HYLIGHTS – TOOLS TO PREPARE THE LARGE-SCALE EUROPEAN DEMONSTRATION PROJECTS ON HYDROGEN FOR TRANSPORT

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DoE Workshop: Refueling Infrastructure for Alternative Fuel Vehicles: Lessons Learned for Hydrogen
Sheraton Grand Sacramento Hotel, Sacramento California
April, 2-3 April 2008
Outline

- Project profile and goal
- HyLights task: cohesion of demo projects?
- Challenges identified
- HyLights tasks and first results

- Other European hydrogen infrastructure related projects
- Sample results from Germany and Norway
Project profile

“Coordination Action (CA)” Project
6th Framework Programme, Jan 06 – Dec 08
21 partners
Industry: 7 vehicle, 5 oil, 2 utility, 3 process; 4 institute
Funding
~ 4 M€ and additional funds from industry

Focus by (international) expert reviews
Executive Advisory Board (EAB)
Associated partners (German Transport Ministry, Chevron)

liaison project
Goal

Assist the European Commission and European industry to plan the large-scale demonstration projects of the 7th Framework Programme (FP7) and Joint Technology Initiative (JTI) by

• the development of assessment tools and
• supporting advice on relevant key issues.

Focus

Demonstration activities on „Hydrogen for Transport”
HyLights task: cohesion of demo projects on H₂ for transport

Learn from past projects
Support ongoing projects
Provide advice/tools for future projects

Hydrogen vehicle uptake

EU – LHPs*
Transition to early markets

* LHP – Lighthouse Project
Challenges identified when kicking off HyLights

Missing overview / coherent learning from large number of individual demo projects!
Missing overview of regional strategies and relevance of activities and funds!
No comparability of project performance, no broadly accepted monitoring & assessment framework as foundation for EC or national/regional project negotiation!
Missing international benchmarking of strategies for demo projects!
Diverging regional and industry’s interests asking for alignment under joint EU roof!
Foster a more positive approach by “expectation management”.
Unknown performance level and user demand of vehicles and refuelling infrastructure in the transition from demo phase to first commercial markets! Benchmarking required.
Missing knowledge on project governance, IPRs and legal issues!
No clear picture of required policy support mechanisms to effectively introduce hydrogen and fuel cell vehicles in demo phase and first commercial market phase!
Missing coherence of EU actors and different level of commitment in industry!
HyLights task list

- Report on concluded / ongoing demo projects
- Overview active regions in Europe
- Monitoring & Assessment Framework (MAF)
- Gaps analysis for H₂-vehicles and -infrastructure
- Legal and project management issues in demo projects
- Assessment of policy support issues (demo projects, early markets)
- Support to the project family “Hydrogen for Transport”
# Projects Assessed by HyLights (to be expanded)

<table>
<thead>
<tr>
<th>Project</th>
<th>Vehicles</th>
<th>Fuel stations</th>
<th>Hydrogen refuelled</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2ange-muc</td>
<td>4 ICE buses, 1 FC bus, 1 ICE car, 1 fork lift</td>
<td>1</td>
<td>138,000 kg</td>
</tr>
<tr>
<td>ECTOS</td>
<td>3 FC buses</td>
<td>1</td>
<td>17,342 kg</td>
</tr>
<tr>
<td></td>
<td>27 FC buses</td>
<td>9</td>
<td>&gt; 192,000 kg</td>
</tr>
<tr>
<td></td>
<td>5 in D &amp; 3 in I FC cars</td>
<td>2</td>
<td>&gt; 500 kg</td>
</tr>
<tr>
<td>HyFLEET-CUTE</td>
<td>9 (+24) FC buses, 7 (+7) ICE buses</td>
<td>2 (+8)</td>
<td>227,252 kg</td>
</tr>
<tr>
<td>CEP</td>
<td>16-24 FC and ICE cars, 1 FC bus</td>
<td>2</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td>34 wheelchairs, 40 cargobikes, 30 scooters, 44 utility vehicles, 10 midibuses</td>
<td>N.A.</td>
<td>0*</td>
</tr>
<tr>
<td>HYCHAIN</td>
<td>15 (+30) ICE cars, 0 (+5) FC cars, 0 (+8) H₂ buses</td>
<td>2 (+6)</td>
<td>N.A.</td>
</tr>
<tr>
<td>LONDON</td>
<td>10-12 H₂ buses, 60 H₂ cars, vans, motor bikes and other vehicle types</td>
<td>tbd.</td>
<td>0*</td>
</tr>
</tbody>
</table>

* hardware in preparation
## Overview active regions in Europe

### Ongoing and planned (2007 - 2015) demonstration activities

<table>
<thead>
<tr>
<th>Region</th>
<th>Timeframe</th>
<th>Vehicles &amp; Vans [e/p]</th>
<th>Buses [e/p]</th>
<th>Other vehicles [e/p]</th>
<th>Marine refueling stations [e/p]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berlin</td>
<td>2007-2016</td>
<td>17 / further vehicles</td>
<td>15 / 100-105 further buses</td>
<td>...</td>
<td>... / 1 FC boat 2</td>
</tr>
<tr>
<td>Hamburg</td>
<td>2007-2020</td>
<td>1 / 40-50 vehicles</td>
<td>9 / 100-125 further buses</td>
<td>3 / +25</td>
<td>1 / 2 further boats 2 / 2</td>
</tr>
<tr>
<td>Nordrhein-Westfalen</td>
<td>2007-2011</td>
<td>0</td>
<td>3 / +8</td>
<td>150-100 (HyCHAIN)</td>
<td>... 2 (1 mobile,1*) / 1</td>
</tr>
<tr>
<td>Rhein-Main</td>
<td>2007-2012</td>
<td>2 / planned H2/NG fleet plans</td>
<td>...</td>
<td>...</td>
<td>... 1</td>
</tr>
<tr>
<td>London</td>
<td>2007-2015</td>
<td>6 / +60</td>
<td>3 / +10-12</td>
<td>10</td>
<td>... 2 / several stations</td>
</tr>
<tr>
<td>Wales</td>
<td>2007-2015</td>
<td>... / 5-35 (H2/CNG)</td>
<td>1</td>
<td>...</td>
<td>1</td>
</tr>
<tr>
<td>Piemonte</td>
<td>2007-2015</td>
<td>3</td>
<td>10 in preparation</td>
<td>...</td>
<td>... 1</td>
</tr>
<tr>
<td>Lombardia</td>
<td>2005-2010</td>
<td>10 (H2/CNG)</td>
<td>2 (FC hybrid)</td>
<td>...</td>
<td>... 1 / 1</td>
</tr>
<tr>
<td>Toscany</td>
<td>2007-2010</td>
<td>... / fleet tests</td>
<td>1</td>
<td>...</td>
<td>... 1 / 2</td>
</tr>
<tr>
<td>Abruzzo</td>
<td>2007-2015</td>
<td>... / fleets (Methane/H2)</td>
<td>...</td>
<td>...</td>
<td>... 1</td>
</tr>
<tr>
<td>Emilia-Romagna</td>
<td>2006-2011</td>
<td>...</td>
<td>...</td>
<td>1 / 22 (HyCHAIN)</td>
<td>... / refuelling facility</td>
</tr>
<tr>
<td>South Norway</td>
<td>2007-2012</td>
<td>15 / 5</td>
<td>plans for buses</td>
<td>...</td>
<td>... 2 / 4</td>
</tr>
<tr>
<td>West Sweden</td>
<td>2007-2012</td>
<td>1 / 10 (ICE)</td>
<td>2 / +100</td>
<td>...</td>
<td>... 1/1</td>
</tr>
<tr>
<td>West Denmark</td>
<td>2007-2012</td>
<td>...</td>
<td>...</td>
<td>6 / further LDVs</td>
<td>... 1 (2008) / 7</td>
</tr>
<tr>
<td>South Holland</td>
<td>2007-2012</td>
<td>...</td>
<td>...</td>
<td>... 25-30</td>
<td>... ... / 1</td>
</tr>
<tr>
<td>Amsterdam</td>
<td>2007-2010</td>
<td>...</td>
<td>3 / further buses</td>
<td>...</td>
<td>... 1 / 1 canal boat 2 / 1</td>
</tr>
<tr>
<td>Arnhem</td>
<td>2007-2010</td>
<td>... / 3-5</td>
<td>planned</td>
<td>planned</td>
<td>... ... / 1</td>
</tr>
<tr>
<td>Reykjavik</td>
<td>2007-2012</td>
<td>12 / up to 30 vehicles</td>
<td>3</td>
<td>1</td>
<td>... / 1</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>2003-2007</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>... 1</td>
</tr>
<tr>
<td>Valencia</td>
<td>2007+</td>
<td>planned</td>
<td>planned</td>
<td>Planned</td>
<td>... ... / 1</td>
</tr>
<tr>
<td>Castilla y León</td>
<td>2007-2011</td>
<td>... / 4</td>
<td>... / 2</td>
<td>30 / 45 (HyCHAIN)</td>
<td>HyCHAIN refueling facilities</td>
</tr>
<tr>
<td>Aragon</td>
<td>2007+</td>
<td>planned</td>
<td>... / 3</td>
<td>planned</td>
<td>... / 1</td>
</tr>
<tr>
<td>Barcelona</td>
<td>2003-2007</td>
<td>...</td>
<td>3</td>
<td>...</td>
<td>... 1</td>
</tr>
<tr>
<td>Madrid</td>
<td>2003-2010</td>
<td>...</td>
<td>3 / 2</td>
<td>...</td>
<td>... 1</td>
</tr>
<tr>
<td>Rhône-Alpes</td>
<td>2007-2011</td>
<td>...</td>
<td>...</td>
<td>47 (HyCHAIN)</td>
<td>2 (1 mobile)</td>
</tr>
<tr>
<td>Nord Pas de Calais</td>
<td>2005-2008</td>
<td>...</td>
<td>2</td>
<td>...</td>
<td>... 1</td>
</tr>
<tr>
<td>Provence-Alpes Cote d'Azur</td>
<td>2012+</td>
<td>planned</td>
<td>planned</td>
<td>planned</td>
<td>... 1</td>
</tr>
<tr>
<td>Midi-Pyrénées</td>
<td>2005-2008</td>
<td>...</td>
<td>3</td>
<td>...</td>
<td>... 1</td>
</tr>
</tbody>
</table>
HyRaMP – EU Regions & Municipalities Partnership on H₂&FC

- **10 October 2007**
  The European Commission (EC) organises a Regions Workshop at the Technical Review Days in Brussels and announces to facilitate the establishment of a Regions representation in the to-be-established Joint Technology Initiative

- **10 November 2007**
  A Task Force Regions (TF) is formed with 8 volunteering regions to prepare the Statutes and the constitution of HyRaMP, HyLights becomes TF coordinator

- **14 April 2008**
  Constitutive Meeting of HyRaMP with high level representatives of the regions and the EC

**HyLights motivation:** support mutual understanding of regions and industry, “Expectation Management”
Monitoring & Assessment Framework

Handbook for the European Commission and industry for the assessment of demonstration projects as part of the European hydrogen and fuel cell strategy (input for project negotiation).

Sound basis to compare project performance for demonstration projects on hydrogen and fuel cells for road transport (vehicles and infrastructure).

To assess performance at demonstration project level (project governance, technical, operational) and demonstration program level (fulfillment of policy goals security of supply, mitigation of GHGs and international competitiveness).
Gaps analysis for H₂-vehicles and infrastructure

Central question for HyLights industry partners (= OEMs):

“Who will be willing to pay more for hydrogen vehicles and which is the underlying motivation to bridge the gap between lighthouse projects and early commercialization phase?”

“How much (money), How many (vehicles), Who (customers) and Why (motivation)?”

• Evaluate today’s operational characteristics on qualitative and quantitative basis such as daily driving range, travel and refuelling patterns
• Specifications for infrastructure
• In-depth interviews with fleet operators of any kind (city fleets such as cleaning, gardening, etc. and private fleets) in the committed regions
• Comparison of vehicle/refuelling station data with conventional vehicles/refuelling stations
Legal and project management issues in demo projects

**Analysis** on legal & contractual forms of cooperation (PPPs) for the realisation of H2 road transport demonstration projects (LHPs); **benchmark** of advantages & disadvantages

**Knowledge** on efficiency and effectiveness of different project management structures

**Indicative list** of key “**Project Governance Indicators**” for future LHPs

**Program Management** – Comparison with other EU JTIs and U.S. DoE Hydrogen Program

Proposal for generic project organisation structure
Assessment of policy support issues (1)
(Demo projects, first markets)

Vehicle cost
[€/year, depending on depreciation]

- Registration tax
- V.A.T.
- Road tax
- Insurance

- Vehicle use (km)
- Maintenance

- Fuel cost
- Excise duty
- V.A.T.

Cost/km
[€/km]

Fuel consumption

Gasoline vehicle
Diesel vehicle
H2ICE
H2ICE hybrid
H2FC vehicle
Assessment of policy support issues (2) (Demo projects, first markets)

Example: Driving costs for gasoline vehicles in Europe in early markets (with de-taxed alternative vehicles)

First observations:
- Differences in vehicle costs have large impact on €/km cost
- Impact increases in countries with vehicle registration tax
- Fuel cost impact is of second order
Support to the project family “Hydrogen for Transport”
Other European hydrogen infrastructure related projects

Selected projects

**HyWays [Europe, 2004 – 2007]**
- How will the hydrogen demand develop in 10 MS*?
- How will the infrastructure be built up?
- What are economic and social impacts?
- How do the regional views diverge across EU?
- Which are relevant policy measures?

**GermanHy [Germany, 2007-2008]**
- Specifically addressing reduced fossil fuel availability or emission constraints:
- Where will hydrogen come from until 2050?
- How will the infrastructure emerge?

**NorWays [Norway, 2006 – 2008]**
- How will the infrastructure emerge locally?
- Is export of hydrogen a relevant option?

* MS – member states
Infrastructure evolution for Germany (onsite vs liquid vs piped)

Preliminary information

[Source: GermanHy 2008]
Hydrogen export chains from Norway to Germany

Preliminary information

[Source: 2008]
Urgent Need for Hydrogen Stations

Source: Larry Burns, GM
2nd April 2008
Relevant websites

**HyWays** – *The European Hydrogen Roadmap*
4 final documents + full background documentation
www.HyWays.de

**HYLIGHTS** – *Preparation for the European demo projects* (H₂ for transport)
Project database and intermediate reports (full background reports on request)
www.HyLights.eu

**H2moves.eu** – The project family of European demo projects
Regions database
www.H2moves.eu
Acknowledgement

This project is financed by funds from the European Commission under FP6 Contract TREN/05/FP6EN/S07.53917/019990.

The project partners would like to thank the EC to create the right framework for the discussion process.