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The role of Hydrogen until 2017

Hanover fair 2012

Christian Machens, TÜV SÜD Akademie



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TÜV SÜD Academy in Figures



- Established: 1986 (Germany)
- > 170,000 participants per year
- > 500 training topics
- World wide presence
- > 500 staff worldwide
- > 2,500 trainers and coaches worldwide



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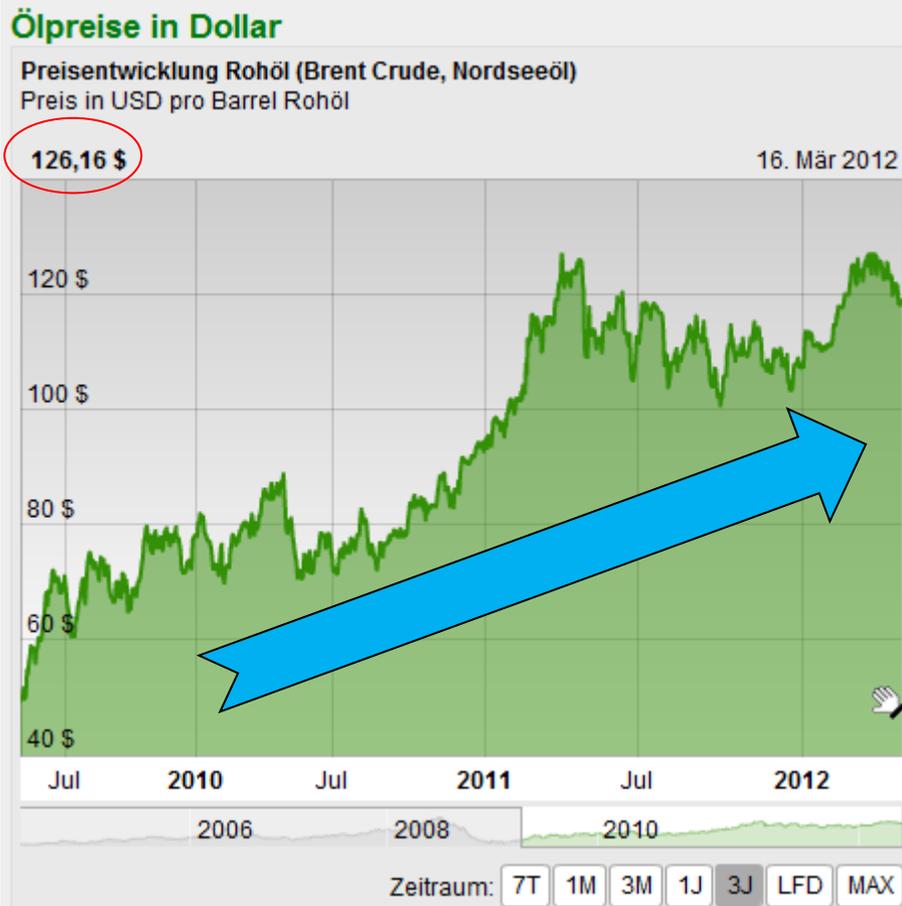
Today's role of Hydrogen

1. Hydrogen is already used as industrial gas since over 100 years
2. Hydrogen can be generated from a variety of sources (green and grey)
3. Hydrogen is a possible energy-carrier for mob.&stat. applications
4. Oil price is climbing continuously (demand also!)
5. Dependency on oil and gas should be decreased (€ / security of supply)
6. Hydrogen is a „technology-based“ energy-carrier
7. H₂ can make regenerative energies better useable
8. Infrastructure is cheaper than for pure EVs
9. FCV have a higher efficiency than conventional cars
10. Many companies are involved in H₂ activities (generation & use)
11. Training and education is necessary for safe implementation



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Oil price development



„If oil reaches 140 US\$/br,
hydrogen cars can be acquired
and operated at costs comparable
to conventional cars“
(HyWays Project, 2007)

Roadmap and action plan (HyWays)

	2010	2015	2020	2030	2050
Phases	<p>Technology development with focus on cost reduction</p>	<p>Pre-commercial technology refinement & market preparation</p> <p>Start of commercialisation</p>	<p>HFP Snapshot 2020 materialisation of first impacts</p> <ul style="list-style-type: none"> New hydrogen supply capacities partially based on low carbon sources improvement in local air quality More than 5% of new car sales H₂ & FC 	<p>HyWays Snapshot 2030 Hydrogen & FC are competitive</p> <ul style="list-style-type: none"> Creation of new jobs and safeguarding existing jobs (net employment effect of 200,000 – 300,000 labour years) Shift towards carbon-free hydrogen supply More than 20% of new car sales H₂ & FC 	<p>H₂ & FC dominant technologies high impact</p> <ul style="list-style-type: none"> 80% of light duty vehicles & city buses fuelled with CO₂ free hydrogen reaching more than 80% CO₂ reduction in passenger car transport In stationary end-use applications, hydrogen is used in remote locations and island grids
Targets	<p>LHPs facilitate initial fleet of a few 1,000 vehicles by 2015</p> <ul style="list-style-type: none"> PPP "Lighthouse Projects" Increase R&D budgets to 80 M€/year Financial support for large scale demonstration projects 		<p><u>Vehicles:</u> 2.5 million of fleet</p> <p><u>Cost</u> H₂: 4 €/kg (50 €/barrel) FC: 100 €/ kW Tank: 10 €/kWh</p>	<p><u>Vehicles:</u> 25 million of fleet</p> <p><u>Cost</u> H₂: 3 €/kg (50 €/barrel) FC: 50 €/ kW Tank: 5 €/kWh</p>	
Required Policy Support Actions	<p>Develop H₂ specific support framework</p> <ul style="list-style-type: none"> Create / support early markets Implement performance monitoring framework Long term security for investing stakeholders Education and training programmes Harmonisation of regulations codes and standards 		<p>H₂ specific support framework</p> <ul style="list-style-type: none"> In place before 2015 at MS level Deployment supports, e.g. tax incentives of 180 M€/year Public procurement Planning and execution of strategic development of hydrogen infrastructure 	<p>Gradual switch from hydrogen specific support to generic support of sustainability (2020 →)</p>	<p>Incentives provided through general support schemes for sustainability</p>
	2010	2015	2020	2030	2050

The full version of the Roadmap and Action Plan are available for download at www.HyWays.de.



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HRS in Europe (H2stations.org)

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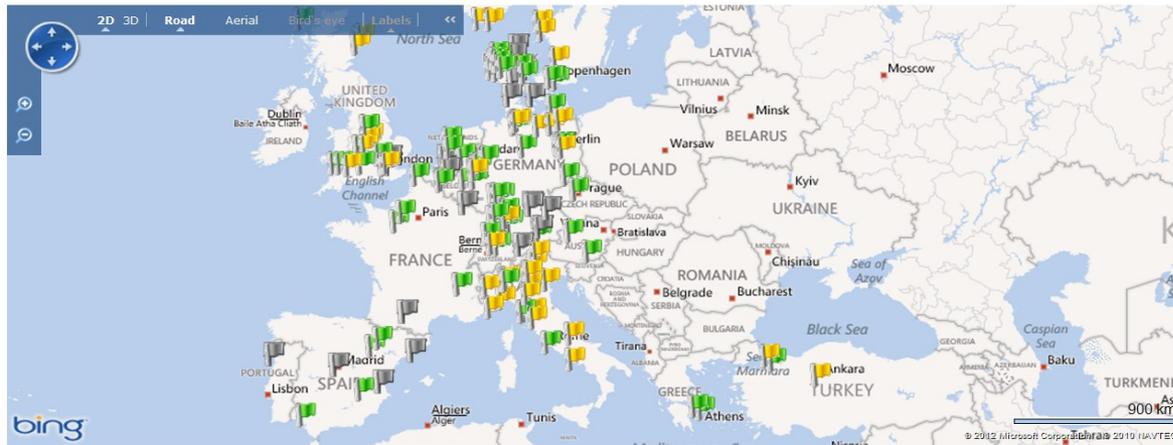
advanced search search

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> Subject Areas > Hydrogen and Fuel Cells > Expert Advices > Hydrogen Stations Worldwide > Overview

Hydrogen Filling Stations Worldwide - Overview

If you wish to submit station data and/or images, please supply such according to this [template](#) and send it to webmaster@h2stations.org. This is an info service of [Ludwig-Bölkow-Systemtechnik GmbH](#) and TÜV SÜD. Please notice the [Terms of Use](#). If you need more information or maps, please [click here](#).



Km Miles in operation planned out of operation



Europe Goto

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Hydrogen refuelling stations (example)

Zero Regio



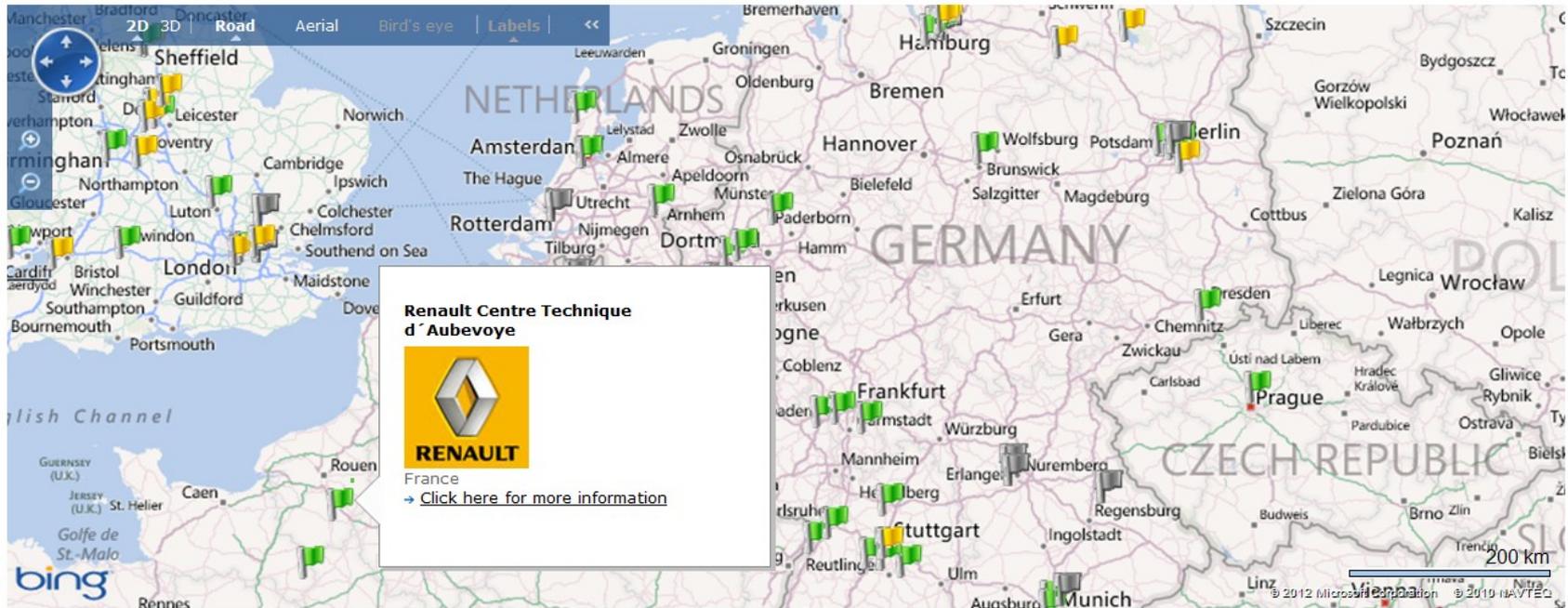
Status	in operation
Start date	17.11.2006
Last changes	24.01.2012 Station stays in operation.
Public access	yes The H2 dispenser is part of a normal refueling station.
Location	Germany 65929 Frankfurt am Main Infraserv Hoechst Industrial Park - Gate South probably exact location Show Station on map
Goal	Use of Hydrogen as an alternative motor fuel. Development of infrastructure systems for Hydrogen as an alternative motor fuel and their itegration into conventional refuelling stations. Adaption & demonstration of Hydrogen refuelling technology (700 bar
Description	A 1.7 km transport line was built which connects the station to the hydrogen production plant of Hoechst. The hydrogen is compressed to almost 900 bar with ionic liquid compression developed by Linde. The station has also solar panels installed on the roof of the multi fuel service station. 22.07.2010 The project is finished. Summary of Results is available. Station will stay in operation.
Operator	Agip
Technology provider	Linde AG Joint Research Center European Commission IEFE Bocconi University Eni Tecnologie Italy
Further partners	Centro Ricerche Fiat Sapio Italy Daimler AG Infraser GmbH & Co. Hoechst KG Germany City of Mantova (Italy), Fraport AG (Germany), Lund University (Sweden), Regione Lombardia Italy, Roskilde University Denmark, Saviko Consultants Denmark, TÜV Hessen GmbH
Fuel	<input checked="" type="checkbox"/> LH2 <input checked="" type="checkbox"/> Passenger car - CGH2 350 <input checked="" type="checkbox"/> Passenger car - CGH2 700 <input type="checkbox"/> Bus - CGH2 350 <input type="checkbox"/> CGH2 (other) <input type="checkbox"/> other
Hydrogen supply	pipeline - with 90 MPa
Hydrogen storage	
Vehicles served	Daimler FC A-Class, 1 Opel HydroGen4 of the Hessen State government
Station-contact	
Station-site	www.zeroregio.com
Comments	This station is part of the EC funded project ZeroRegio. The other station in this project is in Mantova Italy.
LBST-Info	This Information is provided by LBST . LBST Station ID: 150 Please notice the Terms of Use . If you need more information or maps, please click here .





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Differences throughout Europe (D/GB/F)



Km Miles in operation planned out of operation



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Infrastructure costs (H₂ vs. e⁻)

	H ₂	EV
Refuelling / charging point	1M€ (avg.)	7.000 EUR (avg.)
Cars / day refuelling	200 cars (max.)	4 cars (max.)
Refuelling points necessary (1M cars)	1.000 (D)	5.000.000 (D)
Infrastructure costs	1.000 M€	35.000 M€ (!)
Refuelling time	5 min (!)	1h (lifetime?)

Battery-swapping: For each car, 2 – 4 charged batteries need to be held on stock
Batteries: Dependency on Li & other rare earth elements
Battery-chargers: Not really interesting for power companies (low margin)
EV: Problem to heat car in winter



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Action points

1. European (better: global) harmonisation of standards & legislation
2. Training and education necessary (HV safety and H₂ safety) (HyFacts.eu)
3. Implementation of more H₂ refuelling stations
4. Development of cheap fuel cells (catalysts, lifetime, manufacturing costs)
5. Development of cheaper high-pressure storage technologies (70 MPa)
6. Enter into mass-production (2015 ?!)



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