

H₂-Mobility – Towards commercialisation of Fuel cell vehicles

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Presentation to US HTAC

H₂ Mobility

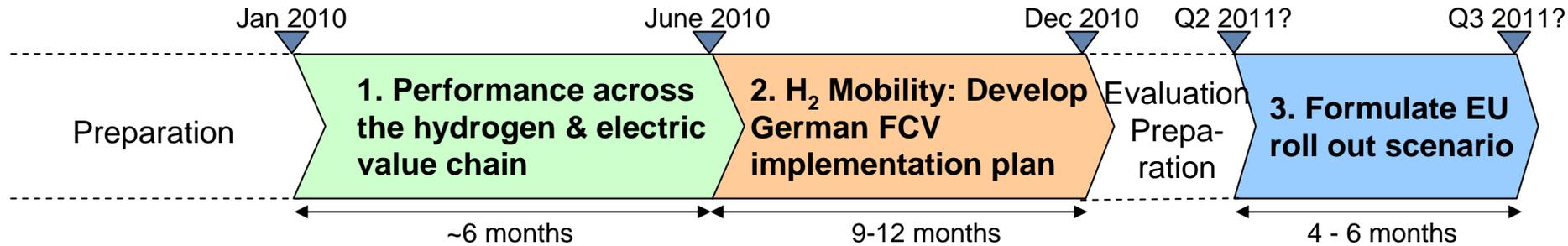
Objective of this meeting

- To explain the H₂ Mobility initiative as the centre piece of the commercialisation plan of hydrogen fuel cell vehicles in Europe

Agenda

- Proposed plan
 - 1st project: evaluation along the value chain
 - 2nd project: H₂ Mobility – Germany as a first market
 - 3rd project: Planning a roll out across Europe
 - Next steps

Fuel cell vehicle commercialization plan



Process

- Companies validate basic data on current and future cost and performance of BEVs, PHEVs, FCVs and ICEs by segment
- Regular steering committees and workshops
- Managed by McKinsey
- Companies do the analysis for major parts of the work and jointly build business case
- Chaired and managed by NOW, with help of McKinsey
- Open to new comers
- Strong involvement MS and EU bodies (JTI)
- Joint process of developing insights & recommendations
- Led by consortium, facilitated by external consultant (public tender)

Deliverable

- Fact based report comparing value chains of BEVs, PHEVs, FCVs and ICEs along value chain
- Business plan, incentive schemes, JV set up
- Report with H₂ business case for EU, EU roadmap, and funding requirements

Stakeholders involved and roles

- 30 organisations involved
- Car OEMs with FCVs, Evs, Hydrogen producers and distributors, Wind, Gas, Power companies, NGOs, and public entities
- 9 – 16 parties involved:
- Car OEMs, Utility, Oil, Gas, Equipment
- German government facilitates group
- 30+ parties involved:
- Companies
- Selected national governments, EC, JTI
- NGOs, and public entities

= private funding

= private + German funding

= private + JTI funding

H₂ Mobility

Commercialisation plan principles

- No obligation to join all three projects; companies can pick and choose based on their business interest
- Participants can leave projects at any time, but without reimbursement of (consulting) fees

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Deliverables: fact based evaluation comparing value chains of Plug ins, BEVs, FCVs and hybridized ICEs

- 1 • Comparison of FCVs and plug in hybrids on most important current and future customer features to electric vehicles and conventional hybridized vehicles (multiple dimensions and on timeline, segmentation)
- 2 • Costs for serial and mass production for reference FCV now and in the future – "how-to approach"
- 3 • Technical challenges that have been overcome and need to be resolved for 2015 mass production including synergies with electric vehicles
- 4 • Definition of main CO₂ lean H₂ production and phased distribution and dispensing method as well as explanation of it in fact-based "technology for dummies" way
- 5 • Cost for each production and distribution pathway now and in the future including "how-to approach" and determination when distributed production will become competitive
- 6 • Comparison of value add of FCVs to BEVs and hybrid ICEs and the macroeconomic impact to various EU regions in terms of employment and job creation
- 7 • Integrated view across the hydrogen value chain compared to electric value chain and advanced cycle ICE and high-level "case to society" for either Europe, US, Korea, or Japan
- 8 • Identification of cost-effective, credible, and scalable EU funding mechanisms to deploy hydrogen infrastructure and rolling assets including FCVs and accelerate take-up and overall market transformation

Coalition status

Study participants	Europe	US	Asia	
Car OEMs	4	2	4	
Electrolyser companies	2	2	-	
Gas companies	2	1	-	
Utilities	2	-	-	
Oil companies	5	-	-	
Other suppliers & equipment manufacturers	3	1	-	
NGOs	1	-	-	
Government	2	-	-	
Total	21	6	4	Σ = 31

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Current hydrogen demonstration projects proving technical viability for end customer usage

Clean Energy Partnership (CEP)

- Since 2003
- 40 cars and 14 buses in usage
- 3 fuelling stations active in 2010
- > 500,000 km driven &
> 5,000 fuelings performed



Demonstration projects show:

- Fuel Cell cars ready for end customer usage (latest challenge “cold start ability” solved)
- Production, supply and fueling of hydrogen feasible and scalable

“H₂-Mobility” Initiative – Overcoming the Chicken and Egg Dilemma

- Signing of Memorandum of Understanding for “H₂ Mobility” Sept. 10th in Berlin
- Nine key stakeholders from industry (OEM, oil, utility & industrial gas) and NOW as public-private-partnership
- Intention to jointly build up hydrogen fueling infrastructure and establishing Germany as lead market



A Way Forward: The H2-Mobility Initiative

- A strong Partnership of Motivated Stakeholders
- Germany as a Pilot Market for Europe
- Additional Partners Welcome
- ✓ Leading industrial companies to agree upon a built up plan for a nationwide infrastructure – NOW as independent chair
- ✓ Significant expansion of hydrogen fuelling stations network in key regions by the end of 2011
- ✓ Important milestone on the way to emission-free mobility
- ✓ Flanking Letter of Understanding on the Development and Market Introduction of Fuel Cell Vehicles

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NOW
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und Brennstoffzellentechnologie

OMV

AIR PRODUCTS



TOTAL

VATTENFALL



Important Steps on the Way to a Commercialization of Fuel Cell Vehicles started in September 2009

Commercialization FCVs

Letter of Understanding
„Commitment to the development
and market introduction
of Fuel Cell vehicles“



Build-up H₂-Infrastructure

Memorandum of Understanding
„H₂-Mobility –
Major companies sign up to
hydrogen infrastructure built-up plan
in Germany“



Common Commitment for Commercialization of Fuel Cell Vehicles until 2015

Letter of Understanding signed in Sept. 2009 for commercialization of fuel cell vehicles until 2015

- The Letter of Understanding was signed by all relevant automotive manufacturers, which are engaged in the development of fuel cell technology.
- From 2015 onwards a quite significant number of fuel cell vehicles could be commercialized. This number is aimed at a few hundred thousand vehicles over life cycle on a worldwide basis.
- In order to ensure a successful market introduction of fuel cell vehicles, this market has to be aligned with the build-up of the necessary hydrogen infrastructure by 2015.
- The network should be built-up from metropolitan areas via corridors into area-wide coverage.

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HONDA



RENAULT NISSAN

TOYOTA

Organisation of the H₂-Mobility Consortium

- **Two successive Phases defined**

- **Phase 1: 2009 – 2011**

- Technico-economical evaluation of the feasibility to deploy a network of HFS alongside the expected deployment of FCVs in Germany by 2015 (2009 – 2010)
- Definition of the future Consortium Agreement Contract / Partners negotiation phase (2011)
- Deployment of new HFS supported by the German Administration (Konjunkturpaket II subsidy scheme)

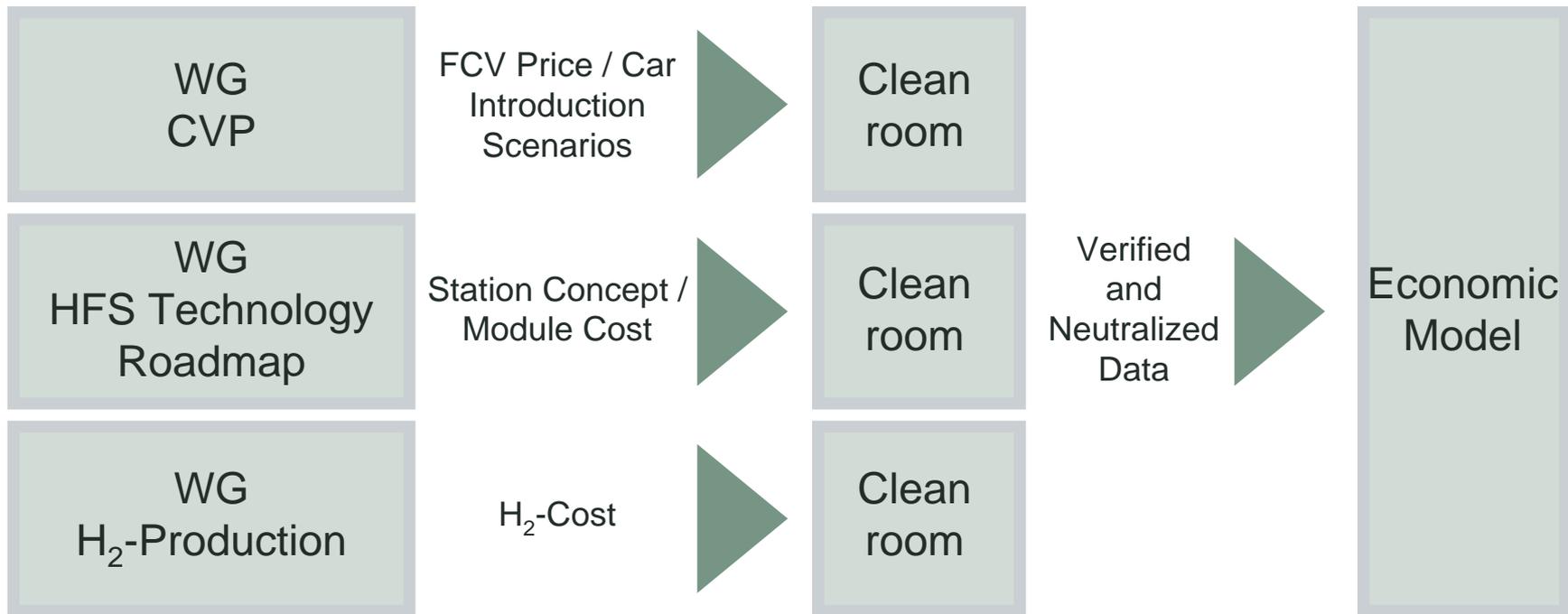
- **Phase 2: 2011+**

- Implementation of the Business Plan defined in Phase 1 through the agreed definitive agreement between partners

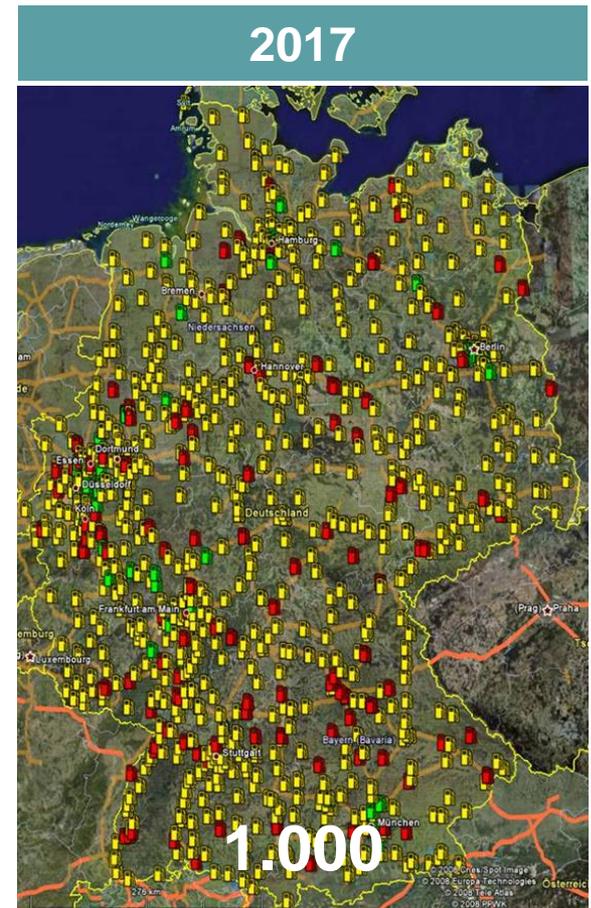
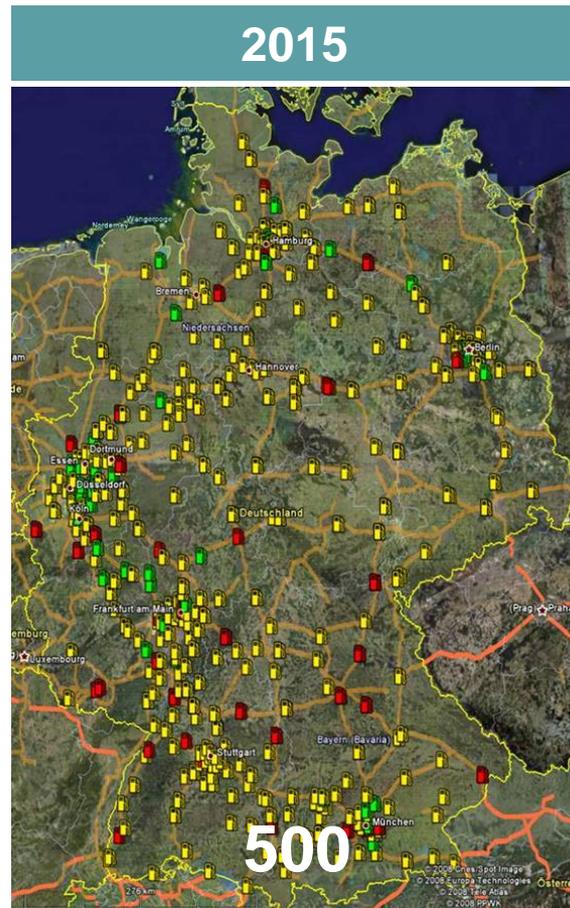
Organisation of the H₂-Mobility Consortium

WGs set up to achieve Phase 1 – McKinsey facilitator – NOW chair

- Customer Value Proposition, H₂-Production & Supply, Hydrogen Fuel Station Technology Roadmap, Incentives Schemes, Economic Modelling (including network planning), Future Consortium and three support WGs



Typical approach for build-up of hydrogen infrastructure in Germany (Schematic)



Fueling stations ■ Large ■ medium ■ small

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Planning an EU roll out

- Study will be made “conditional” to successful outcome of H2 Mobility
- Study will be implemented by the Fuel Cell and Hydrogen JTI with participation of coalition of interested companies and governments

Overview of objectives of “planning an roll out across Europe”

Overall objective

Stimulate implementation of and support for hydrogen based transport systems by providing an inspiring vision and concrete plan on how the roll-out of a hydrogen value chain across Europe could be organized

Main elements

- Overview of economic feasibility, benefits and obstacles of Hydrogen roll-out – summarizing existing knowledge
- Scenario of European green H₂ production and infrastructure roll-out starting from planned and existing (clean - CCS) production and pipelines
- Plausible scenarios for hydrogen FCV penetration across Europe including resulting estimated cost, environmental and economic impact
- Development of a vision on the future role of Hydrogen in Europe that is shared across major stakeholders
- Overview of potential incentive mechanism to stimulate early adoption and reward first movers based on German experiences
- Concrete proposals on how regulatory and governmental support could be organized most effectively (required regulation, subsidies, and methodology)
- Outlook for stationary FCs across Europe and synergies with automotive hydrogen value chain (no detailed scenarios)
- High level view on global potential of hydrogen FCV and implications for Europe

Overview of end-products and communication form per audience

Main End-Products

- A vision and roll-out plan for the future of hydrogen transport in Europe, including:**
 - Recap performance versus alternatives
 - Hydrogen roll-out scenarios, incl. infrastructure and transport mix
 - Overview of long term impact (environment, economic)
 - High level action plan for Europe
 - Potential for other applications and regions

- Overview and assessment of various support measures available for the EU to support Hydrogen roll-out (including funding needs)**

- Overview of various potential regional roll-out models with recommendations linked to archetype of environments**

	General public	EU	National governments	Coalition members
1		<ul style="list-style-type: none"> High-end power-point presentations (for press event) Written vertical report 		<ul style="list-style-type: none"> Detailed model assumptions and data
2			<ul style="list-style-type: none"> Detailed powerpoint presentation for group discussions 	
3			<ul style="list-style-type: none"> Powerpoint presentation for regional stakeholders 	

Communication form per audiences / stakeholders

Elements of a successful outcome

- A realistic and appealing vision on the potential role of Hydrogen towards 2050
- A realistic and easy to communicate hydrogen FCV roll-out plan for Europe
- A set of very concrete recommendations on regulation and financial incentives that can be adopted by European, national and regional governmental institutions
- Buy in from European, national and regional governments and from companies involved in hydrogen value chain
- Regional implications based on standardized ('archetype') characteristics which can be used by local stakeholders to develop their own view and strategy on Hydrogen roll-out



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Thank you very much for your attention

H₂ Mobility