

## **German-French position on core aspects of hydrogen research in Horizon Europe, the EU's Ninth Research Framework Programme**

The EU's Ninth Research Framework Programme Horizon Europe must address the major European societal challenge of both climate protection and competitiveness. To tackle this challenge, **Europe needs innovations for an extensive change** aiming at the long-term replacement of fossil energy sources. It requires efforts **to restructure and refocus the energy system as well as solutions for those sectors where carbon-containing fossil fuels still prevail such as mobility, heat supply and industry**. Research and development (R&D) play an important role in driving and steering this process. They help to shape change for the benefit of the population and to tap the economic potential of a progress-oriented climate protection policy.

### **Climate-friendly generated hydrogen<sup>1</sup> can contribute to solving these challenges:**

Over the coming years, the main focus must be on developing **an integrated overall system based on low-carbon energy**. Fluctuating supply of renewable energy generation technologies such as wind and PV power plants requires solutions to deal with instable supply. Flexible hydrogen production based on renewable energy sources would provide a long-term storage technology for systemic use and would thus be an important option to enhance grid stability, ensure security of supply and the penetration and acceptance of renewables. Furthermore, the chemical resources produced (power-to-fuel) can be used to supply energy as required, particularly in areas where electrification cannot easily be achieved. Hydrogen can also be useful for gas production (power-to-gas) and as such provide a promising option for using existing energy infrastructure like the European gas grid in a sustainable way.

In addition, **hydrogen already is an integral part of industrial value chains in Europe**: Roughly 8 million tonnes of hydrogen were consumed in the EU in 2016 – mostly from fossil sources, releasing up to eight times this amount of greenhouse gases. The substitution of these conventional production methods with cleaner alternatives can already lead to a significant reduction in greenhouse gas emissions in established production processes. "Green" hydrogen is also a key element in numerous innovative approaches to reducing emissions in industry through the valorisation of CO<sub>2</sub>. Thus, hydrogen offers unique opportunities to make European industry sustainable and fit for the future.

This key double role makes sustainable hydrogen technologies an important cutting-edge field where Europe must seek to take the international lead. Europe must develop and expand relevant expertise to retain its technological sovereignty in the face of international competition. This is where Horizon Europe should make its contribution. **Funding for research along the entire chain is needed to bring together European expertise and address specific key issues of hydrogen technology in order to achieve major advances.**

Germany and France **support a clean hydrogen dedicated partnership area within the decision establishing the Horizon Europe specific program with a view to establish an institutionalised European Partnership**. They would like to propose the following vision for hydrogen:

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<sup>1</sup> In this paper "climate-friendly hydrogen" designates hydrogen obtained from production processes using primary sources emitting very little or no GHG.

**1. To keep the momentum given by the networks created by the FCH JU since 2008.**

The JU in the area of hydrogen and fuel cells proved to be an efficient and effective way of bolstering European efforts in research and innovation. The FCH-JU has become the central hub connecting Europe's actors in the field and it is in large part thanks to its existence that the EU remains a global technology leader in the field. It helped set up **an innovative and competitive sectorial European ecosystem** promoting the emergence of SMEs and of a European industrial value chain. In its function as hub it fostered European cooperation and the creation of value chains like no other national institution could have done. Furthermore, by way of the close cooperation the persisting shortcomings in regulatory terms – both on the European and national levels – have been revealed. In particular, when taking into account the massive investments in this technology in other parts of the world, mostly in Asia, and the headway Europe still has on competitors, it becomes clear that the FCH-JU has delivered beyond expectations and that, respecting the principle of subsidiarity, this success story needs to be continued. The JU helped tackle « market failure » where **public support was needed to create a European innovative and industrial field creating jobs and growth**: hydrogen technology deployment often was still too risky to be set up only by the private sector. Nevertheless, the JU successfully **fostered industrial involvements and investments**<sup>2</sup>.

**2. To maximise impact focus research, development and innovation on vital key areas.**

Funding within Horizon Europe should be focused on central key areas, in which Europe is expected to be able to claim worldwide leadership in innovation. **Europe needs a long-term coherent strategy for hydrogen-related R&I ranging from basic and application-orientated research to „world-scale“-demonstration that defines the significant scientific challenges to be addressed.** This can only be done through an institutionalised partnership approach. This strategy shared by industry should also include measurable objectives yearly assessed with regard to economic and environmental performance. The main focus from an economic point of view should be cost reduction, whereas further efficiency gains should be the main driver with regard to environmental concerns. The main research topics pursued in North America and East-Asia as well as developments on the world market shall be monitored and guide the European efforts. Combined with highly innovative funding schemes (➔ No. 3), such an approach could mobilise stakeholders all over Europe to take the international lead. In order to tackle the right challenges with ambitious yet realistic technological goals the open dialogue of all relevant stakeholders is key.

Europe needs to address a variety of social, regulatory, business and economic as well as geostrategic and planning issues in order to achieve the large-scale use of hydrogen. The focus needs to lie on key industrial areas where no commercially viable renewable alternatives to hydrogen use are available in the foreseeable future. Therefore, research efforts must focus on the further integration of green hydrogen in industrial sectors such as **steel production, refinery processes as well as ammonia and methanol production**. In the beginning of the next decade, the use of green hydrogen in refineries is expected to experience a boost with the transposition of the recast of the renewable energy directive. This development could constitute a lever for realizing economies of scale in hydrogen production. Nonetheless, funding will remain a necessity as price projections for certificates under the ETS do not warrant viable business cases for the use of green hydrogen in many industries. Another key aspect is

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<sup>2</sup> The mid-term evaluation of the FCH2 JU shows that the JU generates a 0,98 of operational leverage thanks to the « private in-kinds » of participants in the projects and an additional 0,65 of leverage due to their « private in kind additional activities ».

to drive the costs for hydrogen production down (→ No. 4) in order to make hydrogen a competitive alternative to established feedstocks.

**3. To expand the FCH-JU's focus beyond research to market activation by providing a variety of funding instruments to promote innovation and set up a European management forum dealing with the different funds**

Efficient and flexible funding is the backbone of successful innovation processes. Horizon Europe will offer various opportunities and instruments for funding. These should be used to meet the specific requirements of hydrogen technology.

In particular, **support should be provided for projects which systemically address relevant aspects in the whole range of basic and application-oriented research and demonstration.**

It is necessary to **keep a European top-level research for preparing the next generations of products through lower TRLs research and grant funding.** This overarching pillar could reduce “time-to-market” by funding incremental and breakthrough innovations (low TRLs) through cooperation between short and mid-term expectations of companies and innovative ideas of researchers – academics and RTO. Lower TRLs cannot be funded only by the excellence pillar of the post-2020 framework programme (i.e. ERC or FET) because of the weak link of these programmes with private companies: transfer to industry and market of innovations coming from this excellence pillar remain a challenge<sup>3</sup>. A new JU would cover TRLs from 2 up to 7, always ensuring a strong link between its activities and industry for ensuring smooth market entry and the consideration of commercial aspects.

Furthermore, adequate investment conditions are needed to enable the pioneering world-scale testing of technologies as a major step towards their broad application. This will require efforts to **establish links with other funding programmes at European level.** Horizon Europe would allow the implementation of large demonstration or pre-deployment with a systemic approach on hydrogen. **These projects would involve transport and energy hydrogen applications on a territory – urban, sub-urban, port, airport, logistic centres etc. – and would aim at reaching economical profitability faster.** We mainly need solution-oriented research funding which triggers a 'competition of ideas' between different approaches through its openness to technologies and uses.

Through **the development of pilot lines,** these overarching projects will contribute to the surge of a European hydrogen supply chain on critical generic components.

**These large demonstration or initial deployment activities should be evaluated, ranked and selected in the framework of the institutionalised European Partnership by a committee grouping different funding authorities dealing with the different funding tools** like CEF, EFSI, EIB, InnovFin-EDP, ESIF etc. The JU should have a clear mandate to combine and manage different sources of European funding in order to scale up the application of hydrogen and fuel cells. Ideally, CEF and ETF funds would be allocated to the JU so it can boost deployment and bridge the valley of death. Furthermore, its mandate shall encompass active international cooperation (e.g.: IPHE, IEA-HIA, MI) and cooperation with other funding bodies. On top of that, European stakeholders shall be supported in order to participate in pre-normative activities for setting up ISO, IEC and regulations allowing the deployment of hydrogen activities.

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<sup>3</sup> See Interim Evaluation of the Fuel Cells and Hydrogen 2 Joint Undertaking (2014-2016) operating under Horizon 2020, pp. 9, 87.

The current basic structure, where the JU generates a 0.98 of operational leverage thanks to the private in-kinds of participants in the projects, should be maintained.

The JU should act as the central hub to coordinate access to finance at each step of a project, from the idea (lower TRLs) to the market (highest TRLs) lowering the public support when getting closer to commercialization:

- Development for lower TRLs topics (typically TRL 2-3) addressing different applications could be funded through 100% grants;
- R&D topics dedicated to a market or an application (transport, P2H, H2X, storage etc.): These topics can integrate innovations aiming at reaching validation through demonstration projects (TRL 3/4-6/7) that could be funded by 90% grants for public stakeholders and 70% grants for private stakeholders;
- Large demonstration or pre-deployment activities (local demonstration and deployment of common technical solutions for energy, transport and industry (« H<sub>2</sub> valleys ») and projects putting in place a European industrial value chain through pilot lines for critical generic component or sub-systems. These projects benefiting of lower funding rates (possibly 20-40%) to be completed and co-funded by other programmes: CEF, ESIF, EFSI, EIB, public support from Member States and combined funding.

#### **4. To establish sustainable industrial-scale green hydrogen production as a key competence of European industry**

Notwithstanding upcoming prioritisation, it is clear that the general feasibility of sustainable hydrogen solutions depends largely on one key issue: **the availability of affordable “green” hydrogen**. An efficient and sustainable industrial-scale hydrogen production which can compete with conventional solutions represents a make-or-break technology. Europe must develop and expand relevant expertise to retain its technological sovereignty in the face of international competition. Horizon Europe can make an important contribution by addressing sustainable industrial-scale hydrogen production as a prominent key area. With regard to international competition and exports, breakthroughs are required primarily in terms of economic efficiency.

Research in this area shall be accompanied by a funding programme for measures of market activation to realize economies of scale in this area. The CEF Synergy Calls provide a good example of how electrolyzer deployment can be fostered on a European scale and its use demonstrated for various applications.

#### **5. To improve the governance of the future institutionalised European partnership compared to the current FCH2 JU**

Because a new JU should gather or at least coordinate access to finance at each step of a project, from the idea (lower TRLs) up to the market (highest TRLs), it is important to modify<sup>4</sup> the governance of the new institutionalised European Partnership according to the following principles :

- Keeping private sector representatives coming from different application areas of hydrogen, such as transport, heat in buildings, energy grids, industry and logistics- in the Governing board (GB);

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<sup>4</sup> Currently 10 people representing Industry grouping, Research grouping and the European commission have a seat at the FCH2 JU Governing board: the EC holds indivisible 50% of the voting rights; the industry grouping holds 43% of the voting rights and the research grouping 7% of the voting rights.

- Stronger involvement of the Member states is necessary for sharing quantified targets, risks, funding and regulation alignment. We propose to reinforce interactions with the Horizon Europe program committee and to reserve **one of the GB seats to one representative from the State representatives group (SRG) having the right to vote;**
- Stronger involvement of local authorities is necessary for the concrete implementation of demonstration and deployment projects. We propose to reserve one of the GB seats to a representative of local authorities<sup>5</sup>. This seems especially vital in the context of the hydrogen valleys that are to be implemented under the FCH-JU. By means of involving the local authorities, the awareness of the technology can be increased and advice be spread to local decision-makers.

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<sup>5</sup> Such a representative could be a delegate of the platform that is to connect the regional actors of the H2Valleys.