Towards
a European Hydrogen Energy Roadmap

Preface to HyWays – the European Hydrogen Energy Roadmap Integrated Project

Ececutive Summary - Abstract

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Prepared by the HyNet partners,

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Towards a European Hydrogen Energy Roadmap

HyNet was established, as part of European Commission's Framework Programme 5, to create a network of key European stakeholders that could provide input to high-level strategic discussion on the introduction of hydrogen energy.

This report pulls together the latest perspectives of the HyNet group and of several external hydrogen experts and stakeholders. It is seen as the preface to the proposed European Commission Framework Programme 6 project, called HyWays, which will create a comprehensive European Hydrogen Energy Roadmap. This analysis has already been presented as expert input to the hydrogen policy activities of the Commission, namely the Hydrogen and Fuel Cell Technology Platform (HTP).

The structure of this report reflects HyNet's five Thematic Working Groups: (i) Hydrogen Production & Infrastructure, (ii) Hydrogen End-Use & Storage, (iii) Hydrogen Codes, Standards & Regulations, (iv) Hydrogen Socio-Economic & Policy Issues and (v) Dissemination and Public Outreach.

Hydrogen Production

- Steam reforming and electrolysis for the production of hydrogen are commercially available today and can play a vital role in satisfying hydrogen energy demand in the short and medium term. Hydrogen is already produced in significant amounts today and there is likely to be sufficient capacity to meet its initial introduction as a fuel, but not for mass-market demand.

- Today Hydrogen is more expensive than conventional fuels. However we are optimistic that in the future hydrogen could be produced at untaxed costs per km driven which make it competitive with taxed gasoline and diesel fuel in Europe, and even untaxed gasoline and diesel fuel. This assumes that anticipated long-term technology learning curves and economic scaling factors for series production (both for H_2 production and storage and FC technologies) can be achieved.

- With concerns about energy security, resource depletion and reduction of GHG emissions in the medium and long term, a transition to low or CO_2 neutral technologies will be required. This will include hydrogen derived from renewable sources, including biomass, as well as nuclear and fossil fuel pathways that incorporate carbon sequestration.

- Over the long term as technologies develop, we must continually evaluate parameters such as the impact of technology learning curves, the economic benefits of mass production, and importantly the full life cycle analysis of the whole system. We see an important role for member states and the EC to stimulate RD&D for "future" enhanced technologies and to develop positions on market-introduction policies for proven technologies.

- We anticipate that in the transition period, policy measures must be considered to improve the economic viability of CO_2-neutral and CO_2 free hydrogen production. Such measures need to be consistent with the major political goals of the EC and member states, e.g. energy diversity and independence, reduction of greenhouse gases as well as labour market effects and technological competitiveness.

Hydrogen Distribution Infrastructure

- There is a limited but existing industrial infrastructure for the distribution of hydrogen based on cryogenic liquid or compressed gas transportation. This is principally by road but there are also existing pipelines linking large industrial consumers.

- The costs associated with the transport and storage of hydrogen are one of the key hurdles preventing hydrogen from being cost competitive with conventional fuels in the transition phase, requiring innovative solutions such as decentralised production at or close to the point of sale.

- For transport applications, the costs for refuelling sites are also a major hurdle and will require the development of regulations, codes and standards and planning laws that treat hydrogen like conventional fuels and not as a hazardous industrial material.

- There will also need to be major initiatives to promote public acceptance of hydrogen, particularly addressing concerns about the safety of infrastructure.

- Projected investment costs for hydrogen infrastructure are massive and the risk is high with the uncertainty surrounding the new technologies and the date and rate of market introduction. To manage this uncertainty will require significant stakeholder partnerships (governments, technology developers, and hydrogen suppliers).

- Governments in particular will have a role in (a) stimulating innovation through RD&D (b) supporting early market introduction and (c) minimising risk of investment by industry.

Hydrogen End-use

- Small portable applications are expected to enter the market in the next 2-3 years and will help introduce the benefits of fuel cells and hydrogen to the general public.

- Stationary fuel cells are expected to be commercialised in the latter half of this decade, but these are expected to consume predominantly fossil fuels such as natural gas

- Transport applications will be the main driver for hydrogen demand but mass production of passenger vehicles will not take place before the period 2010 to 2015.

- There is significant uncertainty in future hydrogen demand forecasts, while fuel cell and other enabling technologies such as hydrogen internal combustion engines or their system environments are still not ready for mass market introduction.

Hydrogen Storage

- Hydrogen storage is a critical enabling technology, particularly for vehicle applications.

- The challenges are significant and will require extensive R&D to develop innovative solutions.

Hydrogen Regulations, Codes & Standards

- Legal requirements or regulations are ranked above standards. They are legally binding and enforceable documents emanating from governments. Standards in general are voluntary agreements drafted by standardization committees on a global, regional or national level. Standards are documents, established by consensus and approved by a recognized body.

- Standards are important for the development of any industry and harmonisation across Europe and globally will help ensure the successful introduction of hydrogen and fuel cells.

- It is therefore very important to ensure that expertise from the development of relevant regulations is represented in the standard committees.

- Regulations for Europe which can be transferred to MS laws uniformly are desirable in order to allow the local/ regional implementation of H2 & FC technologies following to the same regulatory requirements in all EU MS

- Public funding can make it easier to justify significant resources to these areas where either a small or no market exists in the near term.

- It will be important to achieve a balance between standards that can facilitate the uptake of new technology and premature standards that can lock-in a sub-optimal outcome.

- The collection of relevant data and the harmonisation of risk analysis methodologies are vital to ensure acceptable risk levels within the field of hydrogen safety. Methods will have to be developed to share risk and safety relevant information in standardised format.

- Gaining and sharing experience and building competence within organisations will be essential to achieve an effective approval process which takes into account the relevant safety aspects of hydrogen.

- Effective collaboration is required between R&D institutions and commercial companies to ensure the implementation of hydrogen safety research results into technical solutions, regulations and standards.

Socio-economic and Policy Issues in building the Hydrogen Supply Infrastructure

- The challenges faced by hydrogen are not simply technical but also socio-economic.

- To ensure success, governments will have to take an active role in stimulating research, development and large-scale demonstration.

- To stimulate commercialisation in its early market introduction, long-term policy support will be essential and fiscal instruments will be needed.

- This support should be of finite duration but long enough to ensure that it bridges the early immature market and the point that the hydrogen economy is robust, self-financing and competitive in a free market.

Dissemination and Public Outreach

- Public education is urgently needed to achieve a level of understanding of hydrogen and fuel cells to facilitate market acceptance and commercialisation. We recommend that the European Commission prioritise support for such outreach activities.

- Academic programmes need to be developed in all member states to help develop the skills needed to sustain this industry and ensure international industrial competitiveness.

- Within Europe, national, regional and local governments need to develop consistent strategies and policies for sustainable energy and transport systems that include the possibility of hydrogen. Such strategies would include the role that public bodies can play in stimulating early markets.

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