Towards sustainable energy systems with fuel cells and hydrogen

IEA H2-Roadmap Kick-Off Meeting
Paris | 9th of July 2013
Dr. Hanno Butsch | Head of International Cooperation, NOW GmbH
Key role of hydrogen as an energy carrier to facilitate the energy transition in Germany

Hydrogen produced from renewable power sources allows to connect various application sectors.

NIP – Integrated Approach for Market Preparation

- **Technology**
  - components
  - subsystem
  - systems + products

- **Application**
  - cost
  - reliability
  - lifetime

- **Markets**
  - customer acceptance
  - safety
  - approval processes
NIP – A success story
BMVBS-funding Status 01/2013

<table>
<thead>
<tr>
<th>Programme area</th>
<th>Lol &amp; approved €k</th>
<th>In discussion €k</th>
<th>total €k</th>
</tr>
</thead>
<tbody>
<tr>
<td>transportation</td>
<td>226,306</td>
<td>46,075</td>
<td>272,380</td>
</tr>
<tr>
<td>H2-production</td>
<td>15,040</td>
<td>8,537</td>
<td>23,577</td>
</tr>
<tr>
<td>industrial applications</td>
<td>33,623</td>
<td>16,858</td>
<td>50,480</td>
</tr>
<tr>
<td>residential cogeneration</td>
<td>58,347</td>
<td>16,074</td>
<td>74,421</td>
</tr>
<tr>
<td>special markets</td>
<td>34,116</td>
<td>21,586</td>
<td>55,701</td>
</tr>
<tr>
<td>cross-cutting issues</td>
<td>18,976</td>
<td>11,664</td>
<td>30,640</td>
</tr>
<tr>
<td><strong>product line</strong></td>
<td><strong>386,407</strong></td>
<td><strong>120,793</strong></td>
<td><strong>507,200</strong></td>
</tr>
</tbody>
</table>

Total number of projects: 206
Approved / LoI: 138 projects (313 applications)

**Total Budget: 1,4 billion €**

- Transportation: 54%
- H2-production: 11%
- Industrial applications: 15%
- Residential cogeneration: 10%
- Special markets: 6%
- Cross-cutting issues: 4%

**Funding T€**

- Total Budget: €1,4 billion
- 2007: €20,000
- 2008: €40,000
- 2009: €60,000
- 2010: €80,000
- 2011: €100,000
- 2012: €120,000
- 2013: €140,000
- 2014: €160,000
- 2015: €180,000
- 2016: €200,000

**Programme area**

- BMVBS: 68%
- BMWi: 32%
Planned fleet of Fuel Cell Vehicles and buses

- 90 Daimler B-series F-CELL
- 20 Opel Hydrogen4
- 8 Volkswagen Touran, Caddy, Tiguan HyMotion, Audi Q5-HFC
- 5 Toyota FCHV
- 2 Honda FCX Clarity
- more car manufacturers are planning to join the CEP
- > 10 EvoBus fuel cell buses in Hamburg, Stuttgart, Karlsruhe
- 4 Buses with Hydrogen-ICE in Berlin
Clean Energy Partnership – Hydrogen Refueling Stations (HRS)

Key achievements
- Safety of stations proven
- Refueling standards agreed
- Storage and compressor technology tested
- H₂ supply chain tested
- Bugs of station technology eliminated

Publicly Accessible Hydrogen Refueling Stations in Germany (GH₂, 700 bar)
Germany to expand nationwide network of hydrogen filling stations from 15 to 50 by 2015
June 20th, 2012

- 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 Programme 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)
Clean Energy Partnership – Workgroups to solve infrastructure issues

<table>
<thead>
<tr>
<th>H₂ filling</th>
<th>H₂ quality</th>
<th>Leakproofness test filling system</th>
<th>H₂ flow measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Inspect filling stations with regard to refuelling (pressure and temperature)</td>
<td>Take samples of hydrogen at filling stations and subject them to analysis/testing</td>
<td>Leakproofness of nozzle, hose and tear-away coupling</td>
</tr>
</tbody>
</table>

Work group Participants [Management]

- Total
- GM
- AIR LIQUIE
- Shell
- Vattenfall
- Daimler
- BMW Group
- EnBW
- Daimler
- Linde
- Vattenfall
- Ford
- Volkswagen

Modelled on

- SAE 2601 / CSA 4.3
- SAE 2719 / ASTM
- SAE 2600

→ Need for international harmonization and potential for collaboration.
NIP Lighthouse Projects – Callux & Clean Power Net

Germany’s biggest field test for fuel cell combined heat and power systems for domestic use:

- 300 fuel cell CHP in the field today

Projects for uninterrupted power supply financed by NIP:

- 10 projects
- 100 fuel cells in field test operation across Germany
Thank you very much!

Dr. Hanno Butsch
Head of International Cooperation
NOW GmbH
Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie
Fasanenstr.5 – D-10623 Berlin – Germany

Internet: www.now-gmbh.de