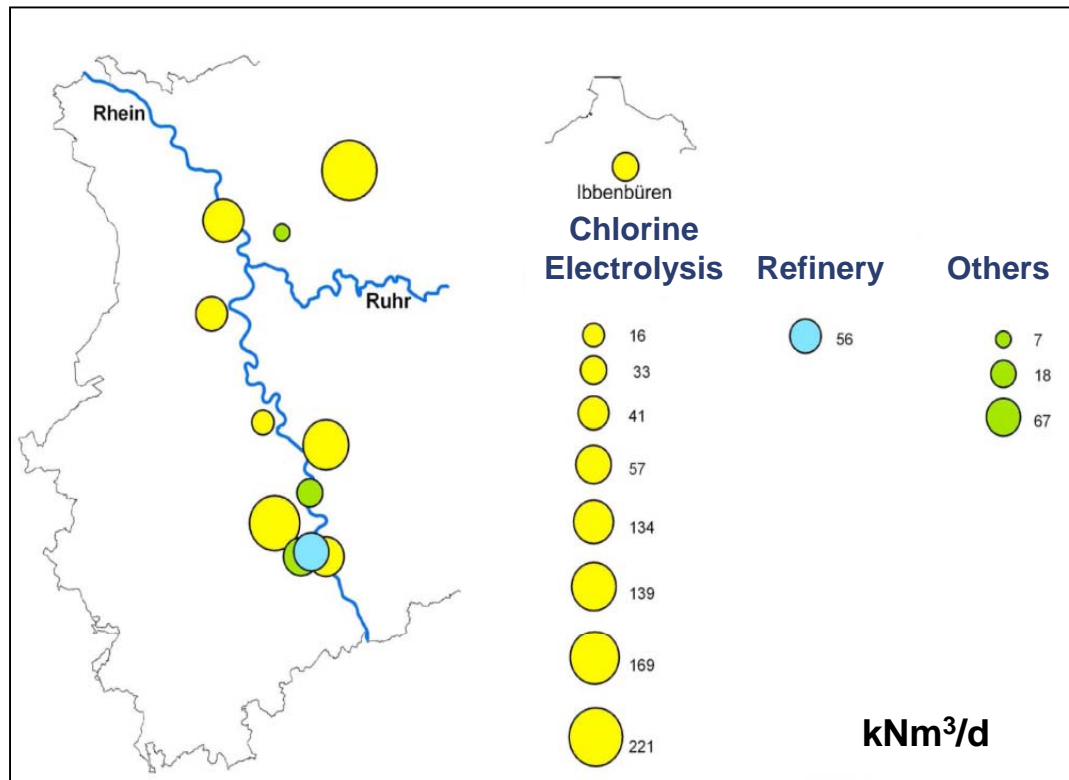
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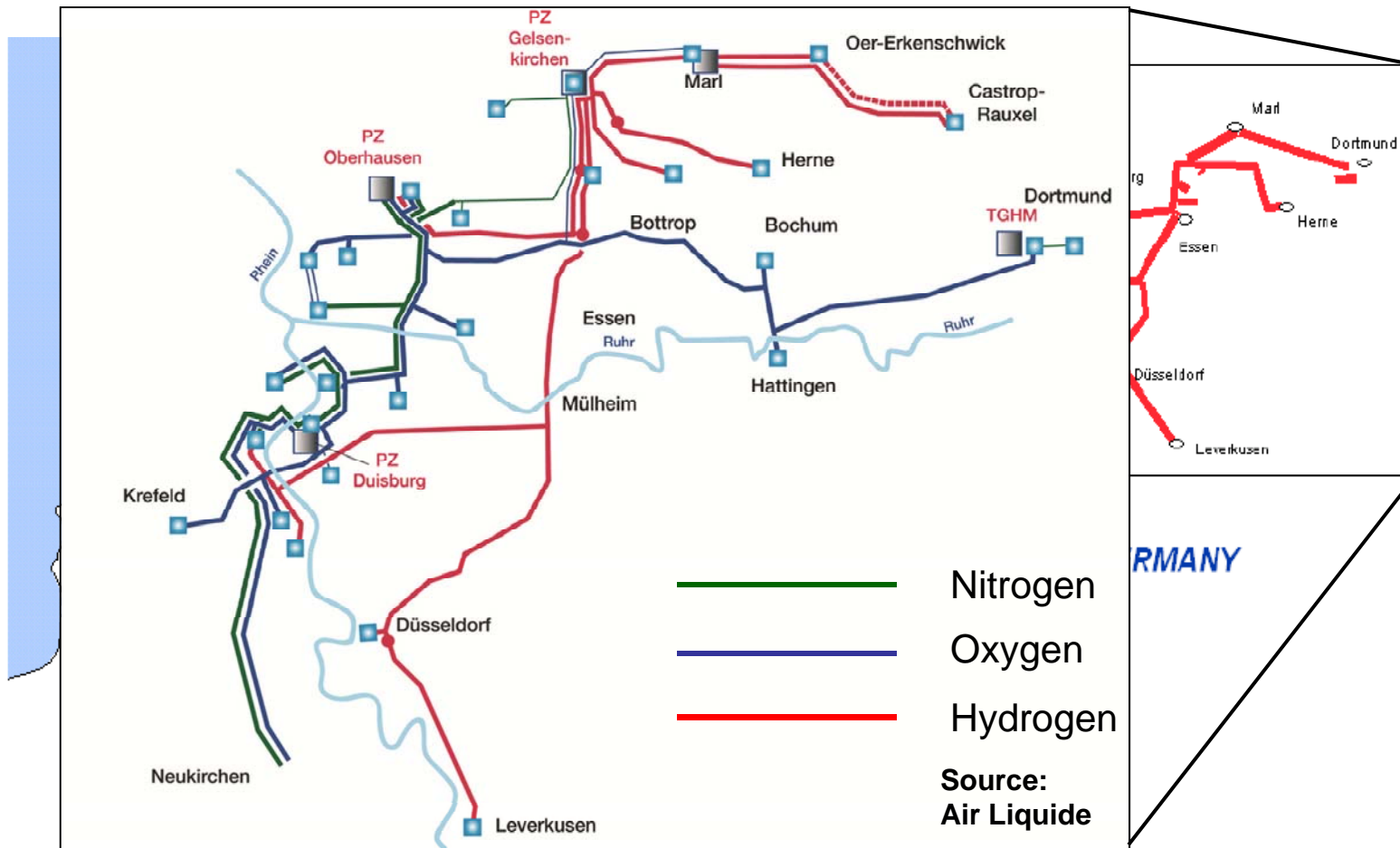
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Hydrogen in NRW – Industrial Waste Hydrogen



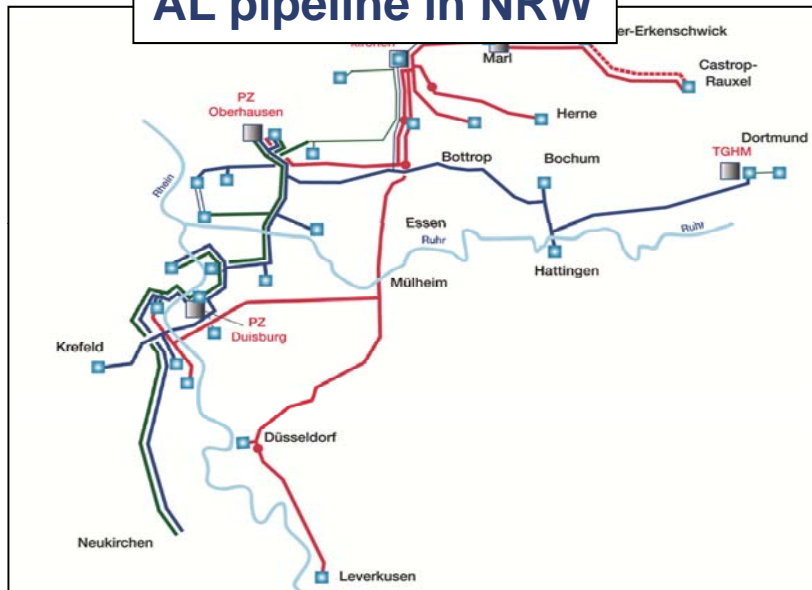
- Only waste hydrogen from large-scale electrolysis is considered to be used (mainly for accessibility reasons) within the first step
- Careful calculation of potential sources (possibly much more available)

Hydrogen pipeline infrastructure NRW

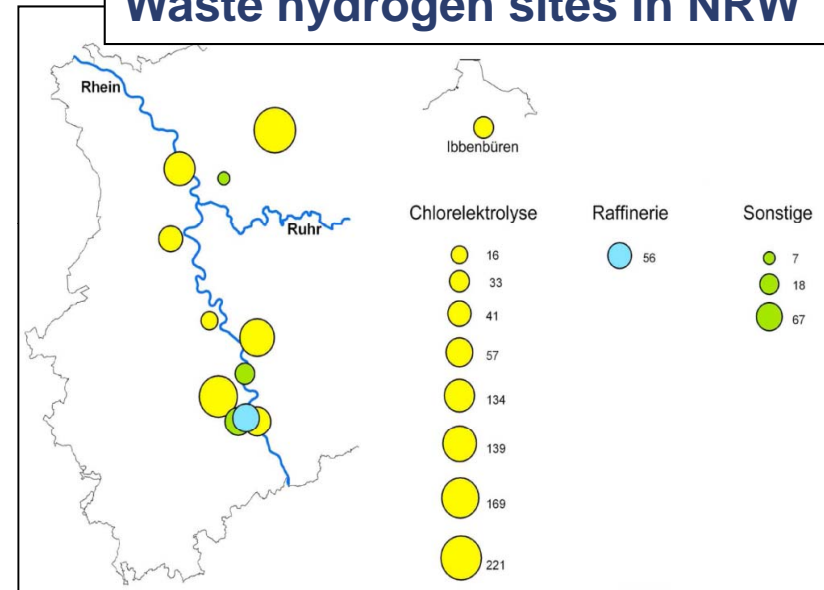


Hydrogen in NRW

AL pipeline in NRW

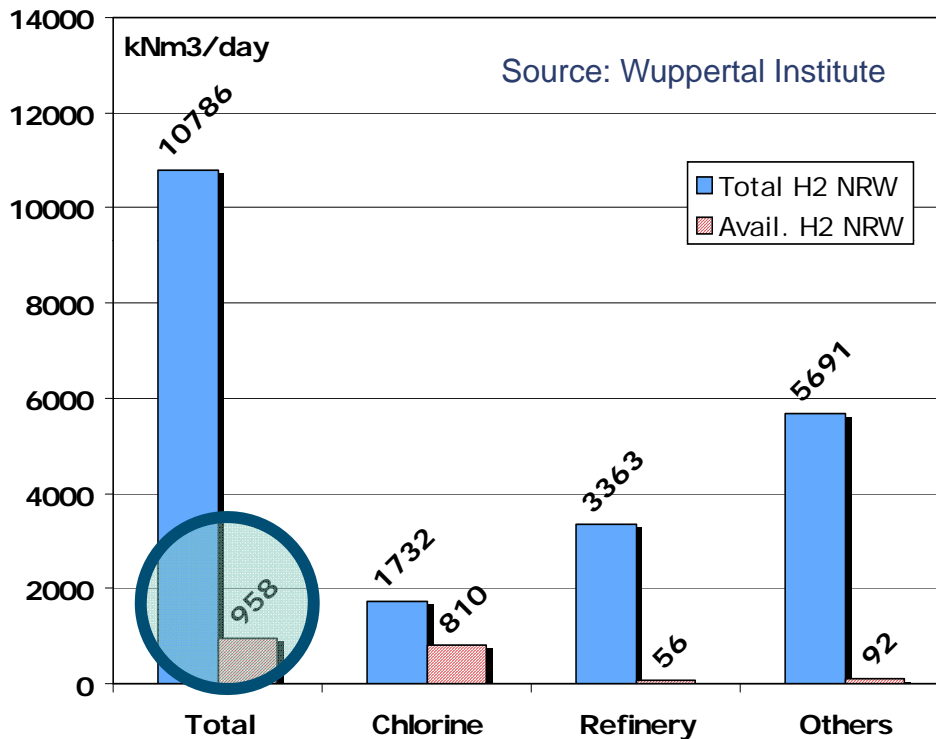


Waste hydrogen sites in NRW



- Hydrogen production sites (chemical plants) are close to the pipeline
- Industrial plants will be in operation for at least another 30 years

Hydrogen Potential in NRW



- ~ 350 million Nm³ industrial waste hydrogen from electrolysis (31.000 t/a)
- Sufficient to operate either ~ 260,000 cars or 6,000 buses
- Costs expected to be at natural gas level plus compression and purification (if needed)
- Conclusion: Excellent conditions for large-scale transport and stationary application projects in NRW



Development of renewable hydrogen sources is a midterm task

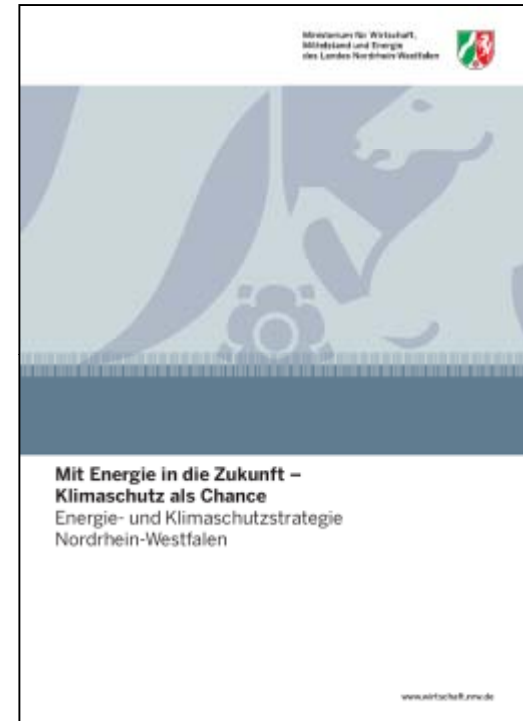
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NRW Climate Strategy

Specific Targets by 2020:

- Mitigation of the CO₂ emission in NRW by 81 million tons compared with 2005
 - equivalent to 29 % of total CO₂ emissions
 - equivalent to 44 % of the overall German target for reduction of CO₂ emissions until 2020



Measures and Action Items:

- Most important - Renewal of coal power plants
- Among further measures - **The “NRW Hydrogen HyWay” Concept**

Lead Project “NRW Hydrogen HyWay”



Framework Programme (2008 -2011)

42 project ideas, ~ 200 mio. € budget
Cofinancing partially by EU and Federal Government
11 locations (along the pipeline)

- **Infrastructure (11 projects)**
Hydrogen production, filling stations
- **Mobile Applications (15 projects)**
Buses, Cars, Light vehicles
- **Stationary Applications (7 projects)**
CHP, UPS, Remote power
- **Research, Developm., Education**
Storage, Components , Materials...



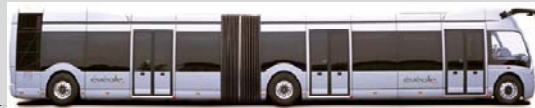
NRW Hydrogen HyWay - Current status

- **8 projects granted**
 - ~ 41 Mio. € total expenditures
 - ~ 18 Mio. € funding
 - **20 projects under negotiation**
 - ~ 80 Mio. € total expenditures
 - ~ 35 Mio. € funding
 - **Numerous projects postponed**
 - Economic situation worldwide
 - Uncertainties as result of discussion battery vs. fuel cell
- **New focus of network activities towards market introduction**
- modification of funding instruments
 - development of market introduction instruments

Project examples: FC-Triple-Hybrid-Bus



NRW-Dutch co-operative project



| | |
|----------------------|--|
| Vehicle: | APTS Phileas (18 m) |
| Weight: | 18 t |
| Drivetrain: | Triple-Hybrid (FC-Battery-SuperCap) |
| Rated power: | 240 kW |
| FC power: | 140 kW (Nedstack) |
| Speed: | min. 70 km/h |
| Schedule: | Start demo phase 06/10 |
| Total budget: | ~ 12 million € |

Test at public transport companies
near Cologne and Amsterdam

Project examples: H₂ User Center Herten



- User Center for Development and Production
- Hydrogen Infrastructure available
- Wind electricity-based electrolysis, storage technology, FC production
- Construction costs ca. 3 mio. €
- Opening in October 2009

Project examples: „Blue Tower“ Herten



- Erection of a demo plant for biomass pyrolysis
- Option: Hydrogen from biomass (up to 1,300 Nm³/h H₂)
- Supply of the user center and of a further filling station planned



Project examples: Fuel Cell Midi Buses



- 2 fuel cell midi buses in regular public transport operation in 3 cities of the northern Ruhr area
- 2 fuel cell midi buses as transport shuttles at fairground Duesseldorf

Project examples: Hydrogen from Digester Gas



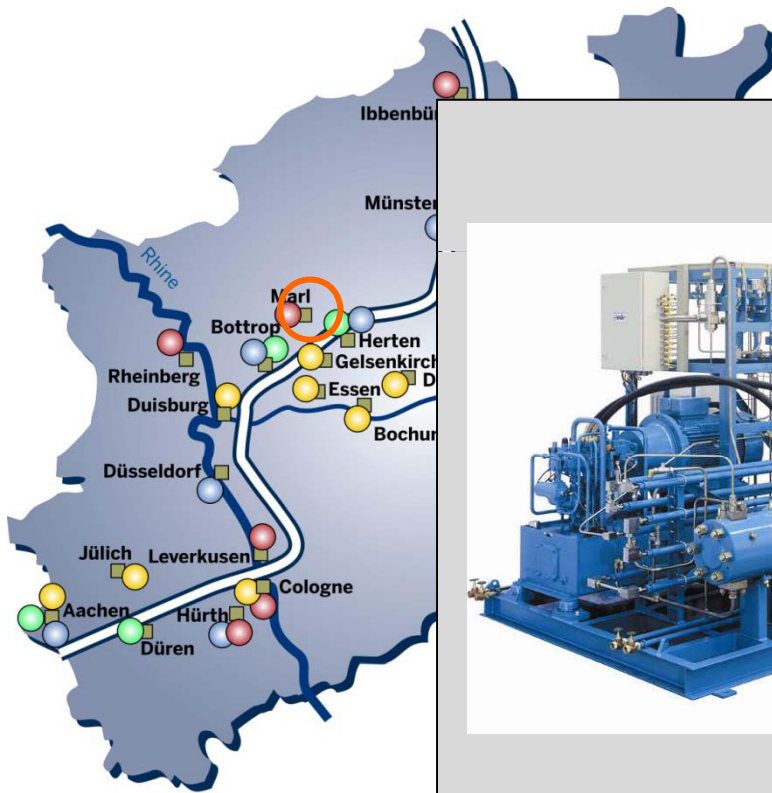
- Production of hydrogen (ca. 40-100 Nm³/h) from digester gas on a waste water treatment plant
- Energy supply of a school via H₂-CHP
- Erection of a hydrogen filling station (350 bar)
- Further options:
700 bar, Fast-Filling-Modul

Project examples: Chemergy Park Hürth



- Erection of an H₂ filling station at chemical park Hürth (near Cologne)
- Hydrogen from Cl-electrolysis
- Hydrogen „over the fence“ (cost reduction)
- Supply of the Phileas buses
- Modular extension planned

Project examples: Refilling of Hydrogen Cartridges



- Operation of a refilling station for portable hydrogen cartridges in Marl (Air Liquide)
- Cartridges designed for smaller mobile and portable fuel cell applications (Dynetek)
- Filling pressure 700 bar
- Volume 2 Litres
- Energy content 3 kWh

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Hydrogen Energy



18th World Hydrogen Energy Conference

May 16 - 21, 2010
Essen, Germany

Conference Topics

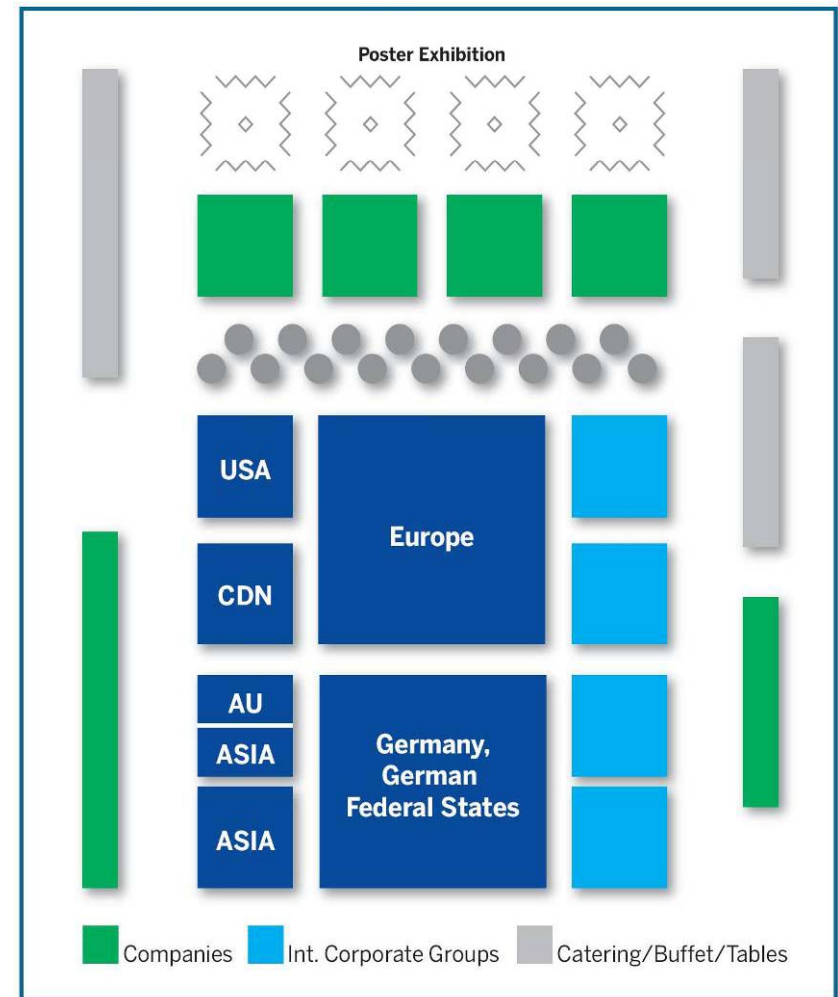
10 Topics – 45 Sessions – 330 Presentations

- Fuel Cell Basics
- Fuel Infrastructure
- Hydrogen Production Technologie
- Storages
- Policy Perspectives, Initiatives and Co-operations
- Strategic Analyses
- Safety Issues
- Existing and Emerging Markets
- Stationary Applications
- Transportation Applications



Complementary Program

- Parallel IPHE and IEA Exco sessions
- International Exhibition of advanced H₂ & FC technology, Ride & Drive Events
- Technical tours
- Student competition
- Cultural events offered by the European Capital of Culture 2010 (Essen)



Thank you!

Beer Break at 3.30 pm

www.fuelcell-nrw.de
www.whec2010.com

or

Visit booth # 531 here at FCS&E Palm Springs