Fuel Cells and Hydrogen Joint Undertaking (FCH JU)

ANNUAL IMPLEMENTATION PLAN 2013

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1. Introduction: mission, objectives and challenges

This document establishes the sixth Annual Implementation Plan (AIP) of the Fuel Cell and Hydrogen Joint Undertaking (FCH JU), outlining the scope and details of its operational and horizontal activities for the year 2013, with a focus on research activities prioritized for the sixth Call for proposals, together with supportive actions required. It also describes the objectives of the FCH JU, the policy and global context, assessment criteria, technical targets and rationale for individual activities.

Fuel Cells and Hydrogen R&D has been supported by the Framework Programmes of the EU since 1986[1] with increasing funding over successive FPs[2]. All relevant application areas - transport, stationary and portable ï as well as hydrogen production have been covered, from basic research to demonstration. Starting from 2009 (i.e. in the course of FP7), FCH activities are supported through the FCH JU, with some complementary support through the FET (Future and Emerging Technologies) scheme of the Energy Theme, Marie Curie actions and European Research Council (ERC). Direct research is carried out by JRC.

Notwithstanding the success of the Framework Programs, it was recognized that accelerating the development and deployment of cost-effective low carbon energy technologies required a stronger synergy between public and private research. In the course of FP6, European Technology Platforms (ETPs) were set up as industry-led stakeholder forums with the aim of defining medium to long-term research and technological objectives and developing roadmaps to achieve them. Launched in January 2004, the Hydrogen and Fuel Cell ETP was one of the first platforms to emerge, and published its Strategic Research Agenda in 2005.

In 2007, and with an update in 2009, the Commission presented the SET Plan[3,4] which was adopted by the European Council[5,6]. The SET Plan establishes an energy technology policy for Europe. The two main pillars of the SET Plan, the European Industrial Initiatives (EIIs) and the European Energy Research Alliance (EERA), represent an important step in the direction of structuring and integrating public and private research efforts.

Building on the foundations laid by the Hydrogen and Fuel Cell ETP, the Fuel Cell and Hydrogen Joint Undertaking (FCH JU)[7] was established by Council Regulation (EC)

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1 http://ec.europa.eu/research/energy/eu/research/fch/support/index_en.htm
2 European Commission: European funded research on Hydrogen and Fuel Cells: review, assessment, future outlook. Hydrogen and Fuel Cells Review Days, Brussels, 10-11 October 2007. Directorate-General for Research, EUR 23171, 2008. p.p. IV-V
3 A European Strategic Energy Technology Plan (SET Plan) ï ñTowards a Low-Carbon Futureò. COM(2007) 723 final
4 European Commission: Investing in the Development of Low Carbon Technologies (SET Plan). COM(2009) 519 final
5 Council of the European Union: Council Conclusions on the Commission Communication ñA European Strategic Energy Technology Plan (SET Plan).ò Brussels, 28 February 2008
6 Council of the European Union: Council Conclusions on the Commission Communication ñInvesting in the Development of Low Carbon Technologies (SET Plan)ò. Brussels, 12 March 2010
7 http://www.fch-ju.eu/

521/2008 of the 30th May 2008 as a Community Body[8] on the basis of Article 171 of the EC Treaty[9], with the European Commission and the Industry Grouping as founding members. The Research Grouping joined shortly after. The FCH JU is considered as one of the European Industrial Initiatives under the SET Plan. With the ETP, the SET-Plan framework and the Joint Undertaking, a new level of coordination, joint agenda setting, cooperation and commitment including co-financing was reached.

Fuel Cells and Hydrogen are key components of our future energy system. The attractiveness of fuel cells using hydrogen lies in the near-zero CO_2 performance and high energy efficiency of the process. The oxidation of hydrogen produces water and heat but no CO_2, which makes it the cleanest burning fuel. Harnessing this process in a fuel cell allows capturing most of the hydrogen's energy content as electricity, possibly combined with the recovery of heat. Hydrogen is also expected to play an increasing role in large-scale energy storage in grids in order to balance the intermittent nature of renewable electricity. Currently, hydrogen is mainly produced from fossil fuels. In the future energy system, hydrogen should be produced from renewable feedstock using renewable energy in order to be considered "zero CO_2". In the bridging phase towards renewable hydrogen, hydrogen production from fossil fuels should be pursued. Provided this level of sustainability is aimed for and reached, FCH technologies can become essential in realizing the EU societal goals such as decarbonisation, better air quality, energy security, international competitiveness and employment.

FCH are emerging technologies that have to compete with incumbent technologies, with a high commercial risk for first movers. Large investments in hydrogen distribution infrastructure will be needed, and an improved performance and lower cost of all parts of the FCH chain are still required. This chain includes the production, purification, transport, storage and distribution of hydrogen, and the conversion of its energy content into electricity through fuels cells. Technology improvements can be achieved by the development of innovative materials, better system integration and new manufacturing processes. All contribute to increased performance and cost reduction which are the driving criteria for market implementation. Significant improvements have been achieved over the last decades[10] through R&D, but these improvements are up to now insufficient to support mass market applications.

The FCH JU was granted autonomy on 15 November 2010 and consequently 2013 will be its third full year of operations as an autonomous entity. From 2008 to 2012, the FCH JU finalized respectively 16, 28, 26, 33 (under negotiation) and 28 (under negotiation) grant agreements for a total Union funding of about 380 Mú.

The risk management exercises carried out in the last years identified one critical risk, namely the potential impact on the quality of work of the shortage of staff resources

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[8] Council Regulation (EC) No 521/2008 of 30 May 2008 setting up the Fuel Cells and Hydrogen Joint Undertaking. OJEU. L153/1-20, 12.6.2008

[9] Now Article 187 of the Treaty on the Functioning of the European Union (TFEU)

[10] ó*Hydrogen and Fuel Cells*ô, Scientific Assessment in support of the Materials Roadmap enabling Low Carbon Energy Technologies, JRC Scientific and Technical Reports, May 2012

compared to the workload (number of projects to manage). To address this risk the following actions will be pursued (1) the use of all possible resources ï including trainees and interim staff where adequate and a close monitoring of resources aiming at ensuring a sustainable workload and (2) negotiation with FCH JU stakeholders on increase in resources notably in the context of possible implementation of the FCH JU under the Horizon 2020 program. It should be noted that the need to increase staff for project management was also identified in the Interim Evaluation report.

In 2013, the FCH JU will also follow-up on the recommendations of the Advisory Bodies and of the evaluators and will implement actions as relevant.

2. FCH JU Governance

The FCH JU is composed of two executive bodies: the Governing Board and the Executive Director. In addition there are three advisory bodies, the Scientific Committee, the FCH States Representatives Group and the Stakeholders' General Assembly.

2.1 Governing Board

The Governing Board shall have the overall responsibility for the operations of the FCH JU and shall oversee the implementation of its activities in accordance with Article 5 of the Statutes. The NEW-IG has 6 seats, the EC 5 seats and the RG 1 seat respectively.

The Governing Board is planning to hold three Board meetings during 2013. The key activities are listed below:

Key activities in 2013 - timetable	
Adopt the call for proposals 2013	Q1
Adopt the MSPP 2014-16	Q1
Adopt the AAR 2012	Q1
Adopt the updated Implementing Rules regarding Staff Regulation	Q1
Approve the lists to start negotiations for call 2013, including reserve lists, lists of proposals which failed thresholds and ineligible proposals	Q3
Approve the Final Account 2012	Q2-3
Approve the 2014 Budget	Q4
Adopt the Work Programme 2014	Q4
Monitor the FCH JU activities in the context of H2020	Q1-4

2.2 Executive Director and the Programme Office

The Executive Director is the legal representative of the FCH JU, and the chief executive for the day-to-day management in accordance with the decisions of the Governing Board in line with Article 6 of the Statutes.

Mr. Bert De Colvenaer, following the GB decision taken on 15 June 2010, was appointed Executive Director and took up duty in September 2010.

He is assisted by the Programme Office, which is composed of 20 full time employees (temporary and contract agents).

The activities of the Programme Office include the implementation of all the decisions and activities decided by the Governing Board and support of the advisory bodies described in this chapter and the day-to-day execution of the FCH JU programme as described in Chapters 4 and 5 below.

The Programme Office could also facilitate and maintain institutional relations at EU level for monitoring EU legislative activities and policy orientations with a view to promote FCH-JU and its activities.

2.3 Scientific Committee

The Scientific Committee is an advisory body to the Governing Board. It shall conduct its activities in close liaison and with the support of the Programme Office.

The members shall reflect a balanced representation of world class expertise from academia, industry and regulatory bodies. Collectively, the Scientific Committee members shall have the scientific competencies and expertise covering the complete technical domain needed to make strategic science-based recommendations regarding the FCH JU. It shall have a maximum of 9 members.

According to Article 8 in the FCH JU Statutes the role of the Scientific Committee is to:

(a) advise on the scientific priorities for the Annual and Multiannual Implementation Plans proposal;

(b) advise on the scientific achievements described in the Annual Activity Report;

(c) advise on the composition of the peer review committees.

Nine members were appointed to the Scientific Committee in the first half of 2009[11]. Due to some resignations, memberships have changed since the first appointment.

The Scientific Committee will hold two to three meetings in 2013. Its main activities will be:

Key activities in 2013 - timetable	
Provide input on scientific priorities in FCH sector	Q1-4
Advise on scientific achievements	Q3-4
Programme review days	Q4

2.4 FCH States Representatives Group

The FCH States Representatives Group (SRG) shall consist of one representative of each Member State and of each country associated to the 7th Framework programme.

[11] For the list of members, see http://www.fch-ju.eu/page/scientific-committee

According to Article 9 in the Statutes the SRG shall have an advisory role to the JU and shall act as an interface between the JU and the relevant stakeholders within the respective countries. It shall in particular review information and provide opinions on the following issues:

(a) programme progress in the FCH JU;

(b) compliance and respect of targets;

(c) updating of strategic orientation;

(d) links to Framework Programme Collaborative Research;

(e) planning and outcome of calls for proposals and tenders;

(f) involvement of SMEs.

It shall also provide input to the JU on the following:

(a) status of and interface to JU activities of relevant national research programmes and identification of potential areas of cooperation;

(b) specific measures taken at national level with regard to dissemination events, dedicated technical workshops and communication activities.

The FCH States Representatives Group may issue, on its own initiative, recommendations to the FCH JU on technical, managerial and financial matters, in particular when these affect national interests. The FCH JU shall inform the FCH States Representatives Group of the follow up it has given to such recommendations.

The States Representatives Group will hold two to three meetings in 2013. Its main activities will be:

Key activities in 2013 - timetable	
Dissemination and communication actions at national level	Q1-4
Provide opinions on programme progresses	Q1-4
Feedback on Stakeholders General Assembly 2012	Q1
Input for the SGA 2013	Q2-3

2.5 Stakeholdersô General Assembly

The Stakeholdersô General Assembly (SGA) shall have an advisory role to the FCH JU. It shall be open to all public and private stakeholders, international interest groups from Member States, Associated Countries as well as from Third Countries.

The Stakeholdersô General Assembly shall be informed of the activities of the FCH JU and shall be invited to provide comments.

The Stakeholders' General Assembly is an important communication channel to ensure transparency and openness of the RTD activities with its stakeholders. It shall be convened once a year.

The 6th Stakeholders' General Assembly is scheduled to take place in October/November 2013. The discussion where the SGA should be held (Brussels or other Member State Capital) is still open. The emphasis of the agenda is foreseen to be on policy and market strategies for the commercialisation of fuel cell and hydrogen technologies.

Key activities in 2013 - timetable	
The 6th Stakeholders' General Assembly	Q4

3. Operational Activities: Objectives and Indicators

3.1 Strategic Objectives

In carrying out a programme of RTD activities in the field of hydrogen and fuel cells, the following constitute the main objectives of the FCH JU:

- Aim at placing Europe at the forefront of fuel cell and hydrogen technologies worldwide and enabling the market breakthrough of fuel cell and hydrogen technologies, thereby allowing commercial market forces to drive the substantial potential public benefits;
- Support RTD in the Member States and countries associated with the Seventh Framework Programme in a coordinated manner in order to avoid market failure, focus on developing market applications and facilitate additional industrial efforts towards a rapid development of fuel cell and hydrogen technologies;
- Support the implementation of the RTD priorities of the Multi-Annual Implementation Plan of the FCH JU, notably by awarding grants following competitive calls for proposals;
- Undertake supporting actions where appropriate through calls to tender;
- Aim to encourage increased public and private RTD investment in fuel cells and hydrogen technologies in the Member States and Associated countries;
- Ensure the coordination and efficient management of funds. Management will be guided by the principles of transparency and openness, competitiveness and excellence, inclusiveness and close cooperation among stakeholders in order to achieve the best possible benefit for Europe. RTD activities will respect the fundamental and ethical principles applicable to the Seventh Framework Programme.

The more specific objectives for 2013 relate to ongoing and new projects funded by the FCH JU and are outlined in the following sections.

3.2 Projects from Previous Calls

A total of 16 contracts from the call 2008 were signed with project consortia. Of those, 4 have finished (NextHyLights, Autostack, PreparH2 and PRIMOLYZER), while the rest will be mostly finished by the end of 2012.

A total of 28 contracts from the call 2009 were signed with project consortia. Two projects, HyGuide and H2FC-LCA, finished during 2011. All others are ongoing, with many of them reaching the midterm point in the second half of 2012.

A total of 26 projects from the call 2010 were signed with project consortia. All projects are ongoing.

The call 2011 was closed on 18 August 2011. A total of 33 Grant Agreements resulting from the successful conclusions of negotiations have been signed or are expected to be signed in Q4 2012.

The call 2012 was closed on 27 May 2012. A decision by the GB on lists of projects to start negotiations and reserve lists was made at its meeting of 11 October 2011.

During the year 2012, several projects will complete reporting periods. Furthermore, several midterm reviews are foreseen during the second half of 2012.

3.3 The 2013 Call for Proposals

The Annual Implementation Plan (AIP) is the result of a joint effort by the major stakeholders - namely the NEW-IG, the RG and the European Commission. It represents a set of prioritised actions, consistent with the long-term objectives of the FCH JU, which are implemented on an annual basis in order to facilitate the rapid deployment of fuel cell and hydrogen technologies, and to achieve the overall objectives of the FCH JU.

Within the framework of the available annual budget, the actions have been chosen based on their potential contribution to achieving Europeô policy objectives, i.e. the Commissionô targets for greenhouse gas reductions, energy security and competitiveness. They include in a balanced way research, technological development, demonstration and cross-cutting activities, including Regulations, Codes & Standards (RCS).

The overall programme of the FCH JU is divided into four major horizontal application areas (AA): Transportation & Refuelling Infrastructure; Hydrogen Production, Storage & Distribution; Stationary Power Generation & CHP; and Early Markets. Cross-cutting activities have also been established as a fifth area in order to make their relevance more visible. The programme structure reflects the RTD cycle from long-term and breakthrough-oriented basic research to demonstration and support activities. Pre-normative research is also included at project level. The emphasis given to different action categories in different application areas reflects the industry and research partners' assessment of the state of technological maturity of the applications.

The main objectives and activities of the different AAs are laid out next.

3.3.1 Transportation & Refuelling Infrastructure

Successful implementation of fuel cell and hydrogen technology in transportation constitute a major objective of the FCH JU program, as it contributes significantly to reach the targets of the SET-plan. Thus, in this last call a significant part is devoted to large-scale demonstration of FCEVs including the build-up of the necessary refuelling infrastructure. Moreover, in this call special attention is given to increased reliability and reduced cost of hydrogen supply. After five calls of the FCH JU program, this application area is close to the foreseen shares between demonstration projects and R&D-projects. Assessment of the current project portfolio and topic coverage after five calls (2008-2012) has led to inclusion of a set of activities with focus on demonstration while including R&D activities in specific areas in which progress is crucial to solve the main challenges for this application area.

Large scale demonstration of fuel cell technology for road vehicles and refuelling infrastructure is the pillar and an inherent part of this application area and will be called this year. As an integral part of preparing for market introduction of vehicles from 2015 on, R&D activities on periphery components for Hydrogen Refuelling Stations are included. Although being farther from commercialisation (than that for vehicle propulsion), fuel cell systems as APUs for various applications is of high relevance to reduce GHG emissions, and is consequently included. To support these developments cost optimized, compact and efficient system components are required.

With a vast number of European R&D projects on developing fuel cell membrane and electrode assemblies, with focus on catalysts and degradation issues, this call opens for activities on R&D on bipolar plates for automotive applications, an area in which only one project has recently been initiated.

Demonstration projects have revealed that reliable and low cost hydrogen quality assurance is still a critical issue, and that there is a need to develop new, methodologies pursuing simplifications to ensure that hydrogen gas of adequate quality is supplied to the vehicles at the refuelling station.

3.3.2 Hydrogen Production & Distribution

This application area aims to develop a portfolio of sustainable hydrogen production, storage and distribution processes which can meet an increasing share of the hydrogen demand for energy applications from carbon-free or lean energy sources. Considering the limited budget for this application area in the 2013 call, the topics are focused on R&D rather than demonstration. Special attention is again given to the production of hydrogen from renewable electricity sources, which is needed to enable the integration of the increasing share of RES in Europe. To achieve this, several topics related to improved performance of electrolysers are called. Complementary to this proposals are sought for R&D into conversion of solar energy to hydrogen.

It is also necessary to transport hydrogen to the places of use. Of the various distribution technologies, higher pressure gaseous trucks promise a near term improvement to reduce distribution cost and increase its efficiency. One topic is related to this area.

3.3.3 Stationary Power Generation & Combined Heat and Power (CHP)

The primary objective of AA3 Stationary Power Generation and CHP application area is to continue to support the development of commercially relevant fuel cell technologies. PEMFC and SOFC, together with other such as AFC and MCFC, represent the most promising of these. All require further development to be able to meet the stringent demands of end users be these domestic, commercial or industrial.

The programme aims to achieve the principle technical and economic requirements set out in the MAIP; including high electrical efficiencies of 45% for power only systems and 80% plus for CHP systems, with lower emissions than existing incumbent technologies. Focused efforts remain a priority to achieve the lifetime ambitions of 40,000 hours and to meet commercially competitive costs targets, which will vary according to the type of application.

The 2013 AIP Call supports a portfolio of activities designed to continue and strengthen the focus on development of the various fuel cell technologies through applied research and learning through demonstrations.

Degradation remains a fundamental challenge to durability, reliability and cost and further proposals are invited to improve understand and develop solutions utilising advanced testing techniques. A further effort is proposed to develop a Degradation Roadmap for future work in the sector with proposals invited through a public procurement process.

Development activities are directed at improving cell and stack design, achieving robust and reliable balance of plant components and sub-systems with improved performance, durability and costs to contribute e to system application readiness.

Demonstration activities target proof-of-concept, technology validation or field demonstrations. Proof-of-concept work will develop and test system concepts within in-house test facilities at a representative scale; validation activities will either be in-house or in the field in a representative environment; whilst field demonstrations need to be undertaken in a real operating environment over at least 16,000 hours in collaboration with end-users.

Field demonstrations activities are divided into small scale (residential or commercial scales of 1kWe up to 100kWe) and large scale (other commercial or industrial use of more than 100kWe).

As in 2012 any validation proposal must show that proof-of-concept has been successfully undertaken with several hundreds of continuous operating hours, whilst any field demonstration must show that validation has been successfully completed with at least 4,000 hours continuous operation time.

3.3.4 Early Markets

The primary purpose of the AA4 Early Markets Application Area is to encourage and support more immediate applications where a FCH technology, or set of associated technologies, are at, or close to, commercial market readiness. The intention of the European early market fuel cell funding is to promote niche market solutions whose results and experiences will eventually become implemented in mass markets in a later phase. This includes demonstration of market readiness of special products or at least the rapprochement to commercial viability, the identification and quantification of gaps toward commercial success and the continuous development to close these gaps.

The focus of the first two topics for 2013 is therefore on demonstration projects for the commercially promising areas of material handling vehicles and portable generators, back-up power / UPS systems to gain direct operational deployed ófleetô experience and show operational suitability in live field conditions. It is intended to encourage the take up of the field demonstration opportunities of representative complete material handling vehicles / back-up power / UPS systems together with a representative fuelling solution at a large representative site, or across multiple smaller sites. Importantly, the demonstration projects are also intended to show realisation of, or a clear pathway to, a total cost of ownership (TCO) that is competitive with incumbent technologies.

A third topic this year has been included to promote combined development plus field demonstration to validate next iteration technology designs for portable fuel cell systems against specific application requirements and incumbent technologies. Portable power applications (consumer electronics, emergency responder power, battery recharging) have been highlighted as a breakthrough area for a number of years. Development is required in order to demonstrate a system solution against a specific operational and market requirement.

The fourth and final topic for AA4 in 2013 is targeted at creating competitive next generation PEM stacks and complete fuel cell systems in the 1kW to 30kW range plus hydrogen supply solutions. This is to allow early market applications (such as MHV and BUP / UPS / standby power) to be designed with European components in the future and shall use results of stack developments of the application area Transport. The topic is also intended to combine system level cost reduction and improved performance, through fundamental gains in energy efficiency and durability of stacks and systems, and hydrogen supply, in a wide range of ambient and environmental operating conditions. Verification of proof of concept and field validation against 2015 targets would provide a pathway for early market introduction.

3.3.5 Cross-Cutting Activities

The projects in the section "Cross Cutting" serve to solve problems that refer to several AA's and/or are of a generic and basic nature.

The emphasis in the 2013 call will therefore lie on:

- education: projects that will ensure the human capital necessary in deploying FC & H2 technology in the mid-term is developed
- safety: pre-normative studies of pressure vessel safety
- socio-economics: studies of public perception and social acceptance of FC & H2 technologies in Europe in order to identify any actions necessary in preparing the public for these technologies
- environmental impact: development of procedures for transparently identifying the carbon footprint of hydrogen production
- standardisation: testing standards for SOFC and SOE

3.3.6 Collaboration with JRC

The Framework Agreement between the FCH JU and JRC[12] identifies a number of activities that JRC can provide to the FCH-JU, either upon request of a project consortium, or by the FCH-JU Programme Office. In the latter case, JRC involvement may be identified in the formulation of the call topic, or be called upon during the negotiation phase of an approved project.

[12] The Framework Agreement is available at: http://www.fch-ju.eu/page/documents

3.3.7 List of topics

No.	Topic	Scope	Indicative FCH JU Funding Million ú
Transportation & Refuelling Infrastructure			**23.0**
1	*Large-scale demonstration of road vehicles and refuelling infrastructure VI*		
2	*Research & Development on Bipolar Plates for PEM fuel cells*		
3	*Research & Development of periphery components for hydrogen refuelling stations*		
4	*Field demonstration of auxiliary power units for transport applications*		
5	*Fuel Quality Assurance for Hydrogen Refuelling Stations*		
Hydrogen Production & Distribution			**7.5**
6	*Development of improved road H_2 distribution*		
7	*Diagnosis and monitoring of electrolyser performance*		
8	*Large capacity PEM electrolyser stack design*		
9	*New generation of high temperature electrolyser*		
10	*Validation of photoelectrochemical hydrogen production processes*		
Stationary Power Generation & CHP			**24.0**
11	*Improving understanding of cell & stack degradation mechanisms using advanced testing techniques, and developments to achieve cost reduction and lifetime enhancements for Stationary Fuel Cell power and CHP systems.*		
12	*Improved cell and stack design and manufacturability for application-specific requirements for Stationary Fuel Cell power and CHP systems.*		

No.	Topic	Scope	Indicative FCH JU Funding Million ú
13	*Stationary Power and CHP Fuel Cell System Improvement Using Improved Balance of Plant Components/Sub-Systems and/or Advanced Control and Diagnostics Systems*		
14	*Proof of concept and validation of whole fuel cell systems for stationary power and CHP applications at a representative scale*		
15	*Field demonstration of large scale stationary power and CHP fuel cell systems*		
16	*Field demonstration of small scale stationary power and CHP fuel cell systems*		
17	*Development of fuel cell serial production techniques and equipment for Stationary Fuel Cell Power and CHP Systems*		
Early Markets			**9.0**
18	*Demonstration of fuel cell-powered Material Handling Vehicles (MHV) including infrastructure*		
19	*Demonstration of portable generators, Back-Up Power and Uninterruptible Power Systems*		
20	*Development of portable fuel cell systems for early market applications*		
21	*Development of 1-30kW fuel cell systems and hydrogen supply for early market applications*		
Cross-cutting Issues			**5.0**
22	*European Curriculum on H2&FC technologies: Implementation of Educational and Study Material*		
23	*Training on H2&FC technologies for Operation & Maintenance*		
24	*Social acceptance of FCH technologies throughout Europe*		

No.	Topic	Scope	Indicative FCH JU Funding Million ú
25	*Development of industry wide uniform performance test schemes for SOFC/SOEC cells & stacks*		
26	*Development of a European framework for the generation of guarantees of origin for green H2*		
27	*Pre-normative research on resistance to mechanical impact of pressure vessels in composite materials*		
		Total indicative FCH JU Funding	**68.5**

3.4 Indicators

Indicator	Target	Results 2012
MS represented in the selected proposals (2012)	15	19
SME participation in call (2011 provisional)	15%	35%
Matching correction factor (2012)	Ó67%	80%
Topic coverage by selected projects (2012)	60%	74%
Number of assessment studies (including tendered studies or in house studies)	1 in 2012	3
Coverage of topics by proposals (2012)	> 90%	87%
Observers report (2012)	Positive/good	Good
Minimum score of projects selected (2012)	Ó11.5	10
Number of projects that post a complaint (2012)	Lower than 10%	6/72
Redress procedure (i.e. number of complaints which led to re-evaluation) (2012)	None	None

3.5 Calls for Proposals

3.5.1 Call fiche

Call title: FCH JU Call for Proposals 2013 Part 1

Call identifier: FCH-JU-2013-1

Publication date (tbc): 15 January 2013

Indicative deadline (tbc): 22 May 2013 at 17.00.00 (Brussels local time)

Indicative budget[13]: EUR 68.5 million from the FCH JU 2013 budget[14].

The final budget awarded to this call, following the evaluation of projects, may vary by up to 10% of the total value of the call.

All budgetary figures given in this call are indicative. The repartition of the sub-budgets awarded within this call, following the evaluation of proposals, may vary by up to 10% of the total value of the call.

Topics called:

Area/ Topics called	Funding Schemes	Indicative FCH JU Funding Million ú
Area SP1-JTI-FCH.1: Transportation & Refuelling Infrastructure		**23.0**
SP1-JTI-FCH.2013.1.1 Large-scale demonstration of road vehicles and refuelling infrastructure VI	Collaborative Project	
SP1-JTI-FCH.2013.1.2 Research & development on bipolar plates for PEM fuel cells	Collaborative Project	
SP1-JTI-FCH.2013.1.3 Research & development of periphery components for hydrogen refuelling stations	Collaborative Project	
SP1-JTI-FCH.2013.1.4 Field demonstration of auxiliary power units for transport applications	Collaborative Project	
SP1-JTI-FCH.2013.1.5 Fuel quality assurance for market launch of Hydrogen Refuelling Stations	Collaborative Project	
Area SP1-JTI-FCH.2: Hydrogen Production & Distribution		**7.5**
SP1-JTI-FCH.2013.2.1 Development of improved road H2 distribution	Collaborative Project	

[13] A reserve list will be constituted if there is a sufficient number of a good quality proposal.
[14] The funding includes the FCH JU's own budget only.

Area/ Topics called	Funding Schemes	Indicative FCH JU Funding Million ú
SP1-JTI-FCH.2013.2.2 Diagnosis and monitoring of electrolyser performance	Collaborative Project	
SP1-JTI-FCH.2013.2.3 Large capacity PEM electrolyser stack design	Collaborative Project	
SP1-JTI-FCH.2013.2.4 New generation of high temperature electrolysers	Collaborative Project	
SP1-JTI-FCH.2013.2.5 Validation of photoelectrochemical hydrogen production processes	Collaborative Project	
Area SP1-JTI-FCH.3: Stationary Power Generation & CHP		**24.0**
SP1-JTI-FCH.2013.3.1 Improving understanding of cell & stack degradation mechanisms using advanced testing techniques, and developments to achieve cost reduction and lifetime enhancements for Stationary Fuel Cell power and CHP systems.	Collaborative Project	
SP1-JTI-FCH.2013.3.2 Improved cell and stack design and manufacturability for application-specific requirements for Stationary Fuel Cell power and CHP systems.	Collaborative Project	
SP1-JTI-FCH.2013.3.3 Stationary power and CHP fuel cell system improvement using improved balance of plant components/sub-systems and/or advanced controls and diagnostics systems	Collaborative Project	
SP1-JTI-FCH.2013.3.4 Proof of concept and validation of whole fuel cell systems for stationary power and CHP applications at a representative scale	Collaborative Project	
SP1-JTI-FCH.2013.3.5 Field demonstration of large scale stationary power and CHP fuel cell systems	Collaborative Project	
SP1-JTI-FCH.2013.3.6 Field demonstration of small scale stationary power and CHP fuel cell systems	Collaborative Project	
SP1-JTI-FCH.2013.3.7 Development of fuel cell serial production techniques and equipment for stationary fuel cell power and CHP systems	Collaborative Project	
Area SP1-JTI-FCH.4: Early Markets		**9.0**
SP1-JTI-FCH.2013.4.1 Demonstration of fuel cell-powered Material Handling Vehicles (MHV) including infrastructure	Collaborative Project	
SP1-JTI-FCH.2013.4.2 Demonstration of portable generators, back-up power and uninterruptible power systems	Collaborative Project	

Area/ Topics called	Funding Schemes	Indicative FCH JU Funding Million ú
SP1-JTI-FCH.2013.4.3 Development of portable fuel cell systems for early market applications	Collaborative Project	
SP1-JTI-FCH.2013.4.4 Development of 1-30 KW fuel cell systems and hydrogen supply for early market applications	Collaborative Project	
Area SP1-JTI-FCH.5: Cross-cutting Issues		**5.0**
SP1-JTI-FCH.2013.5.1 European curriculum on H2&FC technologies: implementation of educational and study material	Coordination and Support Actions (Supporting Action)	
SP1-JTI-FCH.2013.5.2 Training on H2&FC technologies for operation and maintenance	Coordination and Support Actions (Supporting Action)	
SP1-JTI-FCH.2013.5.4 Social acceptance of FCH technologies throughout Europe	Coordination and Support Actions (Supporting Action)	
SP1-JTI-FCH.2013.5.4 Development of industry wide uniform performance test schemes for SOFC/SOEC cells & stacks	Collaborative Project	
SP1-JTI-FCH.2013.5.5 Development of a European framework for the generation of guarantees of origin for green H2	Coordination and Support Actions (Supporting Action)	
SP1-JTI-FCH.2013.5.6 Pre-normative research on resistance to mechanical impact of pressure vessels in composite materials	Collaborative Project	
Total indicative FCH JU Funding		**68.5**

Call for Proposals will be selective. There will be competition, based on quality and excellence, between proposals primarily, but nor exclusively, within activity areas, which may result in some topics not being supported in a given call.

Council Regulation 521/2008 set up the FCH JU as a body responsible for implementing the 7th Framework Programme for Research and Development for a period up to 31 December 2017. Accordingly the projects funded as a result of this call for proposals should end by 30 June 2017. For topics 1.1, 3.5 and 3.6, it may, in exceptional cases, be accepted that a project lasts beyond that date. Applicants who are convinced that the success of a project in one of these topics will depend on a longer duration shall clearly explain the reasons in their proposals.

In this case, in accordance with the statutes of the FCH JU an ad hoc procedure will be set up to ensure appropriate management of the concerned Grant Agreements after the termination of the FCH JU. The Programme Office will work with the Commission services and the concerned projects coordinators to ensure a sound and smooth transfer of these grants agreements, the associated commitments and payments, the project files, the IT tools access and the audits rights.

3.5.2 Submission and evaluation procedure

Applications to the FCH JU for financial support to the RTD activities are made following competitive calls for proposals. Further guidelines on how to submit a proposal and related templates can be found in the Guide for Applicants, available in the call webpage from the Participant Portal and the FCH JU website. An additional Excel file has been prepared to help applicants drafting their budget in a proposal (available at: http://www.fch-ju.eu/content/how-participate-fch-ju-projects). While applicants are not required to provide their budget information in the proposal using this tool, applicants should be aware that they will be requested to fill it out if they pass the evaluation thresholds. The evaluation, selection and award procedures of the FCH JU are described in the document "FCH JU - Rules for submission of proposals, and the related evaluation, selection and award procedures".

The evaluation shall follow a single stage procedure.

The evaluation criteria (including weights and thresholds) and sub-criteria, together with the eligibility, selection and award criteria, for the different funding schemes are set out in "Evaluation criteria and procedures" (4.2.1 below).

Proposals will not be evaluated anonymously.

Ranked lists of proposals will be established for each area. At the Panel stage, proposals from different topics with equal overall scores will be prioritised according to the overall FCH JU Annual Implementation Plan coverage. If they are still tied, they will be prioritised according to their scores for the S/T Quality criterion, then by their scores for the Impact criterion, and then by their scores for the Implementation criterion. If they continue to be tied, other characteristics agreed by the Panel members should be taken into account.

Proposals from the same topic with equal overall scores will be prioritised according to their scores for the S/T Quality criterion. If they are still tied, they will be prioritised according to their scores for the Impact criterion, and then by their scores for the Implementation criterion. If they continue to be tied, other characteristics agreed by the Panel member should be taken into account.

A reserve list will be constituted if there are a sufficient number of good quality proposals. It will be used if extra budget becomes available.

3.5.2.1 Evaluation criteria and procedures

1. General

The evaluation of proposals is carried out by the FCH JU with the assistance of independent experts. FCH JU staff ensures that the process is fair, and in line with the principles contained in the FCH JU rules[15].

Experts perform evaluations on a personal basis, not as representatives of their employer, their country or any other entity. They are expected to be independent, impartial and objective, and to behave throughout in a professional manner. They sign an appointment letter, including a declaration of confidentiality and absence of conflict of interest before beginning their work. Confidentiality rules must be adhered to at all times, before, during and after the evaluation.

In addition, independent experts might be appointed by the FCH JU to observe the evaluation process from the point of view of its working and execution. The role of the observer is to give independent advice to the FCH JU on the conduct and fairness of the evaluation sessions, on the way in which the experts apply the evaluation criteria, and on ways in which the procedures could be improved. The observer will not express views on the proposals under examination or the expertsô opinions on the proposals.

2. Before the evaluation

On receipt by the FCH JU, proposals are registered and acknowledged and their contents entered into a database to support the evaluation process. **Eligibility criteria** for each proposal are also checked by FCH JU staff before the evaluation begins. Proposals which do not fulfil these criteria will not be included in the evaluation.

A proposal will only be considered eligible if it meets all of the following conditions:

- It is received by the FCH JU **before the deadline**
- It fulfils the **minimum conditions of participation** defined in chapter 3.5.5.
- It is **complete** (i.e. both the requested administrative forms and the proposal description are present)
- The **content of the proposal relates to the topic(s) and funding scheme(s)**, including any special conditions set out in the relevant parts of the Annual Implementation Plan

The FCH JU establishes a **list of experts capable of evaluating the proposals** that have been received. The list is drawn up to ensure:

- A high level of expertise;
- An appropriate range of competencies.

[15] FCH JU Rules for submission of proposals, and the related evaluation, selection and award procedures (http://www.fch-ju.eu/content/how-participate-fch-ju-projects)

Provided that the above conditions can be satisfied, other factors are also taken into consideration:

- An appropriate balance between academic and industrial expertise and users;
- A reasonable gender balance;
- A reasonable distribution of geographical origins;
- Regular rotation of experts.

In constituting the lists of experts, the FCH JU also takes account of their abilities to appreciate the industrial and/or societal dimension of the proposed work. Experts must also have the appropriate language skills required for the proposals to be evaluated.

FCH JU staff allocates proposals to individual experts, taking account of the fields of expertise of the experts, and avoiding conflicts of interest.

3. Evaluation of proposals

At the beginning of the evaluation, experts will be briefed by FCH JU staff, covering the evaluation procedure, the expertsô responsibilities, the issues involved in the particular area/objective, and other relevant material (including the integration of the international cooperation dimension).

Each proposal will first be assessed independently by at least 3 experts.

The proposal will be evaluated against the pre-determined evaluation criteria and sub criteria outlined in the tables below.

Evaluation criteria applicable to **Collaborative project proposals ï CP**		
S/T QUALITY **ñScientific and/or technological excellence (relevant to the topics addressed by the call)ò**	**IMPLEMENTATION** **ñQuality and efficiency of the implementation and the managementò**	**IMPACT** **ñPotential impact through the development, dissemination and use of project resultsò**
• Soundness of concept, and quality of objectives • Progress beyond the state-of-the-art • Quality and effectiveness of the S/T methodology and associated work plan	• Appropriateness of the management structure and procedures • Quality and relevant experience of the individual participants • Quality of the consortium as a whole (including complementarity, balance) • Appropriateness of the allocation and justification of the resources to be committed (budget, staff, equipment)	• Contribution, at the European [and/or international] level, to the expected impacts listed in the work programme under the relevant topic/activity • Appropriateness of measures for the dissemination and/or exploitation of project results, and management of intellectual property.
Evaluation criteria applicable to **Coordination and support actions (Supporting Actions type) ï CSA-SA**		

S/T QUALITY ñScientific and/or technological excellence (relevant to the topics addressed by the call)ò	IMPLEMENTATION ñQuality and efficiency of the implementation and the managementò	IMPACT ñPotential impact through the development, dissemination and use of project resultsò
• Soundness of concept, and quality of objectives • Quality and effectiveness of the support action mechanisms, and associated work plan	• Appropriateness of the management structure and procedures • Quality and relevant experience of the individual participants • Quality of the consortium as a whole (including complementarity, balance) [only if relevant] • Appropriateness of the allocation and justification of the resources to be committed (budget, staff, equipment)	• Contribution, at the European [and/or international] level, to the expected impacts listed in the work programme under the relevant topic/activity • Appropriateness of measures for spreading excellence, exploiting results, and disseminating knowledge, through engagement with stakeholders, and the public at large.

Evaluation scores will be awarded for each of the three criteria, and not for the sub-criteria. The sub-criteria are issues which the experts should consider in the assessment of the respective criterion. They also act as reminders of issues to rise later during the discussions of the proposal.

The relevance of a proposal will be considered in relation to the topic(s) of the *Annual Implementation Plan* covering the call, and to the objectives of the call. These aspects will be integrated in the application of the criterion "S/T Quality", and the first sub-criterion under "Impact" respectively. When a proposal is partially relevant because it only marginally addresses the topic(s) of the call, or if only part of the proposal addresses the topic(s), this condition will be reflected in the scoring of the first criterion. Proposals that are clearly not relevant to a call ("out of scope") will be rejected on eligibility grounds.

Each criterion will be scored out of 5. Half marks can be given.

The **scores** indicate the following with respect to the criterion under examination:

0 -	*The proposal fails to address the criterion under examination or cannot be judged due to missing or incomplete information*
1 -	***Poor.*** *The criterion is addressed in an inadequate manner, or there are serious inherent weaknesses.*
2 -	***Fair.*** *While the proposal broadly addresses the criterion, there are significant weaknesses*
3 -	***Good.*** *The proposal addresses the criterion well, although improvements would be necessary*
4 -	***Very Good.*** *The proposal addresses the criterion very well, although certain improvements are still possible*
5 -	***Excellent.*** *The proposal successfully addresses all relevant aspects of the criterion in question. Any shortcomings are minor*

No weightings will be applied to the scores for the different criteria.

Thresholds will be applied to the scores. The threshold for individual criteria will be 3. The overall threshold, applying to the sum of the three individual scores, will be 10.

Conflicts of interest: Under the terms of the appointment letter, experts must declare beforehand any known conflicts of interest, and must immediately inform a staff member from the FCH JU if one becomes apparent during the course of the evaluation. The FCH JU will take whatever action is necessary to remove any conflict.

Confidentiality: The appointment letter also requires experts to maintain strict confidentiality with respect to the whole evaluation process. They must follow any instruction given by the FCH JU to ensure this. Under no circumstance may an expert attempt to contact an applicant on his own account, either during the evaluation or afterwards**.**

4. Individual evaluation

This part of the evaluation will be carried out on the premises of the experts concerned ("remotely").

At this first step the experts are acting individually; they do not discuss the proposal with each other, nor with any third party. The experts record their individual opinions in an Individual Evaluation Report (IER), giving scores and also comments against the evaluation criteria.

When scoring proposals, experts must *only* apply the above evaluation criteria.

Experts will assess and mark the proposal exactly as it is described and presented. They do not make any assumptions or interpretations about the project in addition to what is in the proposal.

Concise but explicit justifications will be given for each score. Recommendations for improvements to be discussed as part of a possible negotiation phase will be given, if needed.

The experts will also indicate whether, in their view, the proposal deals with sensitive ethical issues, or if it requires further scrutiny with regard to security considerations.

Scope of the call: It is possible that a proposal is found to be completely out of scope of the call during the course of the individual evaluation, and therefore not relevant. If an expert suspects that this may be the case, a staff member from the FCH JU will be informed immediately, and the views of the other experts will be sought.

If the consensus view is that the main part of the proposal is not relevant to the topics of the call, the proposal will be withdrawn from the evaluation, and the proposal will be deemed ineligible.

5. Consensus meeting

Once all the experts to whom a proposal has been assigned have completed their IER, the evaluation progresses to a consensus assessment, representing their common views.

This entails a consensus meeting (might be in the form of an electronic forum) to discuss the scores awarded and to prepare comments.

The consensus discussion is moderated by a representative of the FCH JU. The role of the moderator is to seek to arrive at a consensus between the individual views of experts without any prejudice for or against particular proposals or the organisations involved, and to ensure a confidential, fair and equitable evaluation of each proposal according to the required evaluation criteria.

The moderator for the group may designate an expert to be responsible for drafting the consensus report ("rapporteur"). The experts attempt to agree on a consensus score for each of the criteria that have been evaluated and suitable comments to justify the scores. Comments should be suitable for feedback to the proposal coordinator. Scores and comments are set out in a consensus report. They also come to a common view on the questions of scope, ethics and/or security, if applicable.

If during the consensus discussion it is found to be impossible to bring all the experts to a common point of view on any particular aspect of the proposal, the FCH JU may ask up to three additional experts to examine the proposal.

Ethical issues: If one or more experts have noted that there are ethical issues touched on by the proposal, the relevant box on the consensus report (CR) will be ticked and an Ethical Issues Report (EIR) completed, stating the nature of the ethical issues. Exceptionally for this issue, no consensus is required.

Outcome of consensus

The outcome of the consensus step is the consensus report. This will be signed/approved (either on paper, or electronically) by all experts, or as a minimum, by the "*rapporteur*" and the moderator. The moderator is responsible for ensuring that the consensus report reflects the consensus reached, expressed in scores and comments. In the case that it is impossible to reach a consensus, the report sets out the majority view of the experts but also records any dissenting views.

The FCH JU will take the necessary steps to assure the quality of the consensus reports, with particular attention given to clarity, consistency, and appropriate level of detail. If important changes are necessary, the reports will be referred back to the experts concerned.

The signing of the consensus report completes the consensus step.

Evaluation of a resubmitted proposal

In the case of proposals that have been submitted previously to the Commission or the FCH JU, the moderator will inform the experts and, if possible, give them the previous evaluation summary report (see below) at the consensus stage, if the previous evaluation took place under comparable conditions (e.g. broadly similar work programme topics and criteria). If necessary, the experts will be required to provide a clear justification for their scores and comments should these differ markedly from those awarded to the earlier proposal.

6. Panel review

This is the final step involving the independent experts. It allows them to formulate their recommendations to the FCH JU having had an overview of the results of the consensus step.

The main task of the panel is to examine and compare the consensus reports in a given area, to check on the consistency of the marks applied during the consensus discussions and, where necessary, propose a new set of scores.

The panel comprises experts involved at the consensus step. One panel will cover the whole call.

The tasks of the panel will also include:

- hearings with the applicants of those proposals that have passed thresholds (see below)
- reviewing cases where a minority view was recorded in the consensus report
- recommending a priority order for proposals with the same consensus score
- making recommendations on possible clustering or combination of proposals.

The panel is chaired by the FCH JU or by an expert appointed by the FCH JU. The FCH JU will ensure fair and equal treatment of the proposals in the panel discussions. A panel *rapporteur* will be appointed to draft the panelôs advice.

The outcome of the panel meeting is a report recording, principally:

- An evaluation summary report (ESR) for each proposal, including, where relevant, a report of any ethical issues raised and any security considerations
- A list of proposals passing all thresholds, along with a final score for each proposal passing the thresholds and the panel recommendations for priority order
- A list of evaluated proposals having failed one or more thresholds
- A list of any proposals having been found ineligible during the evaluation by experts
- A summary of any deliberations of the panel

Since the same panel has considered proposals submitted to various parts of a call (for example different funding schemes, or different application areas that have been allocated distinct indicative budgets in the Annual Implementation Plan), the report may contain multiple lists accordingly.

The panel report is signed by at least three panel experts, including the panel *rapporteur* and the chairperson. If necessary, a further special ethical review of above-threshold proposals might be organised by the FCH JU.

3.5.3 Indicative evaluation and contractual timetable

Evaluation of proposals is expected to be carried out in June 2013.

Evaluation results are estimated to be available within 2 months after the closure date.

This Annual Implementation Plan provides the essential information for submitting a proposal to this call. It describes the content of the topics to be addressed, and details on how it will be implemented. The part giving the basic data on implementation (deadline, budget, additional conditions etc.) is presented in the Call fiche.

- **<u>Indicative</u> timetable for this call**

Publication of call	*15 January 2013*
Deadline for submission of proposals	*22 May 2013 at 17.00.00 (Brussels local*

	time)
Evaluation of proposals	*June 2013*
Evaluation Summary Reports sent to proposal coordinators ("initial information letter")	*July 2013*
Invitation letter to successful coordinators to launch grant agreement negotiations with the FCH JU	*September 2013*
Signature of first FCH JU grant agreements	*From January 2014*
Letter to unsuccessful applicants	*From January 2014*

- **Further information and help**

The FCH JU website (call 2013 page) and Participant Portal call page contain links to other sources that you may find useful in preparing and submitting your proposal. Direct links are also given where applicable.

- **Call information**

Participant Portal call page and FCH JU web-page:

http://ec.europa.eu/research/participants/portal/page/fp7_calls

http://www.fch-ju.eu/

- **Specialised and technical assistance:**

Participant Portal help desk (eFP7 service desk)
http://ec.europa.eu/research/participants/portal/page/contactus

EPSS Help desk

support@epss-fp7.org

IPR help desk

http://www.ipr-helpdesk.org

FCH JU reference documents are available at the website:

http://www.fch-ju.eu/content/how-participate-fch-ju-projects

3.5.4 Consortium

The legal entities wishing to participate in a project shall form a consortium and appoint one of its members to act as its coordinator. In general, the coordinator should come from the IG or from the RG.

3.5.5 Particular requirements for participation, evaluation and implementation

Participation in projects shall be open to legal entities and international organisations once the minimum conditions have been satisfied.

The minimum conditions to be fulfilled for Collaborative Projects and Coordinating Actions funded by the FCH JU shall be the following:

(a) At least 3 legal entities must participate, each of which must be established in a Member State or an Associated Country, and no two of which are established in the same Member State or Associated Country.

(b) All 3 legal entities must be independent of each other as defined in Article 6 of the Rules for Participation of the Seventh Framework Programme[16];

(c) At least 1 legal entity must be a member of the IG or the RG.

The minimum condition for service and supply contracts, Support Actions, studies and training activities funded by the FCH JU shall be the participation of one legal entity.

Forms of grants and maximum reimbursement rates for projects funded through the FCH JU will be specified in the FCH JU Grant Agreement.

3.5.6 Forms of grants

A grant will be awarded by means of a Grant Agreement between the FCH JU and the project participants.

The Grant Agreement will:

- provide appropriate provisions for the implementation of the RTD activities,
- ensure that appropriate financial arrangements and rules are in place relating to the intellectual property rights policy and,
- govern the relationship between the consortium and the FCH JU.

[16] 1. Two legal entities shall be regarded as independent of each other where neither is under the direct or indirect control of the other or under the same direct or indirect control as the other.

2. For the purposes of paragraph 1, control may, in particular, take either of the following forms:

(a) the direct or indirect holding of more than 50 % of the nominal value of the issued share capital in the legal entity concerned, or of a majority of the voting rights of the shareholders or associates of that entity;

(b) the direct or indirect holding, in fact or in law, of decision making powers in the legal entity concerned.

3. However, the following relationships between legal entities shall not in themselves be deemed to constitute controlling relationships:

(a) the same public investment corporation, institutional investor or venture-capital company has a direct or indirect holding of more than 50 % of the nominal value of the issued share capital or a majority of voting rights of the shareholders or associates;

(b) the legal entities concerned are owned or supervised by the same public body.

[Regulation (EC) No 1906/2006 of the European Parliament and of the Council of 18 December 2006 laying down the rules for the participation of undertakings, research centres and universities in actions under the Seventh Framework Programme and for the dissemination of research results (2007-2013)]

The project activities shall be financed through a financial contribution from the FCH JU and through in-kind contributions from the legal entities participating in the activities. The in-kind contribution of industry participants shall at least match the EU contribution, i.e. the financial (cash) contribution coming from the FCH JU.[17]

Reimbursement of direct costs

To ensure that industry in-kind contribution matches the FCH JU contribution, the FCH JU proceeds in two stages for the reimbursement of direct costs:

1. The FCH JU starts with maximum reimbursement rates that are aligned with FP7 upper funding limits. The reimbursement of direct costs will therefore be based on a maximum percentage of actual eligible direct costs, depending on the type of participant, funding scheme and type of activity, as follows:

Type of organisation	**Type of Activity**		
	RTD	Demonstration	Other (including management)[18]
Industry (other than SME)	CP: max. 50%	CP: max. 50%	CP: max. 100% CSA: max. 100%
SME	CP: max. 75%	CP: max. 50%	CP: max. 100% CSA: max. 100%
Non-profit public-bodies, universities & higher education establishments, non-profit Research organisations	CP: max. 75%	CP: max. 50%	CP: max. 100% CSA: max. 100%

Funding schemes: CP: Collaborative project
CSA: Coordination and Support Action

2. The FCH JU will apply a correction factor (reduction) to ensure the matching obligation[19]. Experience from the previous FCH JU Calls for proposals showed that these decreases might be substantial, depending on the type of activity (Research,

[17] Article 12(3) of the statutes of the FCH JU provides: *The operational costs of the FCH Joint Undertaking shall be covered through the financial contribution of the Union, and through in-kind contributions from the legal entities participating in the activities. The contribution from the participating legal entities shall at least match the financial contribution of the Union.*

[18] "Other" activities refer to management activities, training, coordination, networking and dissemination (including publications). It also includes coordination and support activities in case of CSA. Please note that scientific coordination is not considered to be a management activity.

[19] Article 15(3) of the statutes of the FCH JU provides: *"in case lower levels of funding will be necessary to comply with the matching principles referred to in Article 12(3), the decreases shall be fair and balanced proportionally with the above mentioned upper funding limits of the Rules of Participation of the Seventh Framework Programme for all categories of participants in each individual project."*

Demonstration, Other) and type of participants (SME, university, etc.) in the proposals retained for negotiation, as well as on the related matching funds provided by industrial participants in these proposals.

The decreases will be estimated per call for proposals, after evaluation and before signing the Grant Agreement.

These provisions are further developed in the FCH JU Grant Agreement.

Identification and Reimbursement of indirect costs

Indirect costs shall represent a fair apportionment of the overall overheads of the organisation. They shall be identified according to one of the following methods:

1. Participants who have an analytical accounting system enabling to identify them may declare their **actual indirect costs**. This option is mandatory for industrial legal entities, except for those whose accounting system does not allow distinguishing direct from indirect costs.
    a. In Collaborative Projects, their indirect costs will be reimbursed with a maximum amount equal to 20% of the direct eligible costs, excluding its direct eligible costs for subcontracting and the costs of resources made available by third parties which are not used on the premises of the beneficiaries.
    b. In Cooperation and Support actions, their indirect costs will be reimbursed with a maximum amount equal to 7% of the direct eligible costs, excluding its direct eligible costs for subcontracting and the costs of resources made available by third parties which are not used on the premises of the beneficiaries
2. Alternatively, indirect cost may be identified by means of a **flat rate of 20%** of the direct eligible costs, excluding its direct eligible costs for subcontracting and the costs of resources made available by third parties which are not used on the premises of the beneficiaries.
    a. In collaborative projects, indirect costs will be reimbursed with an amount equal to the 20% flat rate.
    b. In Cooperation and Support actions, their indirect costs will be reimbursed with an amount equal to 7% of the direct eligible costs, excluding its direct eligible costs for subcontracting and the costs of resources made available by third parties which are not used on the premises of the beneficiaries.

These provisions are further developed in the FCH JU Grant Agreement.

3.6 Call for Proposals 2013: Topic Descriptions

APPLICATION AREA SP1-JTI-FCH.1: TRANSPORTATION & REFUELLING INFRASTRUCTURE

Topic SP1-JTI-FCH.2013.1.1: Large-scale demonstration of road vehicles and refuelling infrastructure VI

Rationale

In order to start the mass production of competitive hydrogen vehicles and provision of appropriate hydrogen refuelling infrastructure in the 2015 ï 2020 timeframe, continuation and extension of the large-scale demonstration projects comprising vehicles and hydrogen refuelling stations is essential. Further, a broader picture including the connection of transport applications of FCH technology and issues with storage of fluctuating renewable electricity is essential.

Overall project objectives/Scope of work

The objective is to continue extending and/or interlinking the earlier hydrogen demonstration sites and to continue setting up and pursuing initial steps for the demonstration of hydrogen fuelled vehicles and the related infrastructure in European regions/municipalities, increasing public awareness and attracting additional candidates for further demonstration activities. Candidate regions/municipalities should be well populated urban areas to either bridge the regions where hydrogen infrastructures already exist or create new markets close to existing ones. The purpose of the project is to add one or more new regions with the minimum of one new hydrogen station and additional vehicles, in hubs with one or more existing refuelling stations and to address the demonstration of FCEVs within and connecting metropolitan areas. Additionally the project should show benefits and synergies with production of renewable hydrogen for storing renewable electricity.

The demo project shall focus on public transport buses and/or a number of passenger vehicles, which are in a development status of principle series production ability, and also provide high visibility. The consortium needs to develop, deliver and operate vehicles and infrastructure, including their comprehensive performance monitoring, and propose recommendations for commercialisation. Furthermore, a close and binding link with the production of renewable hydrogen has to be shown. The energy production does not necessarily be part of the project itself, but a strong and reliable interface between a sustainable transport technology such as hydrogen and a sustainable energy system needs to be demonstrated. For example, the storage of fluctuating renewable energy as hydrogen and the eventual use as a transport fuel could be such an issue.

The demonstration program needs to address:

- deployment of an additional number of hydrogen vehicles and infrastructure to contribute to the volume targets set in the multi annual implementation plan of the FCH JU (MAIP)

- measurement, evaluation and monitoring of specific vehicle and fuelling station parameters, such as delivered from the HyLights monitoring assessment framework in order to show the potential of the technology for the industries including suppliers. Specific values are to be defined by the project group at the beginning of the project
- public awareness campaign and networking with potential candidate regions/ sites in order to accelerate the commercialization steps
- documentation on approval and certification process of vehicles and infrastructure aiming at simplification and harmonisation of approval procedures Europe wide to facilitate establishing the RCS framework required to enable the large scale deployment of vehicle and fuelling infrastructure throughout Europe
- dissemination of lessons learned and best practices for next demo sites
- perform safety due diligence for all aspects of the demonstration, including documentation of accidents and incidents and monitoring of safety issues in the context of prevailing regulations on site to provide guidelines for proper handling.
- results from the demonstration project to be exchanged with other projects working on fuel cell materials, components and degradation aspects to facilitate new innovations
- the consortium needs to show the path to series production of the vehicles and filling stations applied in the project and proof economic feasibility
- the consortium needs to establish a link to renewable hydrogen production projects. Topics of these projects could be the production of green hydrogen or the storage of fluctuating renewable energy as hydrogen and its eventual use as automotive fuel.
- It is recommended that demonstration sites should preferably be located at, or close to, the network of the Trans-European Transport Network (TENT-T), as laid out in decision No 1692/96/EC of the European Parliament and of the Council of 23 July 1996 on Community guidelines for the development of the trans-European transport network (page 21)[20]

Expected outcome

The project shall provide a minimum of 5 urban buses and/or minimum of 10 passenger cars per site, accompanied by at least one additional fully integrated filling station per site capable of meeting specified performance targets. In total a minimum of at least 30 vehicles and 3 filling stations have to be realized. Filling stations for passenger cars (and if possible these for buses) need to be accessible for private customers/users. The vehicles or the hydrogen station could also be part of another funding programme, be it European, National or Regional.

[20] See for the consolidated version at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1996D1692:20070101:EN:PDF

The consortium needs to develop, deliver and operate vehicles and infrastructure, including their comprehensive performance monitoring, and propose recommendations for commercialisation. The vehicle types should be such which are usually mass produced with the potential of high market penetration in the future. The consortium has to show that the vehicles and their components used in the project are designed in a way that allows mass production. All participating vehicle providers must already sell buses or passenger cars (independent from the drive train technology) in large volumes on the European market. The minimum operation of the vehicles is 12 months or 10,000 km.

Both enlargement of existing sites and interlinking of new sites are considered relevant. New classes of vehicles (e.g., delivery vans) may be included in addition to passenger cars or buses.

The new refilling stations shall qualify for the following performance targets:

- Both 35 and 70 MPa (depending on whether buses or passenger vehicles are used, respectively), refuelling capacity of a minimum of 50 kg at the beginning of the project, to be extended to a minimum of 200 kg H2/day ensuring that 50 cars or 5 buses can be re-fuelled per day and 5 cars or 1-2 buses can be re-fuelled within one hour by the end of the project. Concept for modular upgrade of the filling station for 100 vehicles/day refuelling capacity must be provided
- Availability of the station 98% (measured in usable operation time of the whole filling station)
- Alternative filling station specifications which will ensure that 50 vehicles can be re-fuelled per day and 5 vehicles can be re-fuelled within one hour will be acceptable, or another alternative several filling stations in the region with the total filling capacity equivalent to 50 vehicles refuelled per day
- Hydrogen cost (based on an operation capital expended consideration) at station <ú10/kg (excluding tax) at start of project. Cost improvements due to higher hydrogen production for higher vehicle numbers is anticipated in the course of the project. Conditions under which hydrogen cost can be reduced to < 5ú /kg should be identified. (e.g. use of by-product hydrogen)
- Hydrogen purity and vehicle refuelling process according to SAE J2601 and 2719 and ISO specifications. IR Communication according to SAE TIR J 2799.
- Station hydrogen production efficiency target 50 ï 70%, depending on the method of production (conversion efficiency of the whole production chain from primary energy to filling nozzle)
- A significant amount of the hydrogen (more than 50% per site) supplied has to be produced by using renewable energies

Cost targets:

- The consortium has to show the potential to reduce cost of the vehicle by 25% for the next generation.

Targets for the passenger cars are:

- >2,000h vehicle operation lifetime initially, min 3,000h lifetime as program target
- Major power source of the vehicles must be a fuel cell system
- MTBF >1,000 km

- Availability >95% (to be measured in available operation time)
- Tank-to-wheel efficiency >40% (NEDC), to be validated in a NEDC test
- Pressure at filling station suitable to fill vehicles up to 700 bar CGH2
- Principle series production ability has to be shown

Targets for the buses are:

- >4,000h lifetime initially, min. 6,000h lifetime as program target
- Major power source of the vehicles must be a fuel cell system
- Availability >85% with maintenance as for conventional buses
- Fuel Consumption < 11 - 13 kg H_2 / 100 km depending on drive cycle
- Pressure at filling station suitable to fill vehicles up to 350 bar CGH2

Dissemination of the activities of the project to the broad public is seen as one key part of the demonstration project. It should especially be foreseen to communicate the benefits of hydrogen and fuel cells with reference to the demonstration project. Regional authorities should support the project with communication.

Environmental sustainability: assessment by using Well-to-wheel studies should be carried out. State of the art WTW data have to be used (e.g. JEC WTW study).

Any event (accidents, incidents, near misses) that may occur during the project execution shall be reported into the European reference database HIAD (Hydrogen Incident and Accident Database) at https://odin.jrc.ec.europa.eu/engineering-databases.html.

Other information

The project needs to be co-funded by national, regional or private sources in order to demonstrate a strong commitment towards clean propulsion and emission free public transport.

The maximum FCH-JU contribution that may be requested is ú18m per project. This is an eligibility criterion ï proposals requesting FCH-JU contributions above this amount will not be evaluated. One individual project may be funded.

The project consortium should develop concepts to link their projects with other demonstration projects for FCEVs.

The consortium should include automotive OEMs, integrated infrastructure equipment providers, fuel suppliers, bus fleet operators, industrial players, local and regional bodies, as appropriate. The involvement of SMEs is especially encouraged. The project should make proposals how the project can be coordinated with projects funded under the call FCH JU 2008 (topic SP1-JTI-FCH.1.1 and SP1-JTI-FCH.1.2) as well as the call FCH JU 2009 topic SP1-JTI-FCH.2009.1.1, the call FCH JU 2010 topic SP1-JTI-FCH 2010.1.1, the call FCH JU 2011 topic SP1-JTI-FCH 2011.1.1 and the call FCH JU 2012 topic 2012.1.1.

Expected duration: 4-5 years

Funding scheme: Collaborative Project

Topic SP1-JTI-FCH.2013.1.2: Research & Development on Bipolar Plates for PEM fuel cells

Rationale

The bipolar plate is presently, by weight, volume and cost, one of the most significant components of a fuel cell stack. Bipolar plates can be made from various materials with the most common being graphite, metal, carbon/carbon and carbon/polymer composites.

While metallic plate can have excellent electrical bulk conductivity and be produced via inexpensive manufacturing methods, a major drawback is often the need for a corrosion resistant conductive coating. The higher strength of metallic bipolar plates allows for higher power density stacks, which is desirable especially for transportation applications. Furthermore, metallic plates have a low thermal mass and high thermal conductivity, which is particularly beneficial for efficient cooling and rapid start-up. Any new coating and manufacturing technologies for bipolar plates should be consistent with the prevailing cost targets.

Overall project objectives / Scope of Work

Given the potential for metallic plate for stack development for meeting low cost and performance requirements for transportation applications the project should focus on metallic plate and project activities are expected to include either:

- Development of (i) corrosion resistant conductive coatings for low cost metals, including verification of long-term stability under fuel cell operating conditions, especially for elevated temperatures (up to 130 °C), and
- Identification and quantification of levels of corrosion products and rate of formation, including assessments of their potential contamination on other cell, stack and system components

Or:

- Development of cost effective metallic bipolar plate manufacturing technologies
- Demonstration of formability of metal/coating combination in complex configuration, assuring efficient cooling and enhanced stacking capabilities, and
- Cost reduction potentials of bipolar plates for different production volumes

Expected Outcome

Depending on the direction chosen above, either:

- Sufficient handling properties for stack assembly/manufacture processes, including coating scratch resistance and coating/surface adhesion.
- Corrosion stability for 5,000 h (e.g., via available accelerated test protocols currently under development in the USA or FCH JU projects such as STAMPEM) with verified figures for emissions of detrimental contaminating species (e.g., metallic ions of Fe, Cr, Al, etc.) in the MEA including GDL
- Specific targets for bipolar plates

- contact resistance: < 25 mΩ.cm² at relevant clamping pressures
- H_2 permeability < $2*10^{-6}$ cm^3/cm^2 s
- corrosion resistance < 10 μA/cm^2; testing conditions should be specified
- flexural strength >50 MPa
- tensile strength >40 MPa
- thermal stability up to 130 °C
- thermal expansion coefficient compatible to other stack components (sealant, MEA, GDL, stack interior gas ducts, etc.) in the temperature range of -25°C to 130°C
- thermal conductivity (>10 W/m K)

Or:

- Prove by representative pilot runs the
  - feasibility of bipolar plate production at automotive relevant sizes >250 cm^2 and cell pitch < 1.5 mm
  - formability into complex geometries allowing for high power densities and of adaptability to (advanced) sealing structures and/or concepts

Irrespective of the direction chosen above, the project should demonstrate that the direct cost of bipolar plate can be reduced to less than 2.5 € /kW of rated stack power when manufactured at production volumes of 500,000 stack units annually.

Other Information

The consortium should include a mix of bipolar plate developers, suppliers, research organisations, fuel cell stack developers and application related end users and SMEs in specialised areas according to need. Projects funded should not duplicate previous / current FCH JU funded project activities and should cooperate with funded projects (through attending or arranging common meeting places (workshops) and facilitating knowledge exchange) covering: Development and testing of Bipolar plates as well as "Investigation of degradation phenomena" - on the potential degradation effects of contaminants from bipolar plates.

The maximum FCH-JU contribution that may be requested is €3m per project. This is an eligibility criterion – proposals requesting FCH-JU contributions above this amount will not be evaluated. One individual project may be funded.

Expected duration: 3 years

Funding Scheme: Collaborative project

Topic SP1-JTI-FCH.2013.1.3: Research & Development of periphery components for hydrogen refuelling stations

Rationale

A roll-out of a widespread 70MPa hydrogen refuelling infrastructure requires refuelling technologies and components with a sufficient maturity in order to enable a profitable operation.

Compared with state-of-the-art periphery hydrogen station components (e.g. compression, storage, pre-cooling, valves, mass flow meters etc.) further R&D efforts are needed in order to improve energy efficiency, safety and reduce costs. Of particular importance is further maturing of the technologies and improvement of durability and reliability to ensure a high availability of the hydrogen refuelling station. In addition an expansion of the supply basis for components capable of complying with the SAE J2601 refuelling standard with 70MPa refuelling at minus 40 degrees Celsius, could also contribute to cost reduction and innovation.

Overall project objectives / Scope of Work

Project(s) should conduct dedicated and focused R&D efforts on periphery hydrogen station components with the aim to improve energy efficiency, safety, performance and mature the technology for volume production and cost reduction. Efforts must particular emphasise improvement of durability and reliability of the components. The scope of potential components to be addressed includes (addressing of several components within joint proposals is possible):

- Further R&D of conventional or novel compression technologies, with particular emphasis of durability and reliability combined with improvement of energy efficiency and flow performance. Cost and footprint reduction are also of importance
- R&D of gaseous storage concepts or technologies improving daily and instant refuelling capacities and reducing footprint. Storage concepts should be capable of handling various types of gaseous hydrogen supply methods (trucked-in at different pressure levels or onsite production).
- Further R&D of conventional or novel pre-cooling technologies, with particular emphasis of durability and reliability combined with improvement of energy efficiency and flow performance. Cost and footprint reduction are also of importance
- R&D effort on valves and other secondary components with particular emphasis on durability and reliability combined with reduction of cost and improved safety. Also components should be capable of stable operation at minus 40 degrees Celsius and 70MPa thus compliant with the SAE J2601 standard.
- R&D effort on mass flow meters with emphasis on increased and stable accuracy

Projects should further detail R&D targets in the proposal showing a viable pathway to commercial targets that contributes to reaching profitable operation of hydrogen refuelling infrastructure. The capability for reaching 98% availability of the components when used in HRS solutions is to be documented. In addition, proposals must define their state-of-the-art level, current bottlenecks, the specific progress to be achieved within the project and the development approach to achieve these targets. A roadmap to volume production with intermediate commercial targets through volume build-up shall be delivered. Component(s) to be developed should ensure a use in refuelling stations that enables compliance with the SAE J2601 refuelling standard.

Expected outcome

- Show progress beyond state-of-the-art for the periphery hydrogen station component(s) in focus on energy efficiency, safety cost reduction
- Document capability of components in reaching 98% availability when used in HRS solutions
- Clear R&D roadmaps for reaching commercial targets (if necessary) and plans for initiating further product maturation, volume production and market introduction
- Contribute to expansion of supply basis for component(s) capable of minus 40 degrees Celsius and 70MPa operation in compliance with SAE J2601

Other Information

Consortia(s) should include relevant partners to ensure sufficient coverage of the value chain behind the component(s) to be developed, e.g. research organizations, component suppliers, infrastructure technology providers and operators. Consortia(s) should be capable of showing a committed development and business approach and to the refuelling infrastructure market, both providing a strong past track-record of activities as well as dedicated efforts and plans to further commercialize and market introduce the components. High involvement of innovative SMEs is beneficial.

The maximum FCH-JU contribution that may be requested is ú3m per project. This is an eligibility criterion ï proposals requesting FCH-JU contributions above this amount will not be evaluated. One individual project may be funded.

Expected duration: Up to 3 years

Funding scheme: Collaborative project

Topic SP1-JTI-FCH.2013.1.4: Field demonstration of auxiliary power units for transport applications

Rationale

Complete APU systems need to be demonstrated and proven to pave the ground for large scale deployment. These demonstrations must be performed in real vehicle environments which include interfaces with the vehicle infrastructure for fuel, electric power, control and heat. The APU needs an appropriate operating strategy to achieve a significant overall fuel consumption reduction during real world operation.

The power range of the systems needs to be matched to the power requirements of the board net and its consumers of the particular vehicles.

Overall project objectives / Scope of Work

Projects need to cover at least 7 objectives from list below:

- Install complete integrated APU systems (electrical power 2 to 50 kWe, depending on application) in sufficient numbers to build confidence by redundancy and statistics, exceeding 10 identical units in the range 2-10 kWe, at least 5 identical units for units > 10 kWe
- Demonstrate and test the appropriate amount of vehicles with integrated APU systems installed, over at least 1 year of continuous real world operation
- Demonstrate integration into existing vehicle infrastructures and control systems
- Demonstrate multiple cold start, warm restart and stand by ability as well as redox cycle stability of the systems
- Demonstrate APU system life times above 5,000 h and system availabilities above 98%
- The APU systems must reach weight and volume targets for appropriate integration into the vehicles, without major changes of the basic vehicle configuration
- Provide for training of personnel for installation and maintenance
- Estimate the full life cycle costs and revise periodically this estimate
- Demonstrate the commercial mass manufacturability of the designs to be trialled, including volume capable supply chain

Given that the projects may face tight reliability constraints, they need to demonstrate sufficient levels of technology readiness and capacity to meet key challenges (production cost targets of below 1,500 Euro/kWe and durability of 5,000 h) at a number of produced systems typical for series production. Redundancy through different technologies or solution providers is encouraged in order to minimise the chance of failure for the operator.

As the purpose of this topic is to develop a fleet of pilot applications, investments may be significant. It is therefore required that the project describes the concept for the duration of the support program as well as the operation thereafter. For instance, the project could consist of a period of manufacturing, installation, ñnormal operationsò, optimisation, reliability improvement and also a stack change if being part of the commercial product specifications.

Expected Outcome

Successful demonstration of FC-based APU systems that provide:

- Required electrical efficiencies (>30 %), production cost (below 1,500 ú/kWe) and lifetimes (>5,000 h) which must be demonstrated through a thorough techno-economic analysis, indicating the minimum performance to be achieved in order to provide an acceptable initial proposition to users
- Identification of barriers or risks to full implementation
- Identification of benefits and risks considering the vehicle integration
- Proof of suitable supply chain and field support concept
- Feedback to RD&D activities on required mitigations
- Environmental sustainability: assessment by using Well-to-wheel studies should be carried out. State of the art WTW data have to be used (e.g. JEC WTW study)
- Dissemination efforts to a wider audience, preferably to potential customers and to industrial stakeholders (also electricity grid operators), must be included

Any event (accidents, incidents, near misses) that may occur during the project execution shall be reported into the European reference database HIAD (Hydrogen Incident and Accident Database) at https://odin.jrc.ec.europa.eu/engineering-databases.html.

Other Information

A strong commitment towards the running of the systems after the end of the support phase should be evident.

The consortium could include system integrators (OEMs), component and stack suppliers, service providers (e.g. installation and maintenance providers) and end-users (vehicle manufacturers, vehicle operators) including opportunities SMEs in specialised areas.

The project will be coordinated with ongoing and upcoming projects in verification and validation and may be co-funded by national, regional or private sources in order to demonstrate a strong commitment towards the 2020 European energy policy.

The maximum FCH-JU contribution that may be requested is ú4m per project. This is an eligibility criterion ï proposals requesting FCH-JU contributions above this amount will not be evaluated. One individual project may be funded.

Expected duration: 3 years

Funding Scheme: Collaborative project

Topic SP1-JTI-FCH.2013.1.5: Fuel Quality Assurance for Hydrogen Refuelling Stations

Rationale

The susceptibility of PEMFCs to a series of poisonous species (especially NH_3, CO and H_2S) is known to be high. Therefore, PEMFC materials as well as components used in the auxiliary system (BoP) are carefully selected to prevent corrosion products which may compromise cell durability. Still, impurities in the reactant gases both in the fuel (hydrogen) and air stream may adsorb and accumulate in the PEMFC system, causing reduced performance, some of which may be recoverable. In most cases, however, irreversible degradation takes place, causing cell materials to deteriorate to an extent from which the original cell performance is unrecoverable. The tolerance levels for impurities also rely on the operation profile of the PEMFC, and susceptibility must therefore be characterized at realistic automotive drive cycles, including frequent voltage and start-stop cycling.

A significant amount of R&D has been devoted to map the tolerance levels of PEMFCs to various poisonous species. This has led to very stringent fuel quality requirements, which may eventually hamper the introduction of FCEVs foreseen within 2015.

As stated in the recent US DoE Annual Progress Report 2011, there is still "Insufficient technical data to revise standards". Thus, more field data on actual impurity levels at Hydrogen Refuelling Stations (HRSs) are required.

From European as well as US demonstration projects challenges have been encountered upon qualifying the hydrogen fuel gases for FCEVs. Moreover, a complete fuel gas quality assurance for a new Hydrogen Refuelling Station (HRS) with respect to prevailing impurity limits according to the draft ISO standard has shown to be very costly. To fulfil this standard more than 10 different analysis methods are required and full gas quality assurance is in most cases not achievable because commercially analysis instruments compliant with these very low detection limits are not available.

The hydrogen fuel composition and potential presence of impurities depend strongly on the feedstock. Whereas hydrogen generated by water electrolysis may lead to certain poisonous species in the fuel stream, reforming of natural gas or biomass typically lead to other impurities. Thus the protocols and methodologies for quality assurance of fuel gases should be diversified depending on feedstock and production technology, to reduce cost and increase efficiency and reliability of these fuel quality assurance procedures.

Overall project objectives / Scope of Work

The overall objective is to reduce cost of hydrogen fuel quality assurance (QA) for HRSs by

- Completing current knowledge by identifying the impurity limits of PEMFCs for various poisonous species under actual automotive drive cycles
- Providing technical data on fuel composition and impurity concentrations at HRS
- Build on existing knowledge, through extensive use of results achieved in previous and on-going European projects as well as international networking and exchange.
- Establishing a simplified and diversified set of requirements for hydrogen fuel quality depending on fuel feedstock and production technologies (biogas, reforming, electrolysis, by-product etc.)

- Simplifying fuel quality control by enhance knowledge of correlations between gas impurity concentrations based on extensive in field measurements at HRS fuel nozzle
- Assessing ways to reduce the number of analysis methods required for complete QA
- Establishing new analytical methodology relevant for gas impurity quantification
- Designing and verifying of gas sampling instrumentation applicable to HRS operation, including e.g., novel sensors for identification of ultra-low impurity concentrations.
- Providing feedback to ISO TC 197/WG 12 and to equipment manufacturers.

Expected Outcome

Cheaper and more reliable fuel quality assurance procedures and instrumentation for HRSs

- A more complete overview of the real susceptibility for various poisonous species specifically for automotive applications
- Technical data for (fuel compositions and) impurity concentrations at HRS nozzle
- Documented concentration correlations between contaminant species in fuel
- Diversified hydrogen fuel QA protocol with respect to fuel feedstock & production technology
- New (preferably on-line) methodology for routinely sampling of hydrogen fuel gas under normal HRS operation
- Strategy for significant cost reduction for hydrogen fuel QA
- Recommendations for revision of existing (draft) ISO standard

Any event (accidents, incidents, near misses) that may occur during the project execution shall be reported into the European reference database HIAD (Hydrogen Incident and Accident Database) at https://odin.jrc.ec.europa.eu/engineering-databases.html.

Other Information

The consortium should include academic partners, research and/or industry test facilities, certification agencies, hydrogen fuel suppliers, OEM (user), and preferably stack developers and manufacturers. The work should be complimentary to activities funded in FP6 and FP7 (incl. FCH JU-program). The project should be linked to other relevant international initiatives in this research field.

Specifically, activities should build on publicly available preliminary and final results and findings from FCH JU-projects HyQ (GA 256773) as well as relevant activities in H2movesScandinavia (GA 245101). Collaboration with US (e.g., California Fuel Cell Partnership (CaFCP) and activities at US national Labs (LANL)) and other relevant international efforts is recommended (e.g., JARI of Japan, Korea).

The maximum FCH-JU contribution that may be requested is ú3m per project. This is an eligibility criterion ï proposals requesting FCH-JU contributions above this amount will not be evaluated. One individual project may be funded.

Expected duration: Up to 3 years

Funding Scheme: Collaborative Project

APPLICATION AREA SP1-JTI-FCH.2: HYDROGEN PRODUCTION & DISTRIBUTION

Topic SP1-JTI-FCH.2013.2.1: Development of improved road H_2 distribution

Rationale

Distribution of hydrogen from the production facilities to the final user can be done via a dense and dedicated pipeline network or via road trailer in liquid or compressed form (or their equivalent tanks on board of waterborne barges or railway transport). Pipeline and liquid hydrogen distribution require significant infrastructure investment and therefore compressed hydrogen trucking will be the most likely near to medium term distribution method. With existing 200 bar hydrogen trailers, with a payload of about 300 kg of H_2, hydrogen refuelling stations (HRS) may require several daily deliveries, increasing cost and number of trucks on the roads.

In order to increase the transported quantity in a compressed hydrogen trailer and reduce distribution costs for supplying larger stations, technical potential arises in the use of lighter materials and higher working pressures.

The need for adapted RCS for this specific road transport is already being analysed in a previous FCH JU project. This call topic asks for further technical development of these trailers.

Overall project objectives / Scope of Work

The project should design and build at least one prototype truck-trailer or tank bundles for intermodal transport (equivalent in payload at least to a truck-trailer), featuring service pressures higher than or equal to 400 bar.

Accordingly, new concepts for loading and unloading stations need to be developed, in order to adapt the increased pressure to the existing hydrogen production sources and hydrogen retail users. New architectures for stations (including i.e. compression and decompression units, buffering tanks, control and safety equipment) should therefore be designed, built and tested in real operation, together with the prototype truck-trailer.

The analysis of the current status in regulations, codes and standards and potential improvements is out of scope in this project. Nevertheless, prototypes built should be designed according to existing RCS best practices in order to be marketable without the need for changes in current homologation procedures for a representative part of the European industrial gas market. Therefore, prototypes built should undergo complete homologation in several European countries representing an as big as possible share of the current market.

Expected Outcome

- Proof-of-concept of increased working pressure in a homologated truck-trailer (pressure higher than 400 bar), including a working prototype of a trailer (at full length or part length). Proposals including other transport means, as barges or railway transport, or intermodality, can be considered with regard to an increased versatility.

- Design and proof-of-concept of the loading and unloading stations, in accordance to the working pressure of the truck-trailer.
- Prototype truck-trailer needs to undergo complete homologation procedures for several European countries, representing >30% of the industrial gas market.
- Comprehensive field testing of the complete system, in order to prove proper operability.
- Assessment of the improvement in distribution costs, including periodic maintenance, vs. state-of-the-art for current and future representative scenarios, with special emphasis on serving hydrogen to a HRS network.

Any event (accidents, incidents, near misses) that may occur during the project execution shall be reported into the European reference database HIAD (Hydrogen Incident and Accident Database) at https://odin.jrc.ec.europa.eu/engineering-databases.html.

Other Information

Project consortia should build on existing experience on the subject, especially with regard to RCS issues, in order to avoid overlap.

Expected duration: Up to 3 years

Funding Scheme: Collaborative project

Topic SP1-JTI-FCH.2013.2.2: Diagnosis and monitoring of electrolyser performance

Rationale:

Further progress in sustainable H_2 production and use requires performance improvements, lifetime increase and additional costs reduction in electrolysers. In this context, improved operation monitoring, fault diagnostic and lifetime prediction tools bring a major added value to reach these targets. For that purpose, it is necessary to develop tools for improving operation strategies and to establish a reliable performance test protocol.

Overall project objectives/Scope of Work:

Activities should include, in either or both alkaline and PEM technology:

- Identification and classification of most frequent/harmful failure or degradation modes. For that purpose, methodologies frequently applied in some industries could be used: Failure/Fault Tree Analysis (FTA), Hazard Operation (HAZOP), Failure Mode Effect and Criticity Analysis (FMECA).
- Development, testing and utilization of diagnostic techniques to reveal potential failures and optimize running parameters. For that purpose, test plan definition tools such as Design of Experiments methodologies might be used.
- Development of algorithms and hardware monitoring tools (sensors, controls...) Control development can include: integration into an industrial environment and/or process control interfaces between hardware and software.
- Use of diagnostic tools results to develop prognostic tools.
- Development of performance test protocols and protocols for accelerated durability testing
- Development of strategies allowing recovery of stack performance, in order to improve system reliability and increase lifetime.

Expected Outcome:

- Improved hardware and software for field data retrieval, monitoring and control, including advanced control techniques and remote monitoring, with special emphasis in failure modes and performance degradation.
- Development of diagnostic tools to identify potential failure or degradation situations for state-of-the-art cells, stacks and systems.
- Development of in-service diagnostic tools for cell/stack health checking.
- Development of a standard for performance test protocol at system level.
- Development of a standard test protocol to perform accelerated durability tests at cell/stack level.

Other Information:

The consortium should include academia or research organizations, suppliers and end-users of components, stacks and systems, and software and hardware developers.

International cooperation with third country beneficiaries is recommended for this topic.

Only one project is to be funded under this topic.

Expected duration: Up to 3 years

Funding Scheme: Collaborative Project

Topic SP1-JTI-FCH.2013.2.3: Large capacity PEM electrolyser stack design

Rationale

Centralized and decentralized sustainable H_2 production using low temperature electrolyser technology requires further improvement of performance and reduction of costs.

In contrast to alkaline electrolysis, polymer electrolyte membrane (PEM) electrolysers do not require corrosive electrolytes, resulting in smaller systems that can also be operated at higher pressure, higher current density and can be operated with much more flexibility. In addition, PEM electrolysers need less operation and maintenance efforts. But, in order to fit with the need for on-site H_2 production for Hydrogen Refuelling Station (HRS), Renewable Energy Storage, ñPower To Gasò or Grid Balancing, the capacity of PEM electrolysers need to be increase up to at least 3-4 MW or more.

The main challenge regarding use of PEM electrolyser for large on-site H_2 production is the development of cost-efficient PEM stacks with large active area cells. In this context, the PEM technology, and more specifically stack design, particularly adapted for applications in power levels up to 3 MW will be considered, with strong focus on stack design using large active area cells and medium to high current density. Availability of large area MEAs is today perceived as a possible limitation.

Overall project objectives / Scope of Work

Research on PEM electrolysers stacks design to address the challenges of large active area cells:

- Membranes
  - Membrane swelling → dimensional constraints
  - Membrane robustness → less demanding (=cheaper) pressure control
  - Membrane gas crossover → enable high pressure operation with high faradic efficiency
- MEA:
  - Swelling of the MEA → dimensional constraints
  - Handling of MEAs
  - Homogeneity of the catalysts layers
- Non-active components (GDL, spacers, bipolar plate, sealing, ...):
  - Cost effective materials
  - Design
  - Manufacturing tools and processes
- Cells and stacks:
  - Cell active area higher than 1 000 cm²
  - High pressure operation
  - Homogeneity of fluid and current distribution

- Stacks:
    - Cost effective and repeatability of stack assembly
    - Heat removal and temperature homogeneity
    - Response time evaluation regarding targeted applications
    - Reliability and durability
- Safety
- Optimal operation pressure depending on final application (energy storage or HRS), which may imply high pressures.
- Aspects of RCS harmonisation of electrolyser technology
- Comparative Life Cycle Assessment studies carried out according to the practice guidance developed by the FCH JU

Expected Outcome

- Design and prototype demonstration of PEM electrolyser stack
- Key performance indicators:
    - Hydrogen production capacity of single stack > 100 Nm3/h
    - Current density @ 1.2 A/cm^2 with $\eta > 80\%$ on LHV basis up to @ 2.4 A/cm^2 with $\eta > 70\%$ on LHV basis
    - Modular stack cost < ú 2 500/Nm3/h capacity
    - Stack availability > 99%
    - Lifetime > 40 000 hrs.

Other Information

The consortium should include industry and research organisations and give opportunities for SMEs with expertise in the field of materials, membranes, modelling and design optimization, especially in the field of PEM fuel cells or electrolysis.

The project proposal should demonstrate a significant added value compared to past and running electrolyser development projects in the FCH JU and wider community.

Expected duration: Up to 3 years

Funding Scheme: Collaborative project

Topic SP1-JTI-FCH.2013.2.4: New generation of high temperature electrolyser

Rationale

High temperature electrolysis (HTE) has excellent perspectives for an efficient use of renewable solar, wind or geothermal as well as nuclear energy, especially for large-scale centralised hydrogen production, and with substantial improvement of energy-efficiency. Overcapacities from renewable energy resources, as well as dedicated renewable energy production, can be transformed into fuels for the transport sector. HTE has the advantages of high conversion efficiency (expected to become above 90%), and that external heat sources, such as waste heat from industrial production or from natural, underground sources, can increase even further the efficiency. HTE can electrolyse also CO_2 into CO. By a syngas (CO + H_2) production, synthetic fuels such as methanol, methane, and DME can be produced, which are used easily in the existing infrastructure.

More efficient HTE systems will require high temperatures, pressurised systems and next generation of cells and stacks, which have to be further developed and up-scaled. Progress has already been obtained for HTE (e.g. in the RelHy project), in part because it is building on the SOFC development. However, there are still gaps to cover pressurised systems, stack development and system development, which is needed to bring the technology closer to the demonstration phase. Alongside with needed up-scaling, long-term research is required to help overcome technical constraints and allow proof of concept technology demonstration.

Overall project objectives / Scope of Work

- Develop cells and up-scaling the production of such cells that can sustain the conditions needed, high current loads (> 1 Acm-2), high durability and reliability, high temperature (700-1000º C), and show the potential for efficient, reliable, environmentally friendly and economically feasible production of hydrogen. Optional syngas production from CO2 and steam is also valuable
- Demonstrate low degradation rate (< 0.5% per 1,000 h) under the electrolysis conditions (high humidity, high current density, high temperature), and sufficient mechanical strength for large area cells
- Develop concepts of HTE for use in connection with renewable energy production (wind, solar) and nuclear power
- Develop concepts for pressurised electrolysis for more economical systems (production of hydrogen, but also methane, methanol or DME are valuable)
- Test and evaluation of cells, stacks and systems under realistic conditions

Expected Outcome

- Development of cells and stacks designed for high-temperature (800-1000 ºC), high current density (>1 Acm-2), pressurised conditions
- Manufacture of dedicated HTE cells and stacks for use in large systems for the conversion of electricity from renewable sources and from nuclear power, i.e. large-area cells, high durability under realistic conditions

- Demonstration of a HTE system of kW size under realistic conditions (high humidity, high temperature, pressurised, fluctuating production), showing degradation around 1% per 1,000 h of operation, and durability that can be extrapolated to minimum 5 years of continuous operation
- Proof-of-concept for co-electrolysis, syngas production and final chemical product, and validation of efficiency figures. Total efficiencies are expected in the 85-95% range

Other Information

Projects shall not duplicate outcomes achieved already in past and current European and JU projects on HTE, but extend these results. The consortium should include broad Industry & Research participation.

Expected duration: Up to 3 years

Funding Scheme: Collaborative project

Topic SP1-JTI-FCH.2013.2.5: Validation of photoelectrochemical hydrogen production processes

Rationale

Low temperature hydrogen production technologies are very promising for decentralised applications Research is necessary to develop efficient photoelectrochemical conversion of solar energy for water splitting. In addition, applied research and development is necessary to design and construct devices that efficiently produce and collect the hydrogen.

To commercialize this promising technology and to be able to produce hydrogen sustainably at the EU target cost of 5 ú/kg, several remaining issues need to be addressed, such as durability, scalability, overall efficiency and cost.

At the end, the overall solar power conversion efficiency needs to increase to about 8 ï 10%, in order to be competitive with electrolysers powered by photovoltaic (PV) cells.

Overall project objectives / Scope of Work

The objectives of the project should include:

- To develop technologies that enable controlled, reproducible and potentially large-scale production of large-area stable solar hydrogen production devices.
- To develop diagnostic methods to identify the energy loss and material degradation mechanisms limiting performance.
- To design innovative device architectures that combine efficient sunlight harvesting.
- Test devices under simulated solar radiation conditions and in the field in order to assess their efficiency and degradation rate.
- To carry out life cycle analysis of the developed technologies in order to estimate their feasibility to meet the EU target cost of 5 ú/kg hydrogen produced by sustainable technologies

Expected Outcome

- Efficient, easy to handle prototypes shall be developed and the solar hydrogen production process shall be demonstrated in small to medium scale applications.
- The prototypes should be compact and allow an easy integration in small to medium scale applications ranging from 100 W for domestic use (ca. 3 g/h H2 equivalent) up to 100 kW (ca. 3 kg/h H2 equivalent) for commercial use. Different types of prototypes might be optimal for the different application scales, and the efficiency should be evaluated for the anticipated application.
- Techno-economic assessment considering a full size plant, including comparison with other hydrogen production pathways such as state-of-the-art PV cells coupled to state-of-the-art electrolysers.
- Technology that can routinely produce solar active area ($\geq 50\ cm^2$) made of earth-abundant inexpensive materials that are capable of a solar to hydrogen conversion efficiency greater than 8% and with a projected lifetime above 5,000 h

- Laboratory tests of the abovementioned devices under simulated AM1.5G solar ration conditions for more than 1,000 h demonstrating the abovementioned benchmarks
- Field tests of the abovementioned devices for more than 1,000 h demonstrating the abovementioned benchmarks

Other Information

The consortium should include academia and research organisations with capacity for material development and production, and industrial partners for component and stack suppliers, system integrators, techno-economic analysis, and potential end-users.

International cooperation with third country beneficiaries is recommended for this topic.

Expected duration: Up to 3 years

Funding Scheme: Collaborative project

APPLICATION AREA SP1-JTI-FCH.3: STATIONARY POWER GENERATION & CHP

Topic SP1-JTI-FCH.2013.3.1: Improving understanding of cell & stack degradation mechanisms using advanced testing techniques, and developments to achieve cost reduction and lifetime enhancements for Stationary Fuel Cell power and CHP systems

Rationale

Degradation at both cell and stack level remains a major challenge that must be overcome in order to achieve the endurance required for field use. Most stationary applications require high on-line availability. Achieving long endurance is necessary to meet the key requirements of long service intervals and low cost of ownership.

Overall project objectives/Scope of Work

In order to meet end-user requirements, industrial developers must undertake applied research and development activities on cell and stack degradation to improve endurance, extend maintenance intervals and to reduce total cost of ownership for the target applications. The primary focus of projects will be to:

a) identify, quantify and document relevant degradation and failure mechanisms over the long term (i.e. >20,000 hours)

And

b) identify improvements, and verify these in existing cell and stack design.

Quantification of degradation mechanisms and verification of improvements may be addressed in two ways:

(i) by accelerated testing, and/or

(ii) by durability testing under harsh conditions, compared to application-relevant conditions.

Steady state and 1:1 lifetime tests will not be sufficient in practice. Therefore, accelerated testing, including failure/degradation modelling, must be undertaken in order to forecast endurance under real operating conditions. Testing in harsh conditions, including induced failure, must be undertaken in order to identify the sources of failure and to establish sensitivity. Test strategies should contribute to identification of relevant acceleration factors and improve understanding of lifetime-limiting mechanisms. Consideration of degradation and failure resulting from complex interactions between the different mechanisms must be included.

Statistical significance must be addressed in the planning of experimental work, and the statistical significance of achieved results must be evaluated.

It is expected that iterative loops, which include modelling, testing, analysis and modification of materials, design and/or manufacturing, will be required to achieve overall improvements in lifetime.

The following effects on robustness and/or performance may be considered: microscopic migration/rearrangement; contamination/poisoning; cell fracture; delamination; electrolyte leakage and pinholes; interconnect/bi-polar plate corrosion; and sealing fatigue.

Projects should be focused on the development and validation of solutions to major degradation or failure mechanisms. Advanced testing techniques to improve understanding of cell and stack degradation and enhancing lifetime through improvements in materials, design and manufacturing processes are key.

Projects will be expected to cover the following three objectives:

- Improved long term performance achieved by adjustments to materials, design and manufacturing processes, based on statistically conclusive data.
- Improved robustness to cycling and transient operating conditions, demonstrated under harsh environments comparable to relevant application conditions and/or validated by accelerated testing.
- Development of accelerated testing strategies for specific failure modes, backed by modelling or specific experiments to verify the method(s) used and validate of claimed improvement(s).

This topic is open to all fuel cell technologies. Proposals must identify the technology/application-specific gaps and set the targets for critical parameters, including for improvement over the state-of-the-art.

Expected Outcomes

Projects will increase knowledge of the most pronounced degradation and failure mechanisms for stationary applications and must include the first three and at least two more of the five outcomes which follow:

Mandatory	1. Demonstrate and evaluate measurable significant improvements to one or more of the most pronounced degradation and failure mechanisms (e.g. material, component, design or process) and thus demonstrate an important step towards commercial relevant lifetime estimates. 2. Actual lifetime data and results on improved lifetime potential, statistically significant and compared to pre-project data or other available field test data. 3. Accelerated testing protocols for specific failure modes, validated by modelling or specific experiments and used to validate claimed improvement(s).
A further two of the following five outcomes	1. Development of accelerated test protocols and lifetime prediction methods or verified models valid for 20,000+ hours life time. 2. Achieve tolerance to typical failure modes identified in previous work, i.e. REDOX, carbon corrosion etc., with less than 5% total loss of performance (voltage/power) during start/stop, idle load change and operation. 3. Achieve tolerance to load cycling between idle and rated load with less than 5% total loss of performance (voltage/power) for the rated stack life cycle at application relevant load change rates. Tolerance must be

	demonstrated for a minimum of 100 load cycles taking the effect of aging in consideration. 4. Achieve tolerance to on/off thermal cycling (room to operating temperature) with less than 5% total loss of performance (voltage/power) for the rated stack life cycle at application relevant temperature change rates. Tolerance must be demonstrated for a minimum of 50 thermal cycles taking the effect of aging in consideration. 5. Achieve tolerance to application-relevant field contaminants at relevant levels for EU applications/sites based on hydrogen, natural gas and biogas/landfill-gas fuel (i.e. humidity, dust, salt, sulphur, CO, CO2, ammonia, higher hydrocarbons, halogen, siloxane).

The project must provide statistically significant evidence, physical and/or modelling-based, of the solutions/methods developed in the project, in terms of the metrics listed above. The project must focus on industrially relevant results for near term proof-of-concept and validation.

Other Information

Consortium requirements

The project consortium must include a cell and/or stack manufacturer whose existing cell/stack design should be used as the projectôs point of departure. The project must include degradation field data from this existing cell/stack design.

The cell/stack manufacturer should be the project coordinator or should participate as a Work Package leader in the main R&D Work Packages of the project.

Other consortium members may include academia, research institutes, and material producers.

Projects may benefit from the inclusion of stack end-users (i.e. system integrators), possibly in an advisory function.

Other Projects

The project proposal must document clear and considerable added value compared to previous and ongoing projects funded by the FCH JU.

As a voluntary option, the consortium could consider linking the activities to demonstration projects in order to make a long-term real-life validation.

The consortium should consider whether the harmonised testing procedures developed under the FP6 FCTESQA project (accessible at http://fctesqa.jrc.ec.europa.eu) can be used in addition to its in-house testing procedures.

A maximum of 2 projects are expected to be funded:

- A maximum of one project for high-temperature (>300C) fuel cell technologies; and
- A maximum of one project for low-temperature (<300C) fuel cell technologies.

The maximum FCH JU contribution that may be requested is ú3m per project. This is an eligibility criterion ï proposals requesting FCH JU contributions above this amount will not be evaluated.

Expected duration: Up to 3 years

Funding Scheme: Collaborative project

Topic SP1-JTI-FCH.2013.3.2 Improved cell and stack design and manufacturability for application-specific requirements for Stationary Fuel Cell power and CHP systems

Rationale

Development activities on cell and stack design and compositions continue to be required, in order to meet end-usersô expectations in terms of stack robustness, lifetime, performance and cost. The primary focus of projects should be on addressing challenges in preparation for successful validation, demonstration and market introduction of resulting cell and stack technology within existing system hardware.

Existing cell and stack designs still fall short in meeting the principle market drivers simultaneously: robustness, manufacturability, efficiency and cost. These shortfalls must be addressed before the advantages of the technology can be realised.

Projects should focus on development activities that overcome these shortfalls for stationary applications.

Overall project objectives/Scope of Work

The project must be organised to address on challenges en route to successful validation, demonstration and market introduction, including large-scale manufacturing.

The scope of work covers improvement to designs for cells and stacks that will facilitate market entry by meeting targets for robustness, efficiency and cost (including power density). The activities are open to all fuel cell technologies.

Improvements in cell and stack manufacturing methods that lead to lower stack costs and higher product quality are within the scope of this topic.

The call is open to all fuel cell technology solutions.

Projects must build on existing cell and stack expertise within the consortium, and focus on improving cell and stack technology, for which the consortium has experience, in terms of both manufacturing and knowledge of the target application area.

Proposals should aim to validate a proof of concept and take manufacturing issues into account. Advances beyond the European commercial state-of-the-art must be clearly explained and shown to be substantial by the end of the project.

Projects are expected to focus on cell and stack design improvements and should address the following three top-level objectives:

- increase robustness and lifetime
- increase performance, power density, and efficiency
- reduce materials and manufacturing cost

and doing so while achieving:

- improved system efficiency
- reduced system costs

Proposals should identify the remaining technology-specific gaps, set the targets for critical parameters, including costs, technical parameters (e.g. efficiency and their improvement over the state of the art), define applications and conditions and develop a structured concept for the development activities.

Expected Outcomes

Overall stack cost, lifetime and robustness are the high-level objectives; projects are expected to achieve all of the following top-level outcomes:

- Improved of system electrical efficiency over the state of the art
- Improved robustness (including better lifetime), to be proved by operating in simulated or real-life environments, over a period of time that is sufficiently long to enable credible lifetime predictions to be produced that meet market-entry requirements.
- Considerable cost reductions, consistent with market acceptance requirements for industrial, residential or other relevant applications. Cost reduction at system level by achieving system simplifications (e.g. reduction of BOP components costs)

The final deliverable must be a cell and stack design, validated at the stack level under conditions that are relevant to field operations i.e. simulated field conditions using representative gas compositions, flows and load profiles. Proposals should provide details of the evidence that will be produced (physical and/or modelling-based) in order to show that the above outcomes have been realised.

Other Information

<u>Consortium Requirements</u>

The consortium must include industry, and may include academia, research institutes, and material producers.

The Consortium must include a cell/stack manufacturer with an existing cell/stack design, participating either as project coordinator or as Work Package leader in the cell and stack design Work Packages of the project. The project must use this design as the point of departure.

In addition, projects will benefit from the inclusion of stack end users i.e. system integrators, possibly in an advisory function.

A maximum of 2 small-scale and focused Collaborative projects are expected to be funded:

- A maximum of one project for high-temperature (>300C) fuel cell technologies; and
- A maximum of one project for low-temperature (<300C) fuel cell technologies.

The maximum FCH-JU contribution that may be requested is ú2m per project. This is an eligibility criterion ï proposals requesting FCH-JU contributions above this amount will not be evaluated.

Expected duration: Up to 3 years

Funding Scheme: Collaborative project

Topic SP1-JTI-FCH.2013.3.3: Stationary Power and CHP Fuel Cell System Improvement Using Improved Balance of Plant Components/Sub-Systems and/or Advanced Control and Diagnostics Systems

Rationale

The fuel cell stack is at the heart of the fuel cell system, but the conditions required for effective and efficient operation of the stack, air and fuel for example, need to be produced and maintained by a complex series of balance of plant (BoP) components and sub-systems. These BoP range from components and sub-systems for fuel and air conditioning, through thermal management, to electrical output conditioning systems. Allied to the BoP is the need for effective control and diagnosis of fuel cell system operations; ensuring that the system is functioning within the set parameters and where this is not the case adjusting individual components and sub-systems to achieve this. Optimum operation influences the performance, lifetime and reliability of the individual components, both fuel cell stack and BoP and thus for the whole system, improving fuel utilisation, efficiencies and emissions.

Currently (and for the foreseeable future), BoP components and sub-systems represent a significant proportion of the total cost of a complete fuel cell system. Therefore, this topic supports both, the development of components and sub-systems (excluding fuel cells and fuel cell stack) for fuel cell systems and the development of advanced control and diagnostics tools for the whole system. The objective is to improve individual component and sub-system performance in terms of efficiencies and effectiveness, availability (including optimal maintenance) and durability, and their cost effectiveness.

Overall project objectives / Scope of Work

Fuel cell related sub-system components, based on developed stack designs, may typically include:

- Power generation unit (integrated stack/ BoP)
- Power electronics
- Reforming and fuel/oxidant processing (including clean up, de-sulphurisation, etc.)
- Heat exchangers/thermal management
- Air and fluid flow equipment, including subcomponents
- Fluid supply and management including pumps, turbines, compressors, valves, flow meters, humidification
- Pressurisation devices (e.g. turbine, compressor) for pressurised systems

Diagnosis and/or control tools may typically focus on:

- Diagnosis and/or control hardware and software
- Improvement of available diagnostic instruments
- Better understanding of faults, failures and degradation mechanisms that may be induced by critical operating conditions

Projects are expected to cover a range of objectives from among those listed below:

- Novel designs and optimisation of stack integration and non-stack components

- Manufacturing processes and quality control techniques for high performance and cost effective components
- Protection of fuel cell stack from contaminants emanating from BoP components (e.g. chromium release)
- Advanced controls and diagnostics systems capable of optimizing fuel cell and stack operational efficiencies and mitigating or preventing adverse operational conditions; which may include:
  - Methods for diagnosing or predicting deviations in state-of-health;
  - Detection techniques and BoP components fault identification;,
  - Procedures and methods for diagnosis algorithm design, testing and implementation;
  - Advanced industrial design methodologies (e.g. Hardware- or Software-in-the-Loop)

Projects must also show how the following objectives will be met:

- Demonstration of the ability of components to meet required life-cycle performance targets
- Validation of lifetime, durability/robustness, corrosion rates in application-specific environments
- Cost assessment vs. target cost and demonstration of considerable cost reduction
- Concepts for reworking, recycling, and/or disposal including cost and environmental impact

Expected Outcomes

Development of improved components or sub-systems and/or of both diagnostics methodologies and systems which:

- improve fuel cell systems lifetimes and operational performance
- are viable for mass production and low-cost manufacturing
- improve diagnostics of stationary fuel cell systems through the integration of diagnostics with monitoring and control systems
- provide evidence of realistic life and maintenance cycles for components, consistent with:
  - system life of >15 years for large-scale and >10 years for smaller-scale applications;

    and
  - market acceptance requirements, achieving cost targets using a manufacturing model with high-volume manufacturing targets

Proposals that address improvements to BoP components improvement need to identify ï and will be measured against ï the following technology- and application-specific targets:

Target	For micro & small systems ≤10 kWe	For medium & large systems >10 kWe
Parasitic losses	<5% parasitic power loss, based on input fuel LHV. A major loss occurs in the DC→AC conversion, the specific efficiency target for the inverter is >95% BoP electrical efficiency	<3% parasitic losses based on input fuel LHV. The specific efficiency target for the inverter is >97%
System investment cost, including fuel processing, but excluding fuel cell stack	<2,300 ú/kW in mass production	<1,750 ú/kW in mass production
System reliability expressed as an O&M[21]-cost (excluding fuel cell stack, but including fuel processing)	<5 ú/MWh	<1 ú/MWh
The cost contributions of capital cost and operational cost (including efficiency and maintenance) may be alternatively demonstrated in terms of Cost of Electricity over the product lifetime. For thermodynamic characteristics of the components, individual target performance figures must be specified in the proposal (e.g. efficiencies or losses under well-defined operating conditions) as they cannot be defined in advance here. These targets must reflect the progress intended to be achieved within the project.		

Proposals dealing with development of advanced control and diagnostics tools need to identify ï and will be measured against ï the target cost of control and diagnostics systems:

Target	For micro and small systems ≤10 kWe	For medium and large systems >10 kWe
Cost of control and diagnostics systems (including remote control and condition monitoring) for fuel cell systems	< 5% of total system cost	< 3% of total system cost

[21] O&M: Operational and Maintenance

Other Information

These activities are open to all fuel cell technologies, relevant fuels and levels of power for stationary applications. For advanced controls and diagnostics work should be undertaken in close conjunction with industrially advanced fuel cell stacks and or/fuel cell systems to ensure that these meet the needs of industry. However, this topic will not support any fuel cell or fuel cell stack developments, which are limited to Topics 2013.3.1 and 2013.3.2 of this Call.

Projects should be focused on final component or sub-system developments proven either as part of test systems in a laboratory or as existing whole systems. However, whole system proof of concept or validation will not be funded under this topic; these activities will be funded under Topic 2013.3.4.

The consortium should include industrial system integrators (OEMs) or fuel cell developer and research organisations specialised in the specific areas, relevant component suppliers, and should also provide opportunities SMEs in specialised areas. At the very least, industry must have a leading role in the main R&D work packages.

It will be advantageous for projects to show clear show linkages with previous FP7 and FCH JU funded projects to ensure continuity of developments in key areas. If so, such projects must show how the proposed activity provides considerable added value and also advances both the state-of-the-art for BoP or Advanced Control and Diagnostics components or sub-systems, and the prospects of commercialisation for stationary fuel cell systems.

A maximum of up to three projects are expected to be funded:

The maximum FCH-JU contribution that may be requested is ú2.5m per project. This is an eligibility criterion ï proposals requesting FCH-JU contributions above this amount will not be evaluated.

Expected duration: Up to 3 years

Funding Scheme: Collaborative Project

Topic SP1-JTI-FCH.2013.3.4: Proof of concept and validation of whole fuel cell systems for stationary power and CHP applications at a representative scale

Rationale

Taking technology developments and concepts from the laboratory to the market place requires first that the system technologies and concepts are proven (Proof-of-Concept, PoC) and then that proven system concepts are validated through thorough testing under representative conditions for a minimum period of time (Validation). PoC and Validation are essential steps in achieving commercialisation of fuel cell systems for stationary power and/or CHP (additionally including cooling).

PoC activities will prove or disprove proposed system concepts in the laboratory. Validation activities will ensure that such systems are capable of meeting real end-user requirements in representative operating environments, either within the laboratory or within a controlled external environment, prior to the demonstration activities described in topics 2013.3.5 and 2013.3.6 below. Achieving successful validation of fuel cell systems due to sufficient PoC experience and understanding will enhance the prospects for the industry.

Overall Project objectives/Scope of Work

This topic calls for projects which will undertake: (i) PoC of fuel cell systems for stationary power and/or CHP applications within the laboratory or (ii) the Validation of systems which have already successfully passed through the PoC stage in representative operating conditions, either inside the developerǵs fence or in a controlled environment external to the developer, often an end-user.

Exclusions: The topic will not support any proposal which combines both PoC and Validation.

PoC projects

PoC projects will prove the performance and viability of the whole fuel cell system against specific stationary application requirements. Performance will be assessed against a range of functionalities required by any stationary application, closing existing gaps and highlighting areas where further development steps may be required. The topic will thus support the development and construction of proof-of-concept (PoC) fuel cell systems for any stationary application and fuel cell technology, and show interaction with other devices required to deliver power (with or without heat and/or cooling) to end-users. Projects should draw upon appropriate fuel supplies, utilising any necessary processing technology. PoC systems will need to demonstrate their ability to meet end-usersô requirements and expectations. Key functionalities include: performance, robustness, ease of use (including fully-automated operation), and the potential to meet industrial cost targets for the targeted application(s)/market(s) when produced in large quantities. System integration is expected to make use of the most advanced technologies at the stack, subsystem and control levels.

Projects are expected to cover a range of objectives from among those listed below:

- Development of PoC prototype systems that combine advanced components into complete, fully integrated systems.

- Integration and testing of PoC prototype systems, complete with fuel delivery and processing sub-systems; interface with devices necessary to deliver power (with or without heat and/or cooling).
- Novel system architectures, including new fuel processing and storage materials and processes.
- POC projects will be expected to show successful duration of run times for whole fuel cell systems of up to several hundred hours by the end of the project.

Validation projects

Validation projects must firstly demonstrate a level of maturity consistent with the outputs for PoC listed above, and then show that there is proven market potential in the targeted application area. Successful projects will focus on achieving improvements to the fuel cell system by incorporating lessons learnt from ñreal-worldò operation and feedback from end-users by daily operation. By the end of the project, systems should be ready to be deployed in large-scale demonstrations without the need for further significant re-design.

Projects should verify relevant technology approaches to specific applications and markets by demonstrating full systems in operation under these requirements over a minimum period of 4,000 hours. In addition, they are expected to focus on:

- Meeting relevant application needs in representative environments, and integration into an anticipated real environment;
- Whole system validation, including build, supply chain, costs and end-of-life considerations;
- Establishment of quality-control procedures and techniques to ensure quality and safety of the system;
- Consideration of maintenance and repair issues, to reduce downtimes resulting from foreseeable failure mechanisms.

Projects should show that the validated system is capable of achieving costs that will allow it to successfully compete in the target market(s).

Proposals will be expected to show that they have considered the following issues as criteria for successful validation or as preliminary steps towards demonstrations and commercialisation:

- integration of the hardware necessary for the validation tests and costs related to achieving this,
- engineering support for the test itself, and
- manufacturing process(es).

Additional requirements

Both PoC and Validation projects are expected to show the ability to successfully compete with existing technologies operating in the target application(s)/market(s); and to disseminate the results to industry and research.

The activity is open to all fuel cell technologies, relevant fuels and electrical power output provided that the market potential of the proposed combination is also proven. Proposals need to identify ï and will be measured against ï technology- and application-specific targets.

Expected Outcome

PoC projects will be expected to show the following:

- Proof of feasibility of integrated fuel cell units by demonstrating sufficient duration (i.e. several thousand hours), including operation in a simulation of a representative real-life context.
- Proof of potential to achieve targets required by targeted application(s), consistent with market acceptance requirements such as system cost, system life and system reliability, and thorough cost analysis.

Validation projects shall include all three of the following outcomes:

- Validation of fully integrated systems that fulfil specifications required by end-user(s) in the anticipated real world environment, including identification of a path to mass-production at a defined quality and cost
- Operation in real-life environment > 4,000 hours without a hardware change, and potential to achieve longer run times as required by the application area by extrapolation from test data, and identification of failure mitigation strategies by design and/or maintenance and demonstration of the ability to meet market entry requirements
- Validate maintenance and repair strategies that demonstrate ability to meet reliability and robustness targets required by the target application area/market.

Validation projects will also be expected to:

- Achieve system compliance with all relevant CE regulations and international fuel cell system standards
- Identify the pre-normative RCS (Regulations, codes and Standards) in the targeted application(s)/market(s)
- Provide easily understandable documentation on technology status for dissemination to potential end-users
- Environmental sustainability: assessment by means of Life Cycle Assessments studies should be carried out according to the requirements in the FC-HyGuide guidance document (available at :http://www.fc-hyguide.eu/)

Other Information

Project proposals should clearly state whether the objective is PoC or Validation, and if Validation, show that PoC activities have been successfully undertaken.

For PoC projects, the Consortium should include (future) system integrators (OEMs) and/or fuel cell stack developer, together with component developers and suppliers; inclusion of an end-user is advisable.

For Validation projects, the Consortium should include a system developer, a system integrator (OEMs) (who may or may not be the same organisation), and/or a fuel cell stack developer, and an end-user.

A fuel supply company and may also be included where relevant.

The inclusion of component and stack suppliers is advised.

A maximum of up to three Collaborative projects are expected to be funded. The maximum FCH-JU contribution that may be requested is ú4m per project. This is an eligibility criterion ï proposals requesting FCH-JU contributions above this amount will not be evaluated.

Expected duration: Up to 3 years

Funding Scheme: Collaborative Project

Topic SP1-JTI-FCH.2013.3.5: Field demonstration of large scale stationary power and CHP fuel cell systems

Rationale

Demonstration projects are the final step in the development cycle, and critical to establishing the system viability required for successful market deployment.

Complete fuel cell systems need to be demonstrated and proven in order to pave the way for large-scale deployment. Demonstrations also provide an opportunity to develop expertise in operating and maintaining fuel cells.

Successful projects will make an important contribution to realising the objectives of the MAIP and will demonstrate the ability of fuel cells to play a key role in distributed generation and larger industrial applications by achieving a reduction in costs per kW. In order to best meet the requirements of electricity grid operators, system design preparation for smart grid integration should be addressed where appropriate.

Demonstrations will also increase public awareness in Europeôs regions and municipalities, as well as providing opportunities to build local support structures. They may also attract further support from local and regional government.

Overall project objectives / Scope of Work

Given that the projects will operate in a real environment, they will face stringent reliability and availability requirements, including compliance with codes and standards. Projects must therefore demonstrate an appropriate level of technology readiness by showing that the submitted technology has undergone both a system-level Proof of Concept and Validation of the full-scale integrated system (similar to both parts of topic 2013.3.4 of this call) before submitting to this field demonstration call.

Demonstrations shall be performed in real application environments, which include interfaces with the infrastructure for electricity supply as a minimum, and for heating, cooling, renewable fuels, smart grids, fuel/oxidant processing, or other systems, as appropriate and based on end-user requirements.

Based on the end-user requirements, projects may interface with renewable fuels, smart grids, fuel/oxidant processing or other systems as necessary. These options must be a strategic component of the energy policy of the end-user, in order to convince other end-users, integrators etc. of the relevance of fuel cells for stationary applications.

In addition, projects should fulfil most of the objectives listed below:

- Address how this system will tackle potential reliability issues (redundancy in design, installation of multiple units etc.)
- Install operate and maintain complete integrated systems/applications with significant power generation capacity (> 100 kWe) per system
- Develop the potential for European businesses to realise supply chain opportunities
- Demonstrate integration into power, and where appropriate heat and/or RES and/or smart grids and/or other systems.
- Gain operating experience and identify improvement areas for future projects
- Estimate full life-cycle costs and periodically revise this estimate

- Show a strong commitment toward the running of the system by the operator after the period of grant funding. Note that stack changes can be sponsored as part of the project.

This topic is open to all fuel cell technologies, using common infrastructure and other fuels and field of applications with relevant power generation capacity.

Expected Outcome

Projects are expected to achieve the following outcomes:

- Cost and efficiency targets in line with the MAIP targets (see beginning of AA3 Section)
- Installation and operation of one or more identical system; each system to provide at least 100 kW with on-stream availability of 95% or higher, for a minimum of 16,000 hours
- Address opportunities to maximise a European contribution to the supply chain.
- Efficiencies, cost and lifetime targets must be demonstrated with a thorough techno-economic analysis that shows that the long-term minimum performance targets are achievable, in order to make the fuel cell system an acceptable proposition to end-users. This may be expressed as a lifetime Cost of Electricity, which includes both capital and operational costs.
- Environmental sustainability: assessment by means of Life Cycle Assessments studies should be carried out according to the requirements in the FC-HyGuide guidance document (available at :http://www.fc-hyguide.eu/)
- Identification of barriers or risks to full implementation
- Public awareness: strong dissemination efforts to a wider audience, preferably to potential customers and to industrial stakeholders, shall be included

Any event (accidents, incidents, near misses) that may occur during the project execution shall be reported into the European reference database HIAD (Hydrogen Incident and Accident Database) at https://odin.jrc.ec.europa.eu/engineering-databases.html.

Other Information

The consortium must include system integrators/fuel cell developers (OEMs) and end users (energy businesses or suppliers or industrial customers). Additional members may include component / stack suppliers, service providers (e.g. installation and maintenance), and electrical system operators with opportunities for academia, research organisations or SMEs in specialised areas.

Projects may be coordinated with ongoing and upcoming projects in verification and validation and may be co-funded by national, regional or private sources in order to demonstrate a strong commitment towards the 2020 European energy policy.

A link to project activities under the EU Smart Cities and Communities Initiative could be considered as a non-compulsory option.

A maximum of up to two Collaborative projects can expect to be funded. The maximum FCH-JU contribution that may be requested is ú6m per project. This is an eligibility criterion ï proposals requesting FCH-JU contributions above this amount will not be evaluated.

Expected duration: 3 years

Funding Scheme: Collaborative Project

Topic SP1-JTI-FCH.2013.3.6: Field demonstration of small scale stationary power and CHP fuel cell systems

Rationale

Demonstration projects are the final step in the development cycle, and critical to establish the system viability required for successful market deployment.

Complete fuel cell systems need to be demonstrated and proven in order to pave the way for large-scale deployment. Demonstrations also provide an opportunity to develop expertise in operating and maintaining fuel cells.

Successful projects will make an important contribution to realising the installed capacity targets of the MAIP; a significant number of small systems must therefore be demonstrated within the project. In order to best meet the requirements of electricity grid operators, system design preparation for smart grid integration should be addressed where appropriate.

Demonstrations will also increase public awareness in Europeôs regions and municipalities, as well as providing opportunities to build local support structures. They may also attract further support from local and regional government.

Overall project objectives / Scope of Work

Given that the projects will operate in a real environment, they will face stringent reliability and availability requirements, including compliance with codes and standards. Projects must therefore demonstrate an appropriate level of technology readiness by showing that the submitted technology has undergone both a system-level Proof of Concept and Validation of the full-scale integrated system (similar to both parts of topic 2013.3.4 of this call) before submitting to this field demonstration call.

Demonstrations shall be performed in real application environments, which include interfaces with the infrastructure for electricity supply as a minimum, and for heating, cooling renewable fuels, smart grids, fuel/oxidant processing, or other systems, as appropriate and based on end-user requirements.

Based on the end-user requirements, projects may interface with renewable fuels, smart grids, fuel/oxidant processing or other systems as necessary. These options must be a strategic component of the energy policy of the end user, in order to convince other end-users, integrators etc. of the relevance of fuel cells for stationary applications.

In addition, proposals should fulfil most of the objectives listed below:

- Install and operate complete integrated systems with electrical power <100kWe
- Install and operate a minimum of 25 identical units in the 1-10 kWe range, or at least 5 identical units in the > 10 kWe range, in order to provide confidence in the systemôs reliability through provision of redundancy. Proposals should clearly address how the installed system(s) will respond to a range of reliability issues, e.g. by including redundancy in design, installation of multiple units etc.
- Demonstrate integration into existing power and heat infrastructures and potential for integration into smart grid infrastructures

- Demonstrate the capture of heat generated by the fuel cell sub-system and deployment within home heat and hot water systems, to show genuine CHP operation at total efficiency >80% (LHV)
- Increased experience operating and maintaining fuel cells in Europe
- Provide personnel training in fuel cell installation and maintenance
- Estimate full life cycle costs and periodically revise this estimate
- Demonstrate that mass manufacture of the designs trialled is commercially viable, including volume capable supply chains. Contribute to the formation of a supply chain and support activities for complete systems
- Demonstrate sufficient levels of technology readiness and capacity to meet key challenges (cost reduction curve to meet 2015 and 2020 targets indicated in the MAIP)
- Demonstrate a commitment to operate the installed system beyond the funding period, since the required investments may be significant. Proposals should describe how this will be achieved.

Expected Outcome

The successful demonstration of fuel cell based integrated generator systems should show:

- Cost and efficiency targets in line with the MAIP targets (see beginning of AA3 Section)
- Minimum operational time of 16,000 hours per unit
- Lifetimes of 8 to 10 years, which must be demonstrated by a thorough techno-economic analysis that indicates the minimum performance required for an acceptable initial proposition to consumers
- Identification of barriers or risks to full implementation, including consideration of integration into future smart grids
- Feedback to RD&D activities of required mitigations
- Proof of viable supply chain and concept for field support
- Dissemination efforts to a wider audience, preferably to include potential customers and industrial stakeholders including electricity grid operators.
- Environmental sustainability: assessment by means of Life Cycle Assessments studies should be carried out according to the requirements in the FC-HyGuide guidance document (available at :http://www.fc-hyguide.eu/)

Any event (accidents, incidents, near misses) that may occur during the project execution shall be reported into the European reference database HIAD (Hydrogen Incident and Accident Database) at https://odin.jrc.ec.europa.eu/engineering-databases.html.

Other Information

The consortium must include system integrators/fuel cell developers (OEMs) and end users (energy businesses or suppliers or industrial customers). Additional members may include component / stack suppliers, service providers (e.g. installation and maintenance), and electrical system operators with opportunities for academia, research organisations or SMEs in specialised areas.

The project may be coordinated with ongoing and upcoming projects in verification and validation and may be co-funded by national, regional or private sources in order to demonstrate a strong commitment towards the 2020 European energy policy.

A link to project activities under the EU Smart Cities and Communities Initiative could be considered as a non-compulsory option.

A maximum of up to two Collaborative projects can expect to be funded. The maximum FCH-JU contribution that may be requested is ú6m per project. This is an eligibility criterion ï proposals requesting FCH-JU contributions above this amount will not be evaluated.

Expected duration: 3 years

Funding Scheme: Collaborative project

Topic SP1-JTI-FCH.2013.3.7: Development of fuel cell serial production techniques and equipment for Stationary Fuel Cell Power and CHP Systems

Rationale

Fuel cell manufacturing presents a significant challenge that must be overcome before fuel cell systems will be able to enter the market at the correct price point. Production methodology is typically linked to the volume of parts to be produced. The incumbent technology, such as gas turbines and reciprocating combustion engines, have well established production routes and thus avoid much of the technological and financial risk associated with mass manufacturing scale-up. For stationary fuel cells systems to compete with these technologies, mass manufacturing techniques must be developed to achieve cost competitiveness and ultimately the volumes required for mass deployment.

Every fuel cell type presents a unique challenge in electrode manufacturing, derived from manufacturing of electrode supports (be these metal, ceramic or other material based), gas diffusion layers, MEAs and electrodes, catalyst deposition or other fundamental manufacturing issues, such as consolidation regimes and sealing.

Overall project objectives/Scope of work

This topic aims to support focused manufacturing feasibility and scaling efforts undertaken by industryõs fuel cell developers of any fuel cell technology type. Proposals should be based on existing developed and mature/semi-mature cell and stack concepts and should exploit mature process technologies, (such as robotics, coating, etc.) where appropriate.

Research and development of new, improved and higher volume production techniques used for fuel cell stack manufacture should feature prominently in proposals. Specifically, a single-piece flow methodology and non-batch processes should be adopted where possible. Ideally, roll-to-roll processes, or equivalent, will be developed and exploited where appropriate. A model production facility/ technique must be deployed as a result of this work. The process(es) developed within the project should comply with relevant or widely-used standards, such as SMEMA Mechanical Equipment Interface Standard. Processes should ideally be clean at the point of fabrication, rather than requiring clean room or building environments.

Large-volume production will require up-stream suppliers able to deliver all components in suitable volumes and at the required quality. Therefore, projects should address Supply Chain Management (SCM) issues and the logistics that are associated with the SCM system used.

Exclusions

- Fuel cell balance of plant manufacture is outside the scope of this topic (see instead Topic SP1-JTI-FCH.2013.3.3).
- Proposals which focus primarily focused on earlier stage development of cell and stack design but which include a manufacturability component are out of the scope of this topic (see instead Topic SP1-JTI-FCH.2013.3.2).

Expected outcomes

Develop a “blue print” design alongside critical manufacturing processes and techniques which can then form the basis of a scaling up to complete pilot scale manufacturing development.

- Demonstrate a flawlessly operating process or processes for the mass manufacture of two or more key fuel cell components.
- Demonstrate system output equivalent to >1MW per annum of fuel cell parts. NOTE: This can be a projected output, based on a system's maximum performance.
- Demonstrate a system which achieves targets set for:
  - quality assurance: less than 1% failure rate; and
  - minimised reworking (right first time).
- Demonstrate the commercial viability of the processes developed by:
  - establishing the scalability of the processes developed in the project, and the potential to achieve economies of scale in the post-funding period; and
  - achieving an amortised cost per part that results in a €/kWh cost per stack that is in line with FCH JU targets.
- Projects should give consideration to
  - minimising waste and the carbon footprint of the process; and
  - maximising scope for recycling
- Environmental sustainability: assessment by means of Life Cycle Assessments studies should be carried out according to the requirements in the FC-HyGuide guidance document (available at :http://www.fc-hyguide.eu/)
- Health and safety issues associated with all materials and processes involved in the project must be addressed, and projects must show how health and safety risks to personnel and to the environment have been minimised.

Other Information

This topic is focused on the development of production techniques for Stationary Fuel Cell Power and CHP systems, and is not open to fuel cell systems developed for other applications.

The project will be led by an established and industrially recognised fuel cell developer located in Europe.

A maximum of up to two Collaborative projects can expect to be funded. The maximum FCH-JU contribution that may be requested is €2m per project. This is an eligibility criterion – proposals requesting FCH-JU contributions above this amount will not be evaluated.

Note that this topic is to support the development of a “blue print” design with critical manufacturing techniques, and as such CAPEX is not expected to exceed 25% of the total budget. This is also an eligibility criterion – proposals above this % will not be evaluated.

Expected duration: Maximum duration of three years

Funding Scheme: Collaborative project

APPLICATION AREA SP1-JTI-FCH.4: EARLY MARKETS

Topic SP1-JTI-FCH.2013.4.1: Demonstration of fuel cell-powered Material Handling Vehicles (MHV) including infrastructure

Rationale

Powering material handling vehicles (MHV) by fuel cells and hydrogen is a promising early market application. The technology has already been adopted, particularly in North America, by industrial end-users who have commenced fleet implementation and hydrogen re-fuelling system solutions, at the individual site level. To promote European based technology and commercialisation of hydrogen and fuel cells, fleet level MHV demonstration of the latest fuel cell technologies is required in order to prove performance and reliability for customer acceptance and also to enable system and hydrogen infrastructure cost reductions. Demonstration projects are needed at several end-user sites/MHV applications in order to clearly show that the total cost of ownership can be appreciably reduced using a developed fuel cell technology and the demonstration focus should be on MHV applications where hydrogen and fuel cells show a clear benefit to the end user (e.g. in terms of savings, increased output, emission reduction etc.).

Overall project objectives / Scope of Work

Projects shall focus on achieving a cost competitive Total Cost of Ownership (TCO) compared to conventional MHV units (battery, LPG and/or diesel) with the inclusion of FCH-JU support. This may cover one or several types of MHV application where a competitive TCO can be achieved. Projects should also:

- Be based on a credible fuel cell technology platform capable of meeting fleet level MHE demonstration, and where the proposed project activities will meet or exceed cost, efficiency and durability benchmarks to provide a clear advantage to the end-user over incumbent technology
- Should show clear cost targets within the project for the different applications addressed, documenting a competitive TCO, as well as showing performance improvements and/or cost reductions achieved by the development work and demonstration unit volumes
- Evaluate achieved benefits (e.g. in terms of savings, increased output, emission reduction, operating hours etc.)
- Contribute to the setting of clear technical targets on costs, durability, efficiency and serviceability in order to establish a path forward for commercial deployment.
- Coordinate with existing projects to provide a solid approach for permitting and provide clear recommendations with regards to the Regulation, Codes and Standards (RCS) that are needed to facilitate permitting and commercialization of HFC technology for the MHV application(s) addressed
- Be based on business plans and committed partners to continue on the pathway to volume deployment and roll-out to commercial market introduction

Expected Outcome

Demonstration shall comprise at least 200 or more fuel cell MHV units either at a single end-user site or across multiple end-user sites (with 10+ units per site) and applications aimed at proving a commercial customer value proposition. Demonstration should include necessary and relevant supporting hydrogen supply infrastructure

- Targets should be specific and relevant for the MHV unit type(s) to be developed, demonstrated and commercialised for future deployment. Indicative targets are:
    - Total cost of fuel cell system (at early volume production): <ú3,000/kW (for fuel cell systems>3kW)
    - System lifetime (with service/stack refurbishment): >7,500 hours
    - Fuel cell System efficiency (tank to wheel): >45%
    - Refuelling time: 3 min
    - Hydrogen price dispensed at pump (end-user price): <10 ú/kg
    - Availability of MHV units & refuelling to match conventional & competing technologies
- Clear TCO evaluations for each application shall be delivered together with cost targets for formulating future deployment schemes and mechanisms

- Environmental sustainability: assessment by means of Life Cycle Assessments studies should be carried out according to the requirements in the FC-HyGuide guidance document (available at :http://www.fc-hyguide.eu/)
- Perform safety due diligence for all aspects of the demonstration, including documentation of accidents and incidents and monitoring of safety issues in the context of prevailing regulations on site to provide guidelines for proper handling. Incidents shall be reported into the HIAD (Hydrogen Incident and Accident Database).

Any event (accidents, incidents, near misses) that may occur during the project execution shall be reported into the European reference database HIAD (Hydrogen Incident and Accident Database) at https://odin.jrc.ec.europa.eu/engineering-databases.html.

Other Information

The project consortium should be focused on demonstration activities and is expected to include a mix of system developers, material handling vehicle providers, technology providers and support for permitting and RCS development, fuel suppliers, end-users or other relevant types of actors. They should focus on the maximum number of MHV units for demonstration for example through pooling of several end-users and joint project arrangements. The project can be coordinated with current material handling demonstration projects funded under previous calls, adding additional sites and units of the same or different type, and should share experiences with regard to safety, testing, operational protocols and RCS.

Expected duration: Up to 3 years

Funding Scheme: Collaborative Project

Topic SP1-JTI-FCH.2013.4.2: Demonstration of portable generators, Back-Up Power and Uninterruptible Power Systems

Rationale

Back-Up Power (BUP) and Uninterruptible Power Systems (UPS), together with base load power supply, are promising early market applications for fuel cells and hydrogen and these technologies are being taken up by end-users in the telecoms, utilities, IT and other industry sectors. The potential to move into formal system implementation in the field is driven by the Total Cost of Ownership (TCO) gains resulting from the substitution of diesel gensets and batteries by hydrogen fuel cells. These gains can be very significant in areas where grids are unstable (Asia, Africa, etc.) but are still significant in Europe where grid networks are quite stable.

To promote European based technology commercialisation of hydrogen and fuel cell solutions for BUP and UPS applications (and in remote and/or grid weak areas for base load power systems) needs to be demonstrated at representative end-user sites and against specific end-user requirements to show that acceptable performance, reliability and lifetime targets can be met and that a lower total cost of ownership can be achieved. In the telecom sector the trend is for a reduced power requirement per site and 1-5 kW scale BUP and UPS systems are becoming more prevalent. However, site consolidation is also occurring with multiple operators co-locating their equipment and using the same BUP or UPS system, and providing base power for all system requirements. The major part of the market can be reached with solutions up to 10 kW but TCO gains for fuel cells might be found for systems of up to 50kW in off-grid applications.

Overall project objectives / Scope of Work

The overall objective is to deploy BUP or/and UPS units that can show a cost competitive total cost of ownership (TCO) when compared to legacy solutions (battery and diesel generators). The demonstration focus will be in the power requirement range of 1-10 kW or up to 50 kW on an exceptional basis. Fuel cell BUP and UPS demonstration sites could include more than one power range and type of fuelling solution (hydrogen logistics or on-site reforming of multiple fuels as well as integration with renewable sources where available).

Projects need to:

- Utilise latest development pathways (at the component and full system level) to establish technology platforms with improved reliability, life-time and cost prediction that already show credibility for future volume manufacture and roll-out, and providing a demonstrable advantage to the end-user over incumbent technology
- Measure and evaluate achieved benefits (e.g. in terms of savings, maintenance, emission reduction, operating hours)
- Contribute towards the determination of clear technical targets on costs, durability and reliability in order to establish a path forward for commercial deployment
- Provide for training of personnel for installation, fuelling, maintenance and service

- Coordinate with existing projects to provide clear recommendations for the establishment of the Regulations, Codes and Standards (RCS) framework needed to permit and to facilitate the commercialization of HFC technology for the application(s) addressed
- Be based on business plans and committed partners to continue the transition to volume deployment and future market introduction
- Disseminate results to wider audiences, preferably to potential customers and to the application stakeholders in international seminars/workshops

The fuel cell systems to be demonstrated will need to meet key challenges resulting from increased operation such as LHV average electrical efficiency of 50% (35% for reformate based fuel cell systems) and 2,000 cycles capability. Ideally one scalable system technology can be used to address a broad range of power requirements so as to simplify service and maintenance and to minimise spare parts inventory.

Expected Outcome

- Demonstration shall comprise a sufficient number of sites and a sufficient number of systems to aggregate to the demonstration of up to 250kW of units (for example up to 50 in the 1-5 kW range, up to 25 in the 6-10 kW range or up to 5 systems in the 11-50 kW range) in order to prove a technology readiness and commercial customer value proposition thereby leading to potential commercial supply
- Technical requirements that the proposed systems should include:
    - Reliability >95%
    - Response time of less than 5 ms
    - Projected lifetimes of 3 to 5+ years
    - Target system cost: 3,500 ú/kW (if fuel cell system alone is considered); 6,000 ú/kW (if fuel cell system + hydrogen generator is considered)
- Projected number of start-stop cycles 2,000
- Demonstrate a viable hydrogen supply solution for this application
- Demonstration activities should focus on deployment pathways most likely to lead to market introduction
- Environmental sustainability: assessment by means of Life Cycle Assessments studies should be carried out according to the requirements in the FC-HyGuide guidance document (available at :http://www.fc-hyguide.eu/)
- Systematic identification of technology benefits at system level compared to conventional technologies and TCO evaluations for each application shall be delivered together with cost targets for formulating future deployment schemes and mechanisms for the targeted sectors and markets including wide dissemination to the potential end-user industries and institution

Any event (accidents, incidents, near misses) that may occur during the project execution shall be reported into the European reference database HIAD (Hydrogen Incident and Accident Database) at https://odin.jrc.ec.europa.eu/engineering-databases.html.

Other Information

The project consortium should include a mix of sector relevant end-users (telecoms, utilities, IT, hospitals and other applicable industry sectors), equipment OEMs or/and service providers, fuel cell system developers and fuelling infrastructure or fuelling replenishment providers, alongside research and test organizations.

The delivery of BUP or/and UPS units for field demonstration should be achieved within one year of project commencement. Proposals should indicate a clear commitment of end users and/or service providers to continue with fuel cell system commercialization and technology deployment in Europe and/or external market regions during and post project completion. The project can be coordinated with similar demonstration projects funded under previous calls.

Expected duration: Up to 3 years with at least 1 year of field operation

Funding Scheme: Collaborative project

Topic SP1-JTI-FCH.2013.4.3: Development of portable fuel cell systems for early market applications

Rationale

Europe has only a very narrow technology base in portable fuel cell systems and related fuelling options, particularly below 100 W, which limits opportunities to address a wide number of early market segments which have been shown elsewhere to be attractive for early commercial introduction, such as:

- Construction site tool recharging
- Emergency and/or remote power
- Powering recreational applications (for camping, caravanning, boating etc.)
- Personal portable power / powering consumer electronics

Portable power technologies can also overlap into wider applications such as powering autonomous airborne and ground vehicles and small auxiliary power units for vehicles, particularly if the fuelling capability is extended across the fuel spectrum to include conventional and renewable liquid fuels.

System development and test unit manufacturing should be achieved within the first two years of project commencement, followed by one year of field tests. End-user(s) should be involved throughout the programme, during early design stages and system validation and testing activities, which may be conducted in research organizations/facilities. Final systems should be configured to address a specific early market application and may further be adaptable for additional applications (to reduce commercial risk and aggregate for reduced cost of production / assembly and early market entry). Costs of mass manufactured final systems should be identified in conjunction with end-users or from using commercially experienced production specialist sources.

Overall project objectives / Scope of Work

The topic is open to all types of fuel cell technology (low and high temperature) and related key components, provided the technology can sufficiently demonstrate an ability to meet application and end-user specific requirements when operated with any suitable (including logistic) fuel source. Electrical power output should be between 5 W and 100 We. If possible and applicable, intelligent use of waste heat is recommended.

The primary programme focus will be on performance and cost improvement and design for manufacture to reduce material and assembly costs. It is expected to involve consortia involving SMEs where possible with background expertise and who have already built prototypes, combined with the expertise of research institutions. Dissemination across sectors and development of a European supply chain will strengthen the European portable fuel cell industry, its technical expertise, and design for manufacture and production pathways towards future volume production of portable fuel cell systems.

The objective is to develop and demonstrate complete systems, ready to be used by specified end users. Thus the development should cover:

- Fuel cell system (stack and BOP)
- Fuel storage

- Fuel processing (if required)
- Power electronics and controls integration (if required for the application)

Projects should provide clear recommendations for the establishment of the Regulation, Codes and Standards (RCS) framework that is needed to facilitate the commercialization of these micro fuel cell technologies.

Where appropriate and where technically and commercially feasible, the system shall be designed on a modular basis to allow scale-up and scale-down for a wider range of application requirements.

Expected Outcome

- Development and test of complete systems (stacks, key components, fuel supply) capable of meeting application specific requirements for the intended early market segment being addressed
- Demonstration of 30+ units in system operation against the functionality required for an early market application such as extended, competitive, run-time for a mobile phone or other portable consumer electronics equipment;
- Validation of lifetime and start-stop cycles necessary to commercially compete with incumbent technologies
- Validation of system size and weight (with / without fuel amount) and other design features required to commercially compete with incumbent technologies
- System validation through systematic and widely agreed testing protocols/activities, and demonstration to show a cost prediction for mass production of less than 5,000 ú/kW
- Design approach for production implementation in high volume to meet market roll-out
- Potential for modularity of the fuel cell technology or/and fuel supply capability for adaptation to other markets

Any event (accidents, incidents, near misses) that may occur during the project execution shall be reported into the European reference database HIAD (Hydrogen Incident and Accident Database) at https://odin.jrc.ec.europa.eu/engineering-databases.html.

Other Information

The consortium should include a mix of partners for new development and sufficient industrial capacity for commercialization, plus at least one end-user / system integrator as a consortium partner as well as support for RCS development. The proposal should cover a mix of RTD, proof of application, validation of a specific early market concept, and initial field demonstration against the application specific technology. Involvement of innovative SMEs is strongly encouraged and where appropriate their coordination of the project is also desirable. IPR should be in place at the start of the project with a view for later development.

Up to two projects may be funded under this topic.

Expected duration: Up to 3 years

Funding Scheme: Collaborative Project

Topic SP1-JTI-FCH.2013.4.4: Development of 1-30kW fuel cell systems and hydrogen supply for early market applications

Rationale

Further development efforts are needed to create competitive fuel cell systems in the 1kW to 30 kW range for early market applications. This topic is aimed at bringing next iteration stacks, systems and hydrogen supply options to market readiness and commercial use, combining cost reduction and improved performance, such as energy efficiency and durability of stacks and systems, and hydrogen supply, in a wide range of ambient and environmental operating conditions (freeze tolerance, heat, low humidity, dust, etc.). Hydrogen supply can be produced from feed stocks such as water, ammonia, methanol, ethanol and bio fuels or bio gases. This may entail use of a hydrogen stream with a lower quality than ISO TS14687-2.

Overall project objectives / Scope of Work

Development of new generation high performance, durable and cost-effective fuel cell systems in the 1-30kW power range for early market applications such as backï up power, UPS, distributed power and material handling equipment. Full concepts across the entire value chain should be pursued addressing stacks, fuel cell system and hydrogen supply.

Emphasis should be on development efforts that help:

- Reduce the cost of fuel cell stacks
- Reduce the cost of full systems, through optimization of Balance of Plant components (fewer and more efficient components such as. air / hydrogen compressors, multipurpose components / valve blocks)
- Improve the efficiency of the fuel cell system by optimal power management (e.g. for material handling vehicles, increase of re-generative braking power utilization through use of batteries and/or super capacitors)
- Reduce the cost of hydrogen by new, innovative, supply concepts (e.g. onsite or integrated production or new distribution methods)
- Reduce cost of hydrogen by new innovative supply concepts (e.g. onsite or integrated production or new distribution methods) or/and reduce the total cost of system ownership by developing system level solutions through use of hydrogen which has a lower specification than ISO TS14687-2
- Increase the number of early market applications by using renewable feedstock
- Increase the number of early market applications through enhanced energy efficiency and durability of stacks and systems, and hydrogen supply, in a wider range of ambient and environmental operating conditions (freeze tolerance to -25C, or/and elevated temperature to +50C, low humidity, dust, etc.)

The following main elements should jointly be addressed within the same project:

- Hydrogen supply including either distribution or onsite-production concepts with various feedstocks (1 feedstock to focus on per proposal).

- Fuel cell stacks, systems, balance of plant components and hybridisation / power management

Expected Outcome

Projects should develop and conduct full laboratory testing and limited field trial of new fuel cell system prototypes and hydrogen supply components, verifying reaching the 2015 targets listed below enabling a full commercial use. At least one of the markets listed below should be addressed by a project, and if justified several applications may be addressed within the same project. Accomplishing or exceeding this list of targets for at least one addressed market has to be shown to be achievable for at least one prototype.

<u>Material handling equipment targets</u>

- Hydrogen cost at point of consumption at 5 ú/kg to ú10/kg with renewables at a production of 1000kg a day.
- Fuel cell system cost <ú1,500/kW (@ >1,000 units per year)
- Fuel cell system efficiency >45%
- Fuel cell system life-time 15,000 hours (fuel cell stack 15,000 hours) ï with regular/cost effective maintenance/refurbishment

<u>Stationary ï (extended daily blackouts) targets</u>

- Fuel cell and hydrogen system cost ú2,500/kW (including H2 generator) (@ >500 units)
- Fuel cell system efficiency 45%
- System life-time 20,000 hours (fuel cell stack 20,000 hours)
- System efficiency >30% when working with an integrated hydrogen generator

Projects should further detail the above targets in the proposal showing that they enable a commercial use in the markets addressed on a total cost of ownership basis. Proposals must also define their state-of-the-art level, current bottlenecks, the specific progress to be achieved within the project and the development approach to be taken to achieve these targets. A roadmap to volume production with intermediate commercial targets through scaled build-up shall be a project deliverable.

Other Information

Consortia should include relevant partners to ensure sufficient coverage of the value chain behind the product application(s) and their markets, e.g. research organisations, component suppliers, system integrators and product OEMs. Consortia should be capable of showing a committed development and business approach and to the markets and products in focus, both providing a strong past track-record of activities as well as dedicated efforts and plans to further commercialise and introduce products to the market.

Expected duration: Up to 3 years

Funding Scheme: Collaborative Project

APPLICATION AREA SP1-JTI-FCH.5: CROSS-CUTTING ISSUES

SP1-JTI-FCH.2013.5.1: European Curriculum on H2&FC technologies: Implementation of Educational and Study Material

Rationale

This topic specifically builds on previous projects TrainHy, HyProfessionals and HyFacts. Whilst the named projects concentrated on developing the basis of FC&H2 related teaching, for instance in the way of developing a curriculum, this project will fill the structures by preparing the relevant teaching material. The project extends the scope in providing teaching materials for courses and e-learning and supplying these to the European lecturer community. Universities prepared to participate in the supporting network of the project will be able to access this material as a support to high quality teaching throughout Europe. The emphasis is on university (graduate and post-graduate) teaching and the equivalent level of vocational training.

The supply of high quality teaching and learning material is essential in building the vast human resources needed for further developing and maintaining FC & H2 technology. The university type material can also be ódowngradedô and used for specific target groups (e.g. regulators, first responders etc.) and schools since the curriculum structure is generally valid.

Overall project objectives / Scope of work

The project will supply teaching and experimental material for use in university and vocational training. This will be presented on a web-site in the sense of a source of curriculum structure, of teaching content, and as an e-learning platform. The project should include or cooperate with university networks with the goal of harmonising teaching materials and concepts. Activities shall reach out to other EU initiatives, for instance the SET-Plan.

Expected Outcome

- Preparation of teaching material to cover the TrainHy curriculum in the form of presentation slides and scripts for student learning
- Establishment of a network of universities participating in quality assurance of teaching material and using the material in their (local) courses
- Mutual ECTS points recognition throughout this network
- Installation of a web-site hosting this teaching material for access by associated universities
- Installation of a web-site suitable for e-learning and performance of prototype courses
- Update on TrainHy curriculum development
- Expansion of blueprints for experimental equipment developed in TrainHy
- Continuation of the educational courses (summer schools etc.) as developed by TrainHy and HyProfessionals within project duration

Other information

The consortium will include experienced partners from the named projects in order to supply continuity. It should be expanded to networks of higher education institutions with a proven scope and capability in the field.

Expected duration: Up to 3 years

Funding scheme: Coordination and Support action

SP1-JTI-FCH.2013.5.2: Training on H2&FC technologies for Operation & Maintenance

Rationale

While hydrogen and fuel cell technology is approaching market roll out, citizens and future users lag behind in knowledge of the advantages of the technology, and even, sometimes refuse application based on prejudices about safety, costs or efficiency. This effect is even worse at the level of installation, operation and maintenance technicians and workers. Nowadays some demonstrative projects showcase hydrogen and fuel cell technology throughout Europe, which constitute an excellent base to train maintenance technicians and workers and thus help ensure acceptance by the future potential users involved in O&M.

This topic specifically addresses the need to provide basic knowledge in hydrogen and fuel cell technologies as well as safety training, in order to avoid refusal to the future deployment of the technologies by specific technician levels and in turn prepare a well-trained work force for the next roll out of technology. The target group of activities is technicians and workers, not necessarily with H2&FC experience. The approaches to this, according to the findings of the HyProfessionals project, are very different from sector to sector and country to country. This has to be acknowledged by the project.

The project is to address vocational training at the level of technical schools, ‘lifelong learning’ and ‘process of continuous improvement’ courses. Thus the activity will lend itself as a solid basis for the specific in-house training that companies perform for their newly acquired staff.

Overall project objectives / Scope of work

The project should focus on the development of specific technology related training initiatives specific to H2&FCs, in cooperation with other programmes, such as demonstrative projects funded by the FCH-JU, or specific training programmes for workers. It shall implement training activities focusing on installation, operation and maintenance of H2&FC equipment, where existing facilities belonging to demo projects must be used for this purpose in order to gain access to early stage market entry equipment at low cost for the training initiative.

Suitable already operating facilities shall be identified and specific proposals shall be made to use them in an efficient and effective manner to develop the necessary human resource base while not incurring in additional investment. Identify clustering of ongoing projects at regional level, which can widely spread best practices to other regions.

Proposals shall address the technical needs required to install, operate and maintain H2&FCs facilities and equipment in several applications, such as HRS, stationary fuel cells, buses and passenger cars, special mobility, among others. The proposed initiatives shall be tested and implemented during the project, eventually leading to self-sustained training offers.

Expected Outcome

- Use of existing demonstration projects (automotive, production, refuelling infrastructure, distribution, end use), leveraging their potential as training equipment.

- Develop proposals for specific training on installation, operation, maintenance, safety and proper use of H2&FC facilities, addressing the need to develop a well-trained work force.
- Establish a seed for potential business models for such training, so that the project eventually leads to a self-sustained training offer.
- Dissemination of results to industry, FCH-JU stakeholders, education authorities, and public in general.

Other information

The consortium shall include experienced partners in H2&FC technology from industry or R&D centres, future user associations, training or educational institutions. The proposals should show strong liaisons to existing deployed infrastructure in H2&FCs and to decision makers at regional or national level in education, regulation and certification.

Expected duration: Up to 3 years

Funding scheme: Coordination and Support action

SP1-JTI-FCH.2013.5.3: Social acceptance of FCH technologies throughout Europe

Rationale

Success in market introduction of FCH technologies will partly depend on the social acceptance of hydrogen by final customers. To date, there is little evidence of the social awareness of FCH technologies in Europe and the socio-scientific research dealing with the social impacts caused by the introduction of hydrogen and fuel cell technologies has been limited. Although demonstration projects always include some deliverables dedicated to social acceptance, these investigations are usually not based on systematic opinion polls using representative panels which are the only means to rigorously assess social acceptance and awareness. Complementary studies are therefore needed to identify current gaps and bottlenecks for raising the demand from potential users of FCH technologies.

Overall project objectives / Scope of Work

The overall objective of this project is to answer the following questions with a rigorous scientific survey methodology, in a few countries in Europe where FCH technologies are likely to be introduced first:

- What is the current state of public awareness of FCH technologies in Europe?
- What is the current state of public acceptance of hydrogen energy in Europe?
- How can familiarity with hydrogen technology, and trust in the actors responsible for its implementation, be raised in the public?
- What kind of fears is associated with FCH technologies to date? How is hydrogen safety perceived by the general public?
- How can a successful transition towards the use of hydrogen in the mobility sector be achieved?
- What is the impact of a first use of FCH technologies (especially in the field of mobility) on public acceptance and public interest in FCH technologies? Does the phrase ñseeing/using is believingò applies to FCH technologies?

Expected Outcome

- Develop detailed public opinion poll on current public awareness and social acceptance of FCH technologies
- Conduct this opinion poll in at least 3 countries in Europe which are expected be at the forefront of market introduction of FCH technologies
- Study the impact of several FCH demonstration events on the acceptance of the technology (e.g. study the impact of a Ride & Drive event on the perception of fuel cell electric cars by the general public)
- Provide a detailed report containing the results of the opinion polls and of the impact study, with a set of recommendations to increase the public awareness and the social acceptance of hydrogen energy.

Other information

The consortium should include an opinion poll company and qualified industry experts. Participation of an NGO speaking for the public interest could be considered as well. Experience and outcomes from similar international activities should also be taken into consideration. The choice of the European countries chosen for the opinion polls will be carefully justified. Leverage on current or future demonstration activities within the FCH JU Programme for the impact study will be actively sought.

Expected duration: Up to 2 years

Funding Scheme: Coordinated and support action

Topic SP1-JTI-FCH.2013.5.4: Development of industry wide uniform performance test schemes for SOFC/SOEC cells & stacks

Rationale

The application of the electrochemical solid oxide fuel cell and electrolyser systems is important in increasing the share of sustainable hydrogen usage based on renewable energy sources. In this context the development of new and improved existing hydrogen production methods is one of the priorities of the multiannual plan. Significant exertion is required to reduce the system durability gap compared to the existing methods for hydrogen production.

The successful application of fuel and electrolysis cells in real world conditions requires reliable assessment and prediction of performance and durability observing environmental compliance and safety aspects. In order to establish the potential for high temperature electrolysis, long term tests at standardised conditions are necessary to determine the exact degradation.

To facilitate the interaction of stack developers, system integrators and end users as well as technical development and to assist in the drafting of European and international codes & standards commonly accepted testing procedures and test protocols need to be developed. These protocols which represent the most relevant application areas of Solid Oxide fuel cell stacks or Solid Oxide electrolysers have to be agreed upon among the stakeholders using state-of-the-art expertise and consolidating typical test schemes by experimental verification.

Overall project objectives / Scope of Work

Taking stock of what was achieved under the FCTESQA project, the project shall further investigate the relevant operating parameters for the determination of performance metrics. Additionally, parameters like type of test fixtures, sealing methods, cell and stack materials, electrical and temperature probe positions and contact mesh type need to be examined via a sensitivity analysis.

Moreover, besides current voltage curves, more detailed electrochemical characterisation methods with improved technical methods are now possible, e.g. electrochemical impedance spectroscopy (EIS). This technique enables the determination of the cell and stack resistances and can therefore also be used as a tool for quality assurance.

It is very important to identify the most relevant parameters to be included in the testing procedures and test protocols addressing performance and endurance. Additionally, the compatibility with safety requirements and - where existing - regulatory aspects in typical applications of Solid Oxide fuel cells when used as power generator (e.g. CHP) or as electrolyser for hydrogen production must be ensured.

Testing procedures and test protocols commonly agreed upon by all stakeholders shall be developed to a level readiness for use in industrial technology assessment and ï if accepted by relevant standard developing organisations (SDO) ï to be taken up into codes & standards. The procedures and protocols should allow reliable prediction of stack behaviour based on relevant operating parameters, include descriptions of the required test bench infrastructure and test set-up, and provide a methodology for uniform collection, analysis and presentation of test data as well as results. The developed procedures and protocols are to be experimentally validated preferably by round robin exercises.

Specifically, the procedures and protocols should at least address:

- SOFC-operation
  - Load following mode for stationary (µCHP) applications

    µCHP-SOFC in a smart grid; operation according to the current demand / electricity price.

    The test module should provide information about performance and degradation under an appropriate power output profile.
  - Cycling mode for mobile (APU) applications, e.g. SOFC-APU in a truck,

The test module should provide information about performance and degradation during load, thermal cycling, including start-up and shutdown as well as predictable irregular operating conditions.

- SOEC-operation
  - Dynamic peak power conversion mode

    SOEC in tandem with renewable sources (wind, solar).

The test module should provide information about performance and degradation during a dynamic profile consisting of part load (with low degradation) and max. load (with higher degradation) phases

- Combined SOFC/SOEC-operation
  - A combined SOFC/SOEC-system providing electrical energy from hydrogen (or a hydrogen/natural gas mixture) in the SOFC-mode resp. hydrogen (or syngas) in the SOEC-mode will always be operated dynamically. Therefore an appropriate alternating testing sequence is required.

The test module should provide information about performance and degradation during a dynamic profile consisting of SOFC and SOEC phases

The project should draw on the experience gained in previous 5th and 6th Framework Program projects (e.g. FCTESTNET, FCTESQA) and of on-going FCH JU projects. Establishing liaison to SDOs, for example the Technical Committee 105 of the International Electrotechnical Commission (IEC TC 105) and/or to the Technical Committee 22 of the International Standardization Organization (ISO TC 22) as well as to representative organizations (e.g. international/regional/national and SDO) for different application areas is encouraged.

Expected Outcome

- Identification of the most relevant testing procedures and test protocols for Solid Oxide technology based on fuel cell applications and electrolysis application
- Definition, development and experimental validation of commonly accepted testing procedures and test protocols for a selected number of SOFC/SOEC applications
- Establishment of methodologies for the uniform collection, analysis and presentation of test data
- Description of the required test infrastructure (test benches, system environments, hardware in the loop installations etc.)

Other Information

The consortium should have a balanced representation of academia & research, stack system developers and OEMs as well as of testing organizations. The consortium should interface with relevant other projects as will be identified during the course of the project or upon FCH JU request. The consortium should interface with the relevant SDO (standard developing organisations) and ï upon request ï assist in the development of relevant standardization efforts.

Expected duration: Up to 3 years

Funding Scheme: Collaborative Project

SP1-JTI-FCH.2013.5.5: Development of a European framework for the generation of guarantees of origin for green H2

Rationale

Guarantees of origin have been defined in the European regulation[22]: ñ*Guarantees of origin (é) have the sole function of proving to a final customer that a given share or quantity of energy was produced from renewable sources. A guarantee of origin can be transferred, independently of the energy to which it relates, from one holder to another. However, with a view to ensuring that a unit of electricity from renewable energy sources is disclosed to a customer only once, double counting and double disclosure of guarantees of origin should be avoided. Energy from renewable sources in relation to which the accompanying guarantee of origin has been sold separately by the producer should not be disclosed or sold to the final customer as energy from renewable sources. It is important to distinguish between green certificates used for support schemes and guarantees of origin.*ò

The development of hydrogen as an energy carrier will partly depend on the capacity of market stakeholders to propose low-carbon or carbon-free hydrogen to final customers. However, the production of green H2 and its effective consumption will likely to be unbundled for optimizing transport and distribution, and thereby reducing the cost of hydrogen. This implies that a system of guarantees of origin for green hydrogen is created so that final customers can buy low-carbon hydrogen which is not the molecules they will effectively use in their fuel cell. In addition, these guarantees of origin could also be an appropriate instrument to create financial incentives to use green hydrogen.

Rather than several national guaranty systems are created in parallel, such a guaranty organization should be contemplated at the European level immediately.

Overall project objectives / Scope of work

The overall project objective for this project is to investigate and initiate a unique European framework for green hydrogen certificates, involving all producers and industrial customers of hydrogen energy which want to have their green H2 certified.

Expected Outcome

- Assess the needs and the benefits of H2 guarantees of origin in Europe, based on market projections from the industry and taking into account the recent European public policy documents (e.g. Fuel Quality Directive, Renewable Energy Directive, etc.)
- Identify the relevant stakeholders of a European framework for H2 guarantees of origin

[22] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources

- Investigate the synergies with existing platforms delivering guarantees of origin for other energy carriers and explore the interest in joining such platforms
- Propose a complete procedure for the emission of H2 guarantees of origin, with a strong emphasis on practical implementation
- Elaborate and provide a full description of an implementation strategy

Other information

The consortium should include highly experienced and qualified industry experts, representative of the production or distribution of renewable energy or hydrogen, to ensure sufficient coverage of the whole value chain. The participation in the consortium of an expert having significant previous experience in guarantees of origin will be actively sought.

Experience and outcomes from similar international activities should also be taken into consideration.

Expected duration: up to 2 years

Funding Scheme: Coordination and Support Action

SP1-JTI-FCH.2013.5.6: Pre-normative research on resistance to mechanical impact of pressure vessels in composite materials

Rationale

There is already ample evidence of the fact that pressure vessels for the storage of compressed hydrogen built in composite materials are robust and unlikely to burst as a direct result of an accidental impact that could occur in service.

Nonetheless, continued research is needed to further evaluate and better quantify both the short term and long term effects of single or repeated mechanical impacts on the structural integrity of pressure vessels in composite material, in particular carbon composites, in order to:

- establish improved criteria for removal of service following an impact
- develop improved inspection methods to detect impact damage requiring removal from service to maintain the targeted safety level
- have a better grasp on the available potential for optimization of design, for instance through increase of the allowable design stress level

Furthermore, such improved criteria and inspection methods, while further improving the level of safety, reduce the likelihood of having pressure vessels unnecessarily removed from service following an impact that in fact does not have any effect on structural integrity.

Overall project objectives / Scope of Work

- Identify the different types of alterations that may be produced by mechanical impacts and develop an understanding of their consequences on short term and long term structural integrity
- Through a combination of experimental, analytical and/or modelling approaches, establish a relation between severity of impact, level of damage, and effect on structural integrity, in order to determine which impacts may cause a pressure vessel to fail immediately or later on in service.
- Apply the results of the above to assess the reliability of composite pressure vessels in the foreseen applications and potential needs of protection and/or opportunities of design optimisation.
- Evaluate non-destructive examination methods, such as analysis of acoustic emissions, and associated pass/fail criteria for controlling pressure vessels in service with regards to potential damage from impacts.

Expected Outcome

- Description and quantification of the effect of mechanical impacts on composite pressure vessel structure
- Assessment of the structural reliability of composite pressure vessels in the foreseen service conditions and opportunities of improvement and optimization
- Improved methods and criteria for inspection of pressure vessels in service

- Recommendations to industry and for international standards development

Other Information

The consortium should include a research entity(ies), pressure vessel supplier(s), compressed hydrogen system integrator(s) and/or operator(s), non-destructive examination specialists and standardization expert(s).

Expected duration: Up to 3 years

Funding Scheme: Collaborative Project

3.7 Public Procurement: Benchmark Studies

The activities described in this section are implemented by call for tenders (i.e. public procurement) and fall outside of the call for proposals (i.e. grants, which constitute the main means of implementation of the Annual Implementation Plan.)

Up to 4.65 million EUR will be made available to support the activities. Out of these 4.65 million, 1,458,550 EUR require new appropriations, and the rest comes from funds already reserved for commercialisation studies in the AIP 2012.

Subject (Indicative title)	Indicative distribution of the funding between the studies in EUR
Development of a European Fuel Cell and Hydrogen Vehicles Roll Out Plan including support to national rollout strategies	0.5 million
Development of a European Urban Fuel Cell Bus Commercialisation Strategy based on the results of the fact based comparison of alternative powertrains done in 2012.	1 million
Development of a European commercialisation strategy for fuel cell stationary applications (distributed power generation)	1.5 million
Economic and technical assessment of the role of Hydrogen in Energy Storage	1.25 million
Financing Hydrogen Refuelling Infrastructure: conditions for private investments and required forms of public support	0.4 million
Total FCH JU Funding	**Total: 4.65 Million**

The final budgets awarded to actions implemented through procurement procedures may vary by up to 20% of the total value of the indicative budget for each action.

Whenever possible, these studies will be implemented via the framework contracts the FCH JU signed in February 2012 with three consultancies as a result of an open procedure launched in 2011[23]. For each study, a specific contract will be awarded after reopening competition between the three selected consultants.

If some of these studies require an expertise which is not covered by the framework contracts, the FCH JU shall launch the appropriate procurement procedure.

[23] The contract notice is available at http://ted.europa.eu/udl?uri=TED:NOTICE:321244-2011:TEXT:EN:HTML and the award notice at http://ted.europa.eu/udl?uri=TED:NOTICE:82469-2012:TEXT:EN:HTML

In order to launch each study, the FCH JU will work with coalitions of industrial stakeholders to identify more specifically the areas of interest for each study and to ensure they will support the study, notably by providing the necessary data. A small fraction of the budget foreseen for each study can be used to finance experts supporting the creation and management of a coalition of industrial stakeholders.

4. Horizontal and Support Activities

4.1 Policy and Communication

The priority objectives of policy and communication are to ensure political and public awareness of the Fuel cells and hydrogen Joint Undertaking, its technologies, projects and overall activities in order to:

A) Ensure the highest level of FCH JU membersô involvement and contribution into FCH JU policies and activities as well as ensure consistent messaging, efficient coordination and ñOne Voiceò approach between members

Internal communication objectives

These objectives are implemented notably through regular exchanges and meetings of the Joint Communication task force representing all FCH JU members, but also alignment of the FCH JU vision among stakeholders, especially the State Representatives Group whose role of interface towards Member states and national policies and programmes will become instrumental for that purpose.

B) Actively promote the benefits of FCH technologies and contributions of FCH JU activities, making them more visible and understandable to various audiences at European and national level in order to gain acceptance and support

External communication objectives

In line with the FCH JU communication strategy adopted end of 2011 and annual communication plans, main external communication activities cover:

- The implementation of an advocacy plan in coordination with FCH JU members towards policy makers, notably Members of Parliament and Council representatives, following the activities of 2012, as the legislative process related to the continuation of the FCH JU will take place in 2013, but also Members of Committee of regions and social and economic Committee on issues related to results/ recommendations of studies commissioned by FCH JU

  The focus will be on the discussions related to the adoption of the new Council regulation for the FCH JU and adoption of Horizon 2020, notably the budgetary parts. European policy orientations and regulatory proposals on infrastructure build up, energy storage will also be closely followed and fed.

  Messaging, contributions, proposals to legislative documents as well as contact programme are structured and developed in close and regular coordination between members.

  Results of activities developed in 2012 (bus study, study on employment and growth) will be shared and disseminated accordingly.

- Establish and implement a communication plan to increase awareness of FCH JU activities, projects and FCH technologies towards selected target audiences at EU, national and international level and in turn foster their acceptance. Activities will be developed in close coordination with members and projects teams as well as with other relevant platforms and organisations with a view to optimise synergies and share work.

In 2013 focus will be put more specifically on the following:

- Development of synergies with projects in order to optimise communication opportunities at national level or international level, either through joint participation to events or organisation of workshops involving several projects on specific topics; follow-up of the annual programme review exercise with a possible focus on dissemination of results for the finished projects (transfer of knowledge);
- National outreach, to be supported by multipliers, such as National contact points, Europe Direct Centres, Enterprise Europe Network etc. will be developed in key Member States (H2 mobility states and neighbours but also key Eastern European Countries) in addition to European Outreach towards policy makers. Activities in this regard will be linked to other communication activities wherever possible (e.g. organisation of SGA in a Member State, exhibition opportunity; workshop etcé Support and coordination with EHA and its national associations, as well as key associations or groups in individual countries are encouraged
- Participation in visibility events, such as exhibitions at EU, national or international level (EU Sustainable energy week, Hannover Messe, Open days, Motor shows etcé), will be pursued and developed in order to raise the profile of FCH JU and the technologies at national level and foster media interest. General public events will be considered in that respect, notably in close coordination with members or projects. Social media activities (twitter, Facebook, LinkedIn) will be launched.

Achievement is measured by performance against work plan, quantitative and qualitative feedback on activities.

4.2 Other support activities

<u>Finance and Administration</u>

Finance and Administration is a major component of Horizontal and support activities which main objective is to ensure the Programme Office can efficiently carry out its operational mandate.

The Finance and Administration Unit includes Finance and Budget, Human Resources, General Administration, Legal and IT. It also covers the internal control coordination which comprises notably monitoring the follow-up on action plans regarding implementation of internal control standards and on results of audits and coordinating the preparation of the Annual Activity Report.

Finance and Budget

The main objectives for Finance and Budget are to ensure a sound financial management of the Programme Office resources and compliance with the FCH Financial rules and procedures.

Main activities include the following:

- allocate budget resources in line with planned activities
- establish the necessary commitments to ensure the timely availability of resources for the smooth implementation of all operational and support activities
- execute the necessary payments for services and goods delivered
- provide financial and administrative advice on procurement and grant matters, as needed
- provide financial analysis and financial management support to the operational unit
- monitor budget execution and report to the Executive Director
- update budget forecast for the period up to 2017 and report to the Governing Board
- monitor changes in the Financial Regulations and related rules and implement where required
- develop or update procedures and streamline workflows as necessary in coordination with the Programme Unit
- implement the ex-post audit strategy in coordination with the JU's Internal Audit Capability (IAC)
- coordinate and support missions of the Court of Auditors

In 2013 special focus will be put on the following:

- improve procedures and tools for project financing management and reporting including process for review and approval of cost claims notably by ensuring implementation of IAC recommendations
- ensure implementation of audit findings and further implement the ex-post audit strategy by launching new audits including risk based audits where necessary

- further implement the communication campaign on how to avoid errors in FP7 cost reporting by organizing one or two dedicated sessions and/or presentations at project kick-off meetings
- prepare the revision of the FCH JU Financial rules as relevant in relation with the model Financial Regulation for EU Public Private Partnerships expected to be adopted in 2013

Achievement is measured through the following indicators:

- level of budget execution (at least 90%)
- 90% of payments made within deadlines. (30 days for contracts; 45 days for pre-financing on grants; 90 days for interim/final payments on grants)
- number of exceptions (deviations from rules and procedures) recorded
- number and importance of findings of the JUśs IAC, the Commissionśs Internal Audit Service (IAS) and opinion of the Court of Auditors
- feedback from staff

Human Resources and General Administration

The priority objectives for Human Resources are to ensure that the Establishment plan and Staff policy plan are implemented, to ensure an efficient management of staff resources and to ensure an optimal working environment.

Main activities include the following:

- contribute to the overall FCH JU strategy and planning processes
- develop/update HR policies and procedures (including implementation, monitoring and review)
- monitor adequacy of staff resources in relation to activities
- efficiently replace posts that become vacant as necessary
- identify training needs and promote professional development through training
- facilitate social contact between staff
- promote internal communication
- ensure delivery of logistical support (stationery, supply of goods and services for administration) including launching and implementation of procurement procedures related to general administration

In 2013 special focus will be put on the following:

- development and implement a training plan to ensure continuous development of staff competences and to enable performance at the highest quality standards
- follow up on the results of the 2012 staff opinion survey notably as regards internal communication
- prepare implementation of the revised staff regulations and ensure proper communication to the staff

- follow-up/contribute to the discussions on the future FCH JU notably in terms of staffing needs

Achievement is measured through the following indicators:

- vacancy rate (less than 5%)
- average number of training days per employee per year (10)
- number and importance of audit findings (Internal Audit Capability (IAC), Internal Audit Service (IAS), Court of Auditors)
- feedback from staff

Legal

The priority objectives of Legal affairs are to ensure the legality and regularity of grant agreements, contracts and other agreements (memorandum of understanding, service level agreement, amendment to agreements and contracts) and provide guidance and advice to ensure that the activities of the FCH JU can be organised successfully in compliance with applicable legislation and rules.

Beyond this function of legal advice and compliance, the role of the legal manager may involve the complete management of some activities (notably some procurement procedures). It also includes the Data Protection function and the ABAC Local Profile Management (LPM).

Main activities include the following:

- generate and check grant agreements
- review contracts prior to signature
- provide advice or input on legal issues, on interpretation of texts, on draft legislation or internal rules and procedures
- ensure the data protection and LPM function
- launch and implement procurement procedures in relation to operational activities as requested

In 2013 focus will be put more specifically on the following:

- procurement of commercialisation studies which involve a strong coordination with the contractors and the industrial coalitions supporting the studies
- legal input on the revision of the FCH JU financial rules notably as a consequence of the revision of the EU Framework Financial Regulation or establishment of the model Financial regulation for EU Public Private Partnerships
- legal input in the discussions on the future of the FCH JU and more broadly the Joint Technology Initiatives in the context of the new financial perspectives (2014-2020) and more particularly the Horizon 2020.

- further implement data protection requirements notably by follow-up of EDPS opinions on prior-check notifications

Achievement can be assessed based on the following elements:

- satisfaction of users (Executive Director, Colleagues, Governing board, partners in projects and studies)
- number, quality and complexity of procurement procedures launched and concluded and implemented.
- number of complaints, legal disputes
- number and importance of findings of the IAC, IAS and opinion of the Court of Auditors
- completeness of register of data protection notification; feedback from data subjects and from EDPS

IT

The priority objectives for IT are to ensure a stable and secure IT system, provide IT support to staff in the use of IT applications and equipment and to cooperate with the other JUs to ensure synergy and efficient use of resources.

Main activities include the following:

- follow-up and monitor implementation of the contract with IT supplier, notably service delivery plan; ensure maintenance and upgrades are done as necessary
- monitor stability of the IT system
- participate in coordination meetings with the Commission and other JUs and take action follow-up on the adjustments needed to allow and ensure smooth functioning of FP7 IT tools
- ensure adjustment of IT tools to the FCH needs (expansion, upgrade, etcé)

In 2013 special focus will be put on the following:

- ensure adequate access for the FCH staff to the complete set of IT applications related to the FP7 program and improve the system of access rights to these tools in accordance with the IAC recommendations
- further develop in-house tools for reporting, monitoring and decision-making (matching) with simple common applications like excel or access; acquire application for document management and customize some automated workflows. These will enable improved internal and external communication and will be integrated in the internal control system
- finalize the disaster recovery plan and test the business continuity plan

Achievement is measured by the following indicators:

- compliance by contractors/ service providers with the service level agreements
- user satisfaction on the tools (equipment and applications)

- number and importance of audit findings (Internal Audit Capacity, Internal Audit Service, Court of Auditors)

Internal control

The priority objective is to implement and maintain an effective internal control system so that reasonable assurance can be given that (1) resources assigned to the activities are used according to the principles of sound financial management and (2) the control procedures in place give the necessary guarantees concerning the legality and regularity of transactions.

Main activities include the following:

- ensure awareness and implementation of internal control processes and standards
- assess the effectiveness of the internal control system
- report on compliance and effectiveness in the mid-year management report and annual activity report
- carry out periodic review of risks at least yearly in the context of preparing the annual work programme (Annual Implementation Plan)
- ensure coordination of the drafting of the Annual Activity Report
- coordinate visits of the European Court of Auditors
- follow-up on implementation of action plans on audit recommendations

In 2013 focus will be put on the following:

- follow-up of the action plan for implementation of recommendations of IAC audit on ex-ante controls
- follow-up of action plans on effective implementation of internal control standards and on action plan for risk mitigation

Achievement is measured by the following indicators:

- degree of implementation of action plans (on audit recommendations, on effective implementation of ICS)
- number and importance of audit findings (Internal Audit Capability, Internal Audit Service, Court of Auditors)

Internal Audit Capability

The priority objectives of the FCH JU Internal Audit Manager (i.e. Internal Audit Capability) are to provide the Executive Director with assurance (i.e. independent assessment) and consulting (i.e. advisory and management requested) services as to the effectiveness and efficiency of the governance, risk management and control processes in the Joint Undertaking.

Main activities include the following:

- Establish a multiannual work plan (to be updated annually), including assurance and consulting services, in coordination with the Commission's Internal Audit Service (IAS)

- Implement the annual work plan
- Maintain a smooth, constructive and transparent liaison with the audit community (i.e. Auditnet, IAS and Court of Auditors)
- Upon the Executive Director's request, provide other ad-hoc consultancy or assurance services not foreseen in the annual work plan
- Ensure an advisory role in the Annual Activity Report (AAR) process, internal control and risk management
- Management of ex-post audits of beneficiaries through a Framework Contract with external audit firms.

Achievement is measured by the following indicators:

- Performance against annual work plan
- Participation to Auditnet meetings
- Coordination level with the IAS (joint risk assessment and coordinated multiannual and annual work plan)
- Feedback from audittee
- Compliance with JUô s deadlines established in the framework contract for ex-post audits.

Accounting

The accountant was appointed by the Governing Board on 29 January 2010 and is functionally independent in the performance of her duties.

In line with article 43 of the FCH JU Financial Regulation the accountant is responsible for:

a) proper implementation of payments, collection of revenue and recovery of amounts established as being receivable;

b) preparing and presenting the accounts in accordance with Title VIII (of FCH JU Fin.reg.)

c) keeping the accounts in accordance with Title VIII;

d) implementation in accordance with Title VIII, the accounting rules and methods and the chart of accounts in accordance with the provisions adopted by the Commission's accounting officer;

e) laying down and validating the accounting system and, where appropriate, validating systems laid down by the authorising officer to supply or justify accounting information; the accounting officer shall be empowered to verify the respect of validation criteria.

f) treasury management

Achievement is measured by the following indicators:

- Payments executed in time, cash available when needed

- Provisional accounts and Final annual accounts are ready for Governing Board approval and audit in time

5. Resources

The staff and financial resources of the FCH for the year 2013 are adopted by the Governing Board subject to adoption of the EU budget by the European Parliament and the Council in accordance with the budgetary procedure and are described in the following sections.

5.1 Staff establishment plan 2013

Temporary Agents

Grade	2013 Establishment Plan Budget / Authorised	
	Permanent posts	**Temporary posts**
AD 16		
AD 15		
AD 14		1
AD 13		
AD 12		
AD 11		3
AD 10		
AD 9		1
AD 8		4
AD 7		2
AD 6		
AD 5		
Total *AD*[24]	**0**	**11**
AST 11		
AST 10		
AST 9		
AST 8		1
AST 7		3
AST 6		
AST 5		
AST 4		1
AST 3		2
AST 2		
AST 1		
Total *AST*[25]	**0**	**7**

[24] AD stands for Administrator
[25] AST stands for Assistant

TOTAL	**0**	**18**

Staff resources also include 2 contract agents, 1 in Function Group (FG) III and 1 in FG IV.

5.2 FCH BUDGET 2013

5.2.1 Statement of Revenue

Title Chapter Article Item	**Heading**	**Budget 2013 CA (in ú)**	**Budget 2013 PA (in ú)**
2001	***European Commission subsidy for operational expenditure***	69,991,039	78,000,000
2002	***European Commission subsidy for administrative expenditure***	1,191,805	1,191,805
2003	***Industry Grouping contribution for administrative expenditure***	2,712,167	2,712,167
2004	***Research Grouping contribution for administrative expenditure***	452,028	452,028
2006	***JTI revenues***	295,000	295,000
	Title 2 ð TOTAL	74,642,039	82,651,000
3002	***C2 reactivation of appropriations (2010)***	4,418,654	
3003	***C2 reactivation of appropriations (2011)***	1,500,000	
	SUB TOTAL reactivation		
	GRAND TOTAL	**80,560,693**	**82,651,000**

5.2.2 Statement of expenditure

Title Chapter Article Item	Heading	Commitment Appropriations 2013 (ú)	Payment Appropriations 2013 (ú)
1	**STAFF EXPENDITURE**		
1 1	STAFF IN ACTIVE EMPLOYMENT	2,437,200	2,437,200
1 2	EXPENDITURE RELATED TO RECRUITMENT	15,000	15,000
1 3	MISSIONS AND TRAVEL	100,000	100,000
1 4	SOCIOMEDICAL INFRASTRUCTURE	43,000	43,000
1 7	ENTERTAINMENT AND REPRESENTATION EXPENSES	10,000	10,000
	Title 1 - TOTAL	2,605,200	2,605,200
2	**INFRASTRUCTURE**		
2 0	INVESTMENTS IN IMMOVABLE PROPERTY RENTAL OF BUILDINGS AND ASSOCIATED COST	332,300	332,300
2 1	INFORMATION TECHNOLOGY	132,000	132,000
2 2	MOVABLE PROPERTY AND ASSOCIATED COSTS	10,000	10,000
2 3	CURRENT ADMINISTRATIVE EXPENDITURE	41,000	41,000
2 4	POSTAGE AND TELECOMMUNICATIONS	14,500	14,500
2 5	EXPENDITURE ON FORMAL AND OTHER MEETINGS	56,000	56,000
2 6	RUNNING COSTS IN CONNECTION WITH OPERATIONAL ACTIVITIES OF FCH	650,000	650,000
2 7	STUDIES	5,000	5,000
2 8	EXPERT CONTRACTS AND MEETINGS	805,000	805,000
	Title 2 ð Total	2,045,800	2,045,800
3	**OPERATIONAL EXPENDITURE**		
3 0	IMPLEMENTING THE RESEARCH AGENDA OF FCH JU	75,909,693	78,000,000
	Title 3 - TOTAL	75,909,693	78,000,000
	GRAND TOTAL	80,560,693	82,651,000

6. Annexes

6.1 Abbreviations and Definitions

Term	Definition
AA	Application areas such as Transportation & Infrastructure, Hydrogen Production & Distribution etc.
AA1 / AA-T	Application Area Transportation & Refuelling Infrastructure
AA2 / AA-H	Application Area Hydrogen Production, Storage & Distribution
AA3 / AA-S	Application Area Stationary Power Generation & CHP
AA4 / AA-EM	Application Area Early Markets, short-term markets encompassing a group of applications for which products can be commercially deployed within the 2007-2013 timeframe
AC	Associated Country means a third country which is party to an international agreement with the Community, under the terms or on the basis of which it makes a financial contribution to all or part of the Seventh Framework Programme
AIP	Annual Implementation Plan
APU	Auxiliary Power Unit
AST	Accelerated Stress Test
BoL	Beginning-of-Life
BOP	Balance of Plant
BPP	Bipolar Plates
BTH	Biomass to Hydrogen
BUP	Back-Up Power
CAES	Compressed Air Energy Storage
CAPEX	Capital Expenditures
CCI	Cross Cutting Issues
CCS	Carbon Capture and Sequestration
CFD	Computational Fluid Dynamics
CHP	Combined Heat and Power
CP	Collaborative Project

CSA	Coordination and Support Action
EC	European Commission
Deployment	Development phase for a given technology and/or infrastructure from its market introduction to its widespread use
DME	Dimethyl Ether
DSM	Demand Side Management
ED	Executive Director
EFTA	European Free Trade Area
EMC	Electromagnetic Compatibility
EoL	End-of-Life
ETP	European Technology Platform
FCH	Fuel Cells & Hydrogen
FCH JU	The Fuel Cells and Hydrogen Joint Undertaking: the name refers to the legal entity established as the public & private partnership to implement the Joint Technology Initiative
FCEV	Fuel Cell Electric Vehicle
FP7	Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007-2013)
GB	Governing Board of the FCH JU
GDL	Gas Diffusion Layer
HFP	The European Hydrogen and Fuel Cell Technology Platform
HTE	High Temperature Electrolysis
IDA	Innovation and Development Actions: A programmatic cluster of the HFP Implementation Plan targeting a specific objective of the programme and encompassing a set of relevant technologies and market enablers along with the actions to achieve it
IP	Implementation Plan
ISO	International Organization for Standardization
JTI	Joint Technology Initiative - a policy initiative introduced in the FP7. The Term JTI may also be used to refer to the legally established structure implementing the initiative (cf. above FCH JU)
LCA	Life Cycle Assessment

LHV	Lower Heating Value
MAIP	Multi-Annual Implementation Plan
MCFC	Molten Carbonate Fuel Cells
MBTF	Mean Time Between Failures
MEA	Membrane- Electrode Assembly
MHE	Material Handling Equipment
Members	The term "members" refers to the founding members of the FCH JU (EC & NEW IG) and the RG
MPL	Microporous Layer
MS	The "Member States" shall be understood as the EU-27 Members States
NEDC	New European Driving Cycle
NEW-IG	New Energy World Industry Grouping - European Industry Grouping for a Fuel Cell and Hydrogen JTI also referred to as "Industry Grouping" or " IG"
O&M	Operation and Maintenance
OEM	Original Equipment Manufacturer
OPEX	Operational Expenditures
PEM / PEMFC	Proton Exchange Membrane Fuel Cell
PNR	Pre-normative research
PO	Programme Office (also referred to as JTI PO)
PoC	Proof of Concept
RCS	Regulations & Codes and Standards
RES	Renewable Energy Sources
RG	New European Research Grouping on Fuel Cells and Hydrogen AISBL, also referred to as " Research Grouping" or "N.ERGHY"
RH	Relative Humidity
RTD	Research, Technological Development & Demonstration
SAE	Society of Automotive Engineers
SME	Small and Medium Enterprise
SOFC	Solid Oxide Fuel Cell
SRG	FCH States Representatives Group: Advisory body of the FCH JU

	gathering Member States and Associated Countries' representatives
Stakeholders	The term "Stakeholders" embodies all public or private actors with interests in FCH activities both from the MS or third countries. It shall not be understood as ñpartners" or "members" of the FCH JU.
TCO	Total Cost of Ownership
TRL	Technology Readiness Level
UPS	Uninterruptible Power Supply
WtT	Well to Tank
WtW	Well to Wheel