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Fuel Cells and Hydrogen Joint Undertaking (FCH JU): A Public-Private Partnership for the Commercialisation of Fuel Cell and Hydrogen Technologies in the EU

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1 Summary

This paper describes the structure, research agenda and the current state of play of the Fuel Cells and Hydrogen Joint Undertaking (FCH JU). The FCH JU is a unique public private partnership at European level, bringing together resources and input from the European Community, European industry and academia. Since 2008, the FCH JU manages the large majority of the Commission's support to fuel cell and hydrogen technologies.

The objective of the programme is to accelerate the commercialisation of these technologies by implementing an integrated programme of breakthrough research, research and development and demonstration activities, complemented by a number of support activities necessary to achieve market introduction.

2 Policy Challenge: Technology for a Cleaner Energy System

Europe, like the rest of the world, is currently facing massive – and urgent – challenges in the field of energy policy. The pressing need to cut carbon emissions to combat climate change, but also growing energy import dependency and the depletion of oil reserves in the not too distant future mean that alternative, clean energy solutions must be not only developed but implemented on a large scale and without further delay.

In response to these challenges, the European Strategic Energy Technology (SET) Plan has identified key clean technologies needed to be developed for Europe to achieve its targets for 2020 - 20% reduction in greenhouse gas emissions; 20% share of renewable energy sources in the energy mix; and 20% reduction in primary energy use – as well as achieving the long-term vision for 2050 towards decarbonisation[1] Fuel cells and hydrogen are identified as playing a notably important role in the future energy mix. This is in line with the Commission's Communication, "Energy for a Changing World – An Energy Policy for Europe", the goals of the Lisbon Strategy and the European Council's Conclusion on a European Energy Strategy for Transport, 29 May 2007[2]

As with clean energy technologies more generally, the vested interests in conventional technologies, the scale of investment needed and high risks make the fuel cell and hydrogen promise an elusive one, if left only to market forces. However, public support alone does not bring about change – in the end, impact is brought about through markets only. Therefore, to accelerate the transition from a pre-market phase to commercialisation, coordinated action and use of resources between the public and the private sectors is crucial. Accordingly,

European Industrial Initiatives – public-private partnerships – are a key tool identified in the SET Plan to accelerate the transition to a cleaner energy system by developing technologies ready for market.

To this end one of the earliest such initiatives has been established in the field of fuel cells and hydrogen: The Fuel Cell and Hydrogen Joint Undertaking.

3 Establishing the Joint Undertaking

In May 2003, the Hydrogen and Fuel Cell High Level Group, was established by the European Commission to study the way forward to implement fuel cell and hydrogen energy technology, as presented in its vision report, "Hydrogen Energy and Fuel Cells – A Vision of Our Future". The report recommended the formation of a hydrogen and fuel cell public-private partnership in order to substantially accelerate the development and introduction to market of these technologies.

In December 2003, the European Commission facilitated the creation of a European Hydrogen and Fuel Cell Technology Platform (HFP), bringing together all interested stakeholders: businesses throughout the value chain, research institutes, academia and consumers as well as the European Commission and EU Member States. In March 2005, the HFP published a Strategic Research Agenda and Deployment Strategy, followed by an Implementation Plan in January 2007 setting out a comprehensive, long-term road-map for Europe.

This process confirmed that a coherent, long-term approach at EU level is essential for achieving critical mass in terms of scale, excellence and potential for innovation. The Commission's proposal for a long-term public-private partnership under the 7th Framework Programme of the European Community (2007- 2013) in the form of a Joint Technology Initiative (JTI) on Fuel Cells and Hydrogen was a critical step in addressing the challenge ahead. In practical terms, this JTI was set up as a Joint Undertaking on the basis of Article 171 of the EC Treaty.

For the implementation of the Joint Technology Initiative (JTI) on Fuels Cells and Hydrogen (FCH) a Joint Undertaking[3] (hereinafter referred to as "FCH JU") was set up by a Council Regulation for a period up to 31 December 2017[4] The FCH JU is a public-private partnership composed of the European Communities, represented by the European Commission, the European Industry Grouping for a Fuel Cell and Hydrogen Joint Technology Initiative (NEW IG)[5] and the New European Research Grouping on Fuel Cells and Hydrogen (N.ERGHY)[6]. The FCH JU is an autonomous Community body. Its daily operations are implemented by a Programme Office, accountable to a Governing Board including representatives of all member groupings.

4 Structure of the FCH JU Programme

The FCH JU supports research, development and demonstration activities, as well as a number of support actions necessary for the objective of commercialisation, through annual,

competitive calls for proposals. The work agenda is designed with industry in the lead in order best to identify gaps to be addressed on the way to commercialising the technologies.

In order to achieve the FCH JU objectives, as well as manage and implement the programme of RTD activities in an efficient manner, the Multi Annual Implementation Plan (MAIP) is divided into four main application areas (AA): Transport & Refuelling Infrastructure; Hydrogen Production & Distribution; Stationary Power Generation & Combined Heat & Power (CHP); and Early Markets. Cross-cutting activities have been established as a fifth area in order to emphasise their relevance and provide programme level coordination. These include Regulations Codes and Standards (RCS), Pre-Normative Research (PNR), socio-economic research, technology and life cycle assessments, market support (particularly for SMEs), public awareness and education. Important interfaces and synergies are expected between all these areas drawing mutual benefits from each other's results.

The structure of the plan reflects the RTD cycle and comprises long-term and breakthrough-orientated research, research and technological development, demonstration as well as support actions, including pre-normative research.

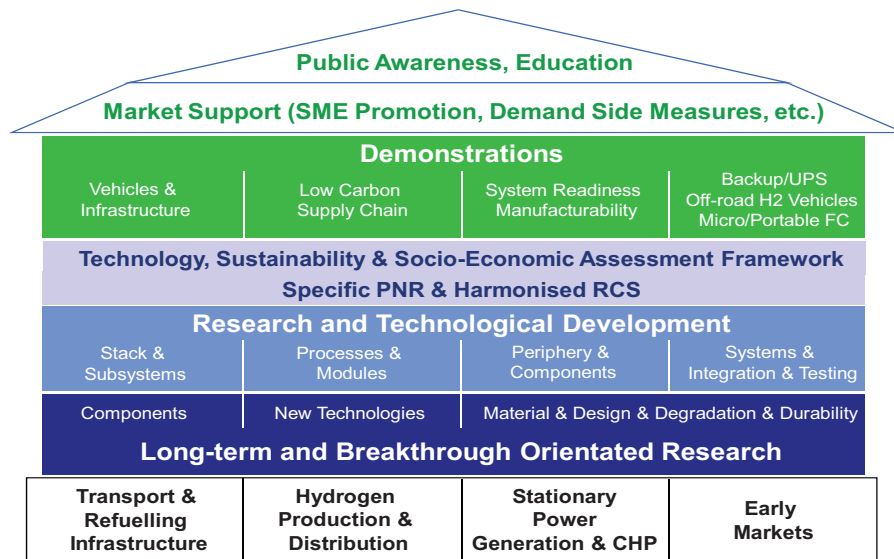


Figure 1: The structure of the Multi-Annual Implementation Plan.

The maximum EC contribution to the FCH JU for the implementation of the MAIP activities will be €450M for the period 2008 – 2013. The Industry is expected to at least match the Community contribution, bringing the total budget of the programme to nearly €1B. The initial tentative budget breakdown of the MAIP is shown in table 1. The rows of the table show the budgets for and reflect the proportional weight of the application areas and cross-cutting

activities within the overall programme. The columns show the budgets for the different action categories and their relative shares.

Table 1: The initial tentative budget breakdown of the Multi-Annual Implementation Plan.

| | FCH JU Funding by Action Categories | | | | | |
|--|--|--------------------------------------|----------------|-----------------|---------|--------|
| Application Areas | Break-through research | Research & technological development | Demonstrations | Support actions | TOTAL | |
| | | | | | €m | % |
| Transportation & Refuelling Infrastructure | 20-23 | 20-22 | 94-106 | 10-11 | 144-162 | 32-36% |
| Hydrogen Production & Distribution | 17-20 | 16-19 | 12-15 | 0 | 45-54 | 10-12% |
| Stationary Power Generation & CHP | 23-25 | 95-103 | 35-38 | 1 | 154-167 | 34-37% |
| Early Market | | 11-13 | 42-49 | 1 | 54-63 | 12-14% |
| Cross-cutting Issues | | | | 27-36 | 27-36 | 6-8% |
| TOTAL (€m) | 60-68 | 142-157 | 183-208 | 39-49 | 450 | |
| TOTAL (%) | 13-15% | 31-35% | 41-46% | 9-11% | | 100 % |

The breakdown emphasises the key importance of Transportation & Refuelling Infrastructure as well as Stationary Power Generation & CHP for the overall programme. A substantial part of the budget is dedicated to Early Markets facilitating near-to-market applications that are important in achieving short-term commercial successes, and more specifically, supporting SMEs in their commercialisation efforts. The budget allocation for Hydrogen Production & Distribution will help to increase the share of sustainable hydrogen production based on renewable energy sources and to not only develop new but also improve existing hydrogen production methods. Cross-Cutting Activities are established as a separate budget category addressing the need for programme level actions on RCS, PNR, Socio-Economic Modelling and Planning, Technology Monitoring and Assessment, and Lifecycle Analysis, all being of key importance to the commercialisation objective.

Activities are divided between long-term and breakthrough research, research and technological development (which together total 44-50%), support actions and demonstrations. The strong role of demonstrations and market orientated actions reflects the growing technology maturity in “Transportation & Refuelling Infrastructure” as well as in “Early Markets”. These include proof-of-concept demonstrations for specific applications to attract additional industrial engagement, and extend the range of products and applications in the market. Demonstrations will deliver valuable experience and gain data from fleet

operations, establish and test initial infrastructure elements including logistic and supply chains and increase customer awareness and acceptance. This will help to further mature technology, reduce investment risks and thus lay the foundations for mass commercialisation.

The focus of application areas “Stationary Power Generation & CHP” and “Hydrogen Production & Distribution” will be on long-term and breakthrough orientated research and research and technological development. This will enable the European research community and industry to address critical issues for these two application areas such as material durability, components reliability, large-scale manufacturing processes, sub-systems and systems design.

Approximately one tenth of the overall budget will be spent on support actions for the removal of non-technical, market barriers; particularly through the development of RCS, assessment of the socio-economic and environmental impact of the technologies, support to SMEs, public awareness and education. Some of the issues will be dealt with in the cross-cutting activities while others (e.g. LCA, safety "due diligence") will be implemented under horizontal activities in the different application areas or at project level.

5 Execution of the Work Programme: The Programme Office

The FCH JU Programme Office (PO) is in charge of the daily management of the Joint Undertaking and therefore executes all responsibilities of the FCH JU. It is accountable to the Governing Board including representatives of all member groupings of the FCH JU.

In its first years of existence, functioning under the European Commission in the interim, the Programme Office has had a dual role of on the one hand establishing the legal and financial infrastructure of the instrument that is the FCH JU while at the same time implementing the work programme. In addition, it has been charged with hiring the permanent staff, renting premises, the procurement of necessary IT infrastructure and setting up of other practical arrangements to run the programme.

In April 2010 the Programme Office had 12 staff and all the required conditions in place to implement its budget autonomously. Autonomy will bring the FCH JU the efficiency gains and increased flexibility of a smaller organisation that is one of the main rationales of this public-private policy instrument. In the meantime, the work of the Programme Office is gathering momentum and is moving forward in its mission to foster the commercialisation of hydrogen and fuel cell technologies by:

- Supporting the development of technologies in accordance with the Implementation Plans by granting awards following annual competitive calls for proposals;
- Advancing the commercialisation of key market segments through support and communication activities to raise awareness and increase the level of political support at the European and Member State level as well as public acceptance;
- Coordinating efforts and enhancing cooperation with and among other key stakeholders in Europe and further afield.

6 Supported Projects (2008 and 2009)

A total of 28.1M€ distributed among 16 projects was committed for the 2008 call for proposals. These projects have been started in January 2010 and are therefore in their preliminary stages. The list of projects is available on the FCH JU website: <http://ec.europa.eu/research/fch/> and their breakdown is illustrated in the following figure:

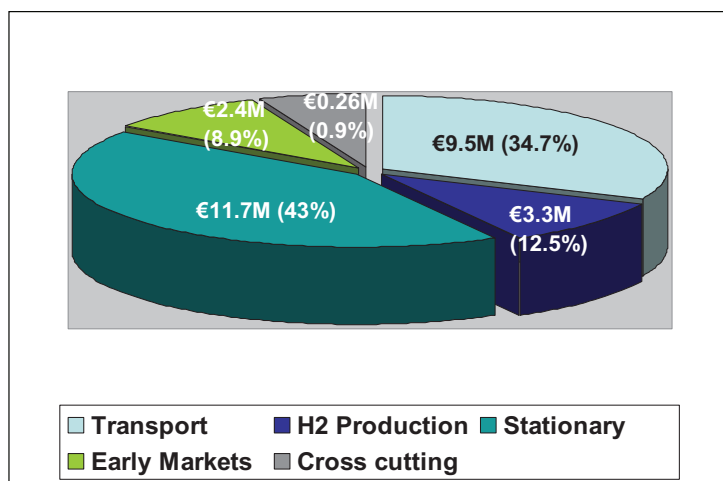


Figure 2: Breakdown of supported projects in the 2008 call for proposals by application area.

The available budget for the 2009 call for proposals was 71.3M€. This call, which closed in October 2009, received a total of 50 proposals for evaluation, out of which 31 passed the threshold. Further details from this call are shown in the next figure.

Proposals were evaluated soon after the submission deadline and notification letters were sent to applicants on 4 December 2009 along with their Evaluation Summary Reports. Soon after clarification letters requesting further information on aspects such as budget figures (including matching), SME declaration, registration/validation of the legal entities and membership of IG/RG were sent. Following responses and after conducting an analysis of the matching funds, a proposal is now ready for the Governing Board to approve a list of projects with which to start contract negotiations, as well as a reserve list of projects.

| Application areas | Proposals submitted to evaluators | Proposals below thresholds | | Proposals above thresholds | | |
|--|-----------------------------------|----------------------------|--------------|----------------------------|--------------|------------------------------------|
| | | nb | % | nb | % | Requested FCH-JU contribution (M€) |
| <i>Transportation & Refueling Infrastructure</i> | 7 | 2 | 28.6% | 5 | 71.4% | 38.33 |
| <i>Hydrogen Production & Distribution</i> | 7 | 5 | 71.4% | 2 | 28.6% | 4.75 |
| <i>Stationary Power Generation & CHP</i> | 21 | 5 (6) | 23.8% | 15 | 71.4% | 34.86 |
| <i>Early Markets</i> | 7 | 3 | 42.9% | 4 | 57.1% | 14.27 |
| <i>Cross cutting Issues</i> | 8 | 3 | 37.5% | 5 | 62.5% | 2.35 |
| TOTAL | 50 | 18 | 36.0% | 31 | 62.0% | 94.56 |

Figure 3: Breakdown of submissions in the 2009 call for proposals by Application Area.
[Note: One proposal in the Stationary Application Area was declared ineligible: no member from the IG/RG was included].

7 Supporting the Commercialisation of Key Markets for Hydrogen and Fuel Cells

In close cooperation with the Industry Grouping, the Programme Office is working to support the implementation of a commercialisation strategy for key market segments. The goal is to show a clear way forward towards the deployment and commercialisation of hydrogen and fuel cell technologies in those areas where they are of particular interest. This initiative follows the push from industry to show a clear commitment to the commercialisation of hydrogen and fuel cells, as exemplified by the letter from September 2009 signed by 7 leading OEMs.

Key market segments will be covered by a comprehensive and objective review of the state of the art, both as regards the technology status and in relation with other competing technologies. Following the outcome of this first phase, a roll-out scenario will be developed, possibly first in key areas or regions, followed by an expansion phase where other regions could also see increasing numbers of fuel cell units. This outline also needs to take into account: (i) funding needs; (ii) the ongoing initiatives by key regions and stakeholders and (iii) the need to share and disseminate information to stakeholders and the public at large to build up support.

One of the critical advantages in this process is the willingness of key industrial players, ranging from oil companies and OEMs through component manufacturers to end-users, to

share their latest field data and to conduct an objective review by an independent body. This will enable these activities to obtain broader support than was previously the case and to gain additional momentum as hydrogen and fuel cells enter the first phase of commercialisation.

Some of the markets already identified as critical components in this commercialisation strategy include, but may not be limited to:

- Fuel cell cars: due to the importance of road transport in our energy mix, particularly through the use of private vehicles, it is critical to ensure that the way forward in the commercialisation of hydrogen and fuel cell cars is clearly addressed and delineated, in order to prepare properly and be able to meet the challenges that lie ahead.
- Fuel cell buses: this particular vehicle segment is believed to be an attractive initial market and stepping stone for broader adoption of hydrogen fuel cell based transport, due to limited refueling infrastructure requirements, and a well-defined user group with relatively uniform requirements in a relatively regulated environment.
- Certain early market applications, such as forklift trucks and backup power units, have seen increasing levels of deployment in recent years. Their potential to provide success stories by showcasing how they can compete in the marketplace with incumbent technologies makes these applications a critical component in the overall scheme to foster the deployment and commercialisation of hydrogen and fuel cells. As such, a proper strategy is required to ensure that these opportunities are not missed, while addressing gaps that may call for public support and actions.

8 Other Activities of the Programme Office

Aside from supporting projects following calls for proposals, the Programme Office of the FCH JU is also undertaking several other initiatives. The most important ones are:

- Preparation of the RTD programme for the call for proposals for 2010. The PO has been interacting with members of the NEW IG and N.ERGHY represented in each of the 5 Application Areas, i.e. Transport, Hydrogen Production and Distribution, Stationary, Early Markets and Cross Cutting, as well as the European Commission, in order to agree on a consolidated version that can be published in June 2010. The aim is to strike the right balance between demonstration and R&D activities, as well as among different Application Areas.
- Formal review of the Multi Annual Implementation Plan (MAIP). In particular, the targets for each Application Area should be revised in light of the latest developments in the technologies, as well as results from the first and preliminary results from the second call for proposals, which reflect the fact that certain topics did not attract project proposals and therefore cannot advance towards achieving those targets.
- Review of funding mechanisms. A thorough analysis of the functioning of the programme has been undertaken and options for amending the original European Council Regulation establishing the FCH JU are currently being assessed in order to increase the level of funding to all beneficiaries receiving grants in the calls for

proposals. The modification sought is not only intended to make the programme more competitive internationally and comparative to levels of support available for other energy technologies, but also to simplify programme management.

- Coordination of activities and cooperation with European stakeholders. Interaction with EU Member States and Associated countries through the States Representatives Group and European Regions represented by HyRaMP is being pursued in order to align activities and increase cooperation to make better use of the resources of all these contributors in Europe.
- International cooperation with partners outside Europe: International relations with countries such as the US and Japan have already been established and ways to develop this on a long term and more widespread basis are currently being explored.
- Communication activities, including the annual Stakeholders General Assembly, organised in 2010 in Brussels on 9-10 November.

9 Conclusions

The FCH JU has been established as a unique public-private partnership with the singular goal of advancing the commercialisation of hydrogen and fuel cell technologies. With the pivotal support and input both from the public and private sectors, it has structured its programme of research, development and demonstration activities in clearly defined application areas, as well as coordination and support actions that will cover numerous horizontal fields of interest. Industry lead and a ring-fenced budget of nearly €1B, contributed jointly by the Commission and industry partners, will set FCH JU aside from conventional research programmes to making a real and indisputable impact on accelerating the introduction to market of hydrogen and fuel cell technologies.

The budget of the FCH JU is being implemented through awards following open and competitive calls for proposals, with committed funds of 28.1M€ to 16 projects to date, and approximately 71M€ expected being committed in the following months to selected projects from the 2009 call.

The Programme Office, the executive arm of the FCH JU, is now ready to focus fully on its key mission after the initial establishment phase and will now be able to benefit from the increased efficiency and flexibility of a smaller organisation. It continues to increase its capabilities not only to execute its core tasks, preparing the next call for proposals for 2010 and executing the research agenda, but also addressing the non-technical barriers to commercialisation of fuel cell and hydrogen technologies.

The FCH JU is off to a good start bringing resources and capacities throughout Europe together to move from the pre-market phase to commercialisation.

References

- [1] COM(2007) 723 final
- [2] COM(2007) 1 final
- [3] <http://ec.europa.eu/research/fch/>

- [4] Council Regulation (EC) No 521/2008 of 30 May 2008 setting up the Fuel Cells and Hydrogen Joint Undertaking; O.J. L 153, 12.6.2008, p.1
- [5] <http://www.fchindustry-jti.eu/>; The NEW IG currently has 67 member companies across the EU. It is open to new members at all times.
- [6] <http://www.nerghy.eu/>; N.ERGHY currently has 63 member universities and research institutes across the EU. It is open to new members at all times.