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HyWays: The European Hydrogen Roadmap and NRW HyWay
Florian Rost
HyWays?

The European Hydrogen Roadmap
HyWays

Summary: Importance of Hydrogen

- Hydrogen is an energy carrier with zero carbon content
- It can be produced from all energy resources, such as biomass, wind and solar energy
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Fuel Cell
Summary: Importance of Hydrogen

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- It can be produced from all energy resources, such as biomass, wind and solar energy
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It improves security of supply due to the decoupling of demand and resources
HyWays

Summary: Importance of Hydrogen

- Hydrogen is an energy carrier with zero carbon content
- It can be produced from all energy resources, such as biomass, wind and solar energy
- Conversion to power and heat with high efficiency and zero Emissions possible
  → Fuel cell
- It improves security of supply due to the decoupling of demand and resources
  → Each European MS can choose its own energy sources.
The possibility of taking the frontrunner position in the worldwide market for hydrogen
**HyWays**

*Project Summary*

- HyWays was an integrated project, co-funded by research institutes, industry and by the European Commission (EC) under the 6th Framework Program.

- Member States (MS): 50 member states e.g. Finland, France, Germany, Greece, Italy, the Netherlands, Norway, Poland, Spain and the United Kingdom.
At oil prices over $50 – $60 per barrel equivalent, hydrogen does become cost competitive as a fuel.
HyWays

Net employment effect of 200,000 – 300,000 labour / year

Impact on environment:

- More and more carbon free hydrogen supply: Wind, solar, biomass etc
- Hydrogen fleet: 20 Million “hydrogen” cars

<table>
<thead>
<tr>
<th>HyWays Snapshot 2030</th>
<th>2050</th>
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<tbody>
<tr>
<td>Hydrogen &amp; FC are competitive</td>
<td>H₂ &amp; FC dominant technologies high impact</td>
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<tr>
<td>• Creation of new jobs and safeguarding existing jobs (net employment effect of 200,000 – 300,000 labour years)</td>
<td>• 80% of light duty vehicles &amp; city buses fuelled with CO₂-free hydrogen</td>
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<tr>
<td>• Shift towards carbon-free hydrogen supply</td>
<td>• reaching more than 80% CO₂ reduction in passenger car transport</td>
</tr>
<tr>
<td>• More than 20% of new car sales H₂ &amp; FC</td>
<td>• In stationary end-use applications, hydrogen is used in remote locations and island grids</td>
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**Vehicles:**
- 25 million of fleet

**Cost**
- H₂: 3 €/kg (50 €/barrel)
- FC: 50 €/kW
- Tank: 5 €/kWh

Gradual switch from hydrogen specific support to generic support of sustainability (2020 – – –)

Incentives provided through general support schemes for sustainability

**2030**

**2050**

HyWays : The European Hydrogen Roadmap and NRW HyWay

Florian Rost
HyWays

Until 2020

- “Early Phase”
- Hydrogen production rely mainly on existing by-product, steam methane reforming and electrolysis

Until 2050

- Production portfolio is broaden:
- Centralized electrolysis
- Renewable feedstocks: Wind, solar, biomass
HyWays

Main challenges

- Cost reduction: Cost of hydrogen end-use applications, ensure that the economic break-even point is reached as soon as possible at minimum cumulative costs.

- Policy support Hydrogen: Generally not on the agenda of the ministries responsible for the reduction of greenhouse gasses

  Lacking of support schemes for hydrogen end-use technologies and infrastructure
HyWays

Main conclusions

- Emission reduction
  - Costs to reduce CO2 decreases
  - Reducing CO2 emissions from road transport by 50% in 2050

- The introduction of hydrogen into the energy system offers the opportunity to increase the share of renewable energy
  - Hydrogen could also act as a temporary energy storage option
  - Wind energy

- Economic opportunity
  - if Europe is able to strengthen its position as a car manufacturer and energy equipment manufacturer
NRW Hydrogen HyWay

Overview

- **Beginning:** March 2008: Government of North Rhine-Westphalia (NRW) published its Climate Protection Programme

- **Main focus:** support marketability of the fuel cell technology by initiation of research and demonstration projects
NRW Hydrogen HyWay

Overview

- **Beginning:**
  - March 2008: Government of North Rhine-Westphalia (NRW) published its Climate Protection Programme
  - NRW Hydrogen HyWay as a component of the program

- **Main focus:** support marketability of the fuel cell technology by initiation of research and demonstration projects

- **HyWay Projects are set up along the existing hydrogen pipeline** total length 230 km in the Rhine-Ruhr- area
NRW Hydrogen HyWay

Overview

- More than 80% of hydrogen is produced from industrial electrolysis

- The costs of hydrogen = natural gas level (plus compression and purification)

- Hydrogen filling stations close to pipeline:
  
  ➡️ avoid transport costs
NRW Hydrogen HyWay

Overview- Targets

- Establish hydrogen as a competitive fuel option
- bring mobile fuel cell applications to market
NRW Hydrogen HyWay

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- Establish hydrogen as a competitive fuel option
- Bring mobile fuel cell applications to market

Fuel cell activities:

Vehicles ➔ bus fleets for transportation companies,

➔ cars applied in pools of public entities utility

➔ vehicles used by logistic companies
NRW Hydrogen HyWay

Overview - Targets

- Establish hydrogen as a competitive fuel option
- Bring mobile fuel cell applications to market

- Fuel cell activities:
  - Bus fleets for transportation companies,
  - Cars applied in pools of public entities utility vehicles used by logistic companies
  - "Virtual power plant" of fuel cell systems is planned in the Ruhr-metropolis
  - Material handling vehicles
  - Uninterruptible power supply etc
NRW Hydrogen HyWay
To be close to the citizens

- Hydrogen used in busses and PKWs (e.g. Cologne)
  -> FC Bus "Phileas" introduced in 2010

  - Used in Brühl and Hürth
  - .... Istanbul...
  - 150 kW, 18 m long
NRW Hydrogen HyWay

To be close to the citizens

H₂ Race
NRW Hydrogen HyWay

Herten: Hydrogen Competence Center

Hydrogen Production

3 Main Projects

Production and Development

Hydrogen Supply
NRW Hydrogen HyWay
Herten: Hydrogen Competence Center

3 Main Projects

Hydrogen Production
- Blue Tower: 1 MWth plant
- Hydrogen from Biomass
  - 37,500 MWh electricity per year
  - 150 m² hydrogen /h

Hydrogen Supply
- Hydrogen filling station

Production and Development
- Offices, laboratories and workshops
- HyChain Minitrans (qualification Project for hydrogen and fuel cell)
Sources

- http://www.energieland.nrw.de
- http://www.blue-tower.de/
Thank You