Federal Ministry
of Transport, Building
and Urban Development

Hydrogen a competitive energy storage medium for large scale integration of renewable electricity

IPHE Workshop, November 15/16, 2012, Seville, Spain

Transforming the Energy System - The Role of Hydrogen: more than a vehicle fuel!

Dirk Inger

Federal Ministry of Transport, Building and Urban Development , Germany

Overall German Energy Goals

- Lower emissions and higher efficiency
- Transforming the energy sector - including transportation!
- Develop a comprehensive, sustainable fuel strategy (national & Europe)
- Electricity – key driver for future mobility
- Over the next decades, no single power-train satisfies all key criteria for economics, performance and the environment. The world is therefore likely to move from a single power-train (ICE) to a portfolio of power-trains in which BEVs and FCEVs play a complementary role.
- Multitalent Hydrogen: Key element for future renewable energy system

Targets

The goals of Germany's energy and climate policy

- Climate-damaging greenhouse gas emissions are to be reduced by 40% by 2020, 55% by 2030, 70% by 2040 and by 80 to 95% by 2050, compared to reference year 1990.
- Primary energy consumption is to fall by 20% by 2020 and by 50% by 2050.
- Energy productivity is to rise by 2.1% per year compared to final energy consumption.
- Electricity consumption is to fall by 10% by 2020 and by 25% by 2050, compared to 2008.
- Compared to 2008, heat demand in buildings is to be reduced by 20% by 2020, while primary energy demand is to fall by 80% by 2050.
- Renewable energies are to achieve an 18% share of gross final energy consumption by 2020, a 30% share by 2030, 45% by 2040 and 60% by 2050.
- By 2020 renewables are to have a share of at least 35% in gross electricity consumption, a 50% share by 2030, 65% by 2040 and 80% by 2050.
- In the transport sector, final energy consumption is to fall by about 10 % by 2020 and by about 40 % by 2050, the baseline in this case being 2005.

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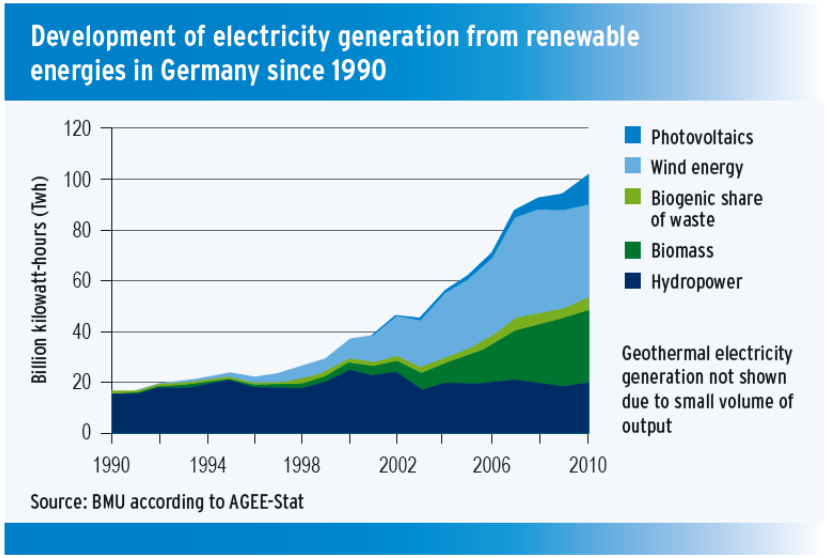
Wind Power and Hydrogen – Matching Partners



Vast expansion of **wind power** capacities turns wind into **main source of energy for H_2 production** after 2020

Also **biomass** important for H_2 production as of 2020: especially **gasification processes** (“bio methane”)

➡ **NOW demonstration projects and studies**

Hydrogen end-use scenarios

- as direct vehicle fuel
- for re-electrification
- use as chemical in industry
- admixture to natural gas grid

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Preparing Hydrogen and Fuel Cell Markets – German Activities:

National Innovation Program (NIP)

Politics	Industry

BMVBS / BMWi / BMBF / BMU

500 million €
for demonstration

+

200 million €
for R&D

+

700 million €
Co-payment from industry

nip

1,4 billion €
2007-2016

- Preparing hydrogen & fuel cell markets
- Focus on R&D combined with everyday demonstration

- Hydrogen & fuel cells driven by applications and markets: transport, stationary energy supply, special markets

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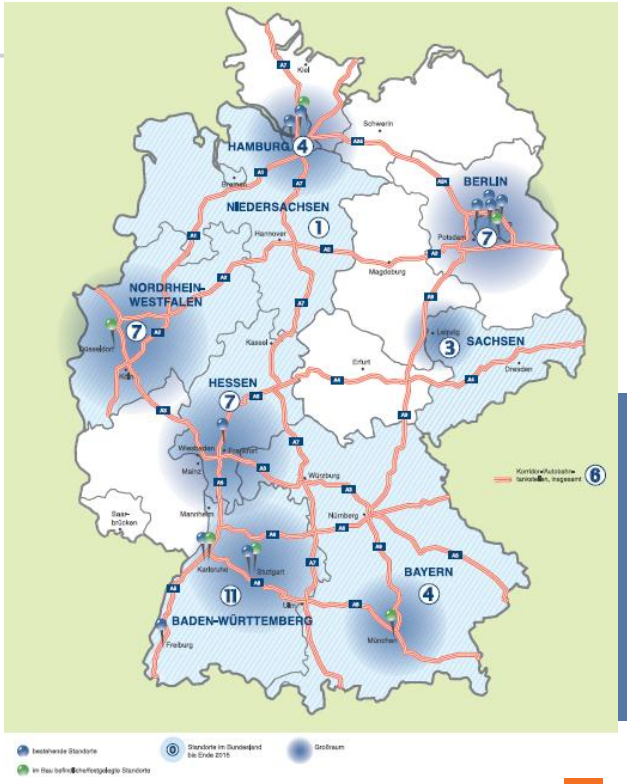
Preparing for a Hydrogen Infrastructure in Germany

- **joint Letter of Intent to expand the network of hydrogen filling stations in Germany**
  - signed by the German Ministry of Transport, Building and Urban Development (BMVBS) and several industrial companies
  - part of the National Innovation Program for Hydrogen and Fuel Cell Technology (NIP)
  - overall investment more than €40 million (US$51 million)

- **market-relevant testing of filling-station technology**
- **ensure a needs-driven supply for fuel cell vehicles**
- **coordination by NOW GmbH in the frame of the Clean Energy Partnership (CEP)**



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Clean Energy Partnership
CEP

Ein Projekt im Nationalen Innovationsprogramm
Wasserstoff- und Brennstoffzellentechnologie
nip

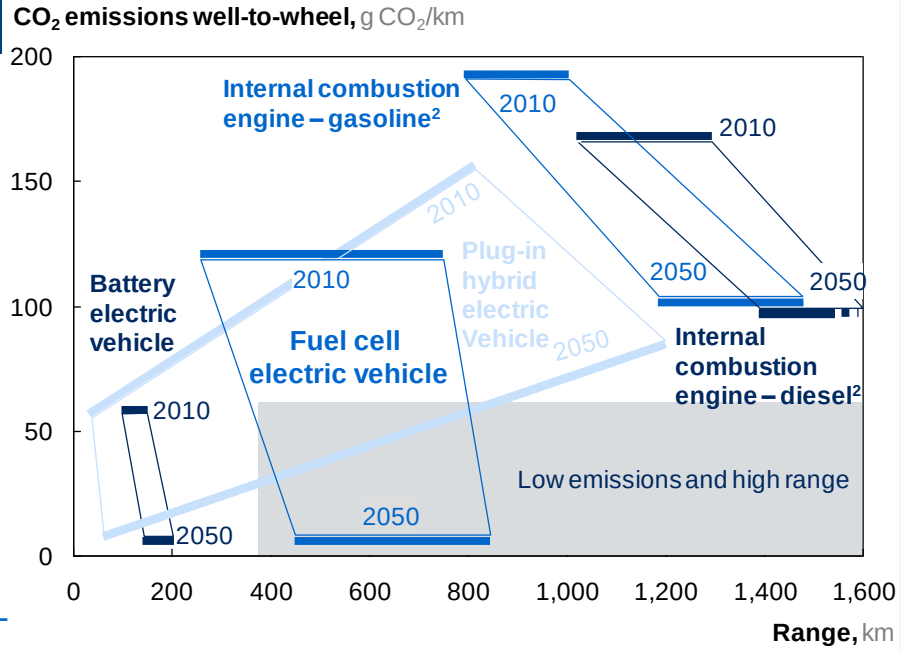
„To facilitate market introduction [of fuel cell vehicles] we need a hydrogen station network covering and connecting the metropolitan regions.“

Dr. Peter Ramsauer, Federal Minister for Transport, Building and Urban Development

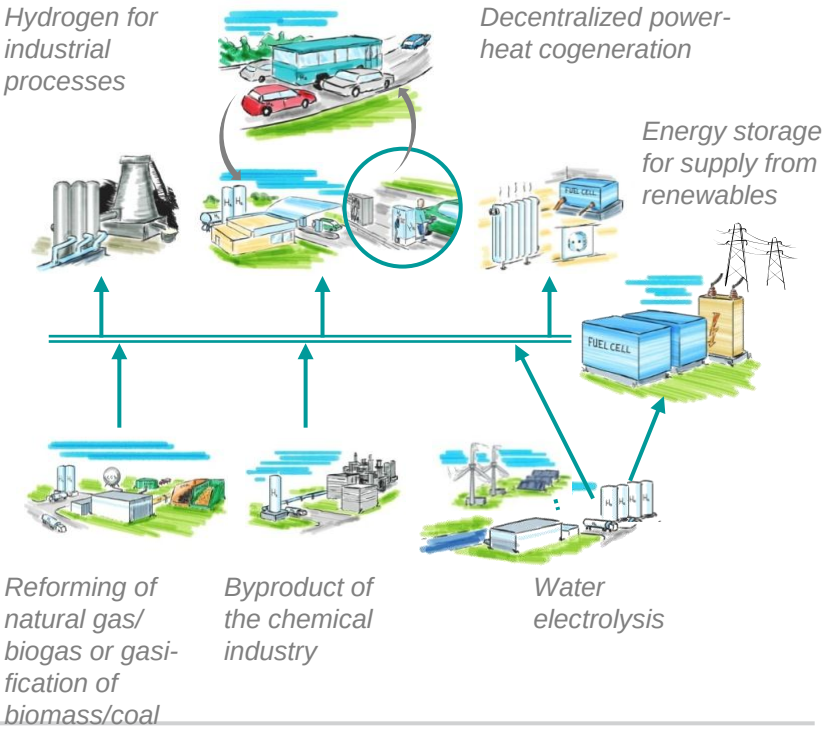
www.bmvbs.de

Hydrogen from Renewable Energy Sources : Key Elements of an Integrated Sustainable Energy System

Fuel Cell Vehicles using hydrogen from renewable energy sources are needed to **decarbonize the transportation sector**

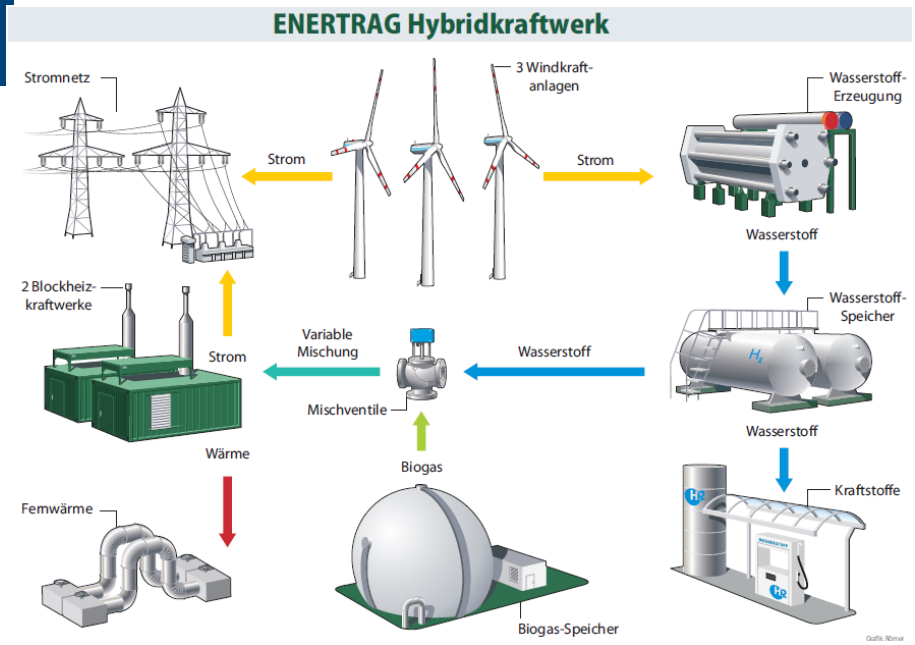


hydrogen produced from renewable power sources is needed to **stabilize the power grid**



Best Practice Example: Demonstrating Wind-Hydrogen for Mobility

hydrogen as part of an integrated energy system ⟹ renewable hydrogen as fuel



Enertrag: Hybrid Power Plant

Total: Refueling Station at Heidestr., Berlin
First delievery of wind-hydrogen on April 18th, 2012

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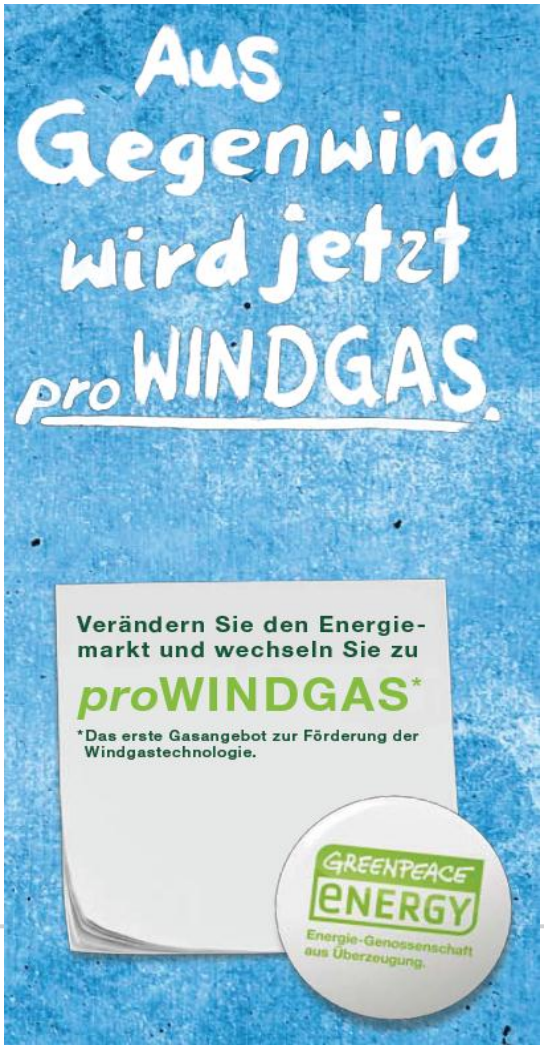
Best Practice Example:
Wind Hydrogen as Energy Storage in the Gas Grid



left and above: extracts advertisement flyer Greenpeace Energy

performing energy
BÜNDNIS FÜR WINDWASSERSTOFF

www.bmvbs.de

Conclusions

General:

- Moving away from oil – renewables is „no-regrets-option"!
- Closer alignment of the ***transport and energy*** systems
- Market preparation of new transport technologies is only possible through close cooperation: politics, industry and science must pool their strengths.
- International Collaboration: only with global approach technology will be commercialized
- The "Energiewende": generation task, long term fitness program for our economy!

Hydrogen:

- Studies show great potential of wind H_2 systems for leveling out fluctuating energy
- Germany bundles sufficient industrial/political support for business case combining H2 as transport fuel from REN power and as large scale storage option
- Large scale demonstration of wind H_2 systems required
- Key technology electrolyses in MW range required
- Improvements e.g. in efficiency & costs needed (renewable energy system in general)
- Most advantageous options central production with large scale storage in salt caverns (low specific storage costs) and onsite production (no need for H2-delivery, flexible and robust business model for power sector).
- H2-demand perspectives and synergies from shared infrastructures grow with multiple use
- Regulatory measures for utility adoption of energy storage technologies that facilitate the integration of renewable energy sources into the electric grids still need to be further developed (adaptation of the EEG) and implemented => next steps !

Thank you!