| **REFERENCE** | EU Fuel Cells Deployment |
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| **Title:** | European Hydrogen and Fuel Cell Technology Platform: Deployment Strategy |
| **Date:** | August 2005 |
| **Author:** | Hydrogen and Fuel Cell Platform Secretariat |
| **Funded by:** | European Commission |
| **Hard copy reference:** | |
| **URL:** | www.HFPeurope.org |
| **Date accessed:** | July 2006 |
| **Web Format:** | pdf |
| **IEA topics covered** | V.2 Fuel Cells<br>V.1.2 Hydrogen storage<br>Hydrogen generation and distribution |
| **Geographical focus:** | Europe |
| **Brief Abstract:** | The report outlines routes to promote commercially viable hydrogen and fuel cell applications, and initiate a hydrogen infrastructure. The emphasis is on deployment, with a timeframe out to 2050. |

| **OUTPUTS** | |
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| Short Report? | No |
| Major report? | Yes |
| **Visualisations?** | Yes |
| Information held on dedicated software? | No |
| **- which package?** | |

| **ARCHITECTURE** | |
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| **Timescales used:** | Intermediate milestone – referred to as 'Snapshot 2020' (from which the SRA's R&D milestones for 2015 are deduced)<br>Long-term - 2050 |
| **Trends and drivers?** | Yes |
| **- list** | • Optimise security of energy supply – hydrogen offers new options for the generation, storage and distribution of energy which is considered vitally important – especially in reducing oil dependency in the transport sector and increasing the diversification of supply;<br>• Reduce greenhouse gas emissions – In the long-term, this means attaining zero carbon emissions, but practical shorter-term options are also urgently required in order to reduce the current carbon burden on a 'source-to-user' basis. Improving local air quality is also of major importance;<br>• Create new opportunities for the European economy by establishing a leading position in hydrogen and fuel cell technologies and |

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| | strengthening its global competitiveness. |
| **Enablers?** | |
| **- list** | |
| **Performance measures/targets?** | Yes |
| **- list areas** | • Promote commercially viable hydrogen and fuel cell applications<br>• Initiate an appropriate hydrogen infrastructure<br>• Reduction in the cost of fuel cell systems<br>• Significant improvement on FC's lifetime<br>• Key assumptions on Hydrogen and Fuel Cell Applications for a 2020 Scenario are indicated as EU units sold per year for Portable FCs, Portable generators & Early Markets, Stationary FCs and Road Transport. |
| **Mapping of RD&D activities?** | No |
| **Critical assessment of capabilities?** | No |

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| **PROCESS** | |
| **Methods used:** | Steering panel |
| **- Desk study?** | |
| **- Consultation** | |
| **- Interviews?** | |
| **- Facilitated workshop(s)** | |
| **- Working groups/task force** | |
| **- Integrated Process** | |
| **Stakeholders engaged:** | Steering panel |
| – **University based researchers** | |
| – **Other public sector researchers** | |
| – **Business – technology** | |
| – **Business – other** | |
| – **Government - energy** | |
| – **Government – SET** | |
| – **Government - other** | |
| – **NGOs** | |
| **No of people engaged:** | Not known |
| **Budget (if known):** | Not known |
| **Commitment to re-visit?** | Not mentioned |

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| **ACTIONS IDENTIFIED** | |
| **List of actions?** | Yes |
| **Actions listed according to timescale?** | Different phases and timings are identified for different applications. |
| **Actions prioritised?** | No |
| **Sequencing/dependencies identified?** | No |
| **Responsibility for actions identified?** | As a Coordination measure it is suggested to:<br>• Include expertise from hydrogen projects supported by the European regions through |

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| | the Steering panel members who are members of a company/organisation represented in all relevant programmes. |
| **Types of actions identified:** | |
| **- Basic research?** | No |
| **- list areas** | |
| **- Applied research?** | No |
| **- list areas** | |
| **- Development & demonstration** | Yes |
| **- list areas?** | |
| **- Other types of action?** | Yes |
| **- list other types** | In terms of hydrogen production, it is suggested that 3 hydrogen pathways be further developed in an initial phase, with the aim of increasing reliability and economic performance:<br>• Hydrogen derived from refineries and chemical plants, to take maximum advantage of existing low cost hydrogen sources;<br>• In parallel, on-site hydrogen production based on different technologies (electrolysis, reforming) and sources (natural gas, biomass, electricity and, in particular, renewable) to stimulate these industries to develop the necessary technologies;<br>• Large-scale, centralised hydrogen production, based on natural gas or other available fossil resources, with future options for CO2 capture and storage.<br>In terms of the infrastructure required to support stationary and transport applications, the following issues have been considered:<br><br>Stationary applications<br>• Connections to the natural gas grid for installations of fuel cells in the range of up to some 100 kWs;<br>• Fuelling via hydrogen (from reforming) or direct use of natural gas;<br>• Pipeline transport for the use of by-product hydrogen, or mixtures of natural gas and hydrogen, from chemical plants and refineries;<br>• Installation of hydrogen-microgrids to supply networks of stationary fuel cells.<br>Transport applications<br>• Central hydrogen production with pipeline transport to the filling station (for compressed gaseous hydrogen);<br>• Central production and liquefaction of hydrogen with tank trailer transport to the filling station (for compressed gaseous and liquid hydrogen);<br>• On-site production of hydrogen with optional |

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| | buffer storage for load levelling (for compressed gaseous hydrogen). AT large fuelling stations, we propose to evaluate the possibility of adding liquid hydrogen storage supplied by trailer to provide a buffer/backup capacity for the on-site reformer.<br>Hydrogen distribution and storage<br>• An infrastructure for portable applications with hydrogen or direct methanol;<br>• Small generators, back-up power systems etc. The system may comprise hydrogen distribution via cylinders and should be developed in close collaboration with the gas industry and application developers;<br>• Improvements in liquid and compressed gaseous hydrogen storage systems (and possible alternatives). Industry standards need to be agreed by 2010;<br>• Centralised hydrogen production and distribution mechanisms to provide a flexible service for early and time critical demonstration purposes;<br>• The deployment of on-site pathways to lay the foundation for the commercialisation decisions expected to be required around 2015.<br>Strategic and socio-economic factors:<br>• Identifying the incentives required and making the transition towards hydrogen a matter of rational boardroom decision;<br>• Identifying early markets and developing the appropriate market strategy;<br>• Establishing large-scale integrated demonstration programmes to validate functionality and prepare for market entry and commercialisation.<br>Political commitment is also mentioned as a key factor in fostering the required technical development. Policy issues requiring attention include:<br>• General vision of Governments and consensus on the need for sustainable development;<br>• Public funding policies covering needs for research and deployment;<br>• Harmonised fiscal and economic incentives for hydrogen, fuel cells and other hydrogen conversion technologies to give manufacturers, infrastructure providers and buyers the confidence to invest in them;<br>• Education and public awareness, including investment in large-scale demonstrations;<br>• Establishment of regulations, codes and standards, and removal of regulatory barriers;<br>• Removal of institutional and regional barriers, e.g. enable the use of hydrogen as |

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| | a fuel and facilitate access to grid for efficient cogeneration systems;<br>• Safety concerns associated with hydrogen storage.<br><br>Specific required actions for the commercialisation of hydrogen and fuel cells are indicated as:<br>• Develop a Proposal for a EU Hydrogen Support Regime<br>• Support demonstration activities with innovative distribution solutions<br>• Develop proposals for attractive investment/financing regimes based on political support for a comprehensive deployment strategy<br>• Cost-of-ownership comparison of stack change (cheap and lower lifetime) vs. higher lifetime targets during large-scale demonstration programme<br>• Decrease FC system cost by more than an order of magnitude based on volume production<br>• Parallel deployment of cost-learning curve effects and SRA cost & performance targets<br>• The launch of a 'Design Phase' in 2005/2006 to develop proposals for a coherent European Hydrogen Policy framework. This should consider fiscal incentives and the development of a legal framework, as well as in-depth analysis of the proposed large scale Integrated Demonstration Programme, based on public-private partnerships structures<br>• An 'Implementation Phase' in 2006/2007 aimed at launching the Integrated Demonstration Projects for all hydrogen and fuel cells applications in 2007 and implementing the proposed European Hydrogen Policy framework. |