Interim Evaluation of the Fuel Cells and Hydrogen 2 Joint Undertaking (2014-2016) operating under Horizon 2020

Experts Group Report

Ana Sofia Caires Sousa Branco
June - 2017

EUR 28613 EN

EUROPEAN COMMISSION

Directorate-General for Research and Innovation
Directorate G — Energy
Unit G.2 — Advanced Energy Production

Contact: Johan Blondelle

E-mail: RTD-FCH-EVALUATION-2016@*ec.europa.eu*
johan.blondelle@*ec.europa.eu*
RTD-PUBLICATIONS@ec.europa.eu

European Commission
B-1049 Brussels

EUROPEAN COMMISSION

Interim Evaluation of the Fuel Cells and Hydrogen 2 Joint Undertaking (2014-2016) operating under Horizon 2020

Expert Group Report

Prepared by:

Ana Sofia Caires Sousa Branco

John Loughhead

Annelie Carlson

Piotr Bujło

Renate Lemke

Directorate-General for Research and Innovation
Energy

2017

EUR 28613 EN

EUROPE DIRECT is a service to help you find answers to your questions about the European Union

Freephone number (*):
00 800 6 7 8 9 10 11

(*) The information given is free, as are most calls (though some operators, phone boxes or hotels may charge you)

LEGAL NOTICE

Luxembourg: Publications Office of the European Union, 2017.

PDF ISBN 978-92-79-68891-1 ISSN 1831-9424 doi:10.2777/990432 KI-NA-28-613-EN-N

Table of Contents

1 EXECUTIVE SUMMARY 5

2 INTRODUCTION 11

2.1 Purpose of the evaluation 11
2.2 Scope of the evaluation 11

3 BACKGROUND TO THE INITIATIVE 12

3.1 Description of the initiative and its objectives 12
3.2 Baseline 12

4 EVALUATION QUESTIONS 16

5 METHOD/PROCESS FOLLOWED 17

5.1 Process/Methodology 17
5.2 Limitations – robustness of findings 18

6 IMPLEMENTATION STATUS OF PLAY (RESULTS) 19

6.1 Main changes between FP7 and Horizon 2020 19
6.2 The Governance of the FCH 2 JU 21
6.3 Mission of the FCH 2 JU 29
6.4 Does the JU operate in accordance with its legal framework? 30
6.5 Monitoring and control 33
6.6 Communication and dissemination strategies 37
6.7 Satisfaction of beneficiaries 39

7 ANSWERS TO THE EVALUATION QUESTIONS 41

7.1 Effectiveness 41
7.2 Efficiency 57
7.3 Relevance 74
7.4 Coherence 76
7.5 EU Added Value 82

8 CONCLUSIONS 84

8.1 Continued Relevance 84
8.2 Implementation 84
8.3 Added value and Necessary Leverage 85
8.4 Coherence with EU policies 86
8.5 The future after FCH 2 JU 86

9 RECOMMENDATIONS 88

10 ANNEXES 93

10.1 Annex 1: Members of the Independent Experts Group 93
10.2 Annex 2: Detailed Analysis of the Intervention Logic 95
10.3 Annex 3: Detailed Analysis of the FCH 2 JU calls 96
10.4 Annex 4: Detailed Analysis of the Coordinators' Survey 99
10.5 Annex 5: Comments from the Coordinator's Survey 106
10.6 Annex 6 Detailed analysis of the Public Consultation 2017 109
10.7 Annex 7: Project portfolio of the FCH 2 JU 115
10.8 Annex 8: List of Stakeholders Interviewed 120
10.9 Annex 9: Documents received and studied 122

ACRONYMS AND ABBREVIATIONS

AAR	Annual Activity Report
AC	Associated Country
AISBL	Association internationale sans but lucratif
AIP	Annual Implementation Plan
APU	Auxiliary Power Unit
AWP	Annual Work Plan
BEV	Battery Electric Vehicles
CAPEX	Capital Expenditure
CCGT	Combined Cycle Gas Turbines
CEF	Connecting Europe Facilities
CF	Cohesion Fund
CHP	Combined Heat and Power
CORDA	Copernicus Reference Data Access
CORDIS	Community Research and Development Information Service
COSO	Committee of Sponsoring Organizations of the Treadway Commission
CSC	Common Support Centre
DG ENER	Directorate-General for Energy
DG MOVE	Directorate-General for Mobility and Transport
DG RTD	Directorate-General for Research and Innovation
DoE	(US) Department of Energy
EC	European Commission
ECA	European Court of Auditors
EEO	European Electro-mobility Observatory
EIB	European Investment Bank
EII	European Industrial Initiative
EIT	European Institute of Innovation and Technology
ELENA	European Local Energy Assistance - a project of the EIB
ERA	European Research Area
ERA-NET	A Networking initiative within the ERA
ERDF	European Regional Development Fund
ERTRAC	European Road Transport Research Advisory Council
ESF	European Social Fund
ESIF	European Structural and Investment Funds
EU	European Union
EURICS	Energy Union Integrated Research, Innovation and Competitiveness Strategy
FCEV	Fuel Cell Electric Vehicles
FCH	Fuel Cells and Hydrogen
FCH JU	Fuel Cells and Hydrogen Joint Undertaking under the 7th Framework Programme
FCH 2 JU	Fuel Cells and Hydrogen 2 Joint Undertaking operating under Horizon 2020
FP7	7th Framework Programme
GB	Governing Board
H2020	Horizon 2020
HRS	Hydrogen Refuelling Station
HyER	Hydrogen Fuel Cells and Electromobility for European Regions
IAS	Internal Audit Service
ICS	Internal Control Standards
IEG	Independent Expert Group
IG	Industry Grouping
IKAA	In-Kind from Additional Activities
IKOP	In-Kind from Projects
IMI	Innovative Medicines Initiative
INEA	Innovation and Networks Executive Agency
IPR	Intellectual Property Rights

JRC	Joint Research Centre
JTI	Joint Technology Initiative
JU	Joint Undertaking
KET	Key Enabling Technology
KIC	Knowledge and Innovation Community
KPI	Key Performance Indicator
LCA	Life Cycle Assessment
LEIT	Leadership in Enabling and Industrial Technologies
LHV	Lower Heating Value
MAIP	Multi-Annual Implementation Plan (2008-2013)
MAWP	Multi-Annual Work Plan (2014-2020)
mCHP	Micro Combined Heat and Power
MHV	Material Handling Vehicle
MoU	Memorandum of Understanding
MS	Member State
N.ERGHY	New European Research Grouping on Fuel Cells and Hydrogen
NEW-IG	European Industry Grouping for the FCH Joint Technology Initiative
NGO	Non-Governmental Organisation
NMP	Nanosciences, Nanotechnologies, Materials and New Production Technologies
OPEX	Operational Expenditure
PEFC	Polymer Electrolyte Fuel Cell
PEM	Polymer Electrolyte Membrane or Proton Exchange Membrane
PEMFC	Polymer Electrolyte Membrane or Proton Exchange Membrane Fuel Cell
PNR	Pre-Normative Research
PO	FCH JU Programme Office
PPP	Public-Private Partnership
PRC	Private for Profit Organisation, excluding education
PRD	Programme Review Days
R&D	Research and Development
R&I	Research and Innovation
RCS	Regulations, Codes and Standards
RG	Research Grouping
RSFF	Risk-Sharing Financial Facility
RTD	Research, Technology and Demonstration
SC	Scientific Committee
SET	Strategic Energy Technology
SETIS	Strategic Energy Technologies Information System
SF	Stakeholder Forum
SGA	Stakeholders' General Assembly
SME	Small and Medium Enterprise
SOFC	Solid Oxide Fuel Cell
SRA	Strategic Research Agenda
SRG	State Representatives Group
STRIA	Strategic Transport Research and Innovation Agenda
TEMONAS	TEchnology MONitoring and ASsessment - a project of the FCH-JU
TEN-T (EA)	Trans-European Transport Networks (Executive Agency)
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference
TRL	Technology Readiness Level
TRIMIS	Transport Research and Innovation Monitoring System
TTG	Time to Grant
TTP	Time to Pay
US DoE	US Department of Energy

1 EXECUTIVE SUMMARY

The FCH 2 JU continues to demonstrate the strengths commended in the Second Interim Evaluation of the Fuel Cell & Hydrogen Joint Undertaking; it has further reinforced a Community of industry and research bodies around a common long-term research agenda.

The JU remains relevant. In a carbon-limited world, hydrogen could be an important energy vector. Stationary and mobile fuel cell applications also have the potential to significantly improve energy efficiency and reduce air pollution. The Independent Expert Group (IEG) is of the opinion that the JU is supporting work across the right spectrum of technologies to ensure they may be effectively deployed in Europe in the light of the specific circumstances of various regions. While the FCH 2 JU is performing well, there are nevertheless some aspects that need more attention as detailed in the recommendations.

The FCH sector is still in a pre-deployment stage, implying that the first-mover risk is still very present for the industrial partners. The choice of a Joint Undertaking as instrument continues to ensure good alignment with both policy and industrial objectives. The IEG is of the view that Europe's competitive position would be less favourable without the activities of the FCH 2 JU.

The Council Regulation of the 6th May 2014 establishing the Fuel Cells and Hydrogen 2 Joint Undertaking[1] specifies that the Commission shall, with the assistance of independent experts, carry out an interim evaluation of the FCH 2 JU. This report fulfils that requirement.

- **Overall Progress towards the Objectives**

The principle objectives of the FCH 2 JU as specified in the founding regulation are: to contribute to the implementation of Horizon 2020 and to contribute to the objectives of the Joint Technology Initiative on Fuel Cells and Hydrogen, through the development of a strong, sustainable and globally competitive fuel cells and hydrogen sector in the Union.

Specific objectives are:

1. To lower the cost of fuel cell systems for transport, while increasing their lifetime;
2. To lower costs and improve performance fuel cells for power production;
3. To lower costs and improve performance of water electrolysis;
4. To demonstrate on a large-scale the feasibility of using hydrogen to support integration of renewable energy sources into the energy systems;
5. To reduce the use of the EU defined 'Critical raw materials'.

There is a significant progress against these objectives beyond the achievements of the FCH JU, through its implementation of the JTI, to the challenges faced by Europe particularly in energy and transport policies. Its activities are highly relevant for these aims, but a key question remains of whether the scale of activities is competitive with other leading international programmes, for example that of Japan which enjoys high level political commitment to FCH technologies as future energy and transport system elements.

The FCH 2 JU is very well aligned with the high-level EU policy objective of smart, sustainable and inclusive growth as embodied in the Europe 2020 strategy for

[1] Council Regulation (EU) No 559/2014 of 6 May 2014 establishing the Fuel cells and Hydrogen 2 Joint Undertaking. J.O. L 169/108 7.6.2014.

growth[2]. Its activities clearly support EU climate and energy policies as outlined in the Roadmap for moving to a competitive low carbon economy in 2050[3] at the same time contributing to environmental and industrial competitiveness goals.

Continuing the trend established during FCH JU, FCH 2 JU MAWP provides an effective structure within which academic and industrial research and innovation decisions are being made.

Analysis of the objectives of the MAWP and the list of projects acquired between 2014-2016 shows that the emerging portfolio is well-aligned with the objectives, except that work on the reduction of Critical Raw Materials has not received sufficient response in the Calls. This is a long-term issue of strategic importance and should be further and more intensively pursued.

It is hard to form a definitive view on the relative global positioning of Europe across the technological spectrum, and to what extent the JU has contributed to developments, as there are so many complicating factors. It is noted that the lack of a deployment support framework and the size of R&D budget available are likely to limit the EU's ability to achieve its objectives of a globally competitive and sustainable sector.

Several major EU companies have maintained FCH innovation programmes since the establishment of FCH JU, and made long-term commitments to maintain their efforts. One example is the FC bus programme, which has resulted in plans for a progressive development of improved vehicles by manufacturers and their revenue-generating demonstration service by operators as part of a longer-term deployment plan. As a result Europe is a world-leader for fuel cell buses; it has the largest deployment globally and has developed a strong and constructive relationship with regions and municipalities to make further progress. However, the bus market alone is insufficient to create and sustain a truly commercial exploitation of FCH technologies. In specific technological areas (for example, in fuel stack development), there is still a need for sustained support to reach the objectives.

- **Main Achievements of the FCH 2 JU**

FCH 2 JU first call was launched in 2014, the successful projects starting in 2015. The current review was undertaken between November 2016 and June 2017 at a point when FCH 2 JU projects had not, as one would expect, produced significant results. Nevertheless, the achievements of the FCH 2 JU as an instrument are not limited to completed projects and some initial outcomes can already be observed.

The main achievements since the end of FCH JU therefore can be identified as:

1. A robust portfolio of projects coherent with the specific objectives assigned in the regulation.
2. Improvements in operations and user satisfaction compared to FCH JU.
3. Implementation of procedures and methods for measuring In-Kind Additional Activities.
4. High levels of leverage as measured by IKAA.
5. Maintaining a high level of participation from SMEs, exceeding the target for H2020.
6. Initiation of stronger competences in communication and financial engineering.
7. Strengthening of relations with the regions.
8. Implementation of a technology assessment and monitoring scheme.

[2] Communication From The Commission Europe 2020 A strategy for smart, sustainable and inclusive growth COM(2010) 2020, Brussels, 3.3.2010

[3] COM (2011) 112

The JU has successfully adopted the procedures and tools of H2020. The establishment of Hydrogen Europe as a new body with dedicated staff to represent the industry has widened participation in, and clarified the goals and functions of, the grouping, underlining the industry commitment. The generation of the Annual Work Plans has been formalised and the roles of the constituent bodies of the JU have been better clarified.

The IEG judges coherence in the strategies and implementation plans for both transport and energy to be highly important. FCH 2 JU reflects this need for convergence in that both the transport and energy pillars are represented in the same Joint Undertaking. However, it is not clear if DG MOVE and DG ENER yet have a common vision for the future development of more interdependent energy and transport sectors and the role that hydrogen and fuel cells can play in that.

Implementation of the PPP has been successful in most relevant aspects. Roles and responsibilities of the FCH 2 JU bodies are clearly defined in the founding regulation and in the MAWP. The IEG recognises that the JU has successfully created an active FCH developer community and is currently extending this to include municipalities and regions through a Memorandum of Understanding.

However, issues have been highlighted in relation to the active participation of the advisory bodies (Scientific Committee, States Representative Group and Stakeholder Forum). The IEG has made some recommendations to improve participation in and by them, and make better use of their potential.

Financial management is robust; the execution of the budget has improved over the period of time and is now very good. The views of the public and beneficiaries sought in the consultations are strongly positive.

There is a strong geographical concentration of activities. The majority of funding is directed to just four countries, and a high proportion of the funding is received by industry, although that can be argued to be compatible with an industry led initiative. It is noteworthy that the participation by SMEs in JU projects continues to exceed the level specified for Horizon 2020.

FCH 2 JU has an explicit EU added value and amongst the FCH innovation community, there continue to be strong benefits received from the work of FCH 2 JU. But in terms of overcoming fragmentation within Europe, the challenges of delivering improved coordination between Member States' FCH research and innovation support remain. There is little sign that the SRG has yet been effective in addressing this, and hence this continues to be a priority for improvement for the remaining life-time of FCH 2 JU.

The original obligation of industry to make matching expenditures on projects introduced for the FCH JU was found to be impractical in view of the H2020 procedures, and has been replaced for the FCH 2 JU by a different approach that requires the JU to measure In-Kind Additional Activities (IKAA). This has necessitated new procedures covering the planning and reporting of IKAA by members and the verification of claims internally by the PO, the EC and by external consultants. The procedures have been successfully introduced and the reported levels of IKAA have been significantly larger than expected.

The build-up of technology assessment and monitoring capacity was first recommended in the First Interim Evaluation of the Fuel Cell & Hydrogen Joint Undertaking and has been a long time in coming. The JU has abandoned the excessively complex tool delivered by a project of the FCH JU and successfully devised and implemented a simpler and more effective procedure. Limitations concerning the confidentiality of data are slowly being overcome.

The JU has acquired new members of staff to manage the communication strategy and for strategy and financial engineering. These functions still need to be further improved, but the direction of travel is good. To support the market deployment of FCH technologies it is crucial to boost its visibility amongst the EU public and to gain broad political support so communication measures to both audiences are highly relevant. The IEG notes that the role of EU funding is often not visible in communications from projects, nor is the EU logo present on material published by the JU.

During the FCH JU Stakeholder Forum on the 23rd November 2016, representatives of European cities and regions signed a Memorandum of Understanding to improve local support for FCH and to raise awareness, foster public-private partnerships and stimulate demand for FCH technologies across Europe. By the end of 2016, 60 European cities and regions have committed to participating in this initiative. This is an admirable initiative of the JU.

- **Main Recommendations of the FCH 2 JU**

A number of recommendations are made to improve the operation and effectiveness of the FCH 2 JU which are summarised below. More details are included in Section 9 "Recommendations".

- *The relationship with Member States should be improved: strategic exchanges and synergies need to be established, leading to an optimal use of the available funding.*

The SRG should collaborate more strongly with the PO to ensure a better alignment between research and innovation priorities and activities at national and EU level, identifying the gaps in further technology development needs. The IEG recommends Member States should appoint to the SRG a representative who has a clear link with their National FCH Programme and with the political decision-making mechanism. The SRG should become a stronger partner in a constructive dialogue on how to exploit synergies between EU-level and national FCH activities and on how these could be optimally aligned. The national representative should be able to transmit FCH JU priorities to national stakeholders and regularly inform the GB and PO of national and regional needs, together with initiatives and available funding mechanisms relevant for FCH JU sector.

- *The role of the remaining FCH 2 JU advisory bodies needs to be re-assessed and potentially updated.*

The Scientific Committee should be revitalised and made more strategic. IEG recommends including experts from outside EU (ensuring non-disclosure agreements), and remunerating if necessary. The SC should be consulted yearly on the first outline of the AWP.

The role and activity of the Stakeholder Forum could be enhanced to improve openness and transparency to the stakeholder communities. The IEG recommends improving means to gather the opinion of other relevant stakeholders (cities, NGOs, consumers …) in FCH deployment.

- *Better alignment is needed between the FCH JU and other Commission programmes.*

FCH JU is generally coherent with the H2020 programme but, despite the Commission's efforts, some gaps exist in the coverage of FCH-related activities across different programmes such as, for example, low TRL research or integration into the broader energy system. Another important example is the discontinuity across the

energy-transport boundary, where the potential of the FCH technologies for creating stronger links between these sectors has not yet been fully recognised.

To this end, the IEG recommends that outputs of the FCH 2 JU should be more fully taken into account in the formulation of related EU policies (e.g. SET, STRIA, …). The IEG recommends that PO could participate in these groups. Moreover, FCH 2 JU research and innovation priorities should be fully considered when discussing the potential of sector coupling between Energy and Transport.

- *Areas where FCH 2 JU Implementation could still be improved.*

FCH 2 JU implementation has been assessed overall as very good but some areas have the potential to be improved. As an example, it is desirable the JU identifies the main technological areas with a higher value or potential (e.g. revise its strategy concerning fuel cell stack development) to pave the way for the deployment of FCH technologies.

As already highlighted in the Second Interim Evaluation of the Fuel Cell & Hydrogen Joint Undertaking, basic research should not be neglected and is needed for further reduction of costs and the development of new breakthrough technologies that could enhance the EU's competitiveness in the global market. Considering the level of support for low level TRL research at national level however, the IEG recommends JU should communicate with SRG to identify any gaps in low level TRL that it might best to address.

- *Communication strategy should be reinforced trough several paths.*

More effective communication is required to ensure that policy makers at national and EU level are aware of the current status and future prospects of FCH technologies.

There is need for a stronger communication and cooperation with those regulators (e.g. health and safety, standards…) additional to the ones in the Governing Board that could foster FCH deployment. The JU should consider how it might deepen its relationships with appropriate institutions.

IEG recommends the PO should undertake additional communication targeting public awareness of the societal benefits of FCH. Moreover, the PO should monitor and ensure compliance with the EC Acknowledgment rules by itself and its grant holders. In the case of FCH 2 JU projects, PO should verify the execution of Grant Agreement conditions related to EC acknowledgment.

- **The future after FCH 2 JU**

The IEG is of the opinion that there is a continued need for support in the field of fuel cells and hydrogen beyond the FCH 2 JU.

The PPP approach remains a viable option, and it is desirable that the community created through the FCH 2 JU be maintained. However, the PPP scheme should be revised if new support to deployment is given, in view of the specific financial and regulatory needs this step will require.

The absence of any deployment support framework for FCH technologies, of the nature provided for other new energy technologies such as renewables, is a limiting factor for the FCH 2 JU to achieve its targets. Without this, there is no incentive for exploitation of FCH technologies still at an early stage of commercial development, and this economic disadvantage will be a material barrier to market development.

The importance of deployment support is illustrated by the fact that Germany alone supports renewable technologies deployment at a level of several billion euros[4] per year, which is of the scale required for FCH. Without the intent to provide a comparable deployment support framework for FCH the rationale for continuing to support FCH technologies development is unclear.

[4] Bundesministerium für Wirtschaft and Energy, German Federal Ministry for Economy and Energy: EEG in Zahlen. Vergütungen, Differenzkosten und EEG-Umlage 2000 bis 2017. Stand: 14.10.2016. Available at:http://erneuerbare-energien.de/EE/Redaktion/DE/Downloads/eeg-in-zahlenpdf.pdf?__blob=publicationFile .

2 INTRODUCTION

2.1 Purpose of the evaluation

The regulation establishing Horizon 2020 provides for detailed scrutiny and evaluation of the programme[5]. It requires the Commission to perform an interim evaluation of Horizon 2020 and its various component institutions and activities by December 2017. As part of the interim evaluation both existing and new public-private partnerships, including the JTIs, are to be assessed in depth; the assessment is to include an analysis of their openness, transparency and effectiveness. The final evaluation of the FCH JU and the interim evaluation of the FCH 2 JU will both feed into the interim assessment of the Horizon 2020 and are expected to help strengthen the design and operation of the present and potential future public-private partnerships to implement the JTI concept.

This report complies with the obligation to perform a first interim evaluation of the FCH 2 JU. It has been prepared by an Independent Expert Group (IEG) convened for the purpose by the Commission in parallel with the final evaluation of the FCH JU that is available in a sister report[6]. The overall objective is to assess the progress and mid-term achievements of the FCH 2 JU in its activities during the period 2014-2016.

2.2 Scope of the evaluation

As stipulated in Article 32(3) of Regulation establishing Horizon 2020, the interim evaluation of the FCH 2 JU should focus on the following main aspects:

- Openness: The extent to which the JU has enabled world-class research that helps Europe drive in to a leadership position globally, and how they engage with a wider constituency to open the research to the broader society.
- Transparency: The extent to which the JU keeps an open non-discriminatory attitude towards a wide community of stakeholders and provide them with easy and effective access to information.
- Effectiveness: The progress towards achieving the objectives set, including how all parties in the public-private partnerships live up to their financial and managerial responsibilities.
- Efficiency: The relationship between the resources used by an intervention and the changes generated by the intervention.

[5]Regulation (EU) No 1291/2013 Of The European Parliament And Of The Council of 11 December 2013 establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) and repealing Decision No 1982/2006/EC, O.J. 347/104 20.12.2013.

[6] Final Evaluation of the Fuel Cells and Hydrogen Joint Undertaking (2008-2014) operating under FP7 Experts Group Report

3 BACKGROUND TO THE INITIATIVE

3.1 Description of the initiative and its objectives

3.2 Baseline

The European Union has had an interest in hydrogen technologies since the earliest days of the research programme, although the emphasis and logic have changed along the years. The initial logic was linked to the great expectations of nuclear energy, centred around Euratom. The early developments of fuel cells in the 1950s opened the door to use hydrogen as a fuel for transport through an electric drive. The emphasis of research then gradually shifted to the fuel cell. Subsequently the move towards large-scale use of renewable energy sources has widened the vision to embrace the concept of a renewable-based hydrogen economy in which renewable energy, through the medium of hydrogen, can also be stored for extended periods, plus supply heat and mobility.

The institutional basis for hydrogen research in the EU has been conditioned by this shifting rationale. The first systematic effort to move the concept from the research laboratory towards the creation of a hydrogen-oriented economy was made in 2002 when the Commission convened a High-Level Group for Hydrogen and Fuel Cells with the mission to formulate a collective vision of the contribution that hydrogen and fuel cells could make to the realisation of a future sustainable energy system. The Group proposed an ambitious programme encompassing research and development, demonstration, and market entry, to be monitored by a Hydrogen and Fuel Cell Technology Partnership. Much of this thinking endures. Following the recommendations of the High-Level Group, the European Hydrogen and Fuel Cell Technology Platform was launched in January 2004 under the 6th Framework Programme.

The Decision of the European Parliament and of the Council of 18 December 2006 adopting the Seventh Framework Programme introduced the possibility of a Community contribution for the establishment of long term public-private partnerships in the form of Joint Technology Initiatives including a JTI for Hydrogen and Fuel Cells. In October 2007, the Commission submitted to the Council a proposal for a Council Regulation to establish the Fuel Cells and Hydrogen Joint Undertaking[7]. This was accompanied by a Staff Working Document containing an Impact Assessment of the intervention[8]. Following this proposal, the Fuel Cells and Hydrogen Joint Undertaking was established by a Council Regulation for a period to 31st December 2017[9]. It was endowed with a budget of €470 million from the EU and the expectation of a matching commitment from industry. The EU contribution was sourced from the FP7 Cooperation Programme allocations of DGs RTD, ENER and MOVE.

The founding members of the FCH JU were the European Community, represented by the European Commission (EC), and the European Industry Grouping for a Fuel Cell and Hydrogen Joint Technology Initiative (NEW-IG) formed as a non-profit organisation under Belgian law representing industries in the field of fuel cells and hydrogen. The New European Research Grouping (N.ERGHY), representing the research community, became the third member of the JU by a decision of the FCH JU Governing Board on the 14th July 2008.

The ex-ante Policy Impact Assessment of a possible successor to the original FCH JU analysed four possible future options: a continuation of the JU in the same form under

[7] Proposal for a Council Regulation setting up the Fuel Cells and Hydrogen Joint Undertaking, Brussels, COM(2007) 571, 9.10.2007

[8] Accompanying document to the Proposal for a Council Regulation setting up the Fuel Cells and Hydrogen Joint Undertaking, Impact Assessment, SEC(2007) 1272, Brussels, 9.10.2007

[9] Council Regulation (EC) No 521/2008 of 30 May 2008 setting up the Fuel Cells and Hydrogen Joint Undertaking, O.J., L 153/1, 12.6.2008

Horizon 2020; a return to collaborative research projects under the Framework Programme; implementation within Horizon 2020 of work in fuel cell and hydrogen technologies through a contractual Public-Private Partnership; modernisation of the Joint Undertaking through an improved regulatory framework adapted to Horizon 2020. The Impact Assessment concluded that a modernised JU was the preferred option, offering the most efficient opportunity to address the underlying problem drivers and to reach the stated objectives[10]. This assessment was supported by the results from a stakeholder consultation and a public consultation. Based on the findings of the Impact Assessment and the recommendation of the second interim evaluation, the Commission proposed a Regulation to the Council to prolong the FCH JU[11]; the prolongation was agreed by the Council on the 6th May 2014.

3.2.1 Intervention Logic

The main tasks and activities of the JU were specified in the Statutes of the Undertaking appended to the founding regulation. Most tasks are similar to those attributed to the FCH JU. The list was slightly simplified and, recognising that the JU had been established and its operating practices defined, the tasks to establish the JTI and to implement the MAIP were removed.

There is an extensive analysis in the ex-ante impact appraisal of the expected impacts from the intervention[12]. The following discussion and the summary subsume only the most important. The impact assessment found that a reformed JU with increased support to demonstration activities, hydrogen (production, storage and distribution) and market introduction was best placed among available policy options to trigger the required additional funding for full deployment of FCH technologies; it cited the FCH Technology Roadmap, which had estimated that more than €11 billion would be needed for full deployment.

The analysis also expects significant beneficial impact on innovation, especially through access to venture capital through the Risk-Sharing Finance Facility (RSFF) and CIP financial instruments developed under FP7. The impact assessment also envisaged an improved coherence with the programmes of Member States and regions including jointly funded actions, through smart specialisation in regions and the use of Structural Funds; it estimated the contributions from FCH to the resolution of the societal challenges; among the benefits it noted large benefits for health from better air quality. The project on 25 European cities had calculated that the economic cost of local pollution was €31.5 billion[13]; the impacts and costs being proportionally greater when extrapolated to the whole of Europe. These impacts would be much reduced by FCEVs. The assessment noted also the impacts on climate change: the contemporary Roadmap for moving to a competitive low carbon economy in 2050 produced by the Commission estimated that a reduction of emissions from transport of between 54% and 67% compared to 1990 would be needed to achieve the EU target of an 80-95% reduction by of greenhouse gas emissions in 2050 compared to 1990[14]. Decarbonisation of electricity production is the centre-piece of the strategy; the virtual decarbonisation of electricity by 2050 has the consequence that the impact of vehicles using electric drives on greenhouse gas emissions can exceed the 2050 targets. The

[10] Commission Staff Working Document. Executive Summary of the Impact Assessment accompanying the document Proposal for a COUNCIL REGULATION on the Fuel cells and Hydrogen 2 Joint Undertaking, COM(2013) 506. Brussels, 10.7.2013.

[11] Proposal for a COUNCIL REGULATION on the Fuel cells and Hydrogen 2 Joint Undertaking, COM(2013) 506 Brussels, 10.7.2013.

[12] Commission Staff Working Document accompanying the Proposal for a Council Regulation defining the objectives, legal status, operational rules and statutes of the Fuel cells and Hydrogen Joint Undertaking for the period 2014-2024.

[13] http://ec.europa.eu/chafea/health/highlights17.html.

[14] Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions. A Roadmap for moving to a competitive low carbon economy in 2050, COM (2011)112, Brussels 8.3.2011.

Annex to the road-map notes also the expected contribution to climate change through facilitation of decarbonisation of the electricity supply.

The preamble to the regulation establishing the JU revisits the argument that it will contribute to sustainable growth, noting the relevance to the Europe 2020 Strategy[15], and to the implementation of Horizon 2020 and in particular to the Secure, Clean and Efficient Energy Challenge and the Smart, Green and Integrated Transport Challenge. These are the principal policies to which the JU contributes. The relationship is described in more detail in the impact assessment which cites:

- The Climate and Energy Package, adopted in 2009 establishing energy objectives for 2020 with binding commitments from the Member States: to reduce greenhouse gas emissions.
- The Energy Roadmap 2050 adopted by the Commission on the 15th December 2011 that explores the routes towards a secure, competitive and decarbonised energy system by 2050 including the switching to renewable energy sources, managing electricity in new ways and shifting towards alternative fuels, including hydrogen.
- The Communication Clean Power for Transport: A European alternative fuels strategy adopted in 2013. Hydrogen is one of the alternative fuels considered[16].

Since the foundation of the FCH 2 JU there have been several new policy initiatives from within and outside the EU that are coherent with the tasks assigned to the JU. The most important are the Juncker Political Guidelines, the Energy Union Package, the Paris accord on climate change and the Winter package on energy policy. The Political guidelines of President Juncker were first published on the 15th July 2014; of the ten policy areas identified as priorities, one was the search for "A Resilient Energy Union with a Forward-Looking Climate Change Policy", including the ambition to become the world number one in renewable energies[17]. The Commission responded to the political guidelines with a proposal for an Energy Union that would support a sustainable, low-carbon and climate-friendly economy[18]; it followed this on 30 November 2016 with the "Winter Package" of eight proposals to facilitate this transition and to reform the design and operation of the European Union's electricity market [19].

[15] European Commission, Europe 2020 — A strategy for smart, sustainable and inclusive growth, COM(2010) 2020 final, Brussels, 2010.
[16] Clean Power for Transport: A European alternative fuels strategy SWD(2013) 4. Brussels 24.1.2013.
[17] A New Start for Europe: My Agenda for Jobs, Growth, Fairness and Democratic Change. Political Guidelines for the next European Commission, Opening Statement in the European Parliament Plenary Session 15 July 2014.
[18] Communication from the Commission, Energy Union Package: A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy, COM(2015), Brussels, 25.2.2015.
[19] Commission proposes new rules for consumer centred clean energy transition, http://ec.europa.eu/energy/en/news/commission-proposes-new-rules-consumer-centred-clean-energy-transition.

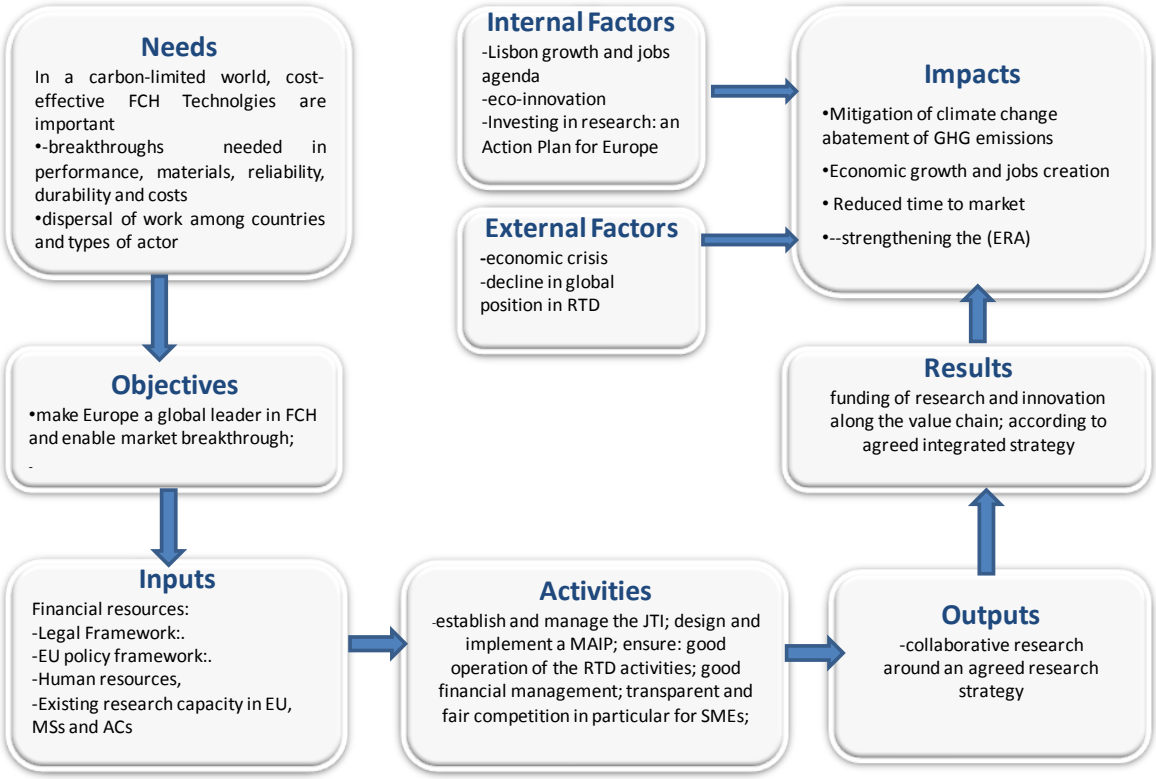


Figure 1. Intervention Logic

A more detailed analysis of the Intervention Logic can be found in Annex 2: Detailed Analysis of the Intervention Logic.

4 EVALUATION QUESTIONS

The Terms of Reference for the IEG define five aspects of the design and practice of the FCH JU that the evaluation should address. These are summarised below:

1 The intervention logic for the FCH 2 JU, including: the strategic context, the problem definition, the objectives of the intervention and the rationale for the selected implementation modalities.
2 The effectiveness of the FCH 2 JU, including: the practical aspects of implementation; the main achievements of the intervention and the extent to which the objectives have been reached.
3 The efficiency of the FCH 2 JU, including: the legal structure and governance; sources of financing; procedures for defining work; the suitability of the chosen modalities of operation; and the efficiency of conducting operations
4 The European added-value, including: the benefits from a coordinated EU intervention; the leverage of resources from industry, municipalities and other actors; contributions to redressing the fragmentation of research in Europe; contributions to definition and implementation of EU policies.
5 The coherence in the internal affairs of the JU and with other policies and interventions of the EU, including the extent to which work was coherent with and contributed to related interventions of the EU; the relation with other Union funding programmes; synergies with similar international, national and intergovernmental programmes.

On the basis of the findings from the evaluation the IEG was requested to draw conclusions and to make recommendations.

5 METHOD/PROCESS FOLLOWED

5.1 Process/Methodology

The report was produced by an independent Expert Group supervised and supported by the Commission Unit G2 of the Commission's Directorate General for Research & Innovation with the support of an Inter-Service Group . The members of the IEG are listed in Annex 1.

The evaluation was based on a wide range of sources. The IEG undertook a detailed review of pertinent literature including: impact assessments on the establishment of the JUs under FP7 and H2020; Council regulations establishing the JUs; Council regulations establishing FP7 / Horizon 2020; 1st and 2nd Interim Evaluations of JUs under FP7; the CORDA database; Annual Activity Reports of the JU; Court of Auditors (CoA) and European Parliament recommendations; the FP7 ex-post evaluation; the Better Regulation Package; sectorial policy documents; surveys of and interviews with stakeholders; a public consultation and a questionnaire aimed at project beneficiaries; programming documents of the JU; studies commissioned by the JU; details of Calls; project outputs.

5.1.1 Schedule and tasks

Several members of the team attended the Programme Review Days of the JU on the 21st and 22nd of November 2016 and the Stakeholders General Assembly on the 23rd November 2016. An inception meeting with the full team was held on the 24th November 2016. At that meeting comprehensive presentations on the nature and practice of the JU were provided by the Commission, the Executive Director of the JU and members of the Programme Office. The Commission also provided a large set of relevant reports by various organisations of the EU and facilitated access to the relevant parts of the CORDA data base on applicants, proposals, grants and beneficiaries. December 31st 2016 was adopted as the cut-off point for information. In the succeeding two weeks, the team agreed via email on:

- Questions for a public consultation through the internet;
- Questions for a survey of beneficiaries and to guide interviews with selected stakeholders;
- Written submissions on some specific matters to be requested from the Programme Office;
- A short-list of significant issues for detailed discussion with the Executive Director and his staff;
- A distribution of tasks among the team based on the questions specified in the ToR.

The Coordinators Survey was launched on 19th December 2016 by the Commission services, and concluded on the 15th February 2017. The survey was sent to 161 beneficiaries of whom 70 replied; some of the most pertinent comments are included in Annex 5. The public consultation was launched on the 8th December 2016 by the Commission services, and concluded on the 10th March 2017. A list of the principal documents surveyed is given in Annex 8.

Group interviews with selected stakeholders were conducted in Brussels on the 24th January and the 20th and 21st February 2017; other stakeholders were interviewed by individual members of the team. A list of the interviewees is given in the Annex 7.

A preliminary outline of the report, together with some factual background was compiled by the rapporteur and refined by the team at the January meeting. Detailed discussions with the JU were held on the short-list of significant issues. The team reviewed the information and insights obtained from the interviews and discussions, forming some preliminary views. On the basis of these discussions and further

research on available documentation, team members prepared submissions on those parts of the ToR that had been assigned to them. Submissions were compiled by the rapporteur into a single document that was discussed by the IEG at their meeting of the 21st February 2017. Following guidance agreed at this meeting, the written contributions from team members in the areas of their competence were further refined and a preliminary draft report was prepared and discussed in detail at a meeting on March 20th and 21st. After further editing to accommodate comments from the meeting, the early parts of the report (Background, Effectiveness, Efficiency) were submitted to the Commission on March 31, as an interim deliverable.

Following comments from the Commission services, a revised report was prepared by the rapporteur and agreed with modifications by the IEG at its final meeting on the 10th and 11th May 2017. The table below lists the dates of the meetings held by the IEG and the main topics that concerned the FCH 2 JU. It should be noted that all meetings equally addressed the final evaluation of the FCH JU, which was performed in parallel.

Table 1. Dates of meetings and principal agenda topics.

Date	Main topics
1st Kick-off meeting 24 November 2016	Agreement on working methodology and distribution of tasks. Discussion of prospective interviewees and key questions. Review of the FCH JU history, structure and practices by EU staff. Transfer from EU of pertinent documentation. Preliminary discussions with staff of the JU.
2nd Meeting 23-25 January 2017	Discussion of initial contributions of experts. Detailed discussions with various members of the PO on a wide range of aspects of the JU according to a schedule previously agreed by the IEG. Hour-long interviews with selected stakeholders of the JU.
3rd Meeting 20-21 February 2017	Hour-long interviews with selected stakeholders of the JU. Expert presentations of their contributions. Review of status. Discussion of the draft materials and agreement on future work plan.
4th Meeting 21-22 March 2017	Expert presentations of their contributions for FCH 2 JU report. Discussion on executive summary and recommendations for FCH 2 JU. Work plan until end of project.
5th Meeting 10-11 May 2017	Discussion on Conclusions and recommendations for FCH 2 JU.

5.2 Limitations – robustness of findings

A relevant limitation was the fact that when this review took place most FCH 2 JU projects had not concluded; therefore no relevant results had been achieved. FCH 2 JU first call was launched in 2014 and the first projects started in 2015. The current review was undertaken between November 2016 and June 2017 when FCH 2 JU projects were still at an early stage of execution.

This limitation has been mitigated by the analysis of the intentions of the MAWP and the portfolio of projects initiated between 2014 and 2016, and by the assessment of the main achievements in the management of the activities and in changed practices since the conclusion of the FCH JU.

6 IMPLEMENTATION STATUS OF PLAY (RESULTS)

The mission of the FCH 2 JU is to contribute to fulfilling the European vision of a low-carbon Economy as visualised in the SET-plan. The current ambition agreed by the IG, N.ERGHY and the EU, represented by the European Commission, is to "develop by 2020 to the point of market readiness, a portfolio of clean, efficient and affordable solutions that fully demonstrates the potential of hydrogen as an energy carrier and of fuel cells as energy converters, as part of a system that integrates sustainable and secure energy supply with low carbon stationary and transport technologies".

6.1 Main changes between FP7 and Horizon 2020

The new phase of the FCH JU under Horizon 2020 was designed to build on the experience gained in under the FCH JU and to adopt improved practices: a leaner governance structure, involvement of a broader range of stakeholders; more efficient operations and a better management of the human and financial resources. The FCH 2 JU was expected to achieve a better alignment and coherence between national, regional, and its own programmes and to leverage their action at the European scale, in particular through large demonstration projects[20]. It also aims to foster jointly funded actions (with other European Industry Initiatives (EIIs) or Key Enabling Technologies (KETs) for example), smart specialisation in regions and the complementary use of Structural Funds.

For the calls under FP7, each consortium was required to contain at least one member of either the IG or the RG to ensure alignment with the JTI strategic objectives. Under H2020, this rule has been abandoned, and is used as an exceptional measure, for duly justified reasons. This approach has increased the participation of non-members: under FP7, 48% of the funding was attributed to non-member entities, whereas (for the three first calls under H2020) this percentage had grown to 54%; in these three calls the members represented only 37% of the beneficiaries and 24% of the participants in signed grants were newcomers. These facts point to greater openness in FCH 2 JU.

The autonomy of the Executive Director has been increased to simplify decision-making although the Governing Board remains the body that takes strategic decisions. The structure of the work plan of the FCH 2 JU was modified to reflect the recommendation of the Second Interim Evaluation of FCH JU to develop an energy pillar including storage and cost-efficient end-use of renewable energy in the form of electricity and hydrogen. Closer cooperation with all stakeholders is planned, enabling the FCH 2 JU to realise its long-term strategy most efficiently in the European context. During the negotiation of grants under FP7 it was possible within limits to modify the content of proposals in accordance with specific suggestions of evaluators. This is not possible with H2020 and may be responsible for the lower success rate of proposals in the later programming period.

- *The Common Support Centre*

A significant change to the administrative functions of the JU occurred when the Commission created a Common Support Centre (CSC) to help coordinate and deliver H2020 efficiently across all the agencies involved. The CSC provided, as of 1 January 2014, common services in legal support, ex-post audit, IT systems and operations, business processes, programme information and data to all research DGs, executive agencies and Joint Undertakings implementing Horizon 2020. The CSC is a Directorate of DG RTD.

The CSC was created at the instigation of the European Court of Auditors to remedy the divergences of practices across different parts of the programme that were

[20] Multiannual work plan, 2014-2020, FCH JU

observed in FP7 and to ensure a consistent and uniform treatment of all beneficiaries and the coherent implementation of the FP. It also had the benefit for smaller agencies such as the JUs of reducing the administrative overheads of the undertaking and allowing more resources to be directed to technical activities as was recommended by the second interim evaluation of the FCH JU.

The IEG feels that the CCS has helped in improving the efficiency of the FCH 2 JU.

- *Technology Monitoring*

Technology monitoring has been implemented, initially based on the TEMONAS tool developed under the FCH JU. This tool was found to be too complex and cumbersome for the task, and a simpler and more efficient tool has since been developed by the Programme Office. A knowledge management activity was added to the tasks of the Programme Office (PO). To measure progress of the research & innovation and innovation activities of FCH 2 JU, Key Performance Indicators (KPIs) have been implemented: these form part of the MAWP. These KPIs should improve the monitoring of the activities and outcomes of the projects.

The technology monitoring activity of the FCH 2 JU will support EU policy making by providing timely information on the state-of-the-art and the achievements of the JU.

- *Collaboration with the JRC*

Collaboration with the Commission's Joint Research Centre (JRC) in relation to technology monitoring and policy support has also been modified between FP7 and Horizon 2020. The JRC undertakes research in the field of fuel cells and hydrogen that is of considerable relevance to the implementation of the FCH 2 JU activities. During the FCH JU period, cooperation between the JRC and FCH JU was structured under a Framework Agreement covering support activities that JRC provided in-kind to FCH JU, as well as possible funded JRC participation to FCH JU projects.

Unlike the situation under FP7, involvement of JRC in FCH 2 JU funded projects is not possible. For the Horizon 2020 period, a Framework Contract between FCH 2 JU and JRC was approved by the Governing Board on 23 December 2015. The scope of the Framework Contract covers the activities that JRC will provide at the level of the FCH 2 JU programme both free of charge and against payment from the FCH 2 JU operational budget. In line with the JRC mission, these support activities will primarily contribute to formulation and implementation of the FCH 2 JU strategy and activities in the areas of RCS, safety, technology monitoring and assessment. In addition, the Programme Office may call upon JRC to perform services for FCH 2 JU, providing added value to programme objectives by complementing the activities of FCH 2 JU funded projects. The JRC support activities to the FCH 2 JU programme covered by the Framework Contract are discussed and agreed on an annual basis between the JRC and the Program Office, with involvement of a representative of Hydrogen Europe and of N.ERGHY. They are also specified in the AWP.

- *Collaboration with MSs, regions and European funds*

An important strengthening of the relationship with Member States, Associated Countries and regions was foreseen within the FCH 2 JU however this is an area where improvements remain to be made.

Additional efforts to link other stakeholders, such as local authorities and European associations, to the development of the FCH 2 JU are planned. The founding regulation obliges the FCH 2 JU to develop close interaction with the European Structural and Investment Fund (ESIF) to strengthen local, regional and national research and innovation capabilities in the area of the FCH; there is a KPI to show demonstrator projects hosted in MS and regions benefiting from EU structural funds. The project

HyBalance is benefiting from Danish co-funding, and the project JIVE on fuel cell bus deployment will use five additional funding schemes in parallel with that of the FCH 2 JU.

There would be additional added value if co-funding arrangements could be reached between the EC, other European institutions and the Member States, Associated Countries and regions to increase the scale of the FCH 2 JU activities, and this should be supported by the PO where possible. The PO has a new financial expert to assist in the identification of this co-funding.

The Second Interim Evaluation of FCH JU recommended improving communication to disseminate achievements beyond the FCH community. This would reinforce the relevance of the FCH 2 JU to European societal challenges to other key stakeholders such as policymakers and the general public. The FCH 2 JU has developed a communication strategy and obligations for better disclosure and dissemination by projects is now included in the grant agreements. This work is expected to be further enhanced soon.

The existence of the FCH JU and now the FCH 2 JU has better integrated and engaged the previously dispersed FCH community. This has helped strengthen the development of strategic priorities, which in turn has delivered more clearly defined objectives to the Programme Office.

6.2 The Governance of the FCH 2 JU

The duties, powers and compositions of the bodies comprising the FCH 2 JU are specified in the Statutes of the Fuel Cells and Hydrogen Joint Undertaking appended to the founding Regulation. The Joint Undertaking comprises five bodies: The Governing Board; the Executive Director, the Scientific Committee, the States Representatives Group and the Stakeholders Forum. The last three bodies are advisory.

- *The Executive Bodies*

The FCH 2 JU is constructed as a public-private partnership and this is reflected in the composition of the Governing Board. The Board includes: six representatives of the industry grouping at least one of which represents SMEs, three representatives of the Commission and one representative of the research grouping. The Commission represents the European Union; it holds 50% of the voting rights. The industry grouping holds 43% of the votes and the research grouping the remaining 7%. Decisions are taken wherever possible by consensus or, failing that, by a majority of 75%.

The Governing Board is the main decision-making body of the FCH 2 JU. It has overall responsibility for the operations of the Joint Undertaking including: implementation of the activities, approval of the annual implementation plan, budget, accounts and the balance-sheet and approval of the list of projects proposed for funding. It elects its chairperson for a duration of two years. The Executive Director is the chief executive responsible for the day-to-day management of the FCH Joint Undertaking in accordance with the decisions of the Governing Board. The Executive Director is the legal representative of the FCH JU appointed for three years and renewable once for up to four years following a satisfactory review of performance. The duties of the Executive Director are specified in detail in the statutes; they include the preparation of an annual budget and work plan, the supervision of the calls for project proposals, evaluation and selection of the projects and the establishment and implementation of internal controls. The Executive Director is supported by a Programme Office that executes the tasks of the JU under the responsibility of the Executive Director.

- *Advisory Bodies*

The Scientific Committee is an advisory body to the Governing Board composed of no more than nine members from academia, industry and regulatory bodies. Collectively, the Committee should encompass the expertise needed to make strategic science-based recommendations to guide the work of the FCH JU. Specifically, it gives advice on the scientific priorities for the annual work plans and the scientific achievements described in the annual activity report.

The States Representatives Group (SRG) comprises one representative of each Member State and of each Associated Country. The SRG gives general advice on the strategy and performance of the JU, but also liaises with the JU on the status of relevant national or regional programmes of innovation and areas of potential cooperation. The Group is intended to meet at least bi-annually and was convened by the FCH JU.

The Stakeholder Forum is open to anyone with an interest in fuel cell and hydrogen technologies, including industry, academia, public sector and Non-Governmental Organisations (NGOs). It is convened once a year by the Executive Director at which meetings the work of the JU is presented.

- *The Industry and Research Groupings*

The industrial grouping is represented by an international not-for-profit association formed under the name of "the European Industry Grouping for a Hydrogen and Fuel Cells Joint Technology Initiative", located in Brussels and governed by Belgian law. This association was originally known as NEW-IG and its main function was to represent industry in the JU. Following the renewal of the JU under Horizon 2020, the association was rebranded as Hydrogen Europe and took on the wider objectives of a full European industry body with external reach that included advocacy towards EU policy-makers beyond the JU. Membership is diverse; numbers have fluctuated but now this body has more than 100 members of which more than 50% are SMEs and where twenty-two countries are represented.

Much of the substantial work of the industry grouping is done through committees that broadly follow the research areas adopted by the FCH JU: Fuel Cells for Vehicles; transport infrastructure; energy to hydrogen; fuel cells for power. A special coordination group was created in 2011 to liaise with the Governing Board of the JU. The committees play two critical roles: they serve as the fora through which the members of Hydrogen Europe members can contribute to shaping the forthcoming FCH 2 JU Calls and they mobilise knowledge and expertise to formulate contributions to European Union consultations on pertinent topics. The latter activity has become more visible over the years.

The New European Research Grouping for Fuel Cells and Hydrogen (N.ERGHY) is a not-for-profit association under Belgian law founded in 2008 by parts of the European research community active in FCH. The main objective is to promote the deployment of hydrogen and fuel cell technology by aligning the objectives of the European R&D community and representing it as a whole, especially within the JU. Currently, the membership of N.ERGHY includes more than sixty universities, umbrella organizations and research institutes. The members of N.ERGHY participated in the preparation of the FCH 2 JU multi-annual and annual priorities.

- *Modalities of operation*

The main instrument to guide operations specified in the regulation is the Annual Work Plan (AWP). Responsibility for the strategic orientation and the operations of the FCH 2 JU is assigned to the Governing Board. The Governing Board has chosen to formulate this agenda within the multi-annual work plan (MAWP).

This was a decision of the Governing Board; the MAWP is not required by the regulation and is not legally binding. It is envisaged that the MAWP should be revised periodically to reflect changes in priorities brought about by changing circumstances in particular by technical progress achieved by the JU or internationally. The MAWP is implemented through the series of Annual Work Plans (AWPs. At least one Call for proposals is published each year based on the AWP for that year.

MAWP: The MAWP adopted by the Governing Board addresses the strategic objectives of the programme as well as specific objectives concerning techno-economic aspects related to the successful deployment of the FCH technology defined in the regulation. In addition, the document addresses operational objectives related to leveraging of private and public investment, maintaining or increasing participation of SMEs and increasing involvement and participation of less-performing regions in the FCH 2 JU's activities. To ensure efficient implementation of the FCH 2 JU programme the MAWP defines some targets related to calls for proposals and applications processing.

A very important improvement in research agenda and specific target definition is the fact that the MAWP includes the state-of-the-art of FCH technologies in 2012 and defines in more detail future targets for the particular applications of FCH technologies for 2017, 2020 and 2023. Besides the price and production volume targets for the FCH technologies, set in the MAIP for the FCH JU, the MAWP defines in detail other future targets (e.g. lifetime, efficiency, availability) for particular applications. The state-of-the-art price levels of FCH technologies were updated for different applications according to the present technology development status and cost, and new ambitious targets were set for FCH 2 JU programme. In some cases the price levels targeted in MAWP are higher than specified previously in MAIP targets for 2015 and 2020. Since future targets set for FCH JU were not actually achieved the revision performed in MAWP gives more reasonable and realistic, but still ambitious, future target values.

AWP: In order to achieve the above-mentioned targets and main deliverables, the activities are broken down into groups of topics and subtopics specified in an Annual Work Plan (AWP) prepared yearly. A detailed description of the topics for the Calls is prepared and published for each individual Call. As described in Section 7.1.1, in the period from 2014 to 2016 FCH 2 JU announced three Calls for proposals covering in total 66 topics related to HFC technology development and deployment.

The IEG is of the view that the activities undertaken by FCH 2 JU constitute effective methods for achieving the programme objectives defined in the regulations. The future target values and deliverables specified in MAWP are ambitious. The EC contribution of €665 million is almost certainly insufficient to reach all the programme objectives and this should be recognised by EC and stakeholders. .

As observed in the past, technical progress actually achieved is not necessarily that desired, so the IEG recommends targets be periodically updated taking into account observed progress.

- *Management of the programme*

The main activity of the FCH 2 JU is to provide finance in the form of grants to participants following open and competitive Calls for proposals. The JU has little discretion in its management of Calls: participation in indirect actions funded by the

FCH 2 JU has to comply with the regulation governing the conduct of Horizon 2020[21]. Details of the administration of Calls are discussed in Section 7.1.6 of this report where it is found to be satisfactory. The timeliness of informing applicants, signing grants and making payment is discussed in Section 7.2 where steady improvements are noted.

- *Funding of the JU*

The contributions of the private members fall into three categories:

- A cash contribution to the administrative costs;
- In-kind contributions incurred in operational activities (referred to as IKOP);
- In-kind additional activities (referred to as IKAA).

The founding regulation of the FCH 2 JU sets the financial contribution of the EC to the FCH 2 JU as an amount up to €665 million, comprising:

- €570 million until the point a) the contribution of the private members exceeds €380 million and b) the total of IKAA exceeds €285 million;
- A further contribution of up to €95 million to match any additional contribution committed by the private Members above the €380 million.

The administrative costs of JU are limited to €38 million and are to be shared 50% by the EU, 43% by the IG and 7% by the RG. IKOP measures the in-kind contributions arising from participation in projects following the calls for proposals issued by the JU and covering non-reimbursed expenses. IKAA comprises the costs of activities incurred in implementing additional activities outside the work plan of the FCH 2 Joint Undertaking that contribute to the objectives of the FCH Joint Technology Initiative, net of any EU funding that might be provided from sources other than the JU. The corresponding activities comprising IKAA must be set out in an annual additional activities plan indicating the estimated value of those contributions; the plan is subsequently adopted by the Governing Board.

Once the conditions on the total private contribution and the amount of IKAA are satisfied then the conditional payment of €95 million from the EU is triggered.

Recital 14 in the preamble to the regulation recognizes that in assessing the overall impact of the Fuel Cells and Hydrogen Joint Technology Initiative, the investments from all legal entities other than the Union that contribute to the objectives of the Fuel Cells and Hydrogen Joint Technology Initiative should be included.

These additional investments are expected to amount to at least €285 million, and so bring the overall contribution of private members up to €665 million, matching that of the EC. The flow of funds is summarized in Figure 2 below.

[21] Regulation (EU) No 1290/2013 of the European Parliament and of the Council of 11 December 2013 laying down the rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)" and repealing Regulation (EC) No 1906/2006

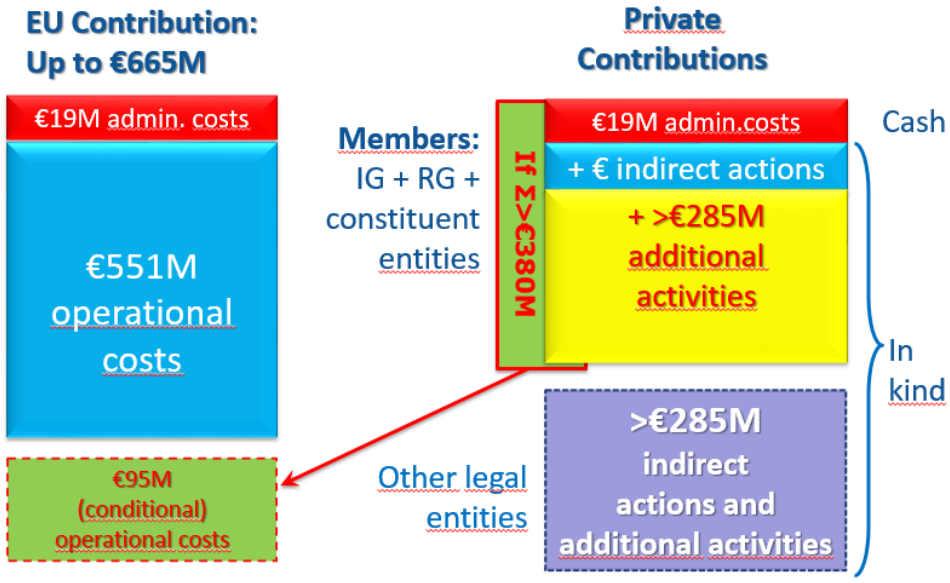


Figure 2. Flow of funds for the FCH 2 JU.

- *IKAA plans*

The FCH 2 JU and its members have developed and agreed a methodology for planning, reporting, certifying and verifying IKAA. Three annual plans have been adopted (for 2014-2015 combined, 2016 and 2017) and the first reporting exercise for 2014-2015 took place at the beginning of 2016. The graph below shows the IKAA from industry and research for the three periods: 2014-2015 (18 months), 2016 and 2017 taken from the plans submitted.

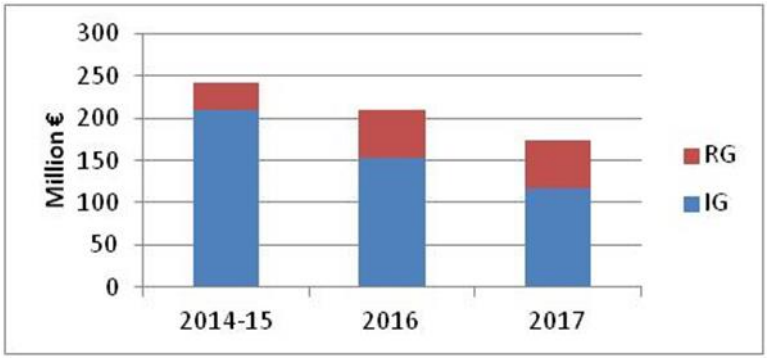


Figure 3. Value of IKAA by type of member.

The impression of a monotonically falling contribution is erroneous because 2014-2015 covers 18 months. As the reporting produces greater and more accurate data, there are indications that the contribution from research is proportionally increasing and that of industry is falling.

The graph below shows the number of members contributing to the IKAA plan. Here the impression that numbers are falling is correct.

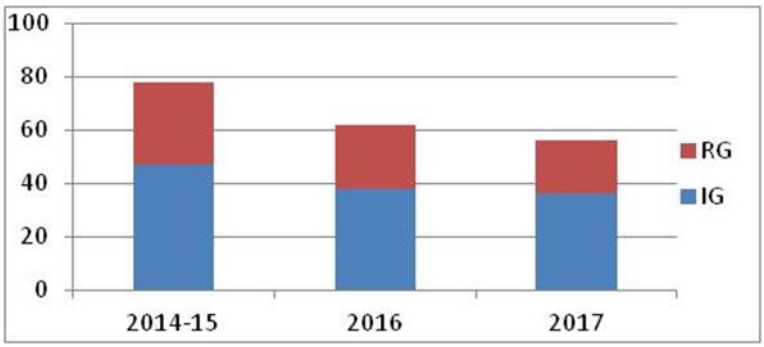


Figure 4. The number of members reporting IKAA in each period.

Figure 5 shows the value of IKAA per reporting member. This measure shows strong variation. There is a significant increase over the period in the average amount per research group member and a substantial fall in the amount per industrial member. It was suggested to the IEG that this is because the research entities are learning to present their activities more effectively as contributions to IKAA, whereas interest from industry is declining generally. This proposition is difficult to prove or to refute as the data is insufficient to attribute any underlying causality.

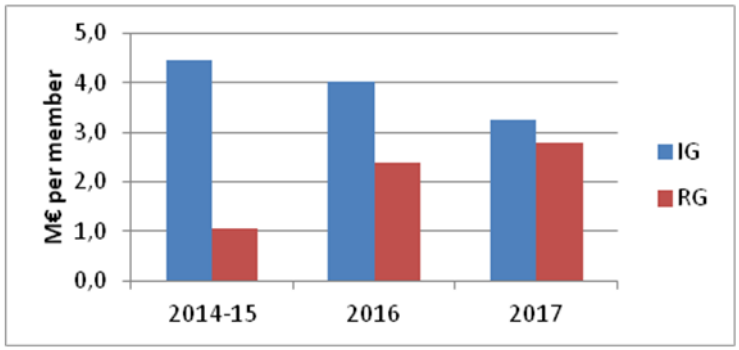


Figure 5. Average IKAA (millions of €) per reporting member.

The IKAA component is required by the Regulation 559/2014 to reach at least €285 million. This has already been achieved. The total of verified IKAA for 2014-15 and estimated IKAA for 2016 is €393 million.

Although the obligations to generate €285 million of IKAA have been exceeded already, the IEG understands that the JU intends to ask its members to continue reporting IKAA in order to demonstrate the congruity with industrial ambitions. The IEG agrees that this is desirable.

Hydrogen Europe and N.ERGHY members reported their final certified investment figures for the reporting period 1st July 2014 to 31st December 2015 to the FCH 2 JU Governing Board in June 2016.

Industry or Research / Submissions		
Sector	**Number of members**	**Estimated investment eligible as IKAA (M€)**
Industry	39	167,04
Research	20	21,53
Total	**59**	**188,57***

* Out of 188.57 M €, an amount of 2.15 M € was not subject to certification since below the threshold

Figure 6. 2014-2015 IKAA (source Additional Activities Certified Report).

According to the Additional Activities Final Certified Report, the eligible IKKA was €188.57M of which €2.15M was not subject to certification. In order to be considered as "reported", the figures of the submitted activities had to be certified by an external auditor, or an independent public officer in the case of research organizations, in line with Horizon 2020 practices. Members whose cumulative contributions during that period were below the threshold of €325,000 (largely SMEs and small research organizations) were encouraged to report despite being exempted from certification

Amounts claimed as IKAA for the period 2014-2015 inclusive are €188.6 million, of which €167 million is from members of Hydrogen Europe and the balance from research members, N.ERGHY. This should be compared with the planned expenditure of €243 million in the same period and the intended minimum of €285 million in the period 2014-2020 inclusive.

Submissions over the three periods have been made by fourteen countries. There is a high degree of concentration as indicated in Figure 7 showing the total of estimated eligible investment up to end 2017. The top three countries create 79% of the IKAA.

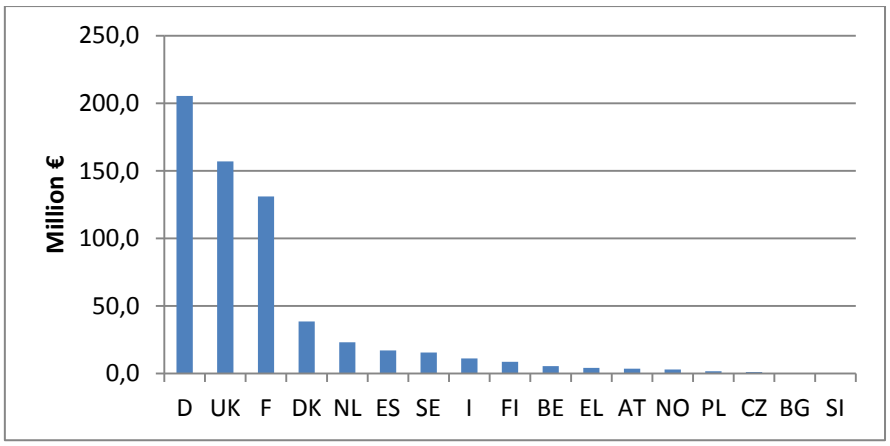


Figure 7. Estimated eligible investment as IKAA in 2014-2017 per country.

Although around 25% lower than planned, the IKAA for 2014-2015 shows a large additional R&D effort undertaken by FCH 2 JU members outside the JU programme. It suggests that FCH 2 JU is, at EU level, building on and leveraging a strong R&D base within Member States but it is not clear to what extent the level of IKAA is itself influenced by the JU activity. However, should a comparable effort be maintained over the life of the JU then it might be expected that over €600 million of IKAA will be realised, thus increasing the level beyond that expected from FCH 2 JU.

- *IKOP Plans*

According to AAR 2016, as of 31st December 2016, the estimated in-kind contributions for the 30 projects signed in relation to the H2020 programme (2014 and 2015 calls) was as follows (in EUR):

H2020 IN 2016	ACCUMULATED VALIDATED IKOP AT 01/01/2016	VALIDATED IKOP IN 2016	IKOP RECEIVED BUT NOT VALIDATED AT 31/12/2016	IKOP ESTIMATE (PRO-RATA) AT 31/12/2016	IKOP ESTIMATE TO BE VALIDATED AS FROM 1/1/2017	FORECAST OF AGGREGATED LEVEL OF IKOP
Industry grouping			4 838 616	16 737 620	116 313 739	137 889 975
Research grouping			43 372	64 570	468 060	576 003
TOTAL			4 881 988	16 802 191	116 781 799	138 465 978

Figure 8. IKOP Plans (Source: AAR 2016).

As of 31st December 2016, no IKOPs were certified, as this will happen later in the course of the H2020 programme.

- *Leverage*

Under the Horizon 2020 indicators, leverage is defined as the total amount of funds leveraged through the initiative, including additional activities, divided by the EU contribution.

$$Total\ leverage = Operational\ leverage + Additional\ leverage$$

The Operational leverage only refers to Private contributions to the activities mentioned in a signed GA for an indirect action receiving EC contribution. It can be calculated on the basis of committed eligible IKOP , that is Total project costs less EC contribution:

$$Operational\ leverage = \frac{\sum IKOP\ of\ private\ partners\ in\ signed\ GA}{\sum EU\ contribution\ (*)committed\ in\ the\ signed\ GZ}$$

For the Calls 2014-2015, the total project costs were €565 Million and the EC contribution was €286 million, therefore the **operational leverage is: 0,98.** This is more than was expected because many of the demonstration projects have a low effective funding rate, being close to market and generating massive leverage.

The Regulation also defined the additional leverage as:

$$Additional\ leverage = \frac{\sum IKAA\ of\ members}{\sum EU\ contribution\ (*)committed\ in\ the\ signed\ GZ}$$

Taking into account that the certified IKAA is €186.4 million (€188.57 million minus €2.15 million not subject to certification) the **additional leverage is 0,65**.

Therefore the total leverage for the period 2014-2015 has been estimated as 1,63 for its first two years of operation. Based on the planned AA figures for 2016 and 2017, this figure is due to increase further. It is a strong indicator that the JU is aligned to industrial priorities.

6.3 Mission of the FCH 2 JU

- *How were the scope and priorities of the MAWP developed?*

There is a no formal procedure for the MAWP drafting as this is not done on a regular basis. The MAWP was constructed at the start of the FCH 2 JU and is now being revised. The approach is comparable to that adopted for drafting the individual AWP's in the sense that it is an iterative process whereby the initial concept is developed by industry through the NEW IG and then commented upon by others, including the Programme Office and European Commission delegates.

For the current revision of the MAWP, it has been agreed to initiate the process through a joint working group formed by the NEW-IG and N.ERGHY, supported by the PO, to evaluate the state-of-the-art, based on international and EU experience. Its findings will be a major input for defining and detailing the technical tasks within future updates of the MAWP. Initial drafting is being done by Hydrogen Europe and N.ERGHY, and will be followed by a consultation period where the FCH 2 JU bodies and members can comment.

The first draft will be revised initially by the GB, EC, and the advisory bodies SRG and SC. The PO will also provide its feedback based in its acquired knowledge of the project monitoring. Subsequently, the draft will be discussed within the GB and then two more drafts will be issued where only the EC and PO will be able to make comments. The participation of the EC assures the public interest in the process.

- *Was the process transparent?*

The MAWP was produced at the start of the FCH 2 JU and is undergoing revision in 2017. The process adopted is evident to FCH JU executive bodies and members but neither the original MAWP preparation, nor the present update, includes clear communication to external stakeholders, so the process cannot be regarded as fully transparent.

Recommendation: The IEG recommends adoption of a more transparent process, where the schedule and the involvement of different parties is public.

- *Did it include the relevant stakeholders?*

The initial content is decided by the GB after a meeting where all members present their view. Subsequently, the drafting is done by the IG and RG. All the main stakeholders (that is the GB, Hydrogen Europe, N.ERGHY. and the advisory groups (SC and SRG) can be involved in the process however it is not clear that the opinion of all the relevant stakeholders, especially the Scientific Committee and the States representative group, are adequately involved. Also, there is no indication that other actors that could be important for the further deployment of FCH technologies (such as cities and regions and consumers' organisations) have a clear opportunity to be heard in this process.

- *Were the roles and responsibilities clear and transparent?*

In general, the roles and responsibilities are clearly defined in the process and accord with the roles and responsibilities of the members as defined in the regulation. The only concern is in relation to the advisory bodies: even though their roles are clearly defined, it is not clear how their feedback is taken into account in the final version of the MAWP.

- *Who has the final ownership and responsibility of the MAWP?*

Within the regulation, it is stated that the Governing Board shall have overall responsibility for the strategic orientation and the operations of the FCH 2 Joint Undertaking and shall supervise the implementation of its activities. It therefore must take ownership of the MAWP

6.4 Does the JU operate in accordance with its legal framework?

- *Contractual arrangements*

According to the founding regulation, the Members of the FCH 2 Joint Undertaking shall be: the Union, represented by the Commission; upon acceptance of the Statutes by means of a letter of endorsement, the New Energy World Industry Grouping AISBL, now called Hydrogen Europe, and upon acceptance of the Statutes by means of a letter of endorsement, the New European Research Grouping on Fuel Cells and Hydrogen AISBL. Hydrogen Europe and N.ERGHY operate on the basis of transparency and are open to any European business or research institute with interest and activity in the FCH sector. The statutes of each grouping are public and the membership access and rules are transparent and clearly defined. They represent focused and dedicated partners and provide the FCH 2 JU with a single point of contact for their respective membership, long term stability and resources.

- *Clarity of roles and responsibilities*

The respective roles and responsibilities of GB and PO, are adequately defined and consistent. In the judgement of the IEG the activities of the executive bodies reflects the defined roles.

The roles of the advisory bodies are also clearly defined however their activity and participation could be improved.

- *Scientific Committee*

The Scientific Committee includes a high level of scientific knowledge that could be better used within the AWP and MAWP elaboration. To take better advantage of Scientific Committee know-how, the connection and communication between the SC and GB should be strengthened. The SC should be consulted yearly on the first outline of the AWP. Moreover, to facilitate the exchange of information with the GB and to assist in the more profitable use of SC know-how, it is recommended the Scientific Committee should have a rapporteur to collect and unify opinions. Furthermore, it is the opinion of the IEG that the scientific committee should be revitalised and made more strategic, possibly including experts from outside EU.

Recommendation: IEG recommends including experts from outside EU (subject to suitable non-disclosure agreements), and remunerating if necessary.

- *SRG*

The States Representative Group could facilitate more active support of the FCH in different countries, especially with and from policymakers. It could also assist the PO to identify additional sources of national funding to co-fund FCH projects and boost synergies. It should be noted again the confidentiality rules the SRG follows, which limit its possibility to connect with stakeholders.

Representatives on the SRG are not in all cases in roles that have a direct connection to FCH policy within Member States, or are not of sufficiently senior level to reach agreements on improving consistency of national programmes with the FCH 2 JU. There are many representatives from research institutes that have much to offer in

the way of detailed technical input, but do not have the overview of national programmes that can serve as a basis for creative cooperation. This fact limits the possibilities to attain synergies between the JU and national programmes. Member State contributions to the SRG should be based on research policy cleared at political level and founded on reliable data. Not all contributors are able to do this. Previous evaluations of FCH JU noted these weaknesses and there has been a slight strengthening of the role within the FCH 2 JU, but there does not seem to have been significant change in membership.

It was noted in the Programme Review Report 2015 that relationships and linkages with projects supported by member states are sparse and it is an area that needs improvements. National programmes and interventions are in some countries formed through workshops and discussions with relevant national stakeholders. By evaluating the specific needs at a national level, strategies and work plans are not influenced by the priorities in FCH 2 JU other than indirectly.

The Member States representative group could have a more active role providing data to the FCH JU concerning the national initiatives and programmes. Attendance at meetings is still typically around 50% of members, so as a forum to both influence the FCH 2 JU activities and to identify supporting national activities, the SRG is not proving as effective as anticipated. Also, the information provided to the MSs could be enhanced, especially in relation to the information about proposals funded (and not funded); for the representative of the member state it is important to have prompt information about their national stakeholders. Moreover, Article 12, concerning the Rules of Procedure of the States Representatives Group (SRG), states that "members and other participants at meetings of the SRG are required not to divulge information given in the context of the work, unless it has been indicated that the information is public".

Due to that and the confidential nature of the MAWP process other stakeholders, e.g. the SRG, are prevented from organising a more structured feedback from their members. The IEG recommends the PO should provide to the SRG a summary of the main points that could be distributed by the SRG to their national stakeholders.

Recommendation:

The IEG recommends member states to appoint to the SRG a representative who has a clear link to their National Programme operation and with the political decision-making mechanism.

The SRG should be part of a constructive dialogue to optimally leverage national and JU funding within an overall EU development activity. The national representative should be able to transmit FCH JU priorities to the national stakeholders and regularly inform the GB and to PO about national and regional initiatives and funding mechanisms available relevant for FCH JU sector.

The SRG should collaborate with the PO to ensure a better alignment between research and innovation priorities and activities at national and EU level, identifying the critical gaps.

- *Stakeholder Forum.*

The stakeholder forum is the only FCH 2 JU body open to any interested stakeholder and therefore a channel where relevant actors in the FCH community, not members of other representative bodies, could communicate with the JU.

Nowadays, the stakeholder forum is more a communication event where the FCH 2 JU informs the stakeholders about its achievements and an exchange of information,

opinions and feedback from the stakeholders to the FCH 2 JU is not explicitly programmed.

The IEG notes that the opinion and feedback of some relevant stakeholders important for further deployment (such as cities and regions, NGOs and consumers' organisations) have no clear mechanism to be involved in FCH 2 JU consultations and processes as they are not usually members of the other FCH 2 JU bodies. This third advisory body, the Stakeholders' Forum, could include those entities providing a way for the involvement of external stakeholders.

Recommendation: The Stakeholder's forum activity could be enhanced to promote more active participation of stakeholders not part of other representative bodies.

- *Effectiveness of the communication channels between bodies*

In general, the communications between the different bodies are effective. Some isolated communication issues have arisen during the first years of FCH 2 JU, but no major problems have been detected. The communication between the Governing board and the advisory groups (Scientific Committee and States Representative Group) could be improved, as already mentioned in the section above. In some cases, it could use the PO as channel, but direct communication should be enhanced to take a better advantage of the feedback from these groups. An exchange between FCH 2 JU and the policy DGs is envisaged in the MAWP; DG MOVE, DG ENER and DG Research are represented in the GB and should be the first communication channel to be used to for this.

In relation to the communication to the beneficiaries (mainly through the coordinator), it should be noted that this has been very well evaluated within the coordinator survey. The assessment by the coordinators of the JU methods of communication to provide relevant and useful information had more than 85% positive replies. The effectiveness of the communication to the beneficiaries seems to very high and well done.

- *Do the partners share the same visions and have clearly defined objectives?*

The FCH 2 JU partners come from different backgrounds and naturally there are some conflicts; the Industry Grouping has its own vision and objectives that do not necessarily correspond to those of N.ERGHY or of the European Commission. However, the fact that the MAWP is being drafted by the two groups ensures a shared vision and the EC participation guarantees the public and EU interest.

- *Do the bodies operate and contribute usefully to the mission and objectives of the FCH 2 JU?*

In general, all the bodies have a clear relation to the mission and objectives of the FCH 2 JU. However, the contribution from the SRG is not as high as it could be expected, as already mentioned in Section 6.4.

- *Are the decision-making processes efficient?*

The decision-making processes have already been explained in Section 6.2. The IEG considers decision-making to be efficient however the input of the advisory bodies should be incorporated in a more efficient way.

- *Transparency of its decision-making*

The decision-making mechanism is clearly defined. The procedures of the main FCH JU bodies are public and published on the FCH JU webpage. Interested parties can review and understand the decision-making process and the meeting minutes are public.

In relation to decisions concerning proposals to be funded, it should be noted that FCH 2 JU uses the same evaluation process as H2020 with external independent experts. The evaluation, selection and award procedures are described in the document "Horizon 2020 – General Annexes to the main Work-Programme" and "Horizon 2020 - Grants Manual - Section on: proposal submission and evaluation (sections III.5, III.6, IV.1, IV.2, IV.3, IV.5)". The IEG found that these procedures had so far been applied rigorously by FCH 2 JU.

However, it is noted this procedure is not perceived by the overall community as fully transparent. Within the coordinator survey, only approximately 60% of the coordinators agreed the evaluation process was clear and transparent and that in the Public Stakeholder Consultation, the positive replies to the question if the FCH 2 JU organises a sound and fair proposal evaluation system based on both scientific and technological excellence and industrial relevance were a similar percentage (57%).

As mentioned in the ECA report 2015, the Internal Audit Service (IAS) of the European Commission completed an audit on the evaluation and selection process for Horizon 2020 grant proposals at the FCH 2 Joint Undertaking in November 2015. The IAS recommended that the Joint Undertaking improve the clarity and transparency of its selection of topics for proposals. All the above evidence suggests that more effective feedback to applicants, especially those not successful, is required.

- *Long-term commitments from partners*

The membership of IG has grown from 65 entities in 2008 to 100 entities presently (covering 21 countries) and the membership of RG has grown from 58 members in 2010 to 65 currently (covering 19 countries). The establishment and extensive membership of the IG and RG, coupled with the previously detailed IKAA levels, is an indication of the stakeholders' commitment to the FCH JU. The reform of Hydrogen Europe, with the recruitment of its own staff and Secretary General, could also be highlighted as a significant evolution.

6.5 Monitoring and control

According to Article 12 of the Financial Rules of the FCH Joint Undertaking, the budget should be implemented in compliance with effective and efficient internal control, including prevention, detection, correction and follow-up of fraud and irregularities.

Operational and financial reporting responsibilities for the FCH 2 JU are clearly set out in the regulations.

The FCH 2 JU Internal Control Framework is founded on sixteen Internal Control Standards (ICS) which were adopted by the GB on the 15th June 2010. Following a revision of the control framework by the EC in 2014, the standards and associated requirements were updated in 2015 and were adopted in the first quarter of 2016. More attention is placed on staff allocation, mobility and development, on processes and procedures where an exception report is added as a requirement, and on the business continuity area.

Overall, the standards are informed by the internationally recognised COSO[22] framework and are structured around six building blocks:

1. Mission and values;
2. Human resources;
3. Planning and risk management processes;

[22] Committee of Sponsoring Organizations of the Treadway Commission.

4. Operations and control activities;
5. Information and financial reporting;
6. Evaluation and audit.

The FCH JU Internal Control Framework provides for mid-year management reports from the heads of unit to the executive director, including a declaration of assurance. In the second half of the year, the heads of unit review is encompassed in their input in the AAR and on a review by the internal control coordinator of the state of the internal control system.

In relation to the anti-fraud strategy and according with AAR 2016, FCH 2 JU ensured the implementation of the research community's common anti-fraud strategy, adopted on the 18th March 2015 by the CSC, by attending regular meetings of the Fraud and Anti Irregularity Committee (FAIR) coordinated by DG RTD, and by following up on the action plan derived from the strategy. FCH 2 JU has an anti-fraud correspondent and encourages its employees to take part in the anti-fraud trainings organised by DG RTD.

The Programme Office and the bodies of the FCH 2 JU should observe and comply with the corresponding rules regarding the prevention and management on conflict of interest. In this respect, the Commission issued guidelines in July 2015 to the Joint Undertakings, including a common template for the declaration of absence of a conflict of interest. Within the JU reply to the ECA report 2015, the PO mentioned that the approval of common rules for staff, based on the EC template, is in process.

In the GB assessment of the AAR for 2015, the GB commends the quality of the JU's internal control system (procedures, checks, ex-ante controls) as well as the continuous guidance to beneficiaries aiming at avoiding errors in financial reporting and notes the clean report from the European Court of Auditors (for the financial year 2014 published in November 2015) and the low error rate (cumulative residual error rate on the 31st December 2015 was 1.01%). The processes have been steadily improved each year and the results of the assessments by the ECA are positive.

- *Capacity to monitor use of funds and technical progress*

In relation to progress monitoring, FCH 2 JU should adhere to a so-called H2020 Vademecum which describes the procedures to be followed for each step of the process. Unfortunately, this Vademecum is still under discussion and not yet in force. Therefore the JU in a highly proactive attitude is following a slightly adapted version of the FP7 procedures, awaiting confirmation of the new procedures.

The FP7 procedures are explained in the "FCH JU Internal Procedure for Project Review with External Experts": the monitoring of research projects concerns the assessment of the work carried out under the project over a certain period (e.g. one reporting period or the entire project duration). Such assessment may cover scientific, technological and other aspects relating to the proper execution of the project and grant agreement.

After each reporting period, the FCH JU checks deliverables and reports sent by the project coordinator (see separate procedure on Review of Periodic Reports) in terms of:

- Consistency with the project work plan and Annex 1/DoW;
- Eligibility of the costs claimed;
- Compliance with any other obligation under the Grant Agreement.

As a result of this mandatory check of deliverables and reports, the project manager acting as operational initiating agent will give the "certified as correct" statement needed to execute the interim payment or payment of the balance. In cases where the findings from this check of deliverables and reports show that greater scrutiny of the work carried out by the beneficiaries is required, or if a review was already foreseen during negotiations, the FCH 2 JU will start a review. Reviews comprise an in-depth examination (often done with the help of independent experts) of the progress of the project. On the basis of the review findings, a review report ('outcome letter') would be drawn up. The review report is sent to the coordinator, who may notify observations.

In the Satisfaction Questionnaire[23] procured in 2016 by the PO, more than 75% of stakeholders replied positively (and more than 25% were very satisfied) in their assessment to the work done by the PO project reviews and the assessment of periodic & final reports.

Within the coordinator survey performed by the EC in 2017, the positive replies in relation to the capability and commitment of the project office are very high (more than 90% of positive replies) as well with the perception that the JU strives to provide excellent programme management and high quality service (more than 85% positive replies).

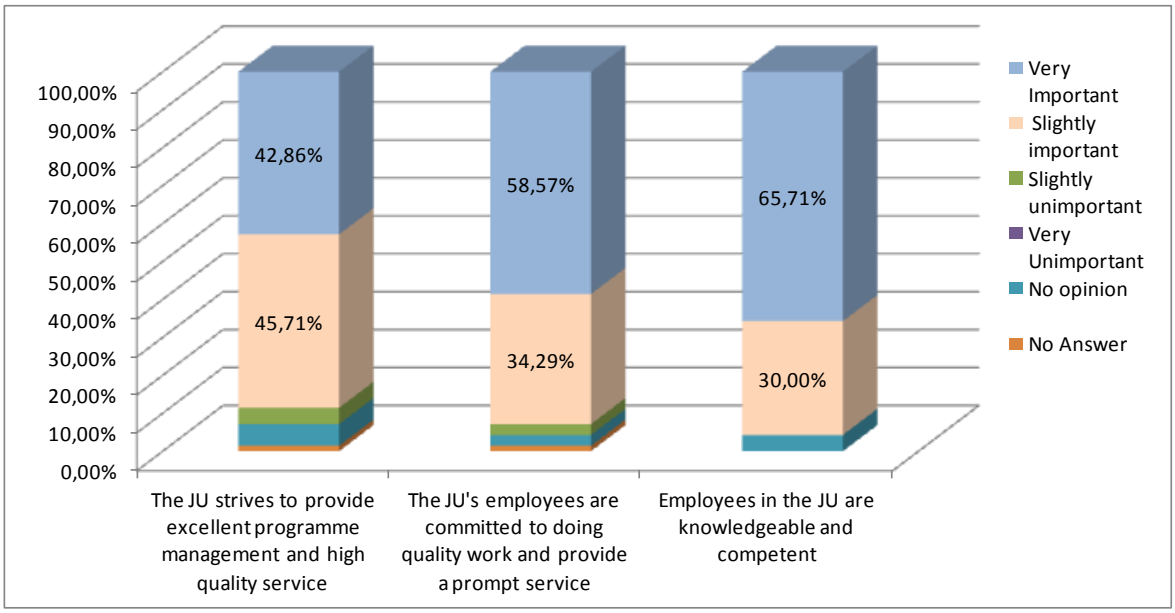


Figure 9. Capability of the JU staff and the quality of management[24].

This procedure explained above to monitor project progress is assessed as adequate and the PO to have a good capability in this respect.

In relation to technical monitoring, it should be noted that FCH 2 JU has, since its establishment, published its Programme Review Report annually, aiming to estimate the achievements of the portfolio projects funded by FCH 2 JU against their strategic objectives as well as to ensure that they aligned with the strategy and objectives set out in the multi-annual plan. Key Performance Indicators (KPI) are contained within the MAWP. These KPIs will also help to improve the monitoring of the activities and outcomes of the projects supported by FCH 2 JU.

[23] http://www.fch.europa.eu/sites/default/files/Satisfaction%20Questionnaire%20-%20Report.pdf
[24] Source: Survey of Coordinators.

The programme review process begins each summer and involves a team of international experts in the FCH field, including independent experts (in some cases employees of the JRC are involved on an individual basis under a H2020 expert contract) and members of the Scientific Committee. The team assesses and evaluates the portfolio against three primary criteria:

- Achievements of the project portfolio against the objectives of both the multi-annual and annual plans;
- Progress towards the FCH JU's horizontal objectives in the fields of RCS, PNR, safety, life-cycle and socioeconomic analyses, education, training and public awareness;
- The extent to which interactions and co-operation are promoted within the FCH JU portfolio, and between the portfolio and projects supported by other European instruments, the Member States and internationally.

JRC participates in the Technology benchmarking by means of project data collection. Currently the internal database is populated by the PO and project participants. A comparison with the international state of the art, so-called 'reference data' is lacking. The PO has asked the JRC to support the design of an improved methodology and to perform the full review cycle for the year 2017, including the final report.

The IEG considers the technical monitoring to be appropriate; the results of the review process are published before the middle of the following year and constitute a useful document to assess the project portfolio.

In relation to the financial monitoring and the appropriate use of funding, FCH 2 JU applies the provision of the Article 66 of the Financial Regulation and Article 18 of FCH 2 JU Financial Rules: "each operation shall be subject at least to an ex ante control based on a desk review of documents and on the available results of controls already carried out relating to the operational and financial aspects of the operation".

In relation to the ex-post audit and according with the financial regulation, the authorising officer responsible may put in place ex-post controls to verify operations already approved following at ex-ante controls. Such controls may be organised on a sample basis according to risk. As mentioned in the AAR 2016, there has been a close cooperation with the CAS to establish working arrangements "FCH 2 JU-CAS"[25] for the effective management of H2020 ex-post audits, including the sampling methodology for joint undertakings. However, no H2020 audit was launched for the FCH 2 JU as no financial statements had been assessed and paid. The first H2020 audits are expected in 2017. Therefore, the effectiveness of the FCH JU's control strategy can only be fully measured and assessed during the final stages of the JU's programme, once the ex-post control strategy has been fully implemented.

The IEG considers the financial monitoring to be adequate.

- *Monitoring through KPIs*

The progress of the research innovation and innovation activities of FCH 2 JU is monitored by Key Performance Indicators (KPIs). The regulation establishing the implementing modalities for Horizon 2020 requires the use of KPIs in the monitoring of work within the societal challenge of Secure, Clean and Efficient Energy: the KPIs are to be determined with reference to the Commission's Information System for the SET Plan (SETIS) and the experience of stakeholders. In conformity with this requirement, the JU has adopted KPIs to monitor the progress of implementation of its programme. The present state-of-the art was assessed in the MAWP at system level, based on the results of a joint working group formed by the NEW-IG, N.ERGHY and the PO. This

[25] Page 56, of the Annual Activity report 2016.

work revealed that some of the targets for performance set in the MAIP for the FCH JU were either too ambitious or not ambitious enough and needed to be corrected. New targets for improvement in the key performance indicators are specified in the MAWP for JU activities in 2017, 2020 and 2023. KPIs can be revised as a part of the revision of the MAWP. The JU has implemented a programme of technology monitoring of the results from its own projects and as far as possible of international best practice. The results of this knowledge management activity serve as a basis for updates of the MAWP and future AWPs.

6.6 Communication and dissemination strategies

As a part of the transition to FCH 2 JU, important priorities in 2014 were revitalising the visual identity and redeveloping the website, as well as improving branding and visibility. In line with this priority, a new communication strategy was adopted by the Governing Board, structured around two core dimensions:

1. Raising the organisation's profile;
2. Highlighting the technology's potential and market readiness.

This new communication strategy is a clear advance however more work is needed to achieve the objectives identified within the strategy.

A priority of the communication strategy is to promote the potential of the technology to public audiences; this is a key step towards the commercialisation of FCH in the target markets. For example, in the results published by the project Hyacinth and mentioned in the AAR 2016, it is mentioned that the awareness of micro-CHP technologies is generally low. For the market deployment of these technologies it is necessary to boost this awareness and the FCH JU could be a suitable instrument**.**

Recommendation: The IEG recommends that more activities should be focused on the public to increase FCH technologies awareness.

The use of social media has improved, but there is still potential with Twitter, YouTube and Facebook. Local activities with students could be relevant to increase the knowledge of the youngest and boost its interest in these technologies.

It is welcome that it is now possible to download from the FCH 2 JU webpage most of the public deliverables of the projects.

For the deployment of the FCH technologies it is crucial to have political support. In the past, the FCH JU has participated in many events and meetings dedicated to increasing awareness amongst politicians at national and European level, as is evident from the AARs of 2015 and 2016. FCH 2 JU should continue these efforts.

Recommendation: The IEG recommends that this activity be continued and strengthened to pave the way for market deployment.

- *Visibility of the EU*

Beneficiaries of the EU's Horizon 2020 research and innovation programme are obliged explicitly to acknowledge that their action has received EU funding. This must be done, if possible and unless the Commission/Agency requests otherwise, in all communication, dissemination and IPR activities as well as on all equipment, infrastructure and major results funded by the grant.

FCH JU website: The JU website displays the FCH JU logo and the tab "Background – Who we are" states it is a PPP between the European Union, Europe's FCH industry and research organisations and the EU emblem was added during the interim assessment.

Social media: The FCH 2 JU has a Twitter account to help build a bigger community and trigger significantly greater interest in the JU programme and the technologies. Because of the increasing political and institutional presence on Twitter, this tool is being developed to support the achievement of the FCH 2 JU communication strategy objectives. At the end of February 2017 the Twitter account had 641 followers and 231 published tweets. The account website displays the FCH JU logo and states that the FCH JU is a unique European PPP supporting research, technological development and demonstration activities in fuel cell and hydrogen technologies. The European Union contribution to the partnership is not mentioned and the EU emblem is not displayed.

FCH JU publications: The JU publishes many reports, including printed and online versions of programme reviews, studies of FCH technology and brochures covering achievements and success stories from funded projects. All the documents have a visual identity and every document displays the FCH JU logo. The EU emblem does not appear in any of the documents.

The Model Grant Agreement of the JU stipulates that all beneficiaries, unless the JU requests or agrees otherwise or unless it is impossible, must in any dissemination of results (in any form, including electronic):

(a) display the JU logo

(b) display the EU emblem

(c) include a suitable and specified text acknowledging the support.

Project websites: Out of 48 projects funded so far by FCH 2 JU under Horizon 2020 only 29% have created websites disseminating information related to the project . This may be because the first projects started in 2015 so at the time of the interim evaluation the projects were at the initial stage of realization and dissemination activities were not well advanced. 57% of the existing project websites correctly apply the rules and display the JU logo, EU emblem and appropriate acknowledgement including grant agreement number; 29% of websites contain only the JU logo and EU emblem, 7% place only the JU logo without the text and 7% do not obey the rules and do not acknowledge source of funding.

Project presentations and posters: Project presentations prepared for PRD display both project and FCH JU logos and include project details. Project overview slides summarise project information and include call topic, grant agreement number, Horizon 2020 pillar, start and end date of the project, total budget including FCH JU contribution as well as stage of implementation and list of project partners. However the EU emblem and funding acknowledgement text are not included in the project presentations.

Project posters prepared for PRD present general information concerning project (acronym, call topic, start and end date, project cost and FCH JU maximum contribution) and display project and FCH JU logos. The information on the posters prepared for participation in other scientific conferences and workshops is even more limited and the funding acknowledgement requirements are not always all fulfilled.

Publications from projects: The AAR 2016 includes data concerning publications from one of the projects funded under Horizon 2020. Five publications are reported from the DEMOSOFC project (ID 671470). None has properly acknowledged the source of funding. One publication does not include any acknowledgement and one does not mention EU financial support. One paper perfunctorily mentions that the project is undertaken by the beneficiary with other European partners ("FCH-JU"). Two publications mention the financial support of the European Union and provide the project ID and acronym, but the correct text of acknowledgement was not used. Moreover, the acknowledged project ID and acronym concern a different project executed by the beneficiary under FP7, namely SOFCOM project (ID 278798).

Open access to publications was made compulsory in the Horizon 2020 programme and the requirement is specified in article 29.2 "Open access to scientific publications of the FCH 2 JU Multi-Beneficiary Model Grant Agreement". It is required that each beneficiary must ensure open access (free of charge, online access for any user) to all peer-reviewed scientific publications related to the project results. Unfortunately, none of the reported publications had an open access status.

Acknowledgement of equipment and infrastructure. : During interviews with project beneficiaries it was confirmed that the required signage on the all equipment and infrastructure funded from the project is marked according to the requirements. Correct EU emblems are displayed and text which acknowledges funding and mentions project details (acronym, ID etc.) is present.

Neither the FCH 2 JU nor its beneficiaries seem to ensure in their activities a proper EU visibility as part of programme promoter.

6.7 Satisfaction of beneficiaries

The Coordinators Survey (on invitation only) launched by the European Commission was performed to collect the views of the beneficiaries about the implementation of the Joint Undertaking under Horizon 2020 for the period 2014 to 2016, the consultation was opened on the 19th December 2016 and closed on the 15th February 2017. See Annex 5 for a detailed analysis. The survey contained several questions concerning the various aspects of the process for submitting and processing the applications.

It should be noted there are not many newcomers participating in FCH 2 JU satisfaction surveys: 83% of the participants in the FCH 2 JU survey had already at least one project under the FCH JU (10% one project, 30% 2-3 projects and even 43% more than 3 projects) and were already aware of the FCH JU. 46% of the respondents have more than one project under FCH 2 JU. In this early stage of the programme, this is a quite high percentage.

Recommendation:

The IEG strongly recommends that, in the light of technology commercialisation and market penetration, the FCH 2 JU should strengthen its efforts to enlarge the FCH community, e.g. by design of the Calls to promote the inclusion of municipalities and regions and other end users. Doing so, would also strengthen the public side in this public private partnership.

Seven questions were asked concerning proposal processes and for most of them the majority of replies were strongly or reasonably favourable. The least well-performing aspects were finding help, and the clarity of the evaluation and the electronic tool. The

application evaluation process was not clear for more than 30% of beneficiaries and 30% did not agree that the electronic tool was user-friendly.

A second block of questions addressed the satisfaction with the timeliness of actions, i.e. time-to-inform, time-to-to contract and time-to-grant. The first two timescales were considered satisfactory by most respondents. The time to grant was acceptable only for 60% of beneficiaries; 30% slightly disagreed with the length of this period and 5.71% strongly disagreed.

A third block of questions addressed the finalisation of grants, in particular the availability and responsiveness of the FCH 2 JU staff, the clarity of requests from the JU regarding proposal modification and grant finalisation as well as user-friendliness of the tool used during contracting process. For almost 90% of beneficiaries the JU staff was easy to contact and responsive and only 2 beneficiaries faced problems. Requests from JU regarding grant finalisation were clear for more than 80% of respondents but 9% did not understand them. The electronic tool used during contracting process was user-friendly for 64% of users and difficult to deal with for 26%.

The assessment of communication methods found e-mail to be the most useful (99%), but telephone and face-to-face contact were also highly rated by many beneficiaries, (77% and 90% respectively). Recorded video briefings and live web briefings with chat function were not popular. It might be that these were not used by beneficiaries because about 50% of respondents answered "not applicable" and many respondents did not answer. The FCH JU website is a useful communication tool in the opinion of 80% of beneficiaries; 14% think that the information available on the website is not useful.

Finally, the beneficiaries were asked to assess the overall services provided by FCH 2 JU which include information, communication, programme management and support offered to the beneficiaries at different stages of application and project. The outcome is very positive; 97.14% of beneficiaries are very satisfied or satisfied with the services and products offered and provided by FCH 2 JU. Only one beneficiary is very dissatisfied and another one couldn't answer the question. The findings of the consultation were reinforced by the interviews conducted with individual stakeholders. The interviewees generally praised the operation of the FCH 2 JU, had positive opinion concerning its services and spoke highly of the FCH 2 JU staff, its knowledge, willingness to help and cooperativeness.

7 ANSWERS TO THE EVALUATION QUESTIONS

7.1 Effectiveness

7.1.1 Overview of calls in the period 2014-2016

The first Call under H2020 was made on the 9th July 2014 with a budget of €95.5 million; it was closed on the 6th November 2014. There appear to have been some initial difficulties interacting with the Common Support Centre, but eventually these were overcome and all supporting documents, including the guidelines for proposals submission, the guide for applicants and the model grant agreement, were successfully adapted to the new H2020 rules. Fifty-seven proposals were found eligible with a total budget of €304M, with a total requested FCH JU contribution of €236M. Fifteen proposals were selected for funding involving 152 participants. The total FCH 2 JU contribution requested was €82M.

The AWP for 2015[26] was amended to reflect the results of the 2014 call and adopted by the Governing Board on the 30th April 2015. The call was published on the 5th May 2015 - with an indicative budget of €123 million - and was closed on the 27th August 2015. Sixty-six proposals were received; four were rejected by the FCH 2 JU for non-compliance with administrative requirements and another was found to be ineligible. 15 proposals were funded for a total FCH 2 JU contribution of €110M. The remaining budget of €13M (about 10.6 %) was not used under the 2015 call.

The 2016 call was published on the 19th January 2016 with a budget of €117.5M and was closed on the 3rd May 2016. Eighty-one proposals were submitted; thirty-two projects passed all thresholds with a combined request of €142M. Nineteen proposals were funded for a total FCH 2 JU contribution of €94M. An overview of the Calls under FCH 2 JU is given in Table 2.

Table 2. Overview of Calls from 2014 to 2016.

Year	Number of proposals submitted	Number of proposals passing all thresholds	Number of proposals funded	% of submissions funded	EU contribution (M€)
2014	57	23	15	26%	82,1
2015	66	23	15	23%	109,9
2016	81	32	19	23%	93,9
Total	204	78	49	24%	286,0

7.1.2 Participation patterns by country and region

Through the first three years of the FCH 2 JU, applications to participate were received from 1401 organisations within the EU28 and another 137 from other parties (associated countries and 3rd countries). This compares to 3018 applications received in the 7 Calls under FCH JU. The applications rate to FCH 2 JU has therefore been a little higher than for the FCH JU.

The breakdown of applications by country is shown in Figure 10 along with the behaviour under the FCH JU. The trends observed for the FCH JU operating under FP7

[26] Annual Activities Report of the FCH JU, 2015.

are largely continued for the FCH 2 JU operating under H2020. The top two countries (DE and the UK) submitted more applications than under FP7; there is also a slight increase in activity from the EU13 counties at the tail of the distribution and a little less activity in the middle of the curve. The differences from FCH JU are still slight and not significant. Among non-EU members that have applied to participate to date in the programme, the leading countries are Switzerland (3% of applicants), Norway (2.5%), Turkey (1%) and smaller numbers from Israel, Iceland and the Ukraine. This level of interest resembles that seen under the FCH JU.

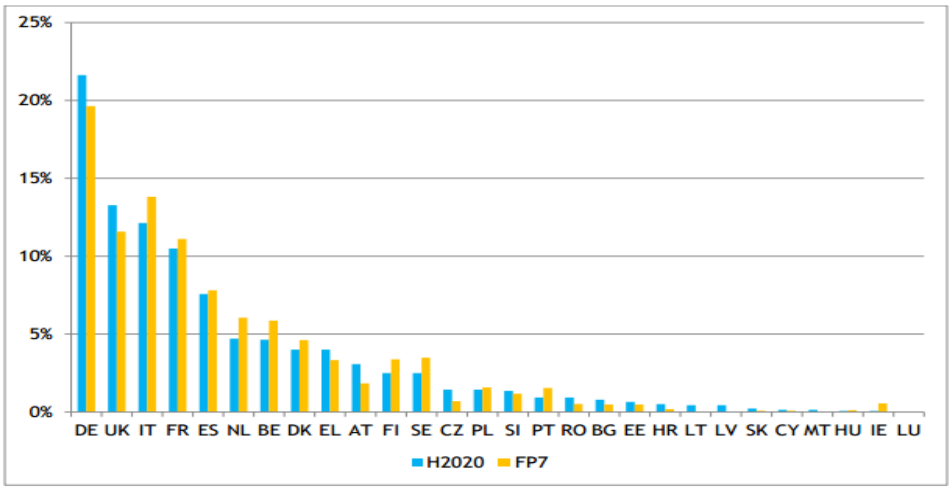


Figure 10. Applications by EU MS for FCH 2 JU (2014-2016) and FCH JU.

The concentration of applications among the larger countries is quite evident, but it does not necessarily indicate a lack of interest elsewhere. Figure 11 shows a different presentation of the data in terms of the number of applications received per million inhabitants. The difference in behaviour is quite strong, especially at the higher end of the distribution. The most applications per person were received from Denmark, Slovenia, Estonia, Finland and Belgium, but most of the EU13 countries are still found in the tail of the distribution. The IEG opinion is that as JTI is industry driven, the natural consequence is that countries with strong FCH industry are more present/active.

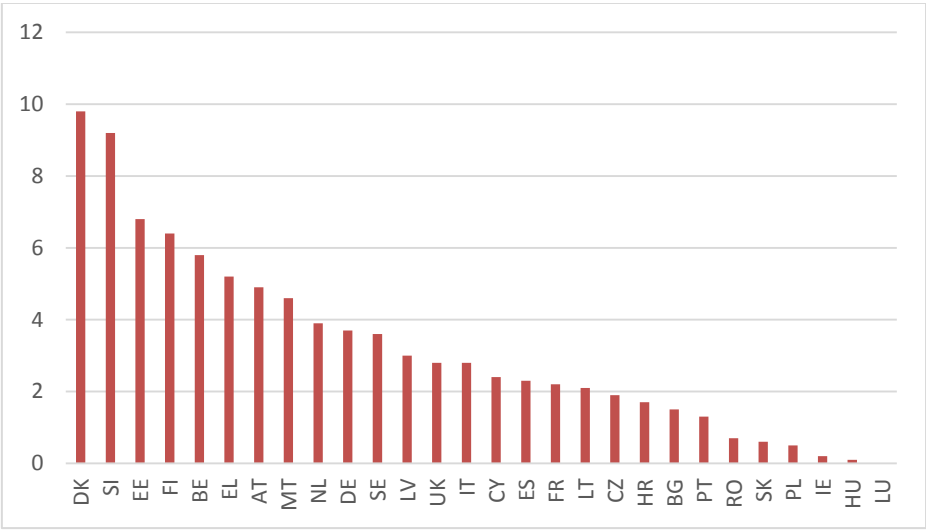


Figure 11. Applications by EU MS for FCH 2 JU (2014-2016) and FCH JU.

Figure 12 shows the growth in the number of entities that had ever participated in proposals funded following each of the successive Calls of the FCH JU; it can be seen as a measure of the growth of the FCH community. The bottom part of the column

shows the number of entities that were new to the FCH JU in each Call. The top part of the column shows the number of repeat entities and together they comprise the running total of all entities that have participated. In the first Call all entities were new; thereafter the community built up rapidly at the rate roughly of 100 new participants per year and then it became stable. This is not surprising because there is a finite number of research and industrial entities that are most likely to apply for funding but it is welcome that JU continues to attract new-comers. The JU though should give some thought as to how to broaden participation to include regions, municipalities and other end-users. This is happening to same extent through the MoU with regions, but greater participation in projects would also be desirable to pave the way for market and social acceptance and deployment.

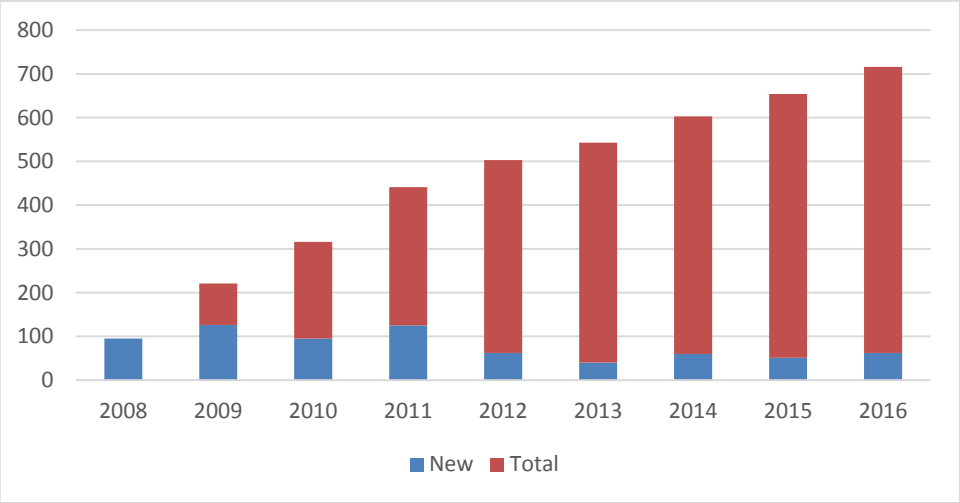


Figure 12. Growth in the FCH Community.

7.1.3 Competition for funding

Table 3 summarizes the data for all three years. There is a tendency, observed in each year, for the total contributions requested by successful projects to be either significantly higher or lower than the available budgets as determined in the AWPs. This could inhibit the construction of a portfolio of projects designed to implement a long-term strategy.

On the other hand, the difficulty of managing the coverage of topics may be an inevitable consequence of trying to implement a long-term technical strategy through annual Calls, driven or constrained by the concept of excellence. Thought might be given to whether there are others ways of managing this task that are more compatible with portfolio management.

Table 3. Summary of the three years (% over threshold).

	2014	2015	2016	2014-2016		
				No. evaluated	Passing threshold	% passing
Transport	40.0	21.1	50.0	53	20	37.7%
Energy	44.7	48.5	36.8	109	47	43.1%
Overarching	0	40.0	28.6	14	4	28.5%
Cross-cutting	30.0		67.0	17	8	47.1%
Total	40.0	37.7	42.1	193	79	40.9%

- *Success rate by type of applicant*

Table 4 shows the success rates over the three years by the type of applicant. Universities have consistently been the least successful applicants; in every year, the success rate of universities has been lower than that of the average of participants. This may be related to the high TRL of the topics. Industry and SMEs by contrast are generally more successful than the average (except in 2016), but the out-performance is not great. Apart from the poor performance of universities there is little obvious structure in the data.

Table 4. Success rate by type of beneficiary.

	Passing all thres-holds	All bene-ficiaries (%)	Univer-sities (%)	Researc h organis-ations (%)	Large industrial companie s (%)	SMEs (%)
2014						
Energy pillar	17	46%	38%	44%	50%	52%
Transport pillar	4	61%	0%	31%	67%	43%
Overarching projects	0	0%	0%	0%	0%	0%
Cross-cutting	2	24%	13%	18%	41%	33%
All projects	23	45%	28%	35%	54%	46%
2015						
Energy pillar	16	48%	47%	52%	48%	49%
Transport pillar	4	18%	25%	15%	19%	3%
Overarching projects	2	66%	67%	29%	72%	82%
Cross-cutting	1	17%	13%	22%	20%	0%
All projects	23	39%	35%	33%	43%	43%
2016						
Energy pillar	14	34%	25%	46%	33%	33%
Transport pillar	12	41%	30%	46%	39%	38%
Overarching projects	2	29%	17%	45%	27%	30%
Cross-cutting	4	58%	44%	79%	35%	44%
All projects	32	39%	28%	50%	35%	35%

- *EU contribution broken down by country activity type of beneficiaries, and thematic area*

The share of participation of member states in grant agreements is summarised in Figure 13, both for the FCH JU and the FCH 2 JU. It follows a very similar pattern to that for the share of applications exhibited in Figure 10. The implication is that success in obtaining funding is primarily determined by the extent of market presence of the large players and is not noticeably disturbed by islands of competence elsewhere. In both the FCH JU and the FCH 2 JU there is a strong concentration of funding in a few countries. This concentration is even more marked in FCH 2 JU than in FCH JU. In the first three years of FCH 2 JU the top three countries signed 64% of the grant

agreements and in FCH JU it was 61%. The difference is small, but suggests that the top countries are winning out with respect to the middle of the distribution where the amounts gained under FCH 2 JU are mostly a little smaller.

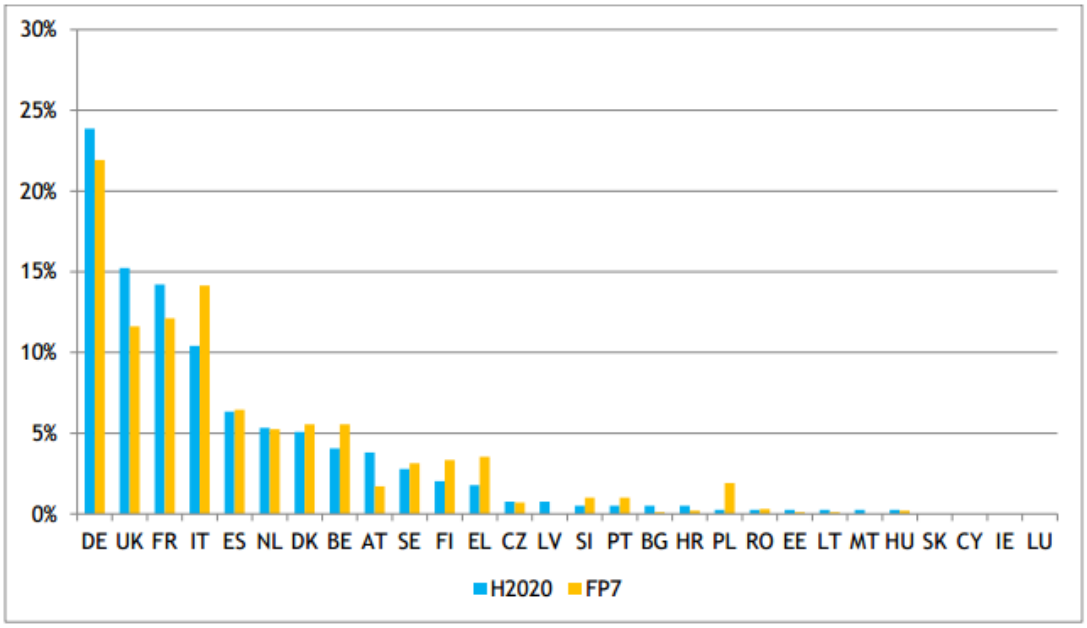


Figure 13. Member state share of signed grant agreements.

The distribution of JU funds by theme and type of beneficiary is summarised in Table 5. The most striking aspect of the Table is the predominance of industrial companies in the Transport pillar. Seventy-one per cent of funds go to large industry and 15% goes to SMEs, presumably for the most part industrial. This indicates that 86% of funding goes to industry. This large share is presumably a reflection of the maturity of the technology in this area and therefore the proximity to commercialisation;

Within H2020 the target set by Council and the European Parliament is to allocate 20% of the budget for Societal Challenges and Leadership in Enabling and Industrial Technologies (LEIT) actions to SMEs. In the period 2014-2016, the participation of SMEs was around 27%: significantly above the target.

The funding share for institutes of higher education n FCH 2 JU has been 5%. This is a failure to integrate fully the third side of the knowledge triangle, but the industrial leadership of the initiative tends to support activities with a higher TRL where institutes of higher education have limited activities.

From 2008 to 2013 the share of funding going to large industry was 57% and that has changed little so far under FCH 2 JU.

Table 5. Distribution of JU funds (% of total 2014 - 2016).

	Univer-sities[27] (%)	Research organisa-tions (%)	Large industrial companies[28] (%)	SMEs (%)	Other[29] (%)	Total grants awarded (M€)	% budget by activity
Energy pillar	7%	15%	49%	28%	1%	125.63	45%
Transport pillar	3%	9%	71%	15%	2%	111.63	40%
Overarching projects	2%	3%	35%	57%	3%	42.00	15%
Total	5%	11%	56%	27%	2%	279.26	100%

Table 6 shows the origin of beneficiaries in successful proposals. It seems the transport sector shows proportionally more industry participation than the energy sector, indicating the difference in market readiness between the pillars. Industry (Large companies and SMEs) are the ones receiving more funds. This is an expected result of the FCH 2 JU focus on innovation to help industry bridge the gap between research and commercialisation

Table 6. Distribution of JU's beneficiaries by organisation type (% of total 2014 - 2016).

	Univer-sities (%)	Research organisa-tions (%)	Large industrial companies (%)	SMEs (%)	Other (%)	Total of beneficiaries
Energy pillar	16%	23%	30%	30%	1%	214
Transport pillar	8%	12%	52%	20%	7%	166
Overarching projects	7%	7%	42%	33%	11%	57
Cross-cutting projects	20%	27%	20%	21%	13%	56

- *Participation patterns per specific thematic topic broken down by type of beneficiary organisations (universities, research organisations, industrial participation (large companies and SME).*

[27] Classified as Higher or Secondary Education Establishments in CORDA database
[28] Classified as Private for Profit entities excluding SMEs and Higher or Secondary Education Establishments
[29] Classified as public and other bodies that do not belong in any of the other categories

The numbers of organisations of different types applying to the FCH 2 JU and the numbers eventually funded are summarised in the Figure 14. By far the greatest volume of applications comes from industry.

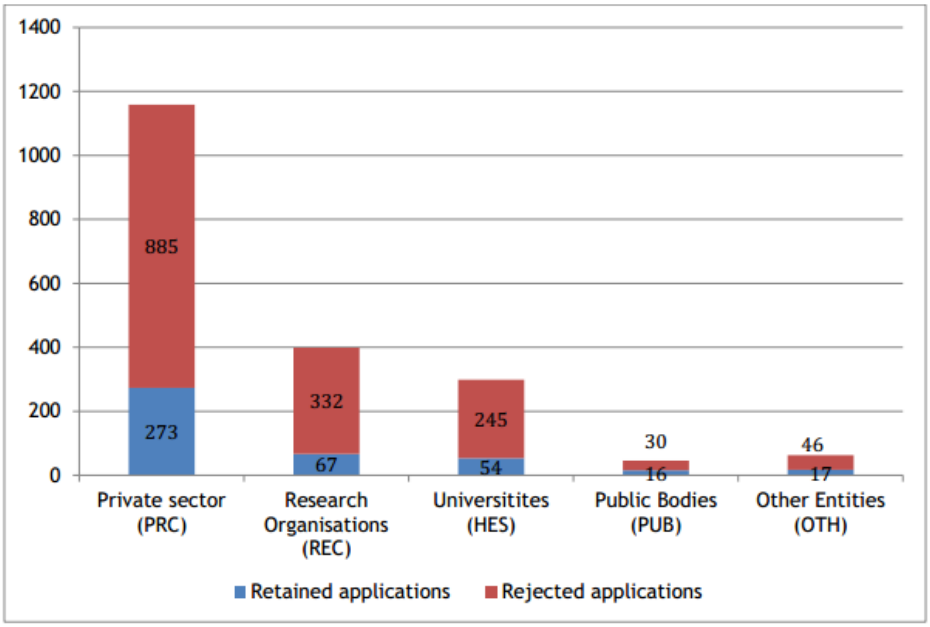


Figure 14. Types of organisation applying to the JU (2014-2016).

- *What is the average grant size in terms of budget and number of beneficiaries (overall and by call and research topic)?*

The average grant size per participant over the three calls to 2016 has been €580,000, but the distribution is very skewed. Figure 15 shows the percentage of the total funds awarded as a percentage of the applicants sharing those funds: 90% of the funds go to 47% of the beneficiaries and 80% of the funds go to 31% of the beneficiaries; the top 2% of beneficiaries receive more than 20% of the funding (€62M out of €286M). This is a high degree of concentration. Most of the ten largest beneficiaries (with grants over €5M) are large companies selling fuel cells for CHP and bus companies involved in demonstration programmes. The large sums involved are related in some way to deployment of end-use devices. It should be highlighted these are the projects that also generate most IKOP/leverage as only a fraction of activities is being funded by the JTI.

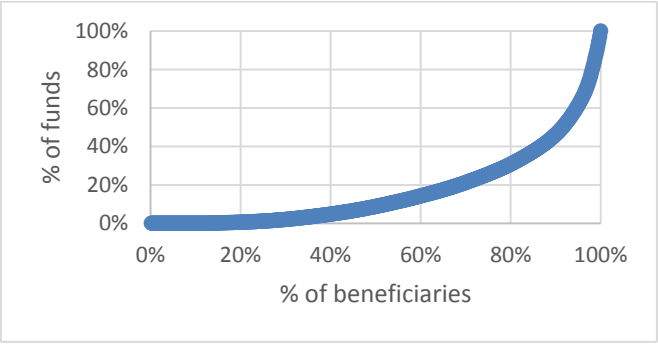


Figure 15. Distribution of EU grants among beneficiaries.

The concentration of the costs of all the projects undertaken under the auspices of the JU is shown in Figure 16. This is because the EU funding as a proportion of total project cost tends to fall with size as shown in Figure 17.The larger size of projects and the lower EU funding arises because the FCH 2 JU is moving more towards deployment activities and additional sources of funding are required for these larger-scale projects. This leads to a high leverage effect, whereby the funding of the FCH 2 JU now triggers much larger projects than did FCH 2 JU.

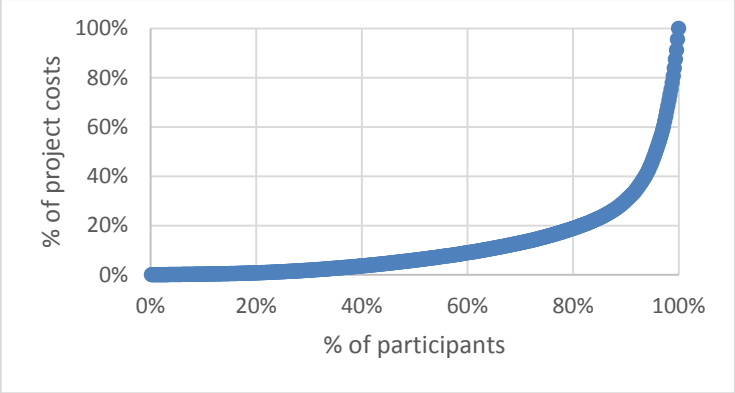


Figure 16. Distribution of total project costs among beneficiaries.

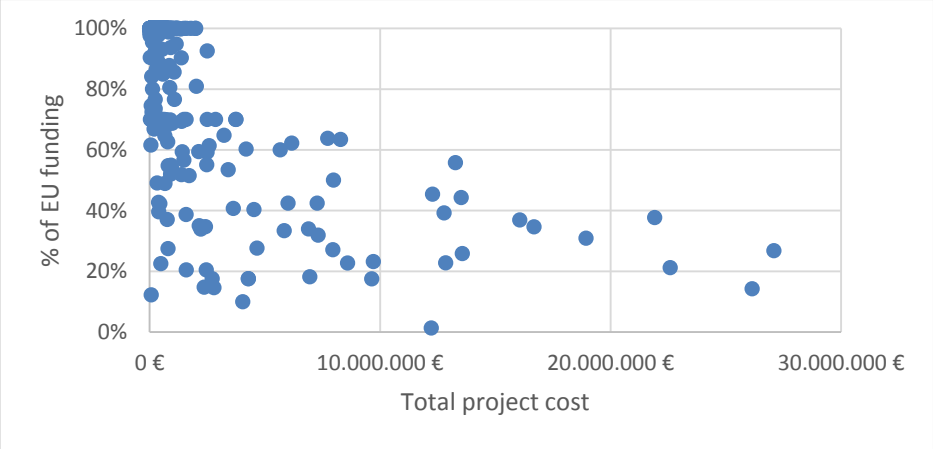


Figure 17. Fall-off of JU funding with project size.

- *How do these trends compare with the respective JU under the Seventh Framework Programme?*

The observed behaviour is broadly similar, but there are two differences that may be significant.

There is a slightly greater concentration of funding on the larger countries, perhaps because FCH 2 JU focuses more on demonstration and so larger and more active FCH countries are more able to bear the costs of deployment and demonstration. There is a higher failure rate among projects, most probably caused by changes in evaluation procedure in H2020. Following the H2020 rules, there is no negotiation after the proposal is evaluated and there is no possibility for the evaluators to propose modifications. The lack of a means in the new regime to remedy weakness in a

proposal at the stage of grant negotiation prevent evaluators from passing a good project with weaknesses that might previously have been remedied in negotiation.

7.1.4 Main achievements

The JU was mandated to support a strong, sustainable and globally competitive FCH sector in the Union. Its activities are relevant for this aims but it remains a question of whether the scale of activities is competitive with other international programmes.

Continuing the trend established during FCH JU, there are clear signs that the FCH 2 JU MAWP is providing an effective structure within which academic and industrial research and innovation decisions are being made.

The IEG is of the view that on balance, the EU position would be less favourable without the activities of the FCH 2 JU, although there are strong international challengers

It is hard to form a definitive view on the strength of the relative global positioning of Europe across the technological spectrum and to what extent the JU has contributed to developments as there are many factors to consider. The lack of a deployment support framework and the budget available are a barrier to reaching all the objectives.

The current review was undertaken between November 2016 and June 2017 at a point when FCH 2 JU projects have not, as would be expected, yet produced formal results or outcomes. However, an analysis of the intentions of the MAWP and the portfolio of projects acquired between 2014-2016 shows that the portfolio is well-aligned with the objectives, except that work on the reduction of the need for Critical Raw Materials is less than sought. This is a long-term issue of strategic importance and should be pursued.

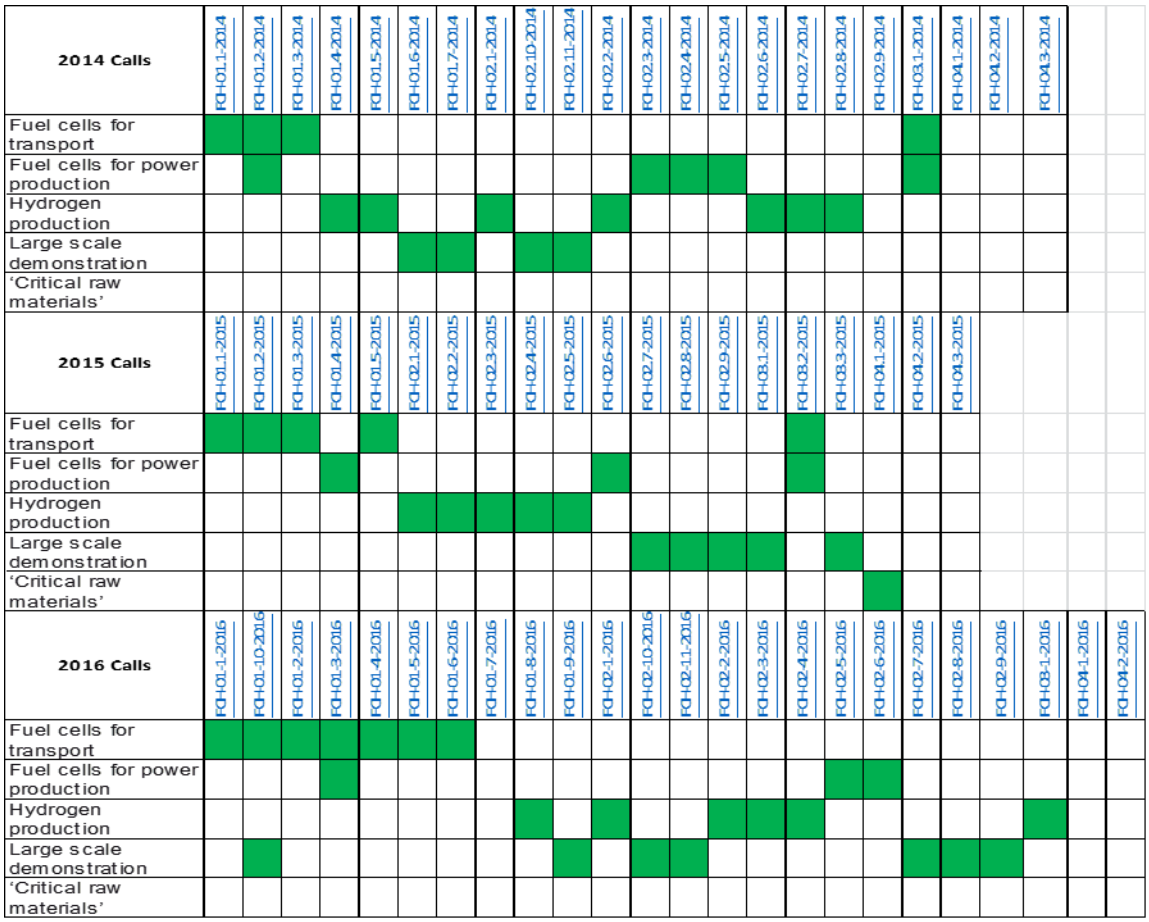


Figure 18. Mapping of Call topics to thematic areas.

The JU has successfully adopted the procedures and tools of H2020. The establishment of Hydrogen Europe as a new body with dedicated staff to represent the industry has widened the participation and clarified the goals and functions of the grouping, underlining the industry commitment. The elaboration of the Annual Work Plans has been formalised and the roles of the constituent bodies of the JU have been improved.

Coherence in the strategies and implementation plans for both transport and energy is highly important. FCH 2 JU reflects this convergence in that both the transport and energy pillars are present in the same joint undertaking.

FCH 2 JU has an explicit EU added value and amongst the FCH innovation community, there continue to be strong benefits received from the work of FCH 2 JU. But in terms of overcoming fragmentation within Europe, the challenges of delivering improved coordination between Member States' FCH research and innovation support remain. There is little sign of the effectiveness of the SRG in this regard evolving, and this continues to be a priority for improvement during the life of FCH 2 JU.

The original obligation of industry to make matching expenditures on projects introduced for the FCH JU was found to be impractical in view of the H2020 procedures, and has been replaced for the FCH 2 JU by a different approach that requires the JU to measure In-Kind Additional Activities (IKAA). This has required new procedures covering the planning and reporting of IKAA by members and the verification of claims internally by the PO and by external consultants. The procedures have been successfully introduced and the reported levels of IKAA have been significantly larger than expected.

The technology assessment and monitoring capacity was first recommended in the first interim evaluation of the JU and has been a long time in coming. The JU has abandoned the excessively complex tool delivered by a project of the FCH JU and instigated a simpler procedure. Limitations concerning the confidentiality of data are slowly being overcome.

During the FCH JU Stakeholder Forum on 23 November 2016, representatives of European cities and regions signed a Memorandum of Understanding to improve local support for FCH and to raise awareness and foster public-private partnerships. To date, 60 European cities and regions have committed to participating in this initiative. This is an admirable initiative of the JU.

Although the content of the portfolio corresponds well to the specific objectives, there is a high degree of concentration: the five largest projects account for more than half of the grants committed by the JU and much of that is for demonstration of fuel cell buses.

7.1.5 Progress in meeting specific objectives

- *Progress towards the objectives set in the Council Regulation*

The FCH 2 JU has made good progress towards the objectives of the Joint Technology Initiative on Fuel Cells and Hydrogen, to develop a strong, sustainable and globally competitive fuel cells and hydrogen sector in the Union.

An indication of the expected progress towards the objectives set out in Article 2.2 of the Council Regulation can be gained from study of the MAWP and of the content of the Calls. The structure and content of the MAWP is clearly related to the specific objectives specified in the regulation. It is proposed to meet the objectives to reduce the production cost and increase lifetimes through demonstration of a sufficiently large fleet of next-generation FCEVs. These are ambitious aims that are consistent with the objectives, but it is not clear from the MAWP that demonstration on the relatively modest scale that can be funded in the activities of the FCH JU will have the desired impact. All the technologies involved have been demonstrated.

The IEG noted that even if demonstration initiatives have been useful to show the viability of the technologies, their size is insufficient to allow large cost-reduction in production.

The JU was set specific objectives:

- To lower the cost of fuel cell systems for transport, while increasing their lifetime;
- To lower costs and improve performance fuel cells for power production;
- To lower costs and improve performance of water electrolysis;
- To demonstrate on a large-scale the feasibility of using hydrogen to support integration of renewable energy sources into the energy systems;
- To reduce the use of the EU defined 'Critical raw materials'.

Analysis of the intentions of the MAWP and the portfolio of projects acquired between 2014-2016 shows that the portfolio is well-aligned with the objectives, except for the reduction of Critical Raw Materials as already mentioned.

- In fuel cell buses, Europe is a world-leader; it has the largest deployment globally and has developed a strong and constructive relationship with regions and municipalities to make further progress.

- For smaller fuel cell vehicles, the European OEMs generally lag competitors from North America and the Pacific Rim; vehicles used in demonstrations come mainly from competitor countries. The level of achievement in Europe though is sufficient to make European customers informed purchasers and to support local manufacture and deployment should the commercial case be proved.
- In MHVs the commercial case is more complex and electric vehicles are well-established in the market.
- In the provision of production distribution and refuelling facilities for FCEVs the EU is probably a global leader through the programme of Hydrogen Mobility Europe, in which the main driver is Germany, but in which the FCH 2 JU has also played an important part.
- In stationary power generation, IEG is the opinion that the global leaders are North America, South Korea and Japan, assisted by favourable regulatory regimes, although the EU does have some isolated success stories. The application struggles everywhere to make commercial headway. The essential problem is that electricity generation from natural gas in low-cost Combined Cycle Gas Turbine (CCGT) is efficient and heat generation from natural gas in low-cost condensing boilers is also efficient, so the gains from CHP applications using fuel cells are scarcely able to compensate for the high cost of the fuel cell device; similar arguments apply to both industrial and residential applications.
- Europe has a strong position in the strategic use of hydrogen to add flexibility and security to an energy supply system drawing a large part of its primary energy input from renewable energy; this involves technologies for electrolysis, large scale hydrogen storage and power-to-gas. There is a clear driver for this effort in Europe arising from the intermittent surpluses of electricity from renewable energy which can be seen both as an embarrassment and an opportunity. However the high degree of autonomy among regions and municipalities in some parts of Europe, each with local and specific requirements, seem to have inhibited progress to this development in energy supply systems.
- The future role of hydrogen should be seen in a broad economic context There is for instance the possibility that hydrogen may displace coal in the smelting of iron ore in the long-run or find other uses in a carbon-limited world, e.g. for upgrading biological feedstocks. If electrolytic hydrogen were available at low cost, then there might be more competition in demand as there is a big opportunity based on Europe's energy and climate policy that aims at cutting fossil fuel use.

It is hard to form a definitive view on the relative global positioning of Europe in FCH technologies as there are so many influencing factors. Overall, the IEG concluded its position is satisfactory, with some notable opportunities such as in hydrogen technologies and bus applications. The IEG is of the view that the activities of the FCH 2 JU play a core role in providing both direction to, and improved coherence of, EU progress in FCH technologies, and the EU the competitive position would be weaker without it..

An important weakness in the EU position is that the region still does not have a competitive and commercially available fuel cell stack. This is serious deficiency as it is the core of the FCH industry and will affect the positioning of European companies in the supply and value chains. To support development of such a stack should be a priority of the FCH 2 JU in the coming years. The MAWP also envisages demonstration of hydrogen refuelling stations embedded in a wider European refuelling infrastructure to support the large-scale market introduction of FCEVs in the EU by 2020. A large-scale market for FCEVs by 2020 is unlikely. A hydrogen refuelling infrastructure would

be necessary, but it is not proven that further demonstration of the technology is the critical factor, or that it cannot be done without funding from the JU.

The activities need to be situated more clearly within a robust strategy for commercialisation demonstrating where funding from the JU is truly directed at critical obstacles. Such a strategy should also recognise the international dimension of commercialisation.

Commercialisation will not occur in a European bubble. There will be an important influence *inter alia* from China: any Chinese intervention in the market would be at large scale and would likely reduce costs considerably. The main market initially would be domestic, but there will be implications for the international supply chain through strategic partnerships with western technology suppliers. Similar processes have been experienced in thermal power generation and in renewable energy technologies.

The IEG recommends that the approach to achieve the specific objectives within the transport sector should be reviewed to justify the strong emphasis on continued demonstration and better to situate the activities within a coherent strategy for commercialisation that recognises its inevitable international character.

The deliverables pertaining to the development and improvement of electrolysers using renewable energy sources are fully in line with the specific objectives, as is the proposed work on large-scale storage of hydrogen and the injection of renewable hydrogen in the natural gas grid. The activities on RCS both for transport and energy are sound and fully in line with the objectives.

7.1.6 Effectiveness of the implementation

The programme administration was assessed as good in the second interim report of the FCH JU and it has continued to improve under the FCH 2 JU. The definition of the work programme contained in the MAWP should be more transparent. The opportunity for capture by a few large industrial interests is evident; some stakeholders are convinced that this has indeed happened but, as is in the nature of such allegations, it is hard to provide evidence. The IEG notes the possibility and reserves its judgement.

Design of the AWPs is relatively open and transparent and has shown some capacity to adapt the contents to unexpected developments. Administration of the Calls is done well; preparations for evaluation are comprehensive and appropriate. The evaluations conform to the best practice of Horizon 2020, using independent evaluators screened for conflict of interests, under the supervision of expert chairpersons and the scrutiny of independent observers.

The times taken to inform applicants of results and the times taken to grant signature have fallen erratically over the years; the present performance under the FCH 2 JU is superior to the targets set in Horizon 2020. The support for coordinators through the implementation of proposals has generally been well-received by the target audience, that found the support generally superior to the practice in past framework programmes. The coordinator survey indicates that coordinators are generally satisfied with the management of the FCH 2 JU and a few find it better than FCH JU; none finds it worse.

7.1.7 Stakeholder engagement

The FCH JU is undoubtedly industry-driven, arising out of the birth of the JTI concept in the logic of the Lisbon Agenda. This simple idea was always conditioned by at least two others: that the JTI was a public-private partnership whereby public goals would be met alongside industrial objectives and that the JTI would integrate the knowledge-triangle, i.e. industry, research institutions and higher education in pursuit of these

twin purposes. The industrial interest and involvement in the JU has been strong; industry has organised itself to make coherent interventions and has created a substantial cooperative structure through Hydrogen Europe to assemble, sift and convey the views of its substantial membership in a manner that is coherent with the processes of the JU. On paper, the arrangements are impressive.

Involvement with local and regional authorities is strong and well-directed. Involvement with academia has been strengthened under FCH 2 JU. There is a good participation of universities in N.ERGHY (more than twenty universities are members), and their involvement in projects has recently increased. A significant failing is the lack of linkages to financial institutions although there is some evidence that this is changing: the EIB is working with Hydrogen Europe and the JU has engaged a financial engineer with this task.

There is a potential for a stronger cooperation with regulators; there is a range of regulators that are potentially relevant – health and safety, energy, standards. The reason for this is probably that FCH technology is not sufficiently close to large-scale deployment to require strong regulatory involvement, but the JU has done much work on RCS and is well positioned to give advice when appropriate and needed.

There are two distinct public benefits that might be expected from the PPP: firstly, whether it contributes to the sectoral policies of the MSs and EU institutions and secondly, whether it makes a convincing case to the public that it is contributing to welfare and that of future generations. The key in both cases is the adequacy of the communication strategy of the JU. It would help if in the Annual Activity Report the PO were to include a short assessment of how completed projects had contributed to solutions to the grand societal challenges. The participation of senior officials from DG MOVE and DG ENER in the Governing Board should ensure alignment of the work of the JU with public policy goals, but it is not entirely clear that this does happen. The sectoral DGs need to set out more transparently their expectations of the JU well in advance of the design (and or revision) of the MAWP. To demonstrate the welfare benefits of research is often difficult, but it is increasingly important in this time of populist politics and public scepticism about EU's added value. The JU is aware of the need and has provided a diagnosis and remedies in its communication strategy,

The low participation of institutes of Higher Education is a loss to the community for two reasons: it diminishes the supply of trained scientists and engineers to contribute to future work and it undermines the long-term provision of new technology. The origins of the problem could be either that the scope of the calls or the funding rates are not attractive to institutes, or that they are not being engaged by or supported by industry to participate. A possible solution to the latter resides in a better dialogue between industry and universities to identify how to formulate projects so that they satisfy the requirements of both partners.

7.1.8 Participation of the best players

Using the 2015 EU R&D Scoreboard[30] ranking as a reference, FCH 2 JU counts among its participants many of the top-ranking car manufacturers (1: Volkswagen, 14: Daimler, 20: Honda, 21: BMW, 34: Nissan, 63: Renault) as well as top energy and utility companies (17: Bosch, 24: Siemens, 33: GE), showing that both for transport and energy applications high innovators are very well represented in the FCH JU.

Out of the 83% of total FCH JU contribution in H2020 projects given to private companies, 37% has been awarded to entities in the top 2500 biggest R&D spender companies (out of which 11% to the top 100 companies). This figure is significantly higher than the 15% awarded to top 2500 companies under FP7, demonstrating that the JU is more successful than the framework programme in involving private

[30] http://iri.jrc.ec.europa.eu/scoreboard15.html

companies. Whether this is a consequence of the PPP structure or of the nature of the work is hard to judge, the structural aspects probably are influential.

The participation of SMEs under FCH 2 JU is much the same as in FP7 (26% in the FCH JU, 27% to date in the FCH 2 JU). This is well above the target in the case of both framework programmes. The attractiveness to SME's is due to a combination of several factors: the topics in the FCH JU are concrete and well-defined, allowing small specialised companies to respond to a clear problem; participation offers the opportunity to get access to the supply chain of a growing sector; the field is highly innovative and in full development, and thus also allows new entrants with limited means to bring new concepts forward; from an administrative point of view, the simplified rules and higher funding rates under H2020, as well as the fact that there is no longer a retention for the Guarantee Funds, have made participation more attractive to SME's; it is not difficult for SME's to become member of Hydrogen Europe. This allows them to contribute to the definition of Work Programmes and gives them representation at the Governing Board.

- *Public consultation*

The extent to which the modalities of the FCH 2 JU were effective in achieving the objectives is assessed in the public consultation launched on the 8th December 2016 by the Commission services, and concluded on the 10th March 2017: 373 answers were received from individuals (24%) and persons representing professional capacity or answering on behalf of an organisation (76%). The group of respondents consisted of private for profit organisation, excluding education (PRC) (42%), Member State administration (2%), regional/local administration (2%), non-governmental organisation (NGO) (3%), research organisation (19%), academia (12%) and other entities (6%). More information can be found in Annex 6 Detailed analysis of the Public Consultation 2017.

The majority of respondents found that the FCH 2 JU was very or somewhat effective in developing a strong, sustainable and globally competitive fuel cells and hydrogen sector in the EU. A substantial majority thought that FCH 2 JU was very or somewhat effective in reducing the production cost of FC systems for transport applications. For increasing of the electrical efficiency and durability of fuel cells for power production, the response is similarly favourable. Activities related to hydrogen production were assessed as somewhat or very effective by 80% of respondents and a similar majority thought the same of the activities related to large scale demonstration of feasibility of hydrogen. 70% thought the actions of the JU were effective in reducing the use critical raw materials. On the whole, the responses indicate a favourable perception of the effectiveness of the JU.

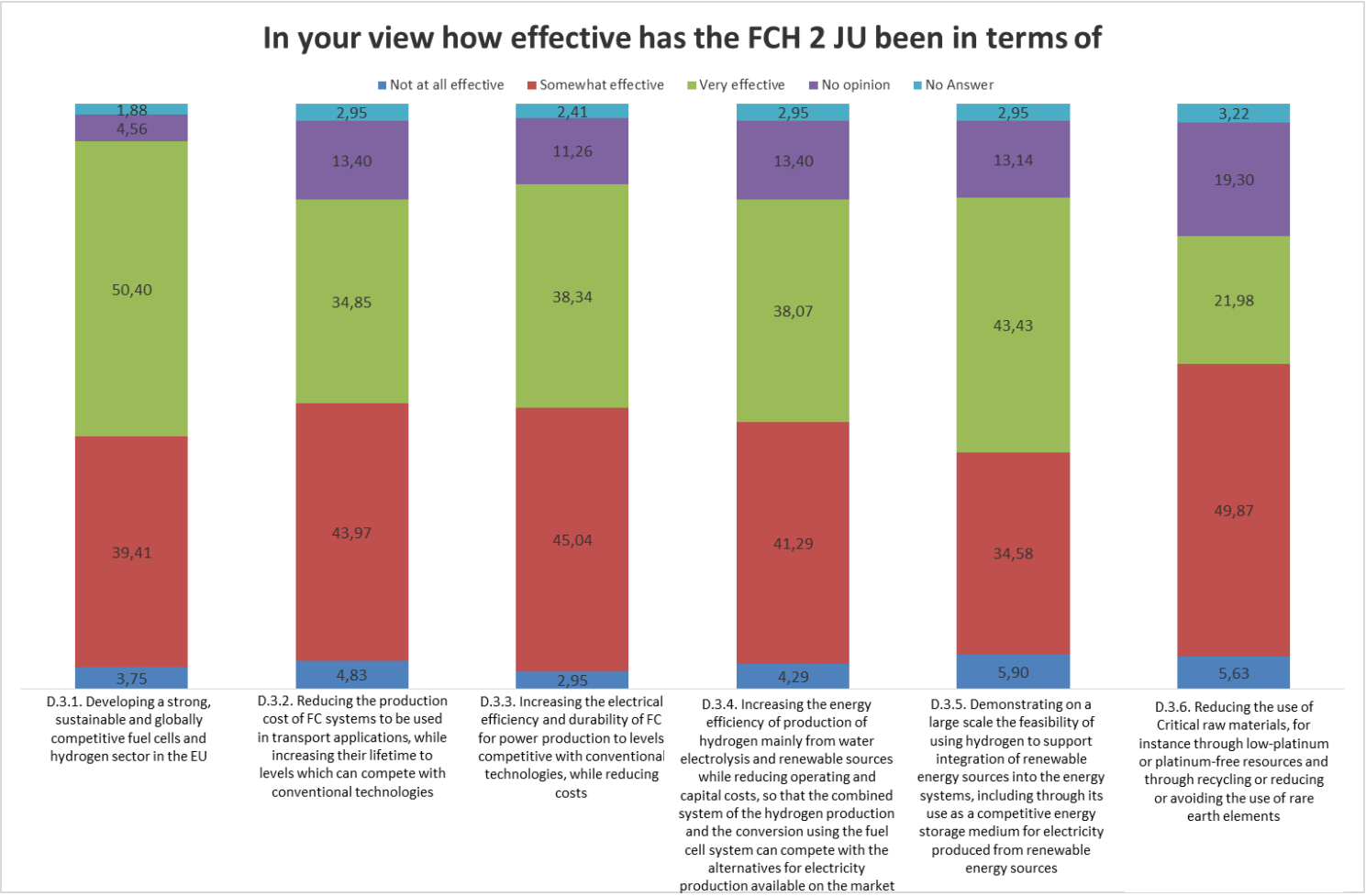


Figure 19. Perceptions of the effectiveness of the JU in obtaining objectives[31]

[31] Source : Public consultation for FCH 2 JU Interim evaluation

7.2 Efficiency

- *Efficiency of operations*

Efficiency describes the relationship between the resources used and changes generated. The "Better Regulation Package" defines efficiency as "The benefits versus the costs. (Alternatively, to which extent objectives can be achieved for a given cost, defined as cost effectiveness.)". The operational efficiency is evaluated in accordance with the ToR based on an analysis of Key Performance Indicators describing the:

- Timely execution of the functions;
- The cost efficiency of the management and control arrangements;
- The budget execution of commitment and payment appropriations;
- Suggestions for simplification and reduction of the administrative burden for participants.

The FCH 2 JU has successfully made the transition to Horizon 2020 by completing the Grant Agreements resulting from the annual Calls 2014 to 2016. By the end of 2016, the FCH 2 JU was managing 46 H2020 projects (15 projects each from Calls 2014 and 2015 as well as 16 projects from Call 2016), another 3 were under preparation. The total number of projects under management until 31st December 2016 in real terms is depicted in Figure 20. (Projects which run only a certain share of the budget year, are included per this respective share). Originally, all FP7 projects should have been closed by the 31st December 2017. Due to project extensions there is a tail of projects beyond 2017 (seven projects will end in 2018 and another three only in 2019).

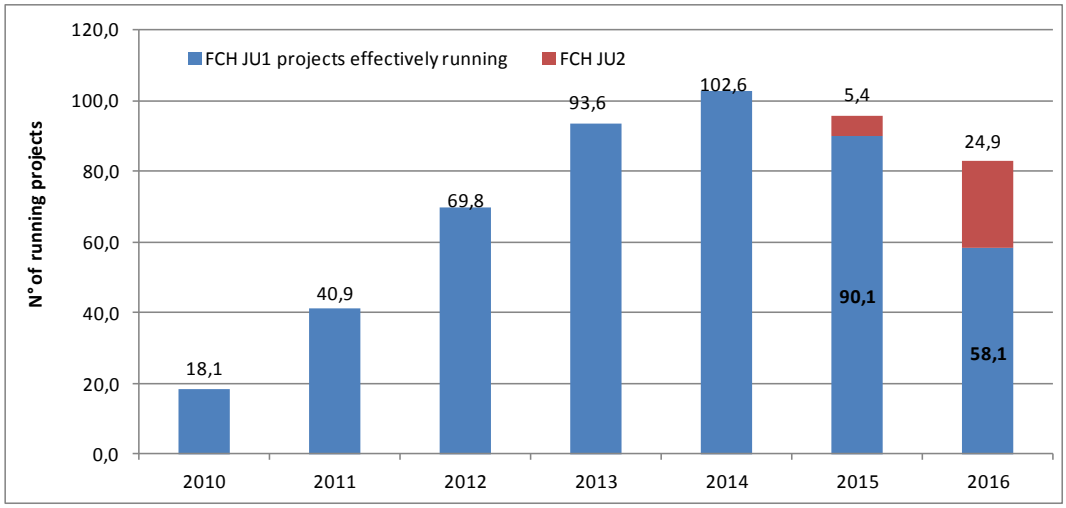


Figure 20. Number of projects effectively running (31/12/2016).

- *Timeliness: Timely execution of the functions.*

This section concerns the timely execution of the project preparation and payment processes. In particular, it considers the operational efficiency of the FCH 2 JU based on an analysis and interpretation of the KPIs related to "Time to Grant", "Time to Pay" and "Average Evaluation Cost per Proposal". The KPI's have been defined for the entirety of H2020 and do not change over the duration of the programme. All Joint Undertakings have to report their administrative KPIs on an annual basis, e.g. in the AAR. The template for the AAR is imposed by the Central Services. It is not published because it is an internal working document and changes from year to year.

- *Time-to-grant in Horizon 2020*

The proposal for a Council Regulation on the FCH 2 JU requested an efficient implementation of the FCH programme, in particular by substantially shortening the time-to-grant (TTG). The average TTG for the FP7 programme was 370 days (or 12.2 months) until the 31st December 2014. The H2020 Rules for Participation provide a maximum of 8 months (i.e. 243 days) between the deadline for submission of proposals and the signature of grants for successful proposals.

The FCH 2 JU has successfully completed the Grant Agreements of the Calls 2014-2016. The first Grant Agreements under H2020 (Call 2014) were signed with an average Time-to-Grant (TTG) of 8.5 months[32], only one GA was signed within the 8-month-deadline. Signing of the Grant Agreements of the Call 2015 took an average of only 7.5 months; only two GAs did not pass the 8-months-deadline. Sixteen out of nineteen Grant Agreements of Call 2016 have been signed within the deadline[33]. This is a clear indicator that the efforts to accelerate the grant preparation phase under the new H2020 rules have been effective. The deadline for the remaining three Grant Agreements was extended at the request of the consortia due to the complexity and/or size of the project. Two of the related Grant Agreements were signed in January and February 2017. Thus, a preliminary average of 7.5 months has been reached. Deeper data analysis does not show a relationship of number of project participants or requested EC funding with TTG.

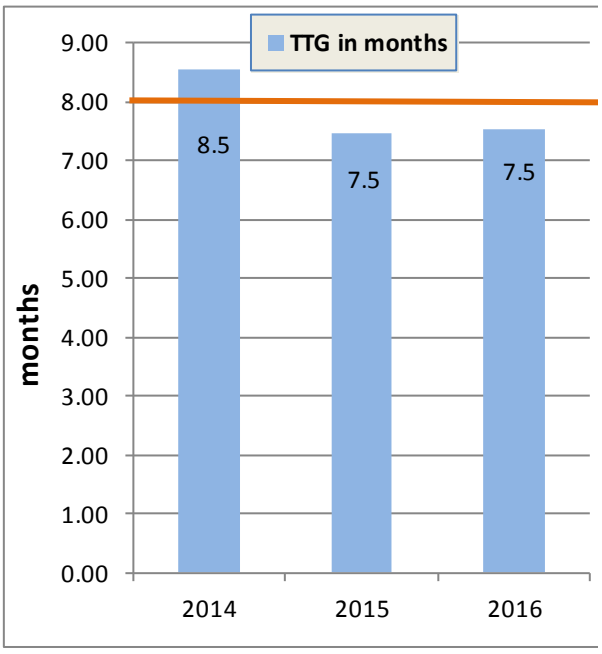


Figure 21. Time to Grant FCH 2 JU under Horizon2020.

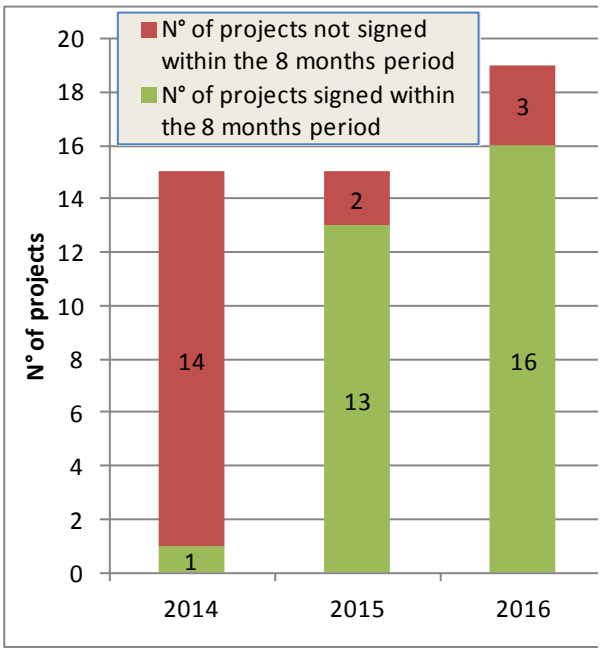


Figure 22. Time to Grant FCH 2 JU under Horizon2020.

The reduction of the TTG from 12 to 8 months was supported by a streamlining of FCH JU internal processes and by several advantages related to the access to the CSC which was provided for FCH JU by the 1st January 2014. This included the application of new and improved IT tools for the FCH 2 JU, see Table 7, e.g. electronic signature and e-submission processes. In addition, under FP7, project participants and the

[32]The AAR 2015 names a TTG for the 2014 Call of "The average time to grant (TTG) was within eight months for 12 of the projects, the slight delay for the remaining three being due to justifiable reasons." However, this is not supported by the CORDA data set.

[33] One GA of the Call 2016 is still not signed (03.03.2017).

Commission engaged in "negotiations" that aimed at improving or adapting the project proposal even after the deadline.

Project negotiations consumed more than 200 days under FP7, thus abandoning the negotiations offer a large potential for shortening the TTG.

Table 7. FCH 2 JU's IT architecture.

FCH JU Core Business	
EC Framework Programme H2020 IT tool family	SEP: submission of applications, call management COMPASS/SYGMA: grant agreement Force/SESAM: submission form C, project reporting
Expert management Results dissemination ABAC	EMI: expert management for evaluations CORDA: statistical database for calls and projects Accrual-based accounting system of the Commission

In a direct benchmarking between all Joint Undertakings, the FCH JU achieved a good result for the KPI TTG for the 2016 projects. Only the Shift2Rail project performed better, the project has more contract agents than the other JUs, that fact may explain the good position.

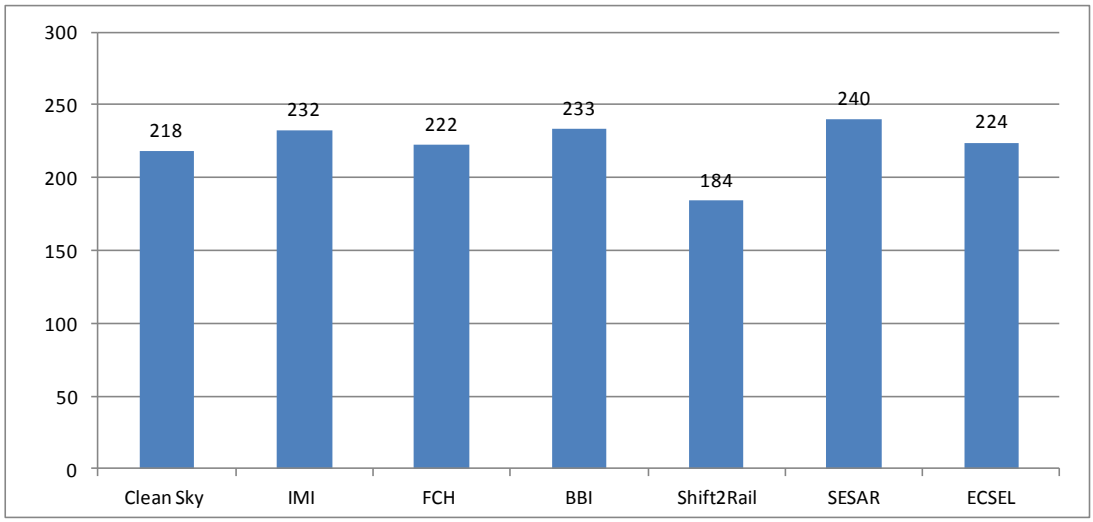


Figure 9. Benchmarking JUs: Time to Grant 2016.

The IEG recognises the progress in the timely preparation of Grant Agreements and the effectiveness of the operational measures implemented (new rules, new documents and harmonised IT tools and procedures). However, for the complete fulfilment of the 245-days target on TTG it could be beneficial to analyse during the evaluation process the maturity of project preparation and the project launching strategy, in particular for large and complex projects, to avoid delays in contract finalisation. For example, one project of the Call 2016 has still not been signed (May 2017) - the consortium requested a further extension to sign the grant, due to risk with site configuration.

- *Time to pay*

The contract management starts with the signature of the grant agreement and ends with the final payment to the beneficiary. The main financial transactions are the contract signature (commitment), the payment of pre-financing, interim or cost claims or other expenditures linked with the project lifecycle (payment of experts, missions etc.) and the clearing of pre-financing. Concerning payments, an important indicator is 'Time to Pay'**.** See Table 8 for a definition of the KPIs on Time to Pay.

Table 8. KPIs on Time to Pay (TTP).

Annual average and percentage of the number of payments made on time:	
• Time to Pre-payment and time to experts:	within 30 days
• Time to pay for administrative costs (invoices, experts, staff missions, etc.):	within 30 days
• Time to pay cost claims:	within 90 days.

The timelines achieved for all payments have been significantly shortened under H2020. However, payments to experts are still struggling with delays, In contrast to FP7, the share of payments to prepayments and costs claims is no longer included in the H2020 list of administrative KPIs and the AAR's template. In consequence, a comparison of the administrative performance of the PO between programmes is not possible. Reinserting the share of timely prepayments and payments to the AAR is suggested. The use of the mean of respective TTPs conceals not only individual but also structural problems of the project launch phase (which could continue until the end of the projects).

Table 9. FCH 2 JU results on KPIs on time to pay (respective AARs).

	2014	**2015**	**2016**
Average N° of days for payment			
FP7 pre-payments	20 (2013-1) 6 (2013-2)	end of the programme	
FP7 TTP cost claims	65	85	71
H2020 pre-payments	before programme start	8 (Call 2014)	15 (Call 2015)
H2020 cost claims	no cost claims paid from H2020 by 31/12/2016		
Administrative costs	25	18	17
Percentage of the number of payments made on time			
FP7 pre-payments	100%	end of the programme	
FP7 TTP cost claims	100%	not published under H2020	
H2020 pre-payments	before programme start		
H2020 cost claims	no cost claims paid from H2020 by 31/12/2016		
Administrative costs	65%	87.5%	92%
Workload			
N° of reports, covering N° of cost claims	61 551	81 957	76+2 653+24

After signature of the Grant Agreement, pre-financing payments are made to make funds available to the projects to allow the project to start. The data show that 100% of the 2014 grant pre-payments were made within the deadline,

Under H2020, the average 'Time to Pay Pre-financing' (TTP) increased from 8 days in 2015 (Call 2014) to 15 days and 2016 (Call 2015). The new grant management tool COMPASS/SYGMA was used for the first time in 2015 for the preparation, signature and payment of pre-financing.

The approval of interim or final payments is a time-consuming process. It comprises a review and validation of the technical reports and all financial claims and certificates of financial statements submitted by each beneficiary[34], including any adjustments for previous reporting periods and for audit findings (Ex-ante controls). The current procedure on review/assessment of periodic reports was adopted by the Executive Director in December 2015. It reflects the use of the new internal project monitoring tools and the use of a single submission/rejection mode. The changes aim to simplify the beneficiaries' reporting practice, to improve the monitoring of the submitted reports and to reduce the overall processing time for the payment file.

The number of periodic and final reports validated increased from 61 in 2014 to 81 in 2015 and 76 in 2016. The increase from 551 cost-claims in 2014 to 957 cost claims in 2015 reflects both catching up in the assessment of reports and the finalisation of many FP7 projects[35]. Out of the 151 FCH JU projects 110 were closed by end 2016, of which 26 were closed in 2016.[36] (Also these data, obtained from the Corda database, show a deviation from the data in the respective AARs – data should be harmonised.

In 2014, all reported interim or final payments to cost claims were made on time (within 90 days), with an average time to pay of 65 days. In 2015, TTP was 85 days and 71 days in 2016. This is below the maximum payment limit and KPI target for interim and final payments (90 days). The first cost claims under H2020 are expected to be paid in 2017.

Payment of administrative costs, including experts, was still a problem in 2015, even though the situation has improved. Late payments concerned mainly mission claims, expert claims and payment of communication invoices. The reimbursement of experts (evaluators for the 2014 call and mid-term reviewers) was delayed due to a lack of adaptation of the internal working practice to the newly introduced IT tool. The reimbursement of staff mission costs was delayed due to the increased workload. Corrective measures were introduced to limit the risk of late payments. In 2016, the average time to pay for administrative payments (invoices and claims from experts/staff) reached 17 days (the same as 2015). This is below the deadline.

However, the example of administrative costs reveals the need to publish the late payments to uncover administrative improvement needs. The *number of late payments* (8% of the total number of invoices/claims in 2016) showed an improvement from 2015 (12.5%), reflecting the various rigorous controls put in place.

Even if individual problems still occur, the IEG evaluates that the KPIs on payments are fulfilled. In the 2016 benchmarking between all Joint Undertakings FCH JU achieved a middle position, see Figure 24. However, the IEG recognises that the FCH JU PO handles by far the most projects per capita (Figure 28), thus the individual workload is very high. From this perspective, the IEG evaluates the operational performance of the FCH JU as high.

---

34 Under Horizon 2020 a project beneficiary is either the project co-ordinator or a project participant.

35 Annual Activities Report, 2015.

36 Corda data are not consistent with AAR data, e.g. AAR2015 p. 6: "53 of the 155 FCH-FP7 projects were closed as of 31 December 2015". Corda database shows only 151 projects of which 84 reached the project end date. Only 4 projects, which all have reached the project end date showed the status "closed" by 31.12.2016.

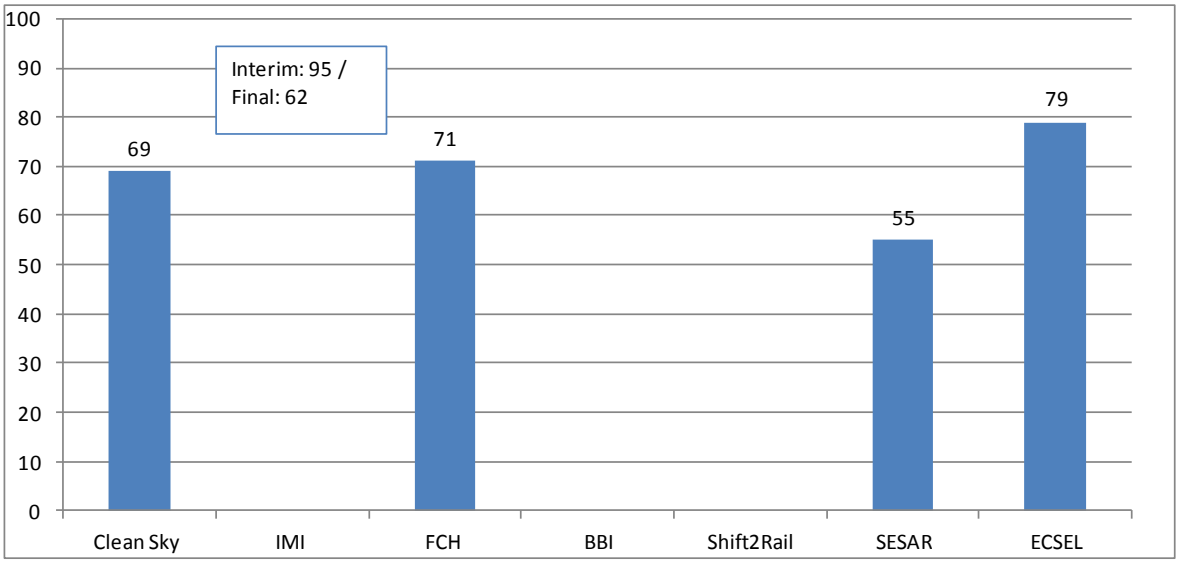


Figure 24. Benchmarking JUs: Time to pay (Interim/Final)-90days 2016.

- *Evaluation cost per proposal*

The average **evaluation cost per proposal** is defined as the number of proposals divided by the costs for the experts. The evaluation of each proposal is carried out by a minimum of three independent experts. In addition, an appropriate number of observers and one chair are needed. The evaluation costs per proposal vary between €3,077 and €4,630, see Table 10. However, in 2014 two evaluation rounds took place (Call 2013-2 with seven proposals and Call 2014 with 57 proposals), increasing the costs.

Table 10. Assessment of the average evaluation cost per proposal (respective AARs and PO).

	2014[37]	2015	2016
Total number of proposals received	57	66	81
Total number of proposals evaluated	57	61	76
Average N° of participants per proposal	7.9	7.7	7.9
Average proposal budget [k€]	4,139	4,533	4,007
Number of independent experts for evaluation	35	34	47
Costs for experts [k€]	250	190.8	299
Average evaluation cost per proposal received [k€]	4.630	3.077	3.934

[37]2014 included the evaluation of the 2013-2 call and the call of 2014.

- *Cost-efficiency of the management*

This section assesses the cost-efficiency of the management and control arrangements. Management efficiency for this purpose is defined as the ratio between inputs (staff) and outputs (the budget managed by the JU. Key figures are summarised in Table 11 and Table 12.

Table 11. Financial figures of the H2020 Calls (respective AARs and Final Accounts).

	Call 2014	Call 2015	Call 2016
N° of projects (granted until 31/12/2016)	15	15	16
of this suspended	1	0	0
plus under preparation	0	0	3
N° of beneficiaries	164	151	178
N° of beneficiaries/project	10.9	10.1	9.4
Average project requested EC contribution	5,474,042	7,326,983	4,946,013
– Min project contribution	1,494,780	497,666	1,143,000
– Max project contribution	32,000,000	34,999,549	32,000,000
Average beneficiary funding	500,675	727,846	-[38]

[38] CORDA database does not show full data for projects under preparation.

Table 12. Management efficiency of the FCH 2 JU PO under H2020.

Budget year	2014	2015	2016
Administrative costs k€	4,415	4,322	4,438
– Staff cost (k€)	2,160	2,485	2,552
– Finance cost (k€)	249	0	103
– Other expenses[39] (k€)	2,006	1,837	1,783
Operating costs k€	162,985	164,168	164,066
Ratio administrative/ operational budget	2.7%	2.6%	2.7%
N° of projects in the budget year	122	118	98
N° of "project years"[40]	102.6	95.4	83.0
Average project management costs			
– Per project[41] (k€)	36.2	36.6	45.3
– Per project year (k€)	43.0	45.3	53.5
N° of staff – planned/actual figures by end of year	24+2/23+2	24+2/24+2	24+2/24+1
– Administrator[42]	14	15	15
– Assistance	9	9	9
– Plus Contract Agents	2	2	1
Budget per head k€	6,519	6,314	6,563
Annual project management cost per running project (staff costs/N° of running projects) k€	21.0	26.0	30.7

Under H2020, 15 to 19 projects have been implemented annually. The average project funding varies between €5 million and €7.3 million, however, the spread is quite large. The observed minimum project funding was €0.5 million, the maximum €35 million.

- *Ratio administrative/ operational budget*

The *annual administrative costs* are about €4.3-4.4 million. Administrative costs are staff costs and other expenses. Staff costs include the salaries and other staff member employment-related allowances. Other expenses are: adjustments/provisions; property, plant and equipment related expenses; external non-IT services; communications & publications; expenses of experts; external IT services and others.

Operating expenses relate to those projects that were carried out in the respective budget year.[43] The *annual operating expenses* have been very stable during the

[39] This includes adjustments/provisions; property, plant and equipment related expenses; external non-IT services; communications & publications; experts expenses; external IT services; others.

[40] Total number of project days per year divided by 365 or 366 respectively.

[41] Calculation method: Administrative costs divided by number of running projects or project years respectively.

[42] Source: FCH JU Annual Implementation Plan – Annex 2, posts actually filled in by 31.12.

[43] A certain share of the operating costs has to be estimated, because the related on-going or finalised projects did not provide validated cost claims by the end of the budget year. The estimation uses the best information available at the time of the preparation of the annual accounts, based on the case-by-case assessment (e.g. reports of JU members on in-kind contributions or costs incurred to date as a proportion of the estimated total costs of the projects ("pro-rata temporis") which ensures that only

H2020 timeframe despite the decreasing number of open projects. The average operating budget per open project increased from €1.34 million to €1.67 million from 2014 to 2015. However, the volume of cost claims to be examined by the PO is linked to the operating expenses and therefore also staid quite stable during the evaluation period.

The staff number (staff assignment) and the other administrative costs were also quite stable. Thus, the *ratio between the administrative budget and the operational budget* was always between 2.6-2.7% under FCH 2 JU. The IEG evaluates this as a good value.

- *Budget per head*

The FCH JU Programme Office's staff establishment plan includes a planned staff of fifteen administrative employees and nine assistance employees (all temporary) plus two contract agents. For the calculation of the budget per head the real number of staff by the end of the respective budget year has been used. The current organisational chart is depicted in figure below.

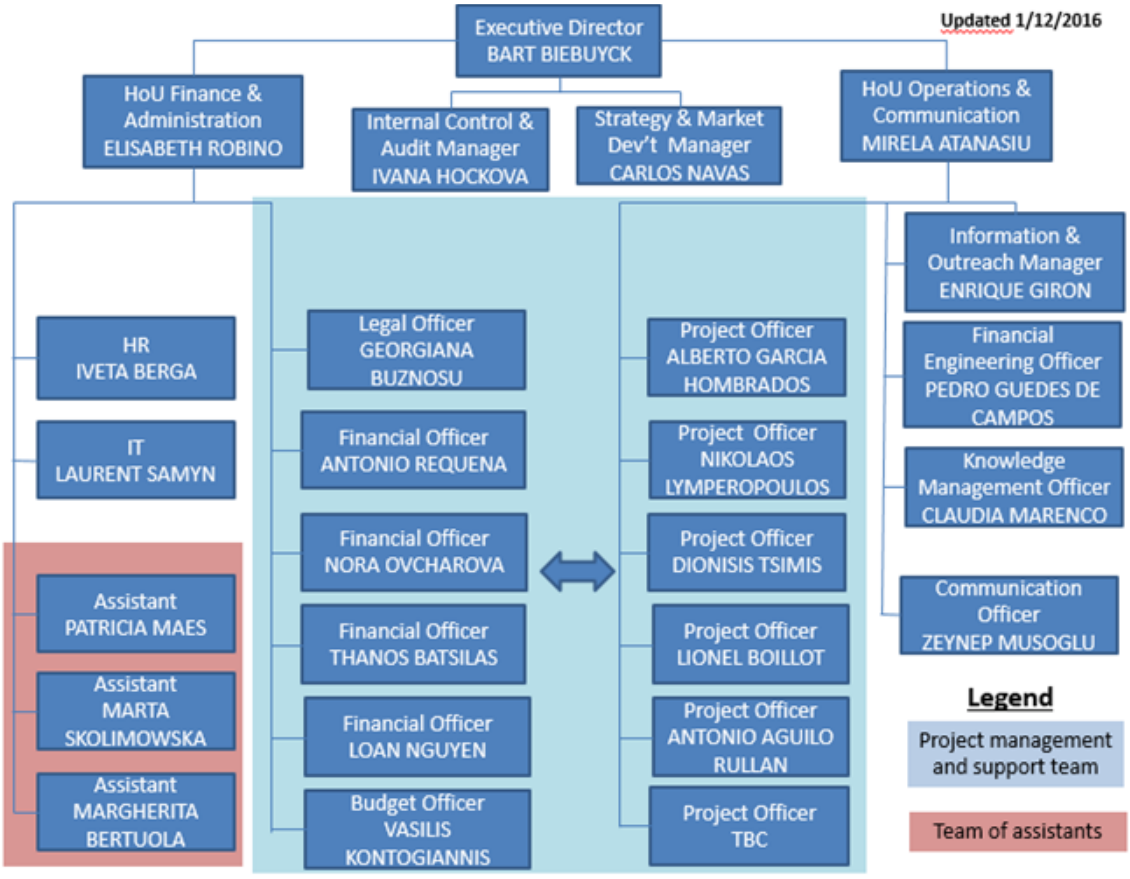


Figure 25. Programme Office Structure.

The *budget per head* is defined as the average operational costs managed by JUs staff members. This KPI develops slightly time-delayed to the number of active projects. It amounted to €6.5 million/head in 2014, to €6.3 million/head in 2015 and €6.6 million/head in 2016. If only the operational staff is taken into consideration, the

costs that reflect services or work performed by 31 December are included in the operating costs of the respective year.

budget per head is even higher. Furthermore, the number of projects managed by each operational staff member is also high.

These KPIs show a very high operational performance of the FCH 2 JU and it could be concluded that the workload is very high. This is confirmed by the benchmarking results, see Figure 28.

However, the work load of the PO is also highly dependent on the average project duration, average project funding and number of participants per project. Most of the projects (63%) show a project duration between 25 and 36 months, however some projects are already planned to run up to 74 months (without any project prolongations yet), see Figure 26.

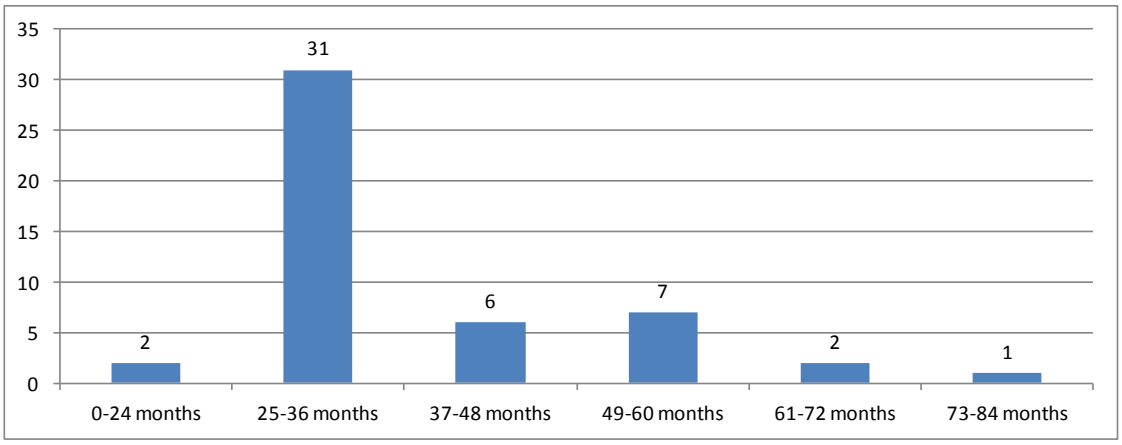


Figure 26. Frequency distribution of project duration under H2020 (31/12/2016).

Most projects have 6 to 10 participants (69%), however some projects are carried out by more participants, increasing project management efforts at the project coordinator and at the PO, see Figure 27.

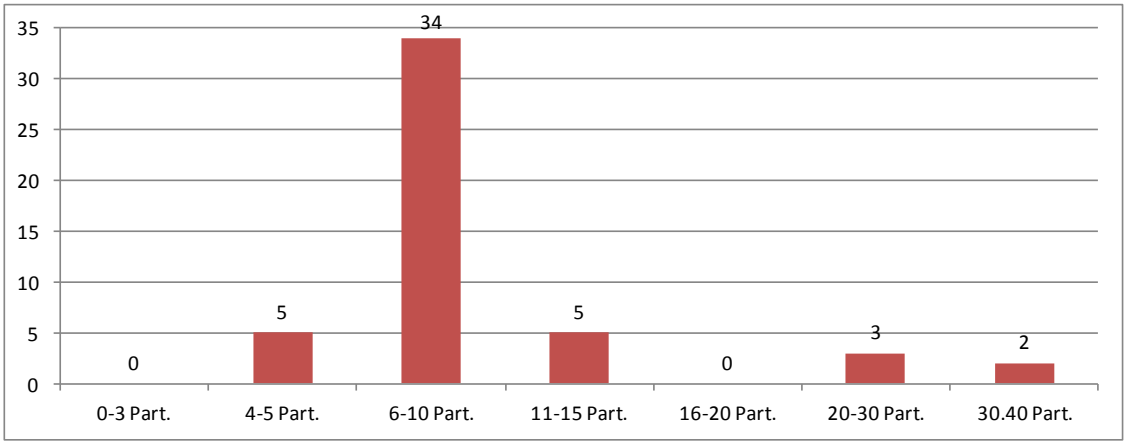


Figure 27. Frequency distribution of number of participants per project under H2020 (31/12/2016) [44].

Furthermore, not all staff members contribute directly to the management of the projects. The FCH JU also employees staff for strategic tasks such as strategy

[44] IEG depiction based on data from Corda database provided by the EC.

development and communication. A comparison of the average budget managed and average number of running projects per operational staff member is provided by the 2016 benchmarking of the various JUs. The data show that each of the operational staff members of the PO manages eighteen projects, which is notably more than any staff member in other JUs has to shoulder. Also in the comparison of the average budget managed per head, the FCH JU takes a leading position. Only the staff of the ECSEL JU have more budget to manage (ECSEL projects are quite large).

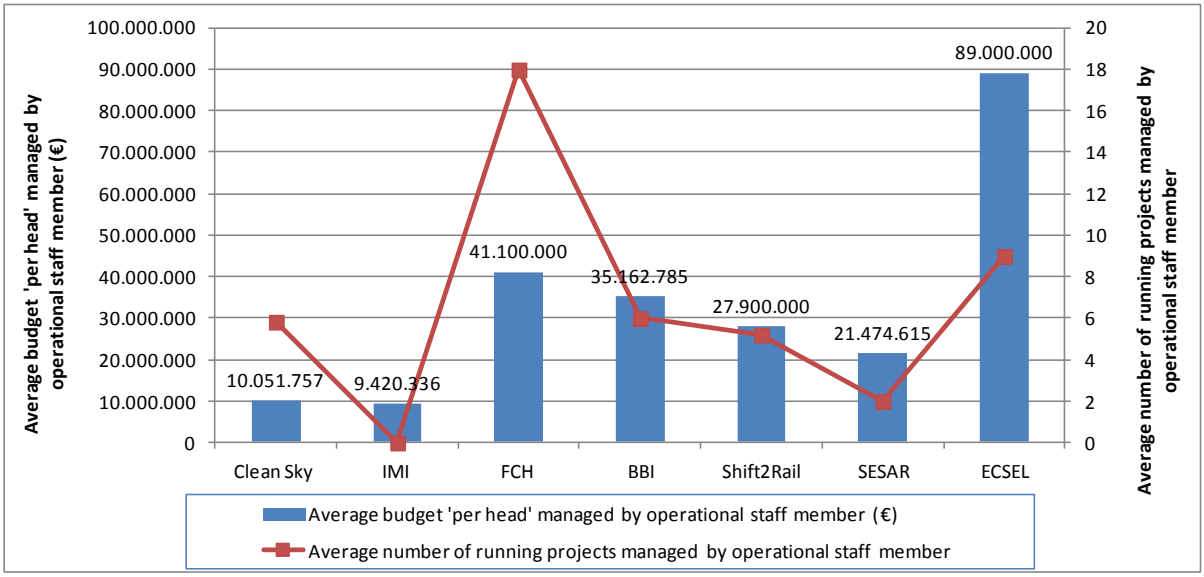


Figure 10. Benchmarking JUs: Average budget managed and average number of running projects per operational staff member 2016[45].

- *Annual project management cost*

The annual project management cost per running project varies between €21,000 and €31,000. The reason for the deviation lies in the nature of project lifetime cycles. In 2014, there were still many FP7 projects running. In consequence, the annual project management costs per running project are low (€21,000). Between 2015 and 2016, 32 FP7 projects were finalised and only 15 new H2020 projects started in 2016, thus, the annual management costs per project increased. However, the relationship between administrative and operational budget stayed quite steady as the costs claims at the project end normally have a higher volume. In conclusion, the project management cost p.a. is in a normal range.

- *Budget execution of commitment and payment appropriations during the reference period.*

The FCH 2 JU's budget concerns the revenue and expenditure sides. On the expenditure side, the budget is divided into three titles:

- Title 1 covers staff expenditure, such as salaries, training, costs associated with the recruitment procedure, missions, medical expenses and representational costs;
- Title 2 covers the cost associated with the functioning of the FCH 2 JU, such as renting premises, IT needs, expenses related to external communication, expert fees, and the cost of ex-post audits;
- Title 3 covers the FCH 2 JU's operational activities for both the FP7 and H2020 programmes.

[45] 2016 Benchmarking of Joint Undertakings, data provided by the Commission.

The budget of the JU is approved by the GB Board on an annual basis. These Commitment Appropriations include:

- Operational and administrative revenues from the EU;
- Revenues from the Industry and the Research Grouping;
- Reactivations of unused appropriations from previous years.

The annual execution of commitment appropriations reached 96%, 87.3% and 77.7% for the years 2014, 2015 and 2016, see Figure 29. The commitment execution rate is highly dependent on the outcome of the evaluations for the calls. In particular, the Call 2016 showed a low commitment against budget due to the call structure that allowed no flexibility in ranking lists, which has now been addressed. The remaining €25.9M of the 2016 budget has been re-entered in the initial budget for 2017.

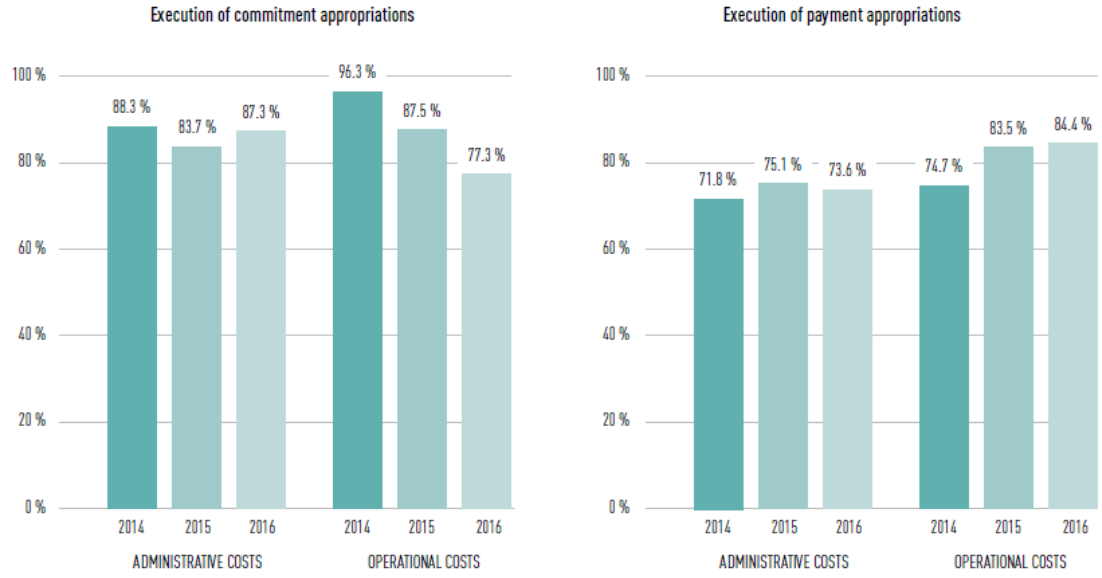


Figure 11. Total budget execution under H2020 (AAR 2016).

Annual budget execution of payment appropriations reached 74.5%, 83% and 83.9% for the years 2014, 2015 and 2016. As regards payments, the 2016 results represent the best execution rate of payments for the FCH JU to date. FCH 2 JU Financial Rules allow for an activation of unused appropriations in the following years.

Until the end of 2016, the cumulative operational commitment refers to the 30 commitments under calls 2014 and 2015 and the commitments for the 2016 call. In addition, it includes commitments for studies in AWP 2014 and 2015 and the commitment for the 2016 contribution to the JRC. The cumulative H2020 operational costs execution rate has reached 26.9%. It is currently anticipated that the final operational costs execution rate will be 100% as the programme is still open and remaining budget could be used in future Calls.

As regards administrative costs, an amount of €805,269 was committed in 2016 but not paid (as services are ongoing and still have to be finalised and invoiced); therefore, it will be carried forward to meet remaining obligations.

H2020 (IN EUR)				
Type	Execution until 31/12/2016	2017	Subsequent years	Total
Commitments (operational costs)	287 805 632	104 598 498	253 595 870	646 000 000
Payments (operational costs)	77 293 833	144 317 998	424 388 169	646 000 000
Cumulative execution (operational costs)	**26.9 %**	**56.5 %**	**100.0 %**	**100.0 %**
Commitments (administrative costs)	337 255	113 516	37 549 229	38 000 000
Payments (administrative costs)	100 746	350 025	37 549 229	38 000 000
Cumulative execution (administrative costs)	**29.9 %**	**100.0 %**	**100.0 %**	**100.0 %**
Overall H2020 execution	**26.9 %**	**56.5 %**	**100.0 %**	**100.0 %**

Figure 30. Overview of H2020 programme implementation.

Compared with the benchmarking results, the level of payment appropriations of the FCH JU is midrange. The FCH JU management has taken measures to avoid another low budget consumption of the committed appropriations in 2017. The IEG recognises the attempts of the FCH JU to improve the execution of the commitment appropriations.

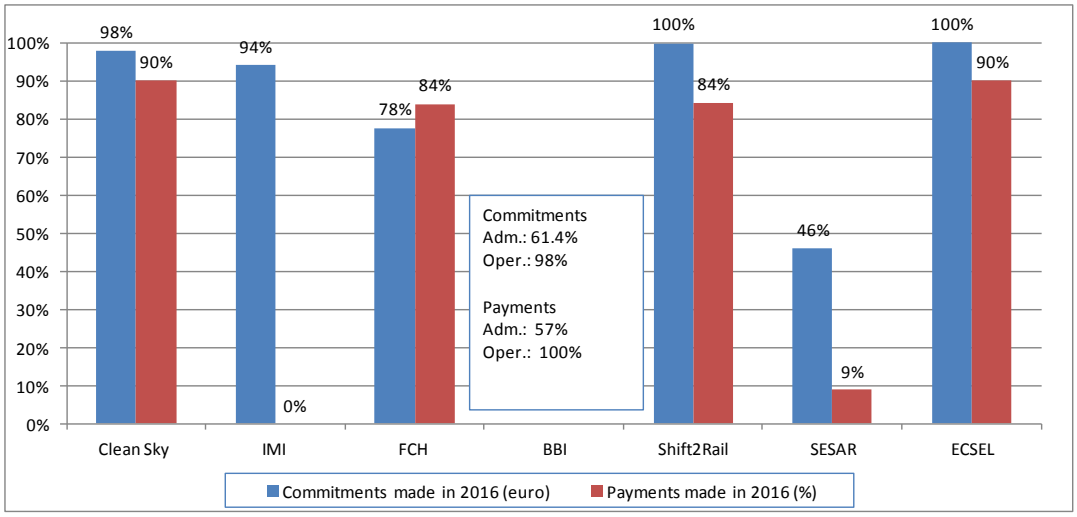


Figure 31. Benchmarking of JUs: Commitments and payments made 2016[46].

- *The administrative burden for participants*

The administrative burden is evaluated using the results of the H2020 participants' coordinator's survey of 2017 (detailed analysis is included in Annex 4) and information obtained from the interviews. According to the current state of the H2020 programme execution, the survey included mainly general items and questions on the administrative burden for participants. In particular, the following questions were relevant for this issue:

- Practical aspects of the application process;
- Practicalities of the process of finalising the grant;
- Overall satisfaction with the JU's services.

[46] 2016 Benchmarking of Joint Undertakings, data provided by the Commission

Seven practical aspects of the **application process** were included in the survey. Most respondents are highly satisfied (90% positive answers) with the availability of information.

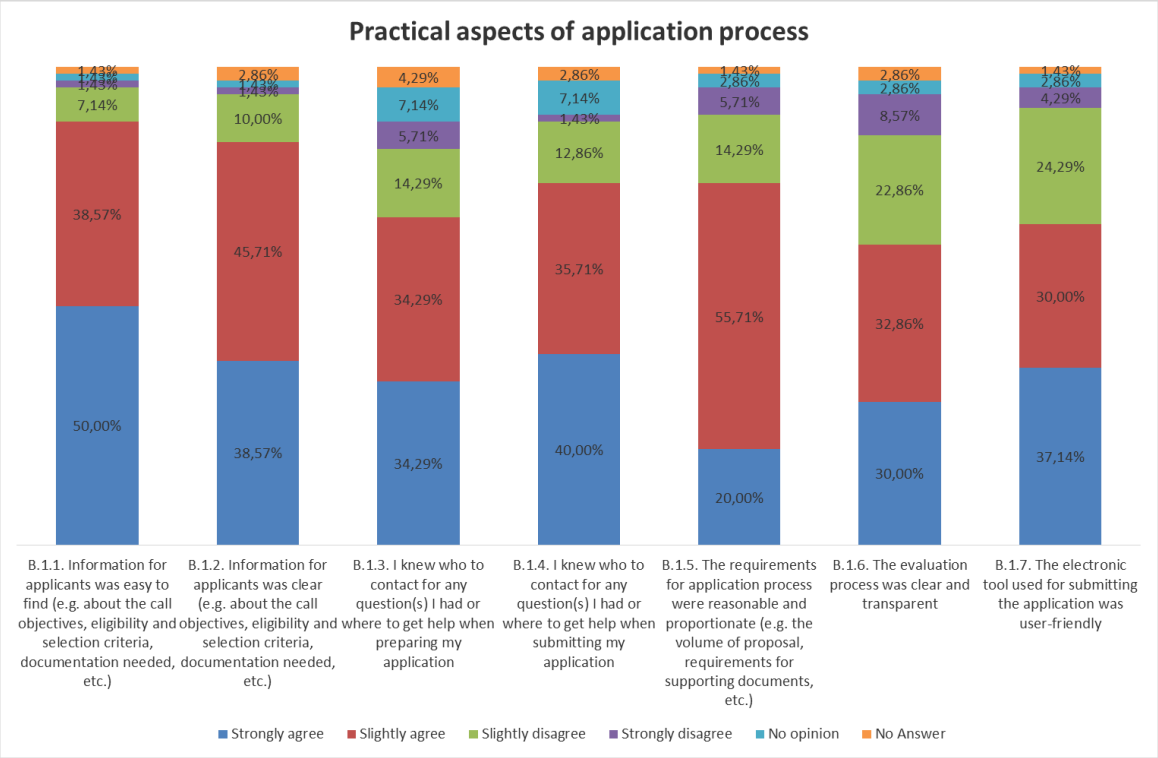


Figure 32. Question B.1. Please assess the following practical aspects of the application process.

Even if *"B.1.5. The requirements for application process were reasonable and proportionate (e.g. the volume of proposal, requirements for supporting documents, etc.)"* has been evaluated quite positively (77% positive answers), the respondents provided several critical comments. In general, the application process is rated to be complex. Participants remark that it needs experienced participants, professionals or support by the PO to be able to apply. The application process is evaluated also as being very time consuming. In particular, the budget regulations are difficult to understand. This criticism runs like a thread through the comments to the following questions and was also mentioned by the interviewed beneficiaries. During the interviews participants commented that:

- Final approval of the cost claims is reached only after the ex-post controls, this is a very long time of uncertainty. The IEG understands that this could be a problem in particular for small companies (SMEs) in projects with a long duration, if funding makes a substantial share of the annual turnover. However, this is part of the overall H2020 regulation and not a specific issue of the FCH JU.
- Make rules on subcontracting more concrete, transparent and definite so that subsequent funding is ensured. This regulation is also part of the overall H2020 regulation and not a specific issue of the FCH JU.

Six respondents highlighted that the administrative requirements for managing proposals or grants are too heavy. Other reasons mentioned were:

- "FCH JU is too bureaucratic, money does not flow and it is not competing with USA and Asia. We have been most depressed by our treatment by Brussels." This is a very individual statement.

- Funding does not cover the costs. This is a very individual statement.
- The potential risk of a consortium member failure can lead to the coordinator losing out financially. The IEG supports this comment, in particular for large projects with a long duration there is a growing risk with time that the commitment of individual project members weakens detrimental to the other consortium members. The IEG recommends paying special attention to the quality of project management in particular for large or long running projects.

Question *"B.1.7. The electronic tool used for submitting the application was user-friendly"* was rated by 68% of the respondents positively. Criticism included that the tool was often unavailable or down due to maintenance procedures. Others complained on the user-friendliness of the tool and a missing consistency between application forms and grant agreement forms. The IT-tools used in the contracting process and the IT-tool used for the validation of the beneficiaries were rated by 67% and 66% respectively positively.

The next set of questions concerned the practicalities of the grant preparation phase. The process of validating the beneficiaries was seen by only 61% of the respondents as smooth and requiring a reasonable effort.

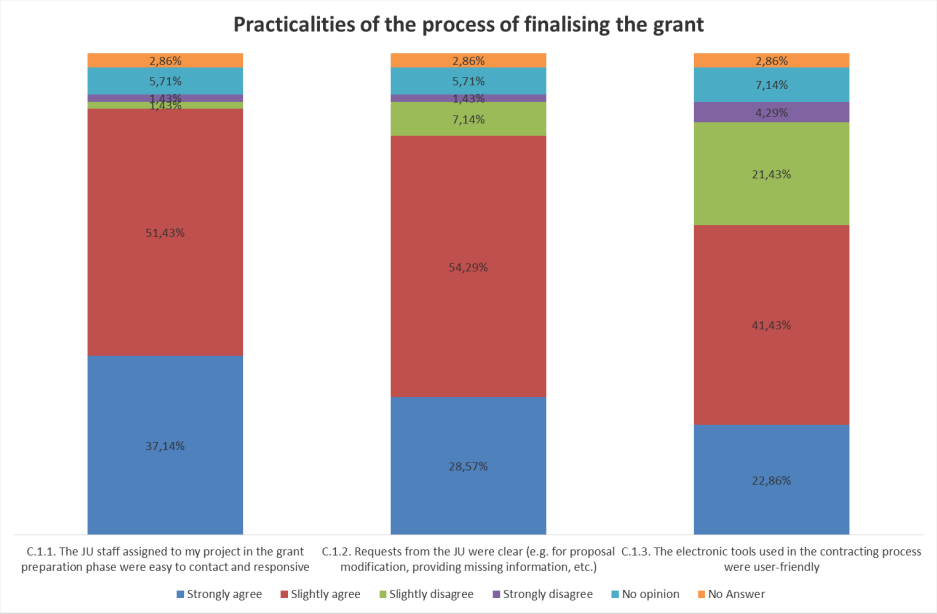


Figure 33. Question C.1. To what extent do you agree with the following statements about the practicalities of the process of finalising the grant?

Only two-thirds voted positively on the user-friendliness of the electronic tools used in the contracting process and for the validation of beneficiaries. Respondents also criticised that in going from proposal to grant preparation phase there is a need to transfer manually the proposal information to (slightly different) forms in the grant preparation form. The IEG recommends providing beneficiaries with a partly prefilled version of the grant application form which already includes all available data from the proposal phase which the applicant only needs to confirm. However, these are overall H2020 IT-tools and the addressee is not the PO of FCH JU.

The various IT-tools are an important source of non-satisfaction, so a comparison between the 2016 and 2017 results was made, see Figure 34. The IT-tool satisfaction rating of 2017 is worse than that of the 2016 survey. In 2016 the methodology was different, the question on the user-friendliness of the IT-tool was split between the

beneficiaries (71%), the members of the GB (86%) and the SRG (89%). The different groups rated as shown in the brackets. Even if the formulation of the questions is slightly different, it can be concluded that the change to the overall H2020 IT-tools did not increase the satisfaction of the users.

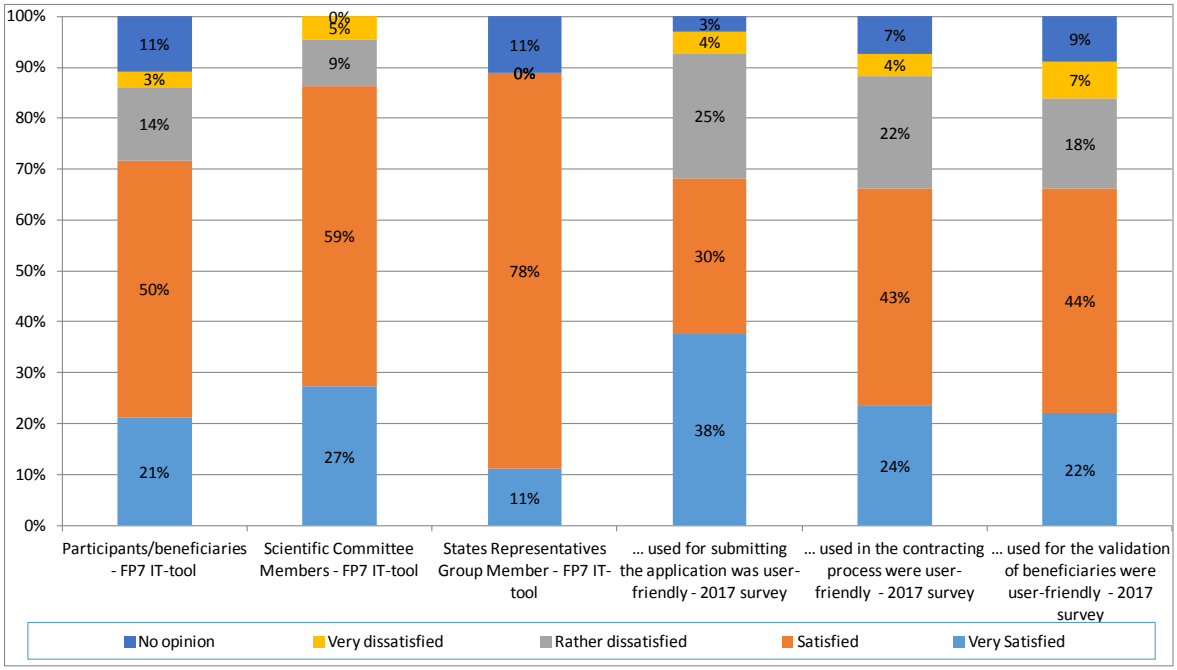


Figure 34. Comparison of 2016 and 2017 surveys' answers to "Amongst all services/products listed above, are you satisfied or dissatisfied with the IT tools …".

The survey covered a comparison between FCH JU and FCH 2 JU; 69% of the respondents agreed that in general, the second generation of the JU presents an improvement compared to its predecessor see Figure 35.

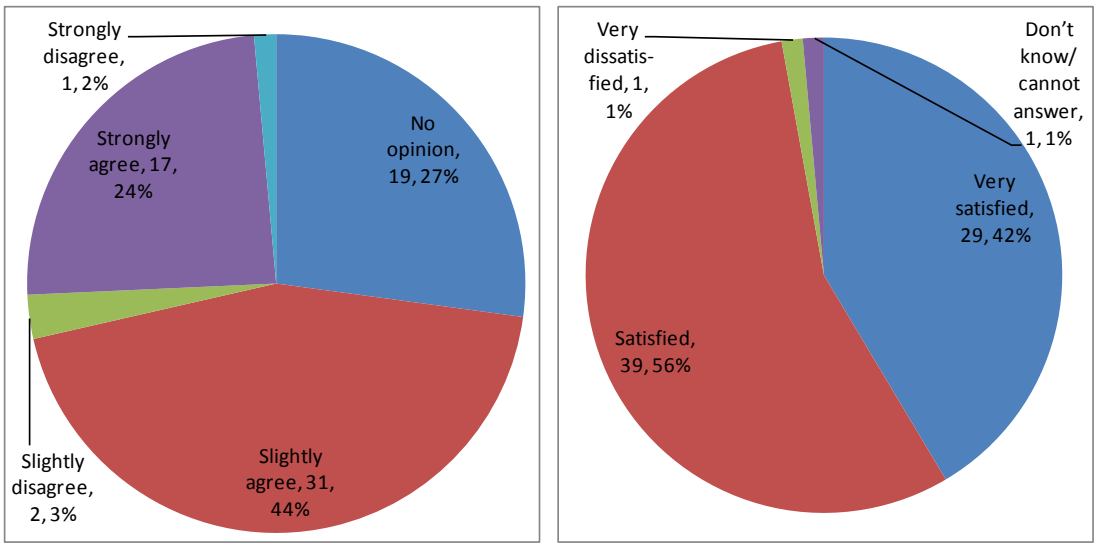


Figure 35. FCH 2 JU presents an improvement compared to its predecessor (left) and overall, how satisfied are you with the JU's services? (right).

In summary, the participants in the Calls and projects of the FCH 2 JU are to a high degree satisfied with the work of the FCH JU. The necessary information, contact and support are easily available and comprehensible. However, the proposal application is seen as complex, in particular by first or small applicants, (more details are given in Annex 5). More specifically, the budget regulations are difficult to understand.

Furthermore, the respondents have similar ideas on possible improvements of the grant application phase which should be considered by the responsible bodies of the FCH JU, see Annex 5.

The IT-tools, which are the "face to the customer", were still a main source of criticism. This included availability, user-friendliness and consistency. Application and grant preparation rules as well as the IT-tool are centrally provided to all H2020 programmes, so changes in procedures are not in the responsibility of the FCH JU. However, the participants acknowledge the support of the FCH JU to beneficiaries to overcome any shortcomings.

In conclusion, the overall level of satisfaction with the JU's services is extremely good, 97% are satisfied or very satisfied. In addition, the respondents highly acknowledged the improvements in programme administration reached since FP7.

7.3 Relevance

The preamble to the regulation establishing the JU revisits the argument that it will contribute to sustainable growth, noting the relevance to the Europe 2020 Strategy[47], and to the implementation of Horizon 2020 and in particular to the Secure, Clean and Efficient Energy Challenge and the Smart, Green and Integrated Transport Challenge. These are the principal policies to which the JU contributes. The relationship is described in more detail in the impact assessment which cites:

- The Climate and Energy Package, adopted in 2009 establishing energy objectives for 2020 with binding commitments from the Member States: to reduce greenhouse gas emissions;
- The Energy Roadmap 2050 adopted by the Commission on 15th December 2011 that explores the routes towards a secure, competitive and decarbonised energy system by 2050 including the switching to renewable energy sources, managing electricity in new ways and shifting towards alternative fuels, including hydrogen the Communication Clean Power for Transport: A European alternative fuels strategy adopted in 2013. Hydrogen is one of the alternative fuels considered.

The problem analysis contained within the ex-ante impact assessment identified the key problems as: the market failure originating from the risk exposure of first movers; sub-optimal leveraging of available funding, and fragmentation of effort and lack of critical mass. The high risk of moving first is conditioned by the high cost of fuel cells and lack of physical and regulatory infrastructure. Deployment on a commercial scale required a reduction of unit costs and an improvement in performance of the fuel cells and balance of plant, together with a sufficient infrastructure for hydrogen supply. No single player can arrange all this and to move first without such support incurs high risks of commercial failure[48].

To provide the support needed to make risk commercially manageable is costly. In 2011, the JU Industry Grouping estimated that the required level of funding to implement their FCH Technology Roadmap was around €17.9 billion between 2014 and 2020[49]. This sum, the impact assessment recognised, was beyond the resources available in the Framework Programme and in the Member States.

A significantly increased leveraging of public funding was needed; the FCH 2 JU was envisaged as a mechanism to deliver this leverage. The public consultation undertaken for the impact assessment identified difficult access to risk finance for deployment activities (82%) as important problems and the IEG supports the work done by the PO and the new financial officer.

Recommendation: FCH JU should have a catalysing role; the IEG endorses the financial officer appointment whose focus should be in finding the most suitable funding options (European, national, including private funding).

[47] European Commission, Europe 2020 — A strategy for smart, sustainable and inclusive growth, COM(2010) 2020 final, Brussels, 2010.
[48] The Ultimate guide to fuel cells and hydrogen technology, Hydrogen Europe.
[49] FCH JU Industry Grouping Financial and Technology Outlook 2014-2020.

7.3.1 Alternative options

The proposal[50] for a Council Regulation concerning the Fuel Cells and Hydrogen 2 Joint Undertaking was proposed based on the prepared Impact Assessment attached to the proposal. In the Impact Assessment document, four policy alternative options were discussed for organising research and innovation on fuel cells and hydrogen during the Horizon 2020 Programme in the period 2014-2020. The four policy options considered were:

- Fuel Cell and Hydrogen PPP in the FP7 form under Horizon 2020;
- Use of the collaborative research projects under Horizon 2020, thus not prolonging the current FCH JU;
- Implement through a Contractual Public-Private Partnership;
- Fuel Cell and Hydrogen PPP through a modernised JU adapted to Horizon 2020.

The public consultation[51] concerning the extension of the Fuel Cells & Hydrogen Joint Technology Initiative under Horizon 2020 favoured continuation of the JU - in its FP7 format or "modernised" - (70% calling for a continuation, incl. 53% in a modernised version), while a contractual Public-Private Partnership was only favoured by 4%. In the end FCH 2 JU was established as "modernised" version of JU operating under FP7 on the 6th May 2014 and its objectives were included in the Council Regulation[52].

The IEG is of the view that this was the correct choice at that time. Neither the continuation under the Framework Programme, nor the contractual PPP would have stimulated the creation of the FCH community that has developed around the JU, nor would it have engaged industry as fully or fostered the development of a strategic research agenda. "Modernisation" of the JU introduced improvements in practice that are described in Section 6.1 and which are confirmed by the Coordinators' survey wherein 70% of respondents agreed that the FCH 2 JU operating under Horizon 2020 presented a general improvement compared to the FCH JU.

The dispersal of work across member states and types of organisations and sectors (major energy and transport companies, high-tech SMEs, research institutes and universities) further contributes to the sub-optimal use of resources and restricts the exchange and pooling of knowledge and experience. The absence of a long-term, integrated RTD and market strategy and the sub-optimal leverage of funding was argued to fragment research coverage and discourage the industry and the research community from committing more of their own resources.

The JU continues to be relevant. In a carbon-limited world, hydrogen could be an important energy vector. It is difficult to foresee precisely how hydrogen technologies will eventually be deployed and how technologies within the energy and transport sectors will relate. In the event of abundant hydrogen from renewable sources there may also be interest from manufacturing and process industries. What is clear to the IEG is that the JU is supporting work across the right spectrum of technologies to support their effective deployment in Europe in the light of the specific needs and circumstances of the region.

[50] Proposal for a Council Regulation on the Fuel Cells and Hydrogen 2 Joint Undertaking, Brussels, COM(2013) 506 final, 10.7.2013.

[51] EC DG for Research and Innovation, Directorate K – Energy, K.2 - Energy conversion and distribution systems, Extension of the Fuel Cells & Hydrogen Joint Technology Initiative under Horizon 2020, Results of the public consultation

[52] Council Regulation (EU) No 559/2014

7.4 Coherence

- *Coherence with other EU interventions*

Horizon 2020 is intended to help drive economic growth, create jobs and secure Europe's global competitiveness. Research and innovation are important in this endeavour and should be coupled to remove barriers to innovation and to make it easier for the public and private sectors to work together. The landscape of the research within H2020 is very complex, where there are disciplinary links of greater or lesser significance between several of the seven specified societal challenges[53]. Important for the FCH technologies are mainly the Secure, Clean and Efficient Energy challenge[54], the Smart, Green and Integrated Transport challenge[55] the Climate Action, Environment, Resource Efficiency and Raw Materials challenge[56] and the cross-cutting action Smart and Sustainable cities[57].

These challenges will support the transition of the different sectors to become more reliable, sustainable and competitive. For the energy system, it includes energy efficiency and low-carbon technologies that are cost- and resource-efficient. The challenge regarding the transport sector will require a move towards transport that is resource-efficient, climate- and environmentally-friendly, and safe and seamless. The aim is also to improve the competitiveness of the European transport industry. The objective of the Climate challenge is to achieve a resource-efficient economy and society, resilient to climate-change, and a sustainable supply and use of raw materials, while the cross-cutting action Smart and Sustainable cities focuses on developing urban spaces powered by energy that are clean, secure and affordable.

The general objective of FCH 2 JU to develop a strong, sustainable and globally competitive fuel cells and hydrogen sector in the European Union, as stated in the Proposal for a Council regulation on the FCH 2 JU, is coherent with the objectives of the above mentioned societal challenges. As a large part of the rational for FCH 2 JU is to improve support for the integration of renewables into energy supply there is obvious scope for synergy and for duplication with other parts of the energy challenge. The same potential for duplication applies to the relationship of the JU to the transport challenge. One area where FCH 2 JU can contribute but where the activities are weak is sustainable supply and use of critical raw materials. With the possibility to focus on the lower level of TRL, this could be an opportunity for future projects. Also, FCH 2 JU could through its technological solutions contribute to Smart and Sustainable Cities, placing fuel cells and hydrogen as possible components in a wider system perspective.

The IEG concludes that the FCH 2 JU will assist in achieving the main objective of smart, sustainable and inclusive growth and it will also support the EU policies on sustainable energy and transport, climate change, the environment and industrial competitiveness as embodied in the Europe 2020 strategy for growth.

The need for coherence in the research area is foreseen at the highest level of the Commission and is explicit in the Energy Union Package; among the several elements of the Package was the framework strategy for a resilient Energy Union[58].

[53] https://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges, Accessed 2017-05-12

[54] Horizon 2020 Work Programme, 2016 – 2017. Secure, Clean and Efficient Energy. European Commission Decision C(2016)4614 of 25 July 2016.

[55] Horizon 2020 Work Programme, 2016 – 2017. Smart, green and integrated transport. European Commission Decision C(2016)4614 of 25 July 2016.

[56] Horizon 2020 Work Programme 2016 – 2017, 12. Climate action, environment, resource efficiency and raw materials, European Commission Decision C(2016)4614 of 25 July 2016.

[57] Horizon 2020 Work Programme, 2016 – 2017. Cross-cutting activities. European Commission Decision C(2016)4614 of 25 July 2016.

[58] Communication from the Commission, Energy Union Package: A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy, COM(2015), Brussels, 25.2.2015.

The formulation of the energy challenge under Horizon 2020 relied heavily on the Strategic Energy Technology Plan (SET-plan), which can be seen as the technology pillar of the EU Energy and Climate policy[59]. It sets out a long-term agenda for Europe regarding energy research, demonstration and innovation, and describing strategic milestones to be achieved in the coming years. The Strategic Transport Research and Innovation Agenda (STRIA) was intended as a key component of the Energy Union's strategy for research and innovation within the transport system. The aim was to set out common priorities and to deploy innovative solutions that will transform the transport system. However, the STRIA document had, at the end of 2016, not passed the conceptual stage and it is uncertain what will happen with it in the future. From the private sector, the European Road Transport Research Advisory Council (ERTRAC) have developed a Strategic Research Agenda (SRA), published in 2010[60]. ERTRAC represents a diverse range of road transport stakeholders and they are brought together with representatives from public authorities at all levels, urban to European.

In the past, there has been little cooperation between research strategies for energy and transport since there have been few common problem areas to address. In recent years, the sectors have drifted together, with an increased electrification of the transport sector, and the entry of renewable energy sources into both sectors: being used for heat and electricity production as well as biofuels. Therefore, it is important to ensure good coherence in the strategies and implementation plans for both transport and energy. FCH 2 JU reflects this convergence in that both the transport and energy pillars are present in the same joint undertaking. Thus, there is a viable potential to study cross-cutting actions and to highlight synergies of using fuel cells and hydrogen as part of a solution to low-carbon economy.

However, the responsibility to improve cohesion between different EU interventions lies with the Commission as it is beyond the possibilities of the JU. The JU recognises the limitations arising from the discontinuities across the various programmes within energy research and is engaging with other programmes to find means to diminish the obstacles: joint Calls are one possibility, but are in practice difficult. There is scope for working with other programmes to ensure fuel-cell options are not excluded from the Calls of relevant cross-cutting programmes through unnecessary constraints and may be in some circumstances deliberately encouraged. According to discussions with the PO it appears that the JU is engaged in such dialogue.

The discontinuity across the energy - transport boundary is more difficult to redress. It is not clear that DG MOVE and DG ENER have a common vision for the relationship between the energy and transport sectors and the role that hydrogen and fuel cells can play. Published policy documents do not demonstrate a common vision and the DGs should take active steps to resolve it. The absence of a common vision makes it more difficult for the JU what R&D priorities it should adopt.

Recommendation:

The IEG recommends that a joint analysis be made of possible scenarios for the future of energy and transport in which research and innovation priorities should fully consider the potential sector coupling between Energy and Transport where priorities for research in FCH can be situated.

The IEG also recommends the JU considers the possibility of contributing to other initiatives, such as Smart and Sustainable Cities, where fuel cells and hydrogen technologies can be included as components in a broader system perspective.

[59] Communication from the Commission. Towards an Integrated Strategic Energy Technology (SET) Plan: Accelerating the European Energy System Transformation, C(2015) 6317, Brussels, 15.9.2015.

[60] ERTRAC Strategic Research Agenda Towards a 50% more efficient road transport system by 2030 Executive Summary, October 2010.

Stakeholder perceptions are generally positive. The Public consultation asked the question, "To what extent are the activities of the FCH 2 JU coherent with other activities of the Horizon 2020 programme?". The response is shown in Figure 40 50% of respondents thought them very coherent; only 4% thought them not coherent.

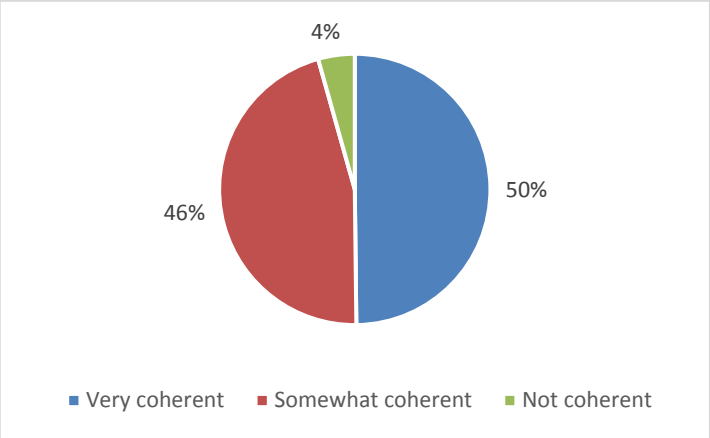


Figure 36. Are the activities of the FCH 2 JU coherent with other activities of the Horizon 2020?

- *Relationship to other Union funding programmes*

There are two distinct areas in which the FCH JU might usefully seek to engage with EU funding agencies. One is in the funding of infrastructure and the second is in the sharing of risk involved in product development.

There are several funding instruments where the FCH JU might seek funding for infrastructure investment. Among them are: the European Structural and Investment Funds (ESIF); Innovation and Networks Executive Agency (INEA), formerly TEN-T, and the Connecting Europe Facilities (CEF). Over half of EU funding is channelled through the five ESIF. These funds have the common purpose to support economic development across all EU countries, in line with the objectives of the Europe 2020 strategy. Two of them that have bearing on activities in FCH 2 JU are the Cohesion Fund (CF) and European Regional Development Fund (ERDF). The CF is aimed at Member states whose Gross National Income per inhabitant is < 90 % of the EU average. It can be used to support infrastructure projects, and projects related to energy or transport. Skilful use of this facility may offer the opportunity to engage EU13 countries more fully.

The ERDF focuses its investments on four key priority areas, of which three are closely related to the work of the FCH JU, specifically: innovation and research; support for small and medium-sized enterprises (SMEs); the low-carbon economy. The ERDF resources allocated to these priorities depends on the category of region. Part of the ERDF funding is dedicated to the programme European Territorial Cooperation (ETC), also known as Interreg[61]. ETC provides a framework for the implementation of joint actions and policy exchanges between national, regional and local actors from different Member States. Each region sets their own agenda and priorities based on the key areas identified in ERDF.

The INEA Programme supports a transport infrastructure policy that connects the continent and aims to close the gaps between MS transport networks and to remove bottlenecks and overcome technical barriers. Infrastructure investment is vital for new

[61] Regulation (Eu) No 1299/2013 Of The European Parliament And Of The Council of 17 December 2013 on specific provisions for the support from the European Regional Development Fund to the European territorial cooperation goal, L 347/259, Brussels 20.12.2013.

technology to compete successfully with incumbents and is often difficult for private operators to finance.

Connecting Europe Facility (CEF) is a funding programme for infrastructure to support projects encouraging synergies between transport and energy infrastructure, in line with the Europe 2020 strategy. It will also enable the EU to achieve its sustainable development targets through the creation of synergies between transport and energy. The funds in CEF can be used to co-fund TEN-T projects in the Member States. Support can be provided through grants and contributions to innovative financial instruments. In the regulation, transport funding priorities are listed including transition to innovative low-carbon and energy-efficient transport technologies[62].

It is evident from the above brief review that there are many opportunities to secure support for infrastructure investment related to the programme objectives of the FCH JU and its component projects. Thus, there is complementarity with the research and innovation in FCH 2 JU with other sources for funding, such as INEA and ECT. INEA (TEN-T) is also engaged in hydrogen infrastructure, for example the Hydrogen Infrastructure for Transport (HIT) project and its successor HIT 2[6364]. An example of an ECT-funded project regarding hydrogen infrastructure is the Scandinavian Hydrogen Highway Partnership[65] with the goal to create a region where hydrogen is available and used in a network of refuelling stations.

These two examples are evidence of synergies with FCH 2 JU and there is a possibility to develop cooperation regarding infrastructure and storage where knowledge gained could be efficiently put into use. However, so far there is little evidence that an extensive cooperation is established and there is potential for improvements regarding exchange of information between different initiatives. Lack of communication and cooperation between different interventions increases the risk of overlapping studies within areas that are of common interest. It can, for instance, concern developing commercial models for the deployment, and implementation plans to bring the technology to the market. This is of interest for FCH 2 JU as well for INEA and ECT and where it could be beneficial to improve the synergies between the initiatives. Other areas where cooperation can be an advantage is the development of standards and better alignment of policies. A coordination group on RCS has also been established, initiated by the JRC, and this group has an influence in the AWP elaboration.

The principal difficulty is that structural funds are managed jointly by member states and the Commission and need to be co-funded. This means that member states' priorities control decision-making and are generally beyond the influence of the FCH JU. The municipalities and regions are better placed as they are more aware of, and sensitive to, national priorities and can exert some influence on national decisions. The FCH JU is well-aware of these considerations and is working closely with the regions to the opportunities that the structural funds provide. The FCH JU has engaged a financial engineer whose function is to facilitate dialogue of the regions and managers of structural funds, contributing particularly to design interventions that are coherent with the objectives, resources and constraints of the FCH JU. The IEG commends and supports this approach.

Different types of funding are required to help bring products to market. There is generally perceived to be a difficult interval between the time when a start-up firm receives an initial capital contribution, for example from a research programme, to the time when it begins generating sufficient revenues to attract conventional funding. It

[62] Regulations Commission delegated regulation (EU) No 275/2014 of 7 January 2014 amending Annex I to Regulation (EU) No 1316/2013 of the European Parliament and of the Council establishing the Connecting Europe Facility.

[63] http://ec.europa.eu/inea/ten-t/ten-t-projects/projects-by-country/multi-country/2013-eu-92077-s, Accessed 2017-05-15.

[64] Hydrogen Infrastructure for Transport, http://www.hit-tent.eu/category/about-hit/.

[65] www.scandinavianhydrogen.org/ Accessed 2017-05-24.

was a statutory obligation of the FCH JU to notify participants with whom it had concluded a Grant Agreement of the potential borrowing opportunities from the European Investment Bank, in particular the Risk Sharing Finance Facility set up under the Seventh Framework Programme. Despite this it appears that no loan under the RSFF was made to any of the JTIs[66]. It appears that the EIB was not convinced of the financial viability of any project put to it and that consequently the RSFF was unwilling to take on the risk. The difficulties to raise venture capital depends most likely on that the FCH technology still means high risk and long pay-back time for an investment. This results in a low success rate in receiving venture capital with the available financial instruments.

In November 2016, the European Investment Fund (EIF), a part of the European Investment Bank, and European Commission launched a new Pan-European Venture Capital Fund(s)-of-Funds programme intended to address this equity gap and to attract additional private funding from institutional investors into the EU venture capital asset class. Under the Programme, EIF will provide a maximum of 25% of the total commitments of a Fund-of-Funds which will then in turn invest in investee funds[67].

IEG is of the opinion that there is potential for the above funding opportunities to be better exploited for FCH technologies deployment. Not all schemes appear to be appropriate for FCH as already explained (e.g RSFF) but others are highly relevant (e.g CEF). The new financial expert that has recently joined the FCH 2 JU staff is considered a useful addition to seek ways of making a better use of those funds to pave the way for the FCH technologies to the market.

Recommendation: The Fund(s)-of-Funds programme may be a mechanism for supporting aspects of the commercialisation of FCH technology developed under the JU and the IEG recommends that the JU should examine these possibilities.

- *Synergies with similar international, national and intergovernmental programmes*

According to the Program Review Report 2015, more projects could describe linkages and synergies with other projects compared to before. This is evidence that the complementarity between projects in FCH JU and other European projects has improved. Most likely it is because, as the IEG were told by interviewees, many of the beneficiaries participate in several projects.

However, there is no obvious evidence that there are overall synergies or cooperation between FCH 2 JU and similar international, national and intergovernmental programmes, as described in Section 6.4. This was noted in the Programme Review Report 2015 stating that relationships and linkages with projects supported by member states is sparse and it is an area that needs improvements. National programmes and interventions are in some countries formed through workshops and discussions with relevant national stakeholders. By evaluating the specific needs at a national level, strategies and work plans are not influenced by the priorities in FCH 2 JU. Consequently, the coherence between national programs and FCH 2 JU can be weak.. Thereby, projects are funded through other channels such as national programmes and Structural funds. A consequence can be that these activities are not visible on the hydrogen and fuel cell map presented by FCH JU. At the same time,

[66] Operations Evaluation. Second Evaluation of the Risk Sharing Finance Facility (RSFF), June 2013.
[67] Pan-European Venture Capital Fund(s)-of-Funds programme, link.

other countries are very active within the FCH 2 JU where the national strategies and programs and are more in line with the MAWP.

The unsatisfactory relationship of the FCH JU programme to the programmes of the member states was noted in both the first and second interim evaluations of the FCH JU. Part of the reason is that the member states were not given any executive status in the JU. There is a logic to this as an executive role for member states is not easily reconciled with the status of PPP. This is compounded by the fact that only a few countries have substantial programmes and it is only they that can contribute constructively to coordination, but it is hard for them to do this within the SRG. This is a difficult idea for the Commission, as it conflicts with the Community spirit, but more effective coordination might be achieved if dialogue were confined to the stronger participants, as mentioned in Section 6.4.

The Public consultation, launched in December 2016 by the Commission services, asked what respondents thought of the relation of the FCH 2 JU with other Union funding programmes and/or with similar international, national or intergovernmental programmes? Some respondents could not answer, but most thought the activities either complementary (20%) or synergistic (41%), see Figure 37. These are positive findings. Comments regarding potential overlap mainly concerned national research programs and research programmes in other continents such as Asia and the US.

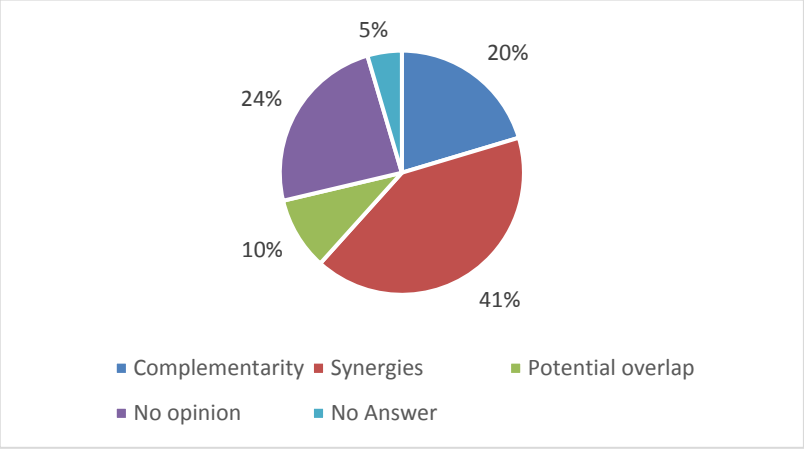


Figure 37. The relation of the FCH 2 JU with other funding programmes.

There is appreciable experience within the FCH community of combining JU funding with other sources. Responses in the Public consultation to the question, "What is the relation of the FCH 2 JU with other Union funding programmes and/or with similar international, national or intergovernmental programmes?" indicates that 40% of respondents had experience of this, see Figure 38.

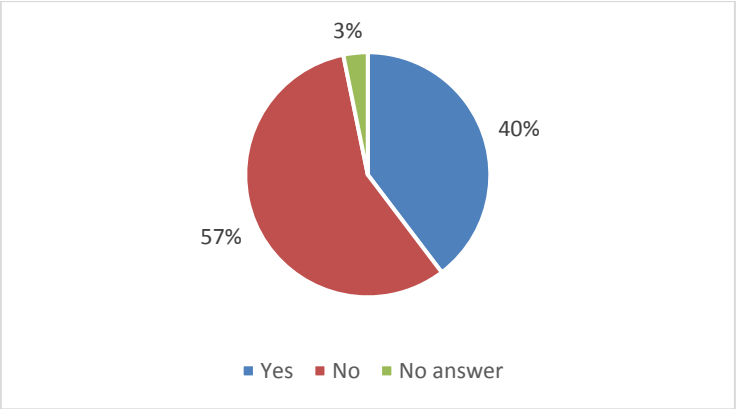


Figure 38. Experience in combining different sources of EU funds or with national funds.

7.5 EU Added Value

7.5.1 Overcoming Fragmentation

The decision to proceed with FCH 2 JU was accompanied by the creation of Hydrogen Europe, which brought together 93 industrial organisations from 22 European countries into a representative body. This has established a strong voice for companies seeking to develop FCH products and a coherent input into the development of the FCH 2 JU activities. This can be regarded as a substantial achievement for Europe, and was almost certainly enabled by the unifying presence of the FCH JU programme and its continuation into FCH 2 JU.

In terms of overcoming fragmentation within Europe, the challenges of delivering improved coordination between Member States' FCH research and innovation support remain. As already mention in section 6.2 there is little sign of the effectiveness of the SRG in this regard evolving, and this continues to be a priority for improvement during the life of FCH 2 JU. A resolution of these shortcomings is an important part of improving overall EU cohesion, and should be addressed as a matter of urgency.

At a working level, amongst the FCH innovation community, there continue to be strong benefits received from the work of FCH 2 JU. Annual meetings provide a useful venue for exchange of information and the development of professional connections, and supplement the collaboration achieved within individual projects. Interviews have confirmed that, in general, project consortia are working well together, and helping to build a genuinely EU-level supply chain capability. Indirect influence on national programmes is also evident through these participants.

7.5.2 Consistent & Coherent long-term strategic investment

Continuing the trend established during FCH JU, there are clear signs that the FCH 2 JU MAWP is providing a powerful framework within which academic and industrial research and innovation decisions are being made. Several major EU companies have maintained FCH innovation programmes since the establishment of FCH JU, and made long-term commitments to maintain their efforts. One example is the FC bus programme, which has resulted in plans for a progressive development of improved vehicles by manufacturers and their revenue-generating demonstration service by operators as part of a longer-term deployment plan. Another is the growing level of field trials of FC micro CHP systems in several EU countries, supported by FCH 2 JU but with rising levels of utility interest and commitment.

However, both these examples of demonstration are by themselves not of sufficient volume to materially reduce production costs, and it is not yet evident how a strategic investment by Europe to achieve such reductions locally will be made. Equally, the large proportion of available FCH 2 JU funds that the demonstration projects absorb caused some stakeholders interviewed to question whether this resulted in inadequate levels of low TRL research being supported, thus reducing the prospects of disruptive cost reduction technologies being developed.

7.5.3 Contribution to EU sectoral policies

The work and ultimate objectives of the FCH 2 JU are coherent with energy, climate, environment, transport & competitiveness policies; part of this coherence is captured in the European added-value.

Major elements of the EU policy to decarbonise the power sector are the development of smart grids including distributed generation. The combination of fuel cells with hydrogen electrolysers and storage systems, all of which FCH 2 JU support, could be a major enabler for the integration of Renewable Energy Systems with electrical networks. Also, the FCH 2 JU contributes towards this through the support of research and innovation in micro-CHP systems based on fuel cells, which are one of the acknowledged potential technologies to this end, and of demonstration projects for both domestic and industrial applications.

In transportation, the transition to cleaner vehicles, including electrical technologies for propulsion, is identified as a key requirement. The FCH JU programmes have focused clearly on this area, with the development of fuel cell power systems for both buses and automobile applications as a central part of its work. Adoption of such technologies will be central to realising EU ambitions for reduction of environmental emissions, and directly supports EU policies in this area.

Decarbonisation of industry and industrial processes can also be supported by all the technologies developed within the FCH 2 JU project portfolio, even though these are not explicitly referenced within the MAWP or AWP. The generation of electricity and conversion of energy between different forms is a key characteristic of both FCH technologies and many industrial processes so potential applications are very broad.

In addition to reduction of GHG emissions, the major value of FCH may be seen as its virtually near-zero pollution performance and thus its potential contribution to EU air quality objectives.

In terms of EU competitiveness the roadmap to a competitive low carbon economy in 2011 stated "the creation and preservation of jobs will depend on the EU's ability to lead in terms of the development of new low-carbon technologies through increased education, training, programmes to foster acceptability of new technologies, R&D and entrepreneurship". The FCH JU activities have supported all of these elements, through innovation support, encouragement of collaborations through the FCH supply chain, demonstration projects to increase public awareness as well as test technologies, and the integrated education, training, exchange, and communication elements within larger projects.

However, while the FCH 2 JU objectives are clearly aligned with the EU sectoral policies, it must be noted that presently the state-of-the-art of FCH technologies and its deployment level remains short of the level necessary for them to make an economically viable contribution to satisfying these policies.

8 CONCLUSIONS

8.1 Continued Relevance

The FCH 2 JU has continued to demonstrate the merits commended in the second interim evaluation of the FCH JU; it has further reinforced a Community of industry and research bodies around a common long-term research agenda and gathered a portfolio of projects that reflects the specific objectives assigned to it.

The JU continues to be relevant. In a carbon-limited world, hydrogen could be an important energy vector. It is difficult to foresee precisely how hydrogen technologies will eventually be deployed and how technologies within the energy and transport sectors will relate. In the event of abundant hydrogen from renewable sources there may also be interest from the manufacturing and process industries.

The IEG is of the opinion that the JU is supporting work across the right spectrum of technologies to ensure they may be effectively deployed in Europe in the light of the specific needs and circumstances of various regions.

The sector is still in a pre-deployment stage, implying that the first-mover risk is still very present for the industrial partners. The choice of a Joint Undertaking as instrument continues to ensure very good alignment with both policy and industrial objectives and strategies, and the large demonstration activities provide adequate support to test business cases, build confidence with end users, and bring together manufacturers and customers in preparation for effective deployment.

8.2 Implementation

Implementation of the PPP has been successful in most relevant aspects. The JU has discharged its funding obligations admirably. The Industry Grouping has organised its participation most effectively. The JU has successfully created an active FCH community and extended this to include municipalities and regions through a Memorandum of Understanding. Financial management appears to be robust and the views of the public and beneficiaries sought in the consultations are strongly positive.

The overall operational efficiency of the FCH 2 JU has improved as the institution has matured. Settlements of prepayments and costs claims (TTP) were never late, which is a very important fact in particular for SMEs and beneficiaries of large demonstration projects.

The TTG of Call 2014 was slightly longer than foreseen under H2020 rules, but subsequently decreased with maturity of processes. There is still a problem with complex and technically demanding projects. In particular the issue of provision of construction and operation permissions should be more carefully considered during the evaluation process when projects are closer to the market. The IEG judges the average evaluation cost per proposal of €3,100-4,650 to be acceptable. The cost efficiency of the programme management and internal controls improved steadily throughout the period (the ratio of administrative and operational costs reached a steady value of 2.6%-2.7%, which is felt by the IEG to be very good value). The final annual cost for management of about €40,000 per project is judged to be acceptable as projects are quite large. The execution of the budget has similarly improved over the period and is now very good. Also against the JUs' internal benchmarks the FCH 2 JU achieved a good to very good position.

It should be noted that the JU has continued to exceed the level of participation by SMEs specified for Horizon 2020.

In terms of overcoming fragmentation within Europe, the challenges of delivering improved coordination between Member States' FCH research and innovation support remain.

There is little evidence that the SRG is effective in this regard, and this continues to be a priority for improvement during the life of FCH 2 JU.

Representatives on the SRG are not in all cases in roles that have a direct connection to FCH policy within their Member States, or are not of sufficiently senior level to reach agreements on improving consistency of national programmes with the FCH 2 JU. Attendance at meetings is still typically around 50% of members, so as a forum to both influence the FCH 2 JU activities and to identify supporting national activities, the SRG is not presently effective.

A resolution of these shortcomings is an important part of improving overall EU cohesion, and should be addressed as a matter of urgency.

In addition, , the FCH JU has engaged a financial engineer whose function is to facilitate dialogue with the regions and managers of structural funds, contributing particularly to design interventions that are coherent with the objectives, resources and constraints of the FCH JU. The IEG commends and supports this approach.

There is need for a stronger cooperation with additional regulators (e.g. health and safety, standards) in addition to the ones in the Governing Board that could foster FCH deployment. The JU should consider how it might deepen its relationships with appropriate institutions.

The FCH 2 JU has put a lot of effort into setting up an improved website which offers easy access to project results, GB decisions and other relevant information. Nevertheless, the FCH JU PO should require projects themselves to improve their communication to the public and dissemination to relevant stakeholders. More communication activities should be focused on the public, to reinforce the image of the FCH 2 JU and facilitate awareness of FCH. The use of social media has improved, but there is still potential for more use of Twitter, YouTube and Facebook, which should be considered.

8.3 Added value and Necessary Leverage

Added value: FCH 2 JU has an explicit EU added value and amongst the FCH innovation community, there continue to be strong benefits received from the work of FCH 2 JU

The decision to proceed with FCH 2 JU was accompanied by the rebranding/restructuring of Hydrogen Europe that now has dedicated staff, and brings together 93 industrial organisations from 22 European countries into a representative body. This has established a strong voice for companies seeking to develop FCH products and a coherent input into the development of the FCH 2 JU activities. This can be regarded as a substantial achievement for Europe, and was almost certainly enabled by the unifying presence of the FCH JU programme.

Leverage: The IKAA component is required by Regulation 559/2014 to reach at least €285 million. It is making good progress in reaching this target: the total of verified IKAA for 2014-2015 and planned IKAA for 2016 is €393M. Even if there is no hard evidence of a causal link between the activities listed as IKAA and the existence of the FCH JU, this can be considered an indication of the leverage achieved by EU funds and is clearly a strong sign that the JU is successfully aligned on industrial priorities.

For the Calls 2014-2016, the JU has estimated that the members will generate an IKOP of €143 million for an EU funding of roughly €147 million awarded to members.

This is more than was expected because many of the demonstration projects have a low effective funding rate, being close to market. Although the obligation to generate €285M of IKAA is likely to be met much earlier than anticipated, the IEG understands that the JU intends to ask its members to continue reporting IKAA in order to demonstrate its alignment with industrial ambitions. The IEG agrees that this is desirable.

To calculate the leverage, we can only take into account period 2014-2015, as it is the only one with certified IKKA. For that period, the FCH 2 JU has generated 0.98 of operational leverage (total participant contribution in projects divided by EU contribution) and 0.65 of additional leverage (certified IKAA divided by EU contribution), yielding a total figure of 1.63.

8.4 Coherence with EU policies

The work of the JU is undoubtedly coherent with policies of the EU in energy, environment, transport and competitiveness. The technologies being developed with the support of the JU are capable of significant contributions to the security of energy supply, to the reduction of global and local pollution, to a clean and sustainable transport sector and to a more competitive European economy in a carbon-limited world.

FCH JU activities have supported those policies through innovation support, encouragement of collaborations through the FCH supply chain, demonstration projects to increase public awareness as well as test technologies, and the integrated education, training, exchange, and communication activities within larger projects.

In some cases, gaps exist in the coverage of FCH-related activities across different programmes, where it is mistakenly assumed that the JU is responsible for funding everything that has to do with applications of either fuel cells or hydrogen. This issue needs to be addressed, both as regards basic (low-TRL) research and applications of FCH technologies in the energy system.

Another important example is the discontinuity across the energy-transport boundary where the potential of the FCH technologies for creating stronger links between these sectors has not yet been fully taken into account. It is also not clear that DG MOVE and DG ENER have a common vision for future more interdependent energy and transport sectors and the role that hydrogen and fuel cells can play. Published policy documents do not show any commonality of vision and the DGs should take active steps to address this.

8.5 The future after FCH 2 JU

The IEG is of the opinion that there will be a continued need for support in the field of fuel cells and hydrogen beyond the FCH 2 JU.

The PPP approach remains a viable option, and it is desirable that the community created through the FCH 2 JU be maintained. However, the PPP scheme should be revised if support to deployment is given, in view of the specific financial and regulatory needs this step will require.

The absence of a deployment support framework of the nature provided for other new energy technologies such as renewables is likely to be a barrier to commercial development of FCH technologies. Without this, there was no incentive for exploitation of technologies still at an early stage of development and this is a material economic disadvantage for potential FCH applications.

The importance of deployment support is illustrated by the fact that Germany alone supports renewable technologies deployment at a level of several billions euros per

year which is of the scale required for FCH. Without the intent to provide a comparable deployment support framework for FCH the rationale for continuing to support FCH technologies development is unclear.

Similarly to renewable energy technologies FCH competitiveness can only be achieved with appropriate regulatory support which is not place at present, so the exploitation route for JU outputs is incompletely prepared. Any new PPP should be considered in the context of the probable need for accompanying deployment support for FCH technologies if the research and innovation outcomes are to make a successful transition to commercial exploitation.

Before conducting a Policy Impact Assessment of a continuation of EU funded activity in this area and without prejudice to the present arrangements, the Commission may wish to consider alternative ways of combining public and private interest and public and private finance to cover the wide spectrum of activities in FCH that are required. The resolution might address also the relationship with MSs, perhaps through an agreement on the allocation of research areas between MSs and the JU to ensure full coverage of relevant topics, coherence and the optimisation of EU added-value.

Research undertaken in a collaborative and European environment such as FCH 2 JU has been shown to be beneficial and should continue as a mean to efficiently support the development of the new technologies needed.

9 RECOMMENDATIONS

In the table below, a number of recommendations are made to improve FCH 2 JU indicating the responsible body assigned to best implement it. The recommendations can be realised within the existing legal framework.

Table 13 FCH 2 JU First Interim Evaluation Recommendations.

Area	Subarea	Assessment	Recommendation of the IEG	Responsibility
Relationship with Member State	States representative Group Role	The relationship with Member States has not delivered the expected results and needs to be revised: strategic exchanges and synergies need to be established, leading to an optimal use of the available funding	- The IEG recommends member states should appoint to the SRG a representative who has a clear link to their National Programme operation and with the political decision-making mechanism. - The SRG should be part of a constructive dialogue to optimally leverage national and JU funding within an overall EU development activity. The national representative should be able to transmit FCH JU priorities to the national stakeholders and regularly inform the GB and PO about national and regional initiatives and funding mechanisms available relevant for FCH JU sector. - The SRG should collaborate with the PO to ensure a better alignment between research and innovation priorities and activities at national and EU level, identifying the critical gaps.	GB SRG
FCH 2 JU Advisory Bodies role	Scientific Committee	The Scientific Committee's comprehensive knowledge and experience should be used in a more efficient way	- Scientific committee should be revitalized and made more strategic. - IEG recommends including experts from outside EU (ensuring non-disclosure agreements), and remunerating if necessary. - SC committee should be consulted yearly on the first outline of the AWP.	GB, SC

Area	Subarea	Assessment	Recommendation of the IEG	Responsibility
FCH 2 JU Advisory Bodies role	Stakeholders forum	Stakeholder Forum is the only fully open body of the FCH JU	- The role and activity of this forum could be enhanced to improve the transparency of JU activity and decisions as well facilitating other relevant stakeholders (cities, NGOs, consumers …) to participate in a more active way. - The IEG recommends ensuring ways to gather more effectively the opinions of these actors	GB
Coherence	Coherence within EU policies	FCH 2 JU is well aligned with EU policies but EU policies in Transport and Energy are not sufficiently aligned between themselves	- The output of the FCH JU should be more fully taken into account in the formulation of related EU policies (e.g. SET, STRIA,…) - It is recommended that consideration is given to FCH JU PO participating in these groups - The potential for sector coupling between Energy and Transport should be better considered when setting FCH 2 JU's research and innovation priorities	EC PO GB
Areas where FCH 2 JU Implemen-tation could still be improved	AWP coverage	FCH 2 JU has funded a limited number of Low TRL activities	- As already highlighted in the second Interim Evaluation, basic research should not be neglected and is needed for further cost reduction and the development of new breakthrough technologies that could enhance the EU's competitiveness in the global market. - Considering the significant level of support for low level TRL research at national level, the IEG recommends JU should communicate with SRG to identify any gaps in low level TRL that it might best address.	GB SRG
	Identification of Main relevant industrial areas for FCH	EU position should be strength in some technological fields	- IEG recommends the JU identifies the main areas with highest added value for the EU (e.g. revise its strategy concerning fuel stack development)	GB

Area	Subarea	Assessment	Recommendation of the IEG	Responsibility
Areas where FCH 2 JU Implemen-tation could still be improved	Openness	Some call topics could have restrictive conditions that can jeopardize openness	- The IEG recommends JU should ensure when a call topic makes mention of previous project results or the possibility of using the results of previous projects, that this does not restrict participation.	GB
	Fostering more participation of regions	The role of the regions in the FCH implementation and demonstration is very important.	- Given the approach to deployment, the JU should continue to promote the inclusion of municipalities and regions and the use of FCH technology to address local needs	GB
	Funding Concentration	Funding is concentrated in a small number of countries and participation of Higher Education Entities in projects is low	- Low participation of some MS and institutes of Higher Education is most likely due to the industrial character of the JTI and the uneven development of FCH Industry within Europe - IEG recommends the JU ensures that the current unbalanced funding is not reinforced by any lack of information/openness/transparency to entities from countries where participation is low.	GB EC
	Assistance with the financial issues for commercial deployment	Given the current status of pre- commercial deployment, there is a need of a systematic strategy to support commercialization that would address the better exploitation of EU intellectual property and would recognize the inevitable international character of the supply and value chains that will emerge.	- FCH JU should have a catalyser role so IEG endorses the financial officer appointment whose focus should be in finding the most suitable funding options (European, national, including private funding).	GB PO
			- European companies will form part of an international supply and value chain and the JU should reflect on what it can bring to optimise EU participation in this environment (see recommendation on main relevant industrial areas for FCH above) - The IEG recommends the FCH 2 JU PO should continue to procure studies to help identify, in a neutral manner, strategic priorities for R&I activities as well as promising business models that can support FCH implementation in the market.	PO GB

Area	Subarea	Assessment	Recommendation of the IEG	Responsibility
			- The findings of these studies should be an input to AWP and MAWP.	
Communication	FCH 2 JU ensure the visibility of the EU	Neither FCH 2 JU nor beneficiaries seem to ensure in their communications a proper visibility of the EU as programme funder and promoter.	- The IEG recommends that the PO should monitor and ensure compliance with the respective rules by FCH JU (Horizon 2020) and beneficiaries (Grant Agreement) to ensure EU funding is properly acknowledged. -	PO
	Improve public awareness of the technology	The understanding of FCH should be enhanced to improve awareness and credibility, so as to pave the way for commercialization at scale.	- IEG recommends the PO to improve communication targeting the public awareness of FCH. - IEG recommends Hydrogen Europe should increase communication of FCH technologies, while taking care not to undermine the credibility of the sector through over-enthusiastic claims in advance of demonstrated capability.	PO Hydrogen Europe
	Communication with the political decision-makers	The communication has been largely improved but there is still room for improvement,	- More communication activities should be undertaken to ensure that policy makers at national and EU level are aware of the current status and future prospects of FCH technologies.	SRG GB
	Communication and coordination with EU regions	The MoU is a relevant step in this line.	- Communication between FCH JU PO and the regions should be continued to attract more regions and more regional support to these activities. - Find ways to ensure better synergies with National/Regional Research and Innovation Strategies for Smart Specialisation (RIS3 strategies).	PO EC (JRC)

Area	Subarea	Assessment	Recommendation of the IEG	Responsibility
	Knowledge Management and Open Data	Knowledge Management has been clearly improved, but some key information is still not supplied on the basis of confidentiality. Open data access is implemented in 2017 call	- PO should enforce the compulsory requirement for the projects to deliver all information about their results necessary for technology and project assessment to the PO; - The opt-out possibility for access to open data should be allowed only in a limited number of cases and with justified rationale behind it. (IPR or clear exploitation reasons). - The process of how the opt-out is accepted or not should be clearly defined.	PO

10 ANNEXES

10.1 Annex 1: Members of the Independent Experts Group

Name of experts	Nationality and gender	Short biography
Ana Sofia Caires Sousa Branco	PT Female	Ana Sofia Caires Sousa Branco is a Technological Physics Engineer with postgraduate qualifications in Innovation Management and the European Union. Having worked previously as a project manager in a multinational and as a technology transfer expert in a research centre, she is now an independent advisor, assisting private and public entities in the market uptake of research results and innovation ideas. She has participated in many EC projects and in several evaluation exercises as an independent expert for the EC, having been also the secretary of EARPA's Urban Mobility TF. She participated in the First Interim Evaluation of the FCH JU.
John Loughhead OBE	UK Male	John Loughhead was appointed Chief Scientific Officer to the Dept. of Energy and Climate Change in October 2014, and subsequently to its successor department, BEIS. He was previously Executive Director of the UK Energy Research Centre. He is a professional engineer and has worked in new energy systems R&D for over 30 years. His current role covers UK research into new industrial technologies and sustainable energy systems. Much of his career has been spent in industry, latterly as Corporate Vice-President for Technology and Intellectual Property of the Alstom group, where he was responsible for technology management and new product developments related to energy systems. He participated in the first interim evaluation of the FCH JU.
Annelie Carlson	SE Female	Annelie Carlson has a PhD in energy systems analysis. Her current position is as a researcher at VTI (Swedish National Road and Transport Research Institute). She has a broad knowledge on both transport and energy, and has through her carrier worked with projects regarding bioenergy, energy efficiency, district heating and CHP. In her present line of work she is focusing on a life cycle approach and different system perspectives in analysing the transport sector in regards to energy and fuel use.
Piotr Bujło	PL Male	Dr Bujło has a PhD in Fuel Cell technology from the Wroclaw University of Technology, and has worked as Associate Professor at the Electrotechnical Institute, Wroclaw Division. He is currently employed as Key Technology Specialist at Hydrogen South Africa Systems Integration & Technology Validation Competence Centre at the University of the Western Cape, where researches fuel cell stacks for combined heat and power applications.

Renate Lemke	DE Female	Renate Lemke is an environmental engineer and economist with a broad international experience. She has worked at Berlin's Municipal Waste Management Company for the past 13 years, where she is responsible for fleet management logistics, including the fleet strategy and investigation of fuel cell or hybrid options. She is currently Chief Executive for two plants for the production of high-quality substitute fuel. She holds a PhD on market introduction of hydrogen.

10.2 Annex 2: Detailed Analysis of the Intervention Logic

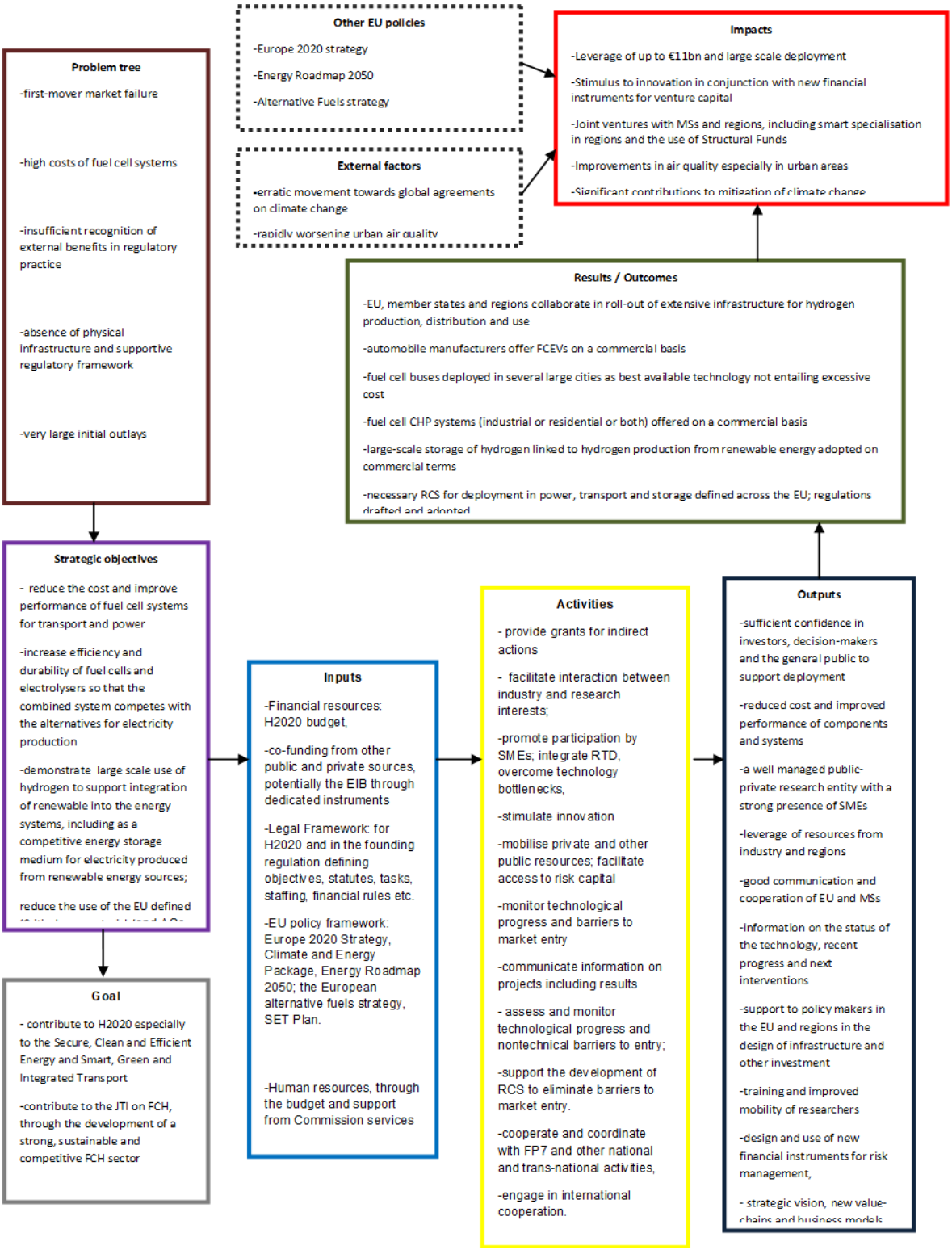


Figure 39 Detailed Intervention Logic

10.3 Annex 3: Detailed Analysis of the FCH 2 JU calls

2014 call

Twenty-two topics were listed in the call. No proposals were received for topics related to hydrogen storage and hydrogen compressor technology. Most of the proposals (38 of a total of 57) were received for the eleven topics in the energy pillar activities, which had an indicative budget of €41.5M. Only ten proposals were received for the seven topics published under the transport pillar activities with a budget of €42M. There is a significant difference: for the energy pillar, there was roughly one proposal for each €1M of budget; for transport, there was one proposal per €4M. The difference cannot be explained by asymmetry in large demonstration projects as both pillars had a substantial demonstration component. A possible explanation is that the need to work with owners of bus fleets who are relatively few and have established relations with incumbent actors restricts the competition.

The table below shows the proportion of calls passing the threshold in the 2014 Call by topic and the indicative budget for each topic. The share of projects above threshold over the entire call was 40%. This is significantly lower than that observed for the JU under FP7 where, after the first year, the share of proposals passing the threshold was stable at about 65%. There was no significant difference in the proportion passing the threshold in different topics. In the transport pillar, it was 40% and in the energy pillar it was 45%. In overarching topics, it was 0% and in cross-cutting it was 30%, but the sample sizes in those cases are too small to draw meaningful conclusions.

Given the small sample sizes it is not possible to say with certainty that proposals in any topic are especially good. Only the topic on electrolysis for cost-effective hydrogen production stands out, where five out of six proposals passed the threshold. Six topics were not covered by any proposal above threshold.

Table 14 Above threshold rates in the 2014 call by topic and their indicative budget.

Topic	Proposals evaluated	Above threshold	% pass	Indicative budget (M€)
Transport pillar	10	4		42.0
Energy pillar	38	17		41.5
Overarching projects	2	0	0	5.0
Cross-cutting projects	7	2		4.5
Total	57	23	40.4	93.0

2015 call

Sixty-six proposals were received for the 2015 call for proposals and sixty-one were evaluated; twenty-three proposals (37.7 %) passed all thresholds. The table below shows the number of proposals that exceeded all thresholds, the available budget and the amount finally spent. Of the 23 projects that passed all thresholds, fifteen were funded for a total contribution from the FCH JU of €110M. The overall success rate in terms of success in being funded was 24.6%. The success rate for the transport projects was rather low and it proved impossible to disburse the entire available funds. Submissions for the cross-cutting area were disappointing: only four were received, only one passed the threshold and only 20% of the available budget was spent. A remaining budget of €13M (about 10.64 % of the total) was not used under the 2015 Call; under H2020 rules, the residual funds could not be allocated to the energy pillar, where fifteen projects passed the thresholds, but only eight could be funded.

Table 15 Above threshold rates in the 2015 call by pillar and their indicative budget.

Area/Panel	Available budget (M€)	Proposals evaluated	Proposals passing Thresholds	Pass rate (%)	Proposals retained	Success rate (%)	Proposed budget (M€)
Transport pillar: Research and Innovation activities	25.0	19	4	21.1	3	15.8	14.1
Energy pillar: Research and Innovation activities	20.0	28	15	53.6	8	28.6	21.4
Energy pillar: Innovation activities	34.0	5	1	20.0	1	20.0	33.9
Overarching: Innovation activities	39.5	5	2	40.0	2	40.0	40.0
Overarching: Research and Innovation activities	2.0	0	0	.	0	.	0
Cross-cutting	2.5	4	1	25.0	1	25.0	0.5
Total/Average	123	61	23	37.7	15	24.6	110

2016 call

The 2016 call was published on the 19th January 2016 and closed on the 3rd May 2016. The results of the evaluation, the budgets available and requested are shown below. The overall pass rate (i.e. exceeding all thresholds) was 42.1% that is rather consistent with performance in 2015 (37.7%) and 2014 (40.4%). In all three years, the pass rate was notably lower than the pass rates observed for the JU under FP7 where, after the first year, the share of proposals passing the threshold was stable at about 65%. There are many factors that confound attempts to attribute this significant difference to a single cause. In the view of the IEG it is unlikely to be a consequence of a sudden deterioration of quality in proposals, but is more likely to be caused by a change in evaluation procedures and criteria: e.g. the elimination of the possibility to negotiate content of proposals under the rules governing H2020 may make evaluators stricter than under FP7. The evidence is not sufficient to form a firm view.

Table 16 Above threshold rates in the 2016 call by topic and their indicative budget.

Area/Panel	Eligible Submissions	Above thresholds	Pass rate (%)	Budget available (M€)	FCH 2 JU contribution requested (M€)
Transport pillar: Research and Innovation actions	22	11	50	57	67.4
Transport pillar: Innovation actions	2	1	50		
Energy pillar: Research and Innovation actions	26	10	38.5	56	57.6
Energy pillar: Innovation actions	12	4	33.3		
Overarching: Research and Innovation actions	7	2	28.6	2	3.9
Cross-cutting Coordination and Support Actions	6	4	66.7	2.5	3.7
Total/Average	76	32	42.1	117.5	132.5

10.4 Annex 4: Detailed Analysis of the Coordinators' Survey

The overall satisfaction of beneficiaries with the services provided by the Joint Undertaking is assessed based on the outcome of the Coordinators' Survey (on invitation only) launched by the European Commission that was performed to collect the views of the beneficiaries about the implementation of the Joint Undertaking under Horizon 2020 for the period 2014 to 2016, the consultation was opened on the 19th December 2016 and closed on the 15th February 2017, 70 answers were received and the group of respondents consisted of academia (17.14%), public or government sector (18.57%), private, not-for-profit sector (25.71%), private industry including SME (35.71%) and other entities (2.86%).

The strongest participation was from Germany, Italy, Spain and United Kingdom; 61% of the respondents are from the private industry (including SMEs), of this 26% of the respondents are from the non-for-profit sector, e.g. research foundations.

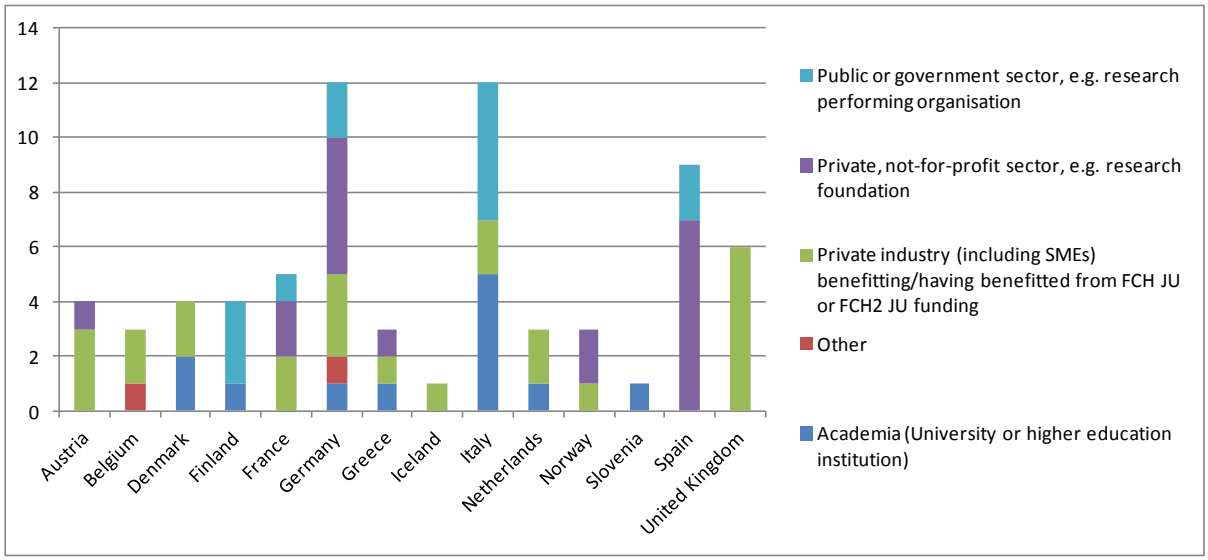


Figure 40. Overview on the participants of the 2017 satisfaction survey.

The EC and the PO are with 67% the **main channel of information** on FCH 2 JU opportunities. The European Commission website (e.g. FP7/H2020 portal, JU website, CORDIS) is an information source for 37% of the respondents, EU/JU events or promotional material (e.g. an info day, an EU info stand at a conference etc.) are recognised by 21% of the respondents. The information channel *"Through my work or invitation as an expert evaluator"* has been used by 9% of the respondents. Also recommendations by colleagues, superiors, etc. (16%) play a role.

However, there are not many newcomers participating in the surveys: 83% of the participants in the FCH 2 JU survey had already at least one project under the FCH JU (10% one project, 30% 2-3 projects and even 43% more than 3 projects) and were already aware of the FCH JU. 46% of the respondents have more than one project under FCH 2 JU. In this early stage of the programme, this is a quite high percentage.

The IEG strongly recommends that, in the light of technology commercialisation and market penetration, the FCH 2 JU should strengthen its efforts to enlarge the FCH community, e.g. by design of the Calls to promote the inclusion of municipalities and regions and the use of FCH technology to contribute to clean air issues in respective demonstrations. Doing so, would also strengthen the public side in this public private partnership.

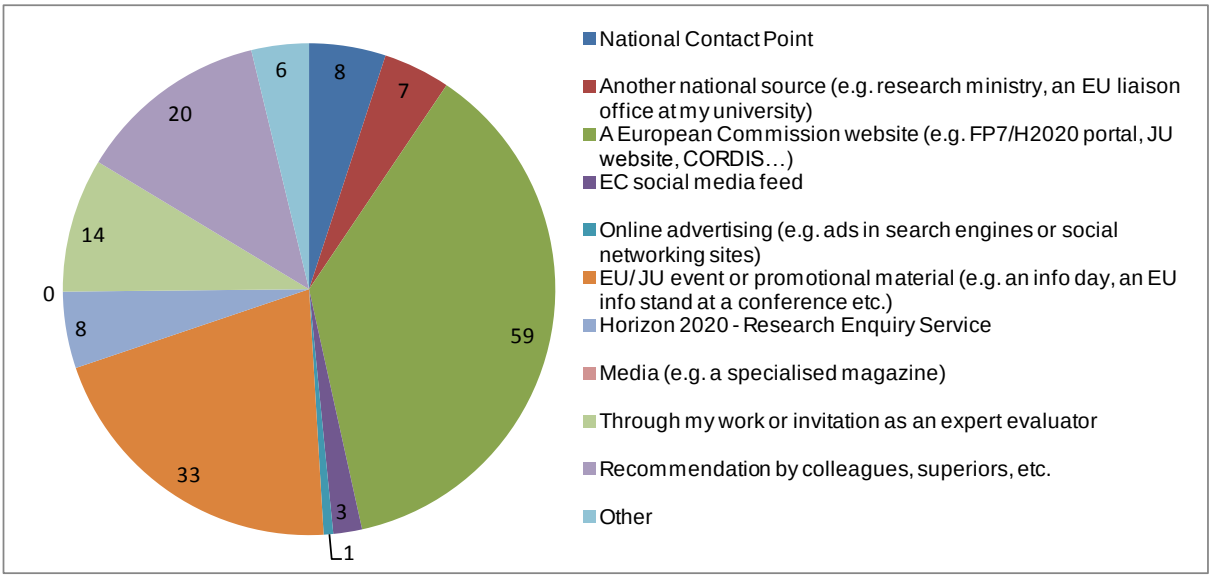


Figure 41. Question A.4. What are your main channels of information on FCH 2 JU opportunities?

The next three blocks of question concerned issues concerning application preparation, submission, timeliness of the processes and application finalization. The block of questions B.1.1. - B1.7. concerned aspects related to the application process, the availability and clarity of information, communication support during application preparation and submission, transparency of the proposal evaluation process and user-friendliness of the IT tool used for application submission.

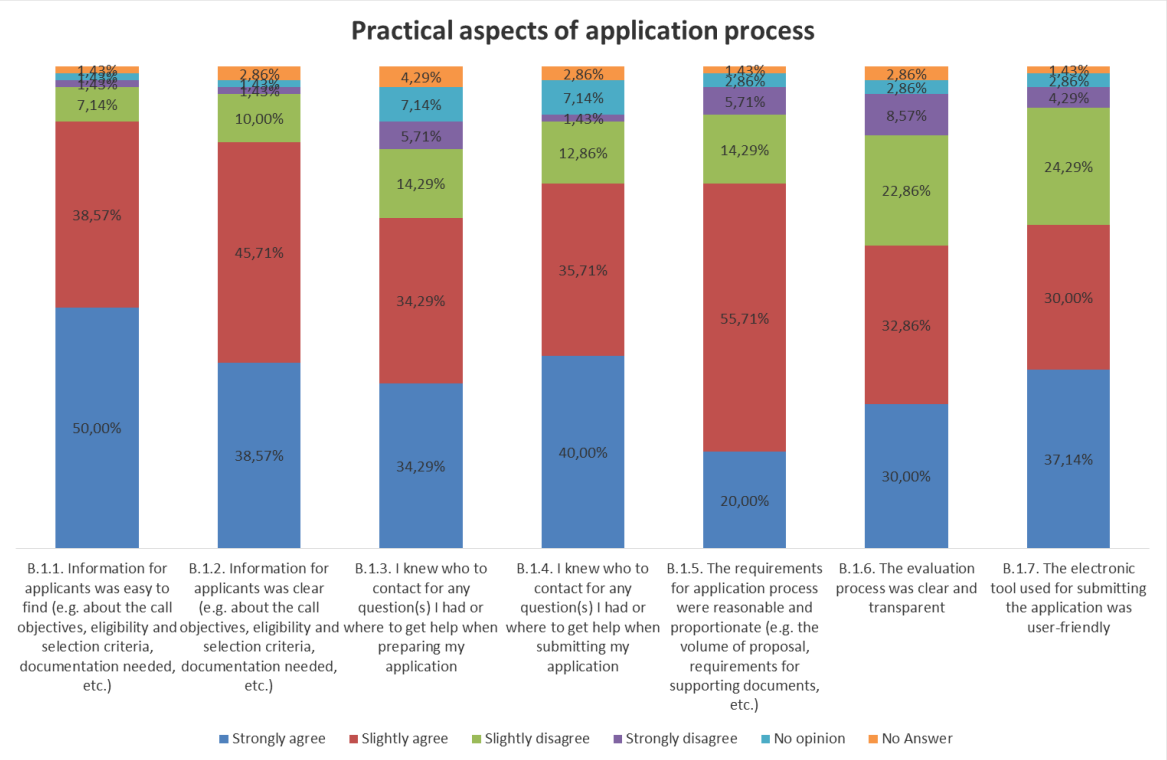


Figure 42. Satisfaction of beneficiaries regarding application submission process.

The obtained results show that beneficiaries did not have difficulties with finding information about the call objectives, eligibility and selection criteria, documentation needed, etc. (almost 90%) and that the provided information was clear (about 85%). In general the beneficiaries were well informed regarding whom to contact in case of questions or where to get help during application preparation and submission process, respectively 68.58% and 75.71%. Nevertheless, 20% of respondents pointed out that would know who is the right person to contact to get help at the stage of application preparation. Strong agreement that the requirements for application process were reasonable was expressed by 20% of beneficiaries and 55.71% slightly agree with the volume of proposal, requirements for supporting documents, etc. For 20% of beneficiaries requirements for documents were not proportionate. The application evaluation process was not clear for more than 30% of beneficiaries. In case of the assessment of the user-friendliness of the electronic tool for application submission, 67.14% responded that the provided tool was user-friendly but at the same time almost 30% did not agree with this statement.

Question *"B.1.6. The evaluation process was clear and transparent"* was evaluated by 65% of the respondents positively. The main criticisms are given in Annex 4. The quality and extent of the Evaluation Summary Report is an important issue of the respondents' remarks. In particular, after the elimination of the negotiation phase as part of the grant agreement procedure, clear and advising evaluation reports are valued by applicants who failed, to allow for a successful redirection of the proposal. The IEG is aware of the difficulties faced by the evaluators in agreeing a common position and translating this to text; it sympathises with applicants, but recognises there are limits to what advice can be given in the context of an evaluation.

The success rate of the respondents was 43%, see Figure 35. Another 13% of the respondents received funding after failing once, 24% failed two to three times and 20% more than three times. However, only 46% of the respondents were positive on the extent to which a clear explanation was provided for the decision why the application was not being selected for funding. Nevertheless 84% of the respondents would apply definitely again for funding, another 7% probably. Another 7% of the respondents announced not to participate in another call. None of the respondents claimed that the eligibility requirements for proposals are too strict. Only one noted that the success rate of applications is too low. However, six respondents highlighted that the administrative requirements for managing proposals or grants are too heavy. Other reasons mentioned were:

- "FCH JU is too bureaucratic, money does not flow and it is not competing with USA and Asia. We have been most depressed by our treatment by Brussels." This is a very individual statement.
- Funding does not cover the costs. This is a very individual statement.
- The potential risk of a consortium member failure can lead to the coordinator losing out financially. The IEG supports this comment, in particular for large projects with a long duration there is a growing risk with time that the commitment of individual project members weakens detrimental to the other consortium members. The IEG recommends paying special attention to the quality of project management in particular for large or long running projects.

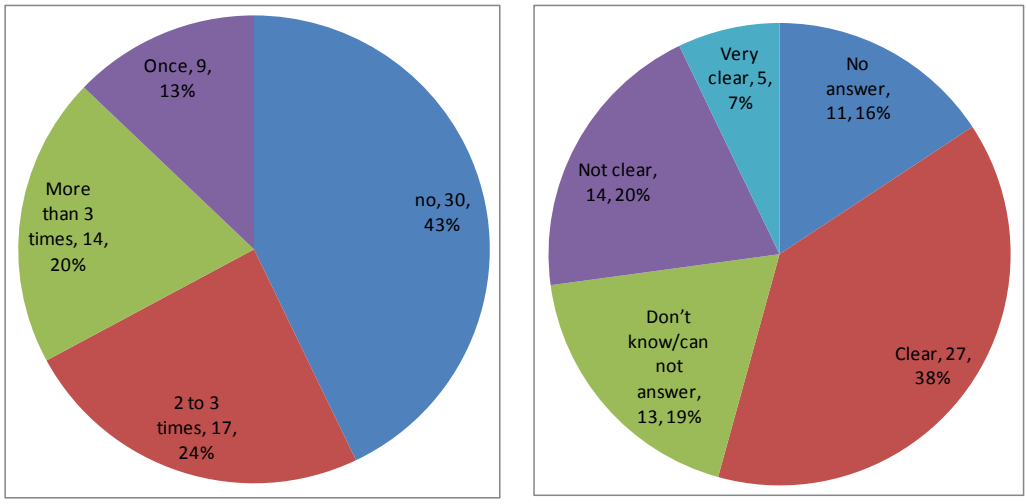


Figure 43. Proposal failure rate (left) and extent to which a clear explanation was provided why the application why the proposal was not being selected for funding (right).

Next the beneficiaries were asked to answer questions concerning the timeliness of the processes during application stage, namely time-to-inform, time-to-to contract and time-to-grant (B.3.1. - B.3.3.).

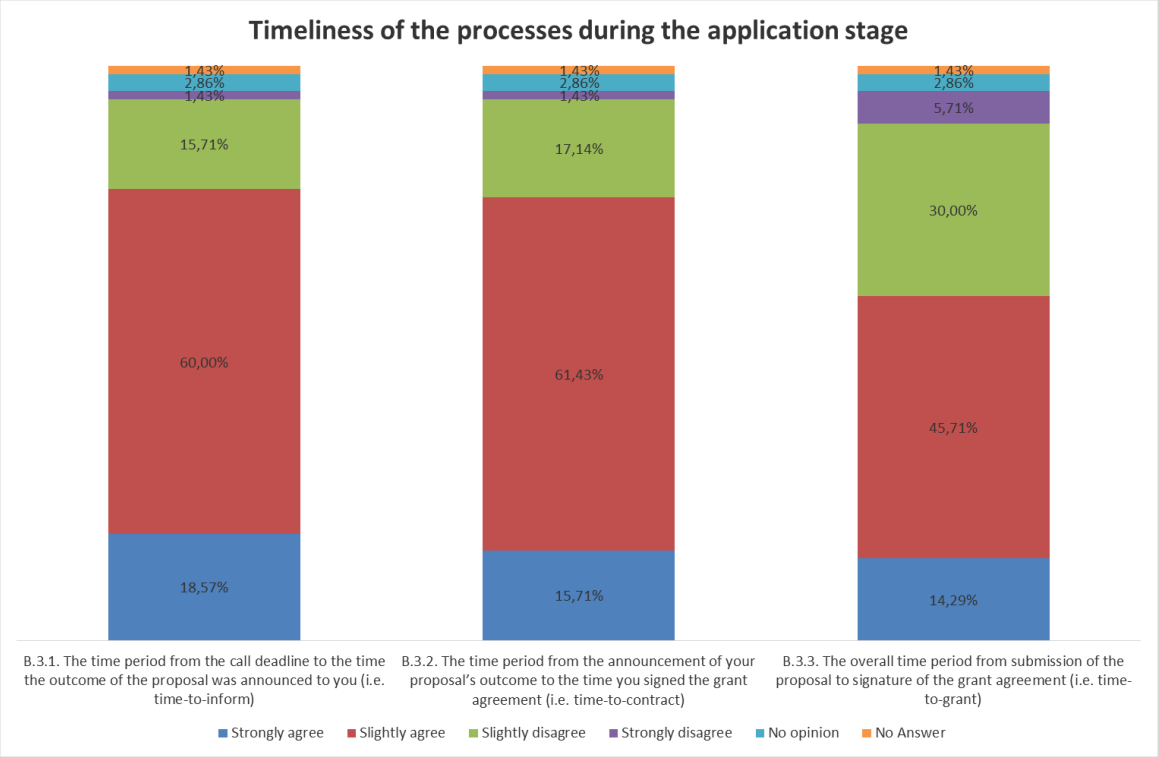


Figure 44. Satisfaction of beneficiaries regarding timeliness at the application stage.

The time-to-inform equalled for the 2014, 2015 and 2016 calls respectively 124 days (target fixed by the Commission 152 days), 90 days (target fixed by the Commission 153 days) and 126 days (target fixed by the Commission 153 days). This time period was satisfactory for 78.57% of beneficiaries who responded to the consultation, 15.71% slightly did not agree with the length of this period and 1.43% strongly disagreed with it. The time-to-contract equalled for the 2014, 2015 and 2016 calls respectively 119-281 days, 106-194 days and 92-101 days. The achieved by FCH 2 JU

time-to-contract period was satisfactory for 77.14% of beneficiaries who responded to the consultation, 17.14% slightly did not agree with the length of this period and 1.43% strongly disagreed with it. The time-to-grant equalled for the 2014, 2015 and 2016 calls respectively 243-405 days, 196-284 days and 218-227 days while the target fixed by the Commission was 243 days. The length of this period was acceptable only for 60% of beneficiaries who responded to the consultation, 30% slightly did not agree with the length of this period and 5.71% strongly disagreed with it.

The next block of questions (C.1.1. - C.1.3.) concerned issues related to application finalization, in particular availability and responsivity of the FCH 2 JU staff assigned to the project, clarity of requests from JU regarding proposal modification and complementation as well as user-friendliness of the tool used during contracting process.

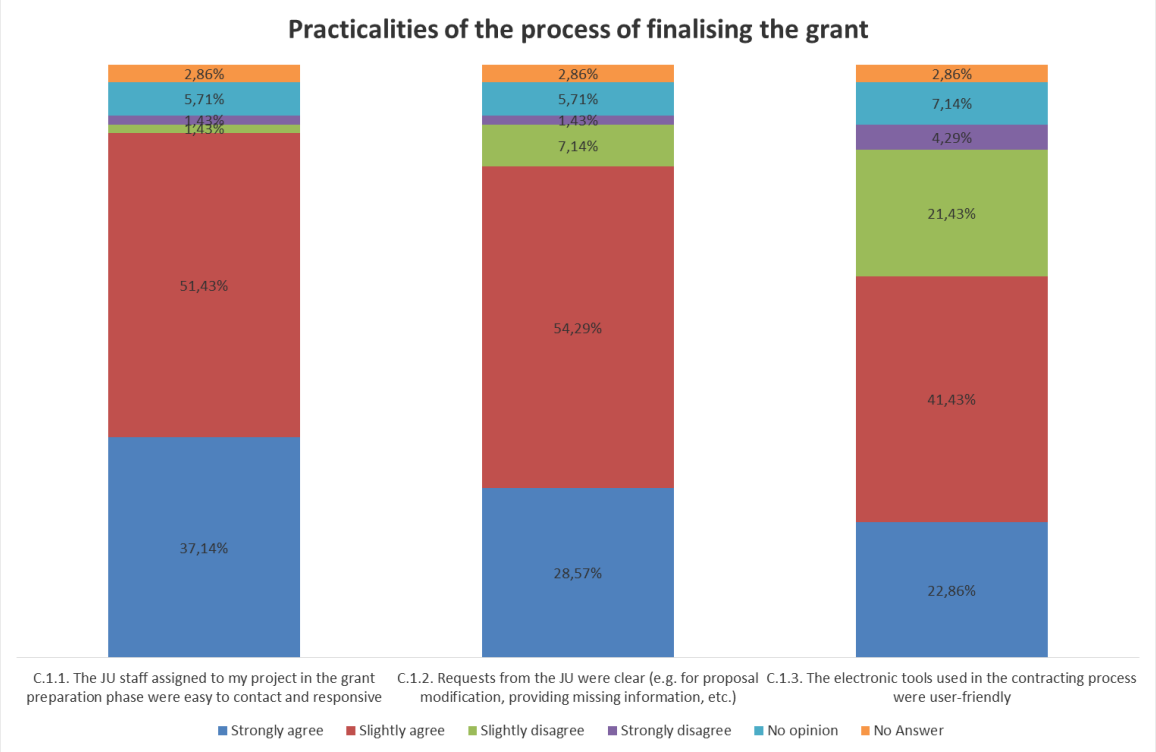


Figure 45. Satisfaction of beneficiaries regarding grant finalisation.

For almost 90% of beneficiaries the JU staff was easy to contact and responsive and only 2 beneficiaries faced problems. Requests from JU regarding grant finalisation were clear for more than 80% of respondents but 8.57% did not understand them. Electronic tool used during contracting process was user-friendly for 64.29% of users and difficult to deal with for 25.72%.

In the next step the beneficiaries had an opportunity to assess the wide range of communication methods that are offered by the FCH 2 JU for beneficiary use at every stage concerning the application preparation and submission or project realization.

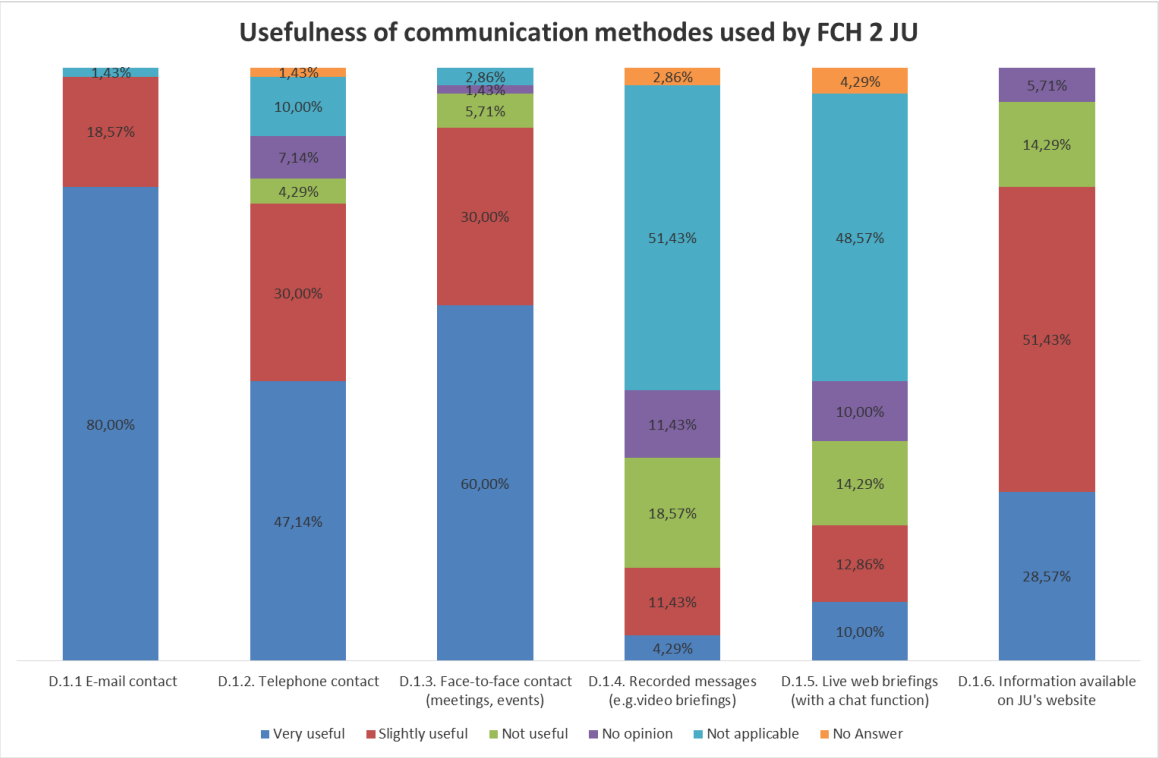


Figure 46. Assessment of communication methods available at FCH 2 JU.

As it might be expected, in the era of electronic communication, the e-mail contact is the most useful way for communication with FCH 2 JU for 98.57%, but the telephone contact and face-to-face contact is also highly rated by significant number of beneficiaries, 77.14% and 90.00% respectively. Recorded video briefings and live web briefings with chat function do not seem to enjoy the popularity as a way for communication. It might be that there were not used by beneficiaries because about 50% of respondents answered "not applicable" and relatively quite high percentage of respondents did not give any answer. The FCH JU website remains useful communication tool in the opinion of 80% of beneficiaries participating in the consultation. 14.29% of respondents think that the information available on the website are not useful and 5.71% has no opinion about it.

Finally, the beneficiaries were asked to assess the overall services provided by FCH 2 JU which include information, communication, programme management and offered to the beneficiaries support at different stages of application and project.

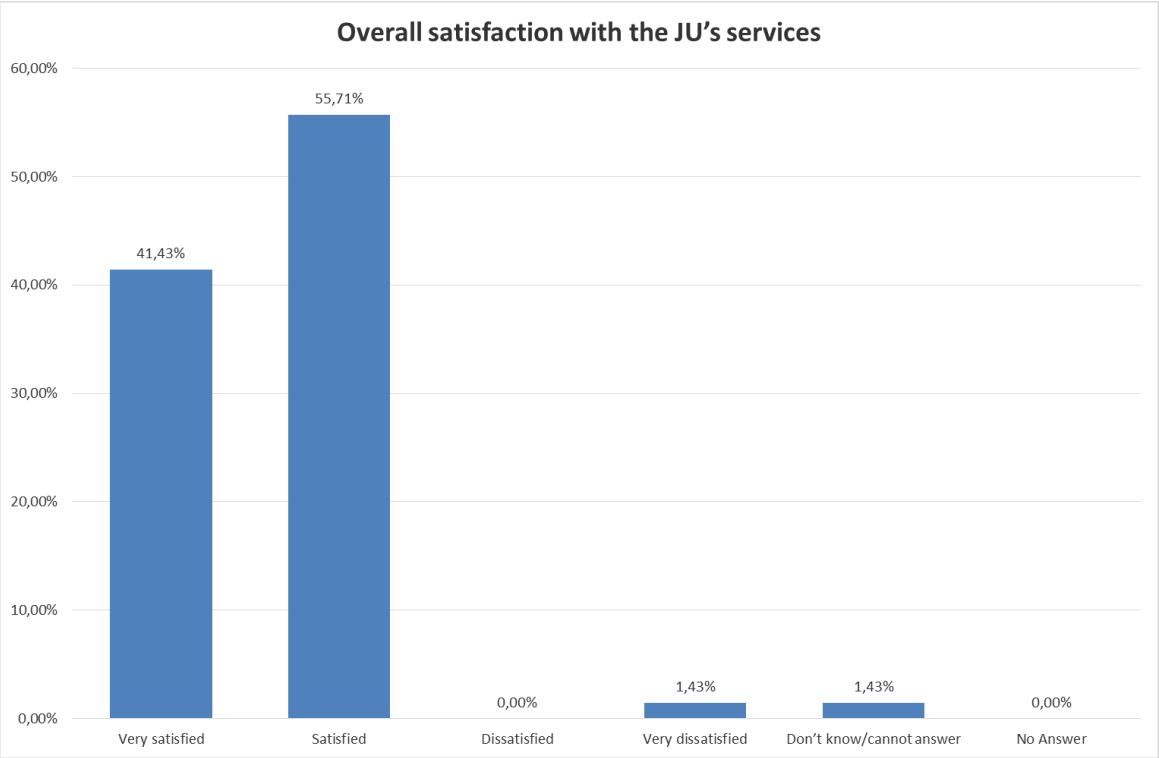


Figure 47. Overall satisfaction of beneficiaries with FCH 2 JU's services.

10.5 Annex 5: Comments from the Coordinator's Survey

Comments from the survey on different topics

General remarks

- FCH 2 JU has become a big company dominated process in my opinion.
- In a lot of cases, the call for topics is giving too many KPI's and mixing too many components: e.g. a call on FC bus, also needs to test an innovative business model AND change HRS technology: too many innovations in one topic.
- As a research group, we find very little opportunities to participate in the FCH 2 JU calls.

Application process

- The application process is competitive as we expected but it has been taken over by professional consultants who write bids full-time. We had two failed attempts in FCH JU and later in FCH 2 JU we have had more failures. Therefore, SMEs like my company have little chance of getting a proposal through.
- Information about the separate payment that is required to FCH JU should have been available in the call. This payment created significant confusion amongst the partners in the consortium after the project was granted. Ideally, this funding of the FCH JU activities should have been handled in a different way, and any dedicated payments from project partners should be incorporated in the electronic application form, and directly deducted from the funding.
- FCH JU shared a word document reflecting the online application: without this Template, the submittal would have been much harder. Please provide this Template (incl. excel for budgeting) on the H2020 portal.
- The general procedure is not anymore fully understandable! Too much documents need to get provided separately and the specific instruction given appears often unclear to none experienced participants. However, too many windows open during editing a proposal and often it appears unclear how to proceed with asked information and requests. At least, partners find heavily their respective parts to enter their individual information.
- Preparing and writing the proposals is too much time consuming. Considering shorter applications would be good idea. Why not a first short step with a pre-selection process?
- Two step proposals will reduce work load a lot.
- A two-stage proposal evaluation could be more convenient. A first evaluation about the technical proposal and its impact can make the proposal preparation much easier.
- Overall application process requires significant efforts and provides little flexibility. This could be improved. Applications process is better suited for "research" process than for "demo" projects.
- The proposal submission procedure with separate plan (5 pages) for dissemination and exploitation may cause confusion.

Evaluation process

- Sometimes the evaluators seem to be not perfectly aware of the evaluation criteria, i.e. almost same proposal submitted two times into two different calls were differently evaluated. Evaluators should be better "taught" on their work.
- Evaluation summary reports should be written by experts in the specific area and should clearly define the weaknesses of the proposal. This is crucial to enable applicants to improve the quality of the document when re-submitting.
- On occasions, it is not always clear to prospective partners exactly what information is being sought in response to some of the proposal criteria, as the language can be ambiguous or unclear.
- The evaluation process is clear and transparent. However the evaluation report is not always clear and fully convincing and there is no way to have re-evaluation with different experts.

- Careful revision of the comments in the evaluation summary report, second check of the proposal would be appropriate as well as avoiding vague comments in the evaluation summary report i.e. not supported by specific and detailed explanations
- The current review process works well. To increase transparency of the reviewing, a blind review process should be applied. This means that the evaluators would not know the identity of the applicants. In this way, personal agendas of the reviewers would not affect the outcome.
- The evaluation process appears neither transparent nor the evaluation report understandable in all details. To have a meaning is an advantage build mostly on expertise. However, evaluators show more and more not respecting other meanings and views which will lead to a disadvantage, or better said, knock-out.
- The absence of negotiation phase causes some time some troubles. A well-regulated negotiation phase could help on improving the project before its start.
- Sometimes the important facts/information elaborated in the proposal have been completely disregarded (reviewers stated they were missing), and as the system stays one cannot complain against this. Even a reviewer does not get a bad mark for missing something like this.

Timelines

- The time from publishing the call text to submission deadline is too short to form consortia.
- Regarding timelines, although the usual period of around 3 months from time of call announcement to proposal submission appears sufficient, in practice because of the time taken to build suitable consortia and agree roles and then to construct a proposal with all the extensive contributions required from all partners satisfactorily addressed, the time allocated is often insufficient. A four-month period may allow enough time to build a better proposal.

Grant validation process

- As I had the last FP7 projects, it was a difficult process. It seems to have improved significantly under H2020
- In general, procedures were ok except for the following: Information from the proposal (e.g. work package descriptions) has to be filled in again in the grant finalisation phase.
- Speed-up the REA validation procedure and the feed-back time.
- Partners need to get instructed personally due to missing information how to access pages and which information is needed and asked by the Commission
- Submission of the piecemeal information required for Part A is very long-winded and time-consuming in the SyGMa system, whereas submission of the single document for Part B is very straightforward, simple and quick.
- Furthermore, one considerable source of confusion amongst our partners occurred with automatic notification messages generated in the Participant Portal where it was totally unclear who the message was directed at and who needed to act on it, i.e. was the message being sent to the partners for information only or because it required action.
- Inconvenient: in the application phase WP descriptions were in a document, in the grant preparation phase in an online table. This requires extra work and the risk of copy-paste-mistakes.
- We had many problems with the LEAR process.
- Initially the tool did not work correctly - the wrong grant distribution number were stated and it took some time for until they were fixed.
- Far too bureaucratic.
- We would like to have a clearer legal basis of the "Standards Project Contribution Clause" to Hydrogen Europe.
- Duplication of work for entering information into the online tool is time consuming and can lead to discrepancies between working version and inline version. In general, and because of complexity of the system, partners do not

use the online tool as a basis for managing work etc.

Reasons why the second generation of the JU presents generally an improvement compared to its predecessor under FP7.

- Process of call structure.
- More easy administration through PP.
- Better software tools, more professional handling.
- I did not note a real difference: the service of FCH JU was already good under FP7!
- No room for relevant roles in the projects for the research centres.
- Common rules with Horizon 2020 help project management.
- The pre-financing is much lower than in FP7 which is an issue for the demonstration projects.
- Rules of H2020 are less flexible. More Project Officers do help in supporting projects better. So, rules are less good. Support staff/the team is better.
- Under FCH 2 JU the procedures have been simplified making them much easier to manage from the applicant's side.
- Clear and simple rules, funding easy to calculate, no surprise in the grant agreement, fixed time to grant even it should be a little bit shorter, the same for the evaluation phase, perhaps we should try to cut two months from the call to the grant.
- The overall structure is better than FCH JU. What I don´t agree is on the unbalanced degree of high TRLs.
- More structured. Better applications form. Better procedures.
- The simplified rules are an improvement. Entirely electronic processes are more practicable and user friendly. The greater level of support provided by the inclusion of FCH 2 JU in H2020 has significantly increased the appeal of participation in the programme.
- To my experience, the processes for application, grant preparation and modifications are clearer.
- Administrative processes slightly improved. Topics too high TRL-oriented, too little research.
- Slightly more user friendly online system and easier programme rules.
- More low TRL level research needs to be included for funding.
- The project JU fee is not insignificant and the JU should put this money to good use.

10.6 Annex 6 Detailed analysis of the Public Consultation 2017

By the end of 2016, the European Commission launched a public stakeholder consultation "Interim evaluation of the Joint Undertakings operating under Horizon 2020".

This public consultation aimed to collect the views of the public about the implementation of the Joint Undertakings (JUs) under Horizon 2020 for the period 2014 to 2016. 373 persons answered to the questionnaire, mainly from private organisations.

The respondents have a good insight in the FCH 2 JU as 75% already have applied for funding under FCH 2 JU and even 54% were directly involved with the FCH 2 JU. This group of participants included members of Hydrogen Europe or N.ERGHY (26%), beneficiaries (37%), advisory board members (5%) and evaluators (2%).

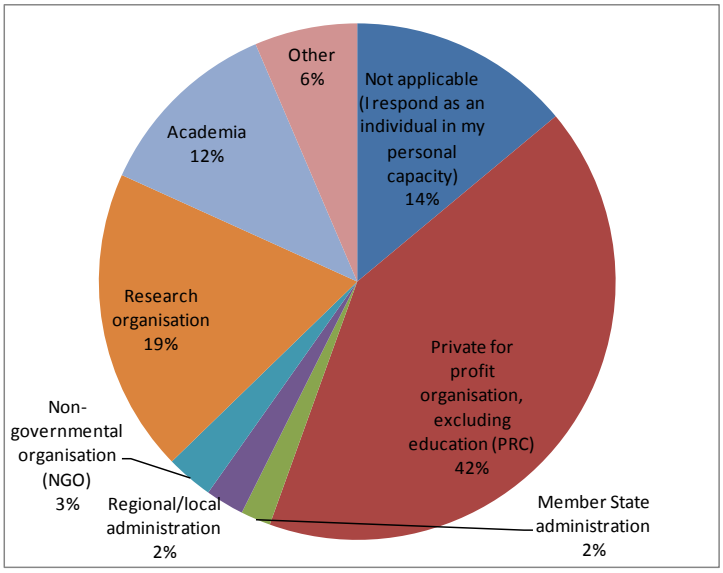
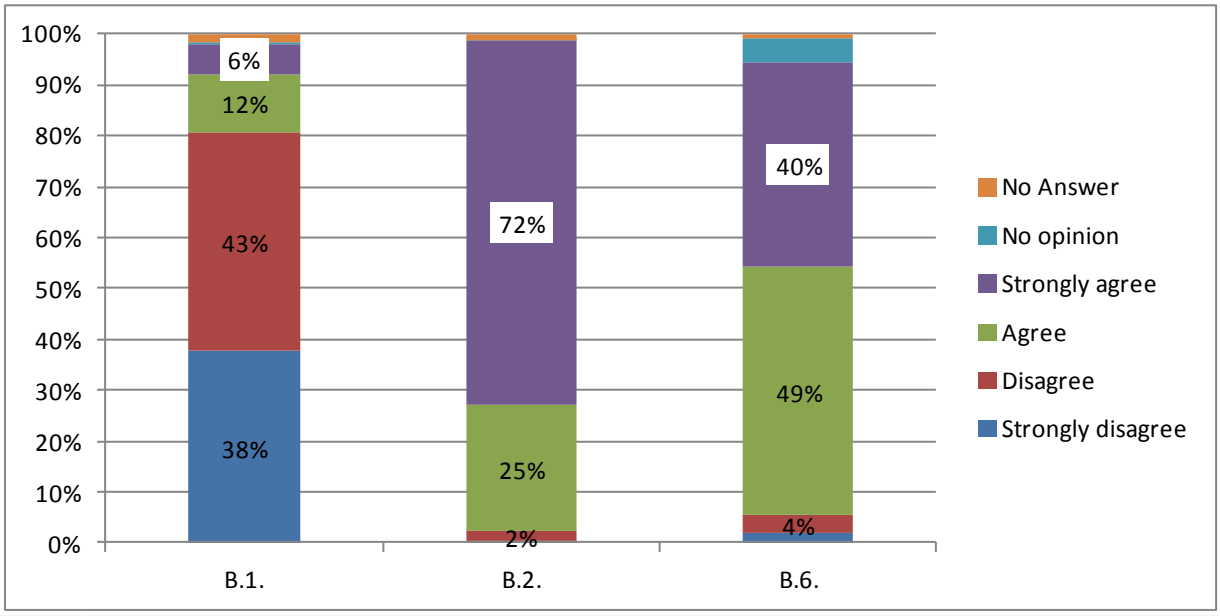


Figure 48. What type of organisation do you represent?

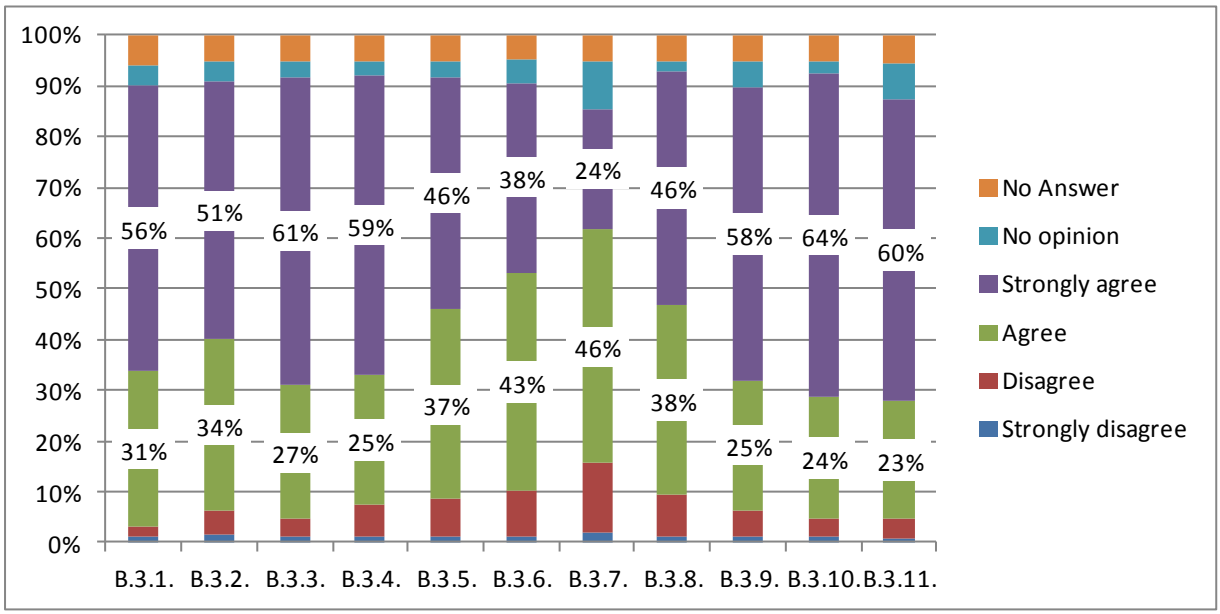
The respondents see a strong dependence of the FCH technology's success on the EC's support. Only 12% agree that the industry along with other possible actors at national level but without the involvement of the EU, would be able to overcome the barriers which hinder the market introduction and deployment of fuel cells and hydrogen technologies. Even 97% agree with the cooperation of the EU in a PPP-model to support FCH technology deployment. 89% of the respondents acknowledge that FCH 2 JU contributes to economic growth and job creation in the EU. In conclusion, respondents strongly believe in the necessity of EU support for FCH technology deployment and strongly agree with the chosen PPP tool.



B.1.	In your view, could industry along with other possible actors at national level but without the involvement of the EU, be able to overcome the barriers which hinder the market introduction and deployment of fuel cells and hydrogen technologies?
B.2.	Do you agree with the EU cooperating with industry in the context of a public-private partnership so that fuel cells and hydrogen technologies can be introduced into the market and deployed?
B.3.	Do you consider that the FCH 2 JU contributes to economic growth and job creation in the EU?

Figure 49. Evaluation of the PPP approach.

The participants were asked their view on the added value of the private-public-partnership. Several benefits were presented. The 'greater scale of cooperation and activities' (88% agreement) and 'better coordination of European research efforts' (87%) were rated highest followed by 'better use of available funding' (87%), 'attraction of best players in the sector' (84%) and 'more cross border collaboration' (84%). 'Increased synergy with sources of funding outside FCH 2 JU' was rated worst (69%). In conclusion, the argument of improved cooperation was evaluated as the most prominent advantage of the PPP.



B.3.1.	Better use of available funding
B.3.2.	Attraction of best players in the sector

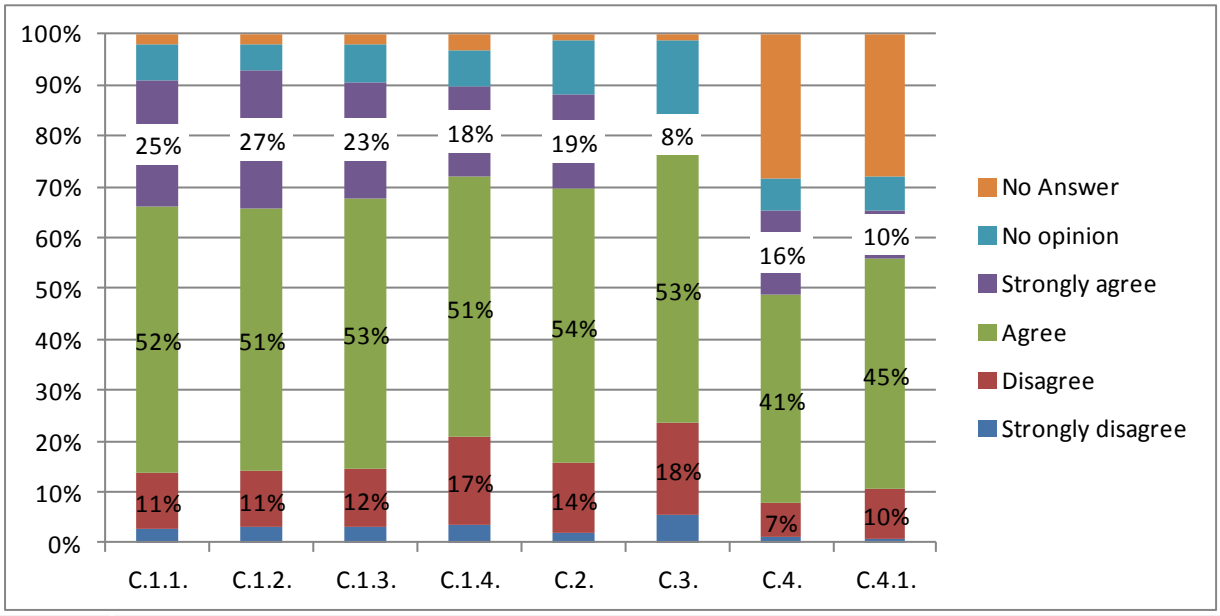
B.3.3.	Better coordination of European research efforts, overcoming fragmentation
B.3.4.	More cross border collaboration
B.3.5.	More cross-sector/interdisciplinary/multi-stakeholder collaboration
B.3.6.	Quicker adoption of standards
B.3.7.	Increased synergy with sources of funding outside FCH 2 JU
B.3.8.	Better availability of research results and cross-fertilisation of knowledge
B.3.9.	Help in overcoming first mover risk
B.3.10.	Greater scale of collaborations and activities
B.3.11.	Faster introduction on the market

Figure 50 What is the added value of this public-private partnership?

In addition, the respondents were invited to provide any other elements of European added value they considered to be relevant. Comments included the following additional aspects:

Other elements of European added value they considered to be relevant
• Political integration of objectives in the renewable energy area.
• Networking and gathering of critical mass to move from bunch of individual companies towards an industry in an emerging field.
• Underline the strength of European manufacturing versus emerging Asiatic technology markets. Only with innovation and research and so with quality of its products Europe can face the challenges of the future in a competitive market.
• Be a reference for national programmes, i.e. gives clear indication on priorities and KPIs which can be used to steer and align also national activities.
• FCH 2 JU indeed serves as a platform consolidating R&D effort that otherwise would be rather fragmented and scattered, thus helping to achieve "critical mass".
• Sharing the risk especially in the Research Actions, these initiatives allow to the research and industrial agents to develop and introduce in the market disruptive technologies.
• More political focus.
• Strong added value with regard to climate targets of the union and energy independence for Europe.
• Help in overcoming national restrictions e.g. national legal influences.
• Better and broader visibility of activities in fuel cells and hydrogen.

The next set of questions concerned the quality of the JU's homepage: Three quarters of the respondents agreed that the website offers easy and effective access to information to the public; e.g. about funded projects and the application process. However, the level to which access is provided to knowledge generated by the projects funded under this JU is slightly less (69%).



C.1.1.	Do you consider that the FCH 2 JU website provides the general public and potential participants with easy access to information?: easy and effective access to information to the public
C.1.2.	The FCH 2 JU website provides easily accessible and sufficient information about its funded projects
C.1.3.	The FCH 2 JU website provides effective access to information and sufficient guidance to interested organisations facilitating their participation in proposals
C.1.4.	The FCH 2 JU website provides easy and effective access to knowledge generated by the projects funded under this JU
C.2.	Do you consider that the FCH 2 JU encourages the participation of SMEs?
C.3.	Do you consider that the current way of defining topics for the calls of proposals is open and inclusive?
C.4.	Do you consider that the FCH 2 JU organises a sound and fair proposal evaluation system based on both scientific and technological excellence and industrial relevance?
C.4.1.	Do you consider that the communication of the evaluation results and the feedback provided to the applicants is effective and meaningful?

Figure 51. Quality of communication and cooperation?

73% agrees that the FCH 2 JU encourages the participation of SMEs. This seems to be a weak recognition of the achieved high level of SME participation in the FCH 2 JU. Also the opportunities for participation in the current way of defining topics for the calls of proposals is not transparent enough, only 61% of the respondents agreed that the current process is open and inclusive.

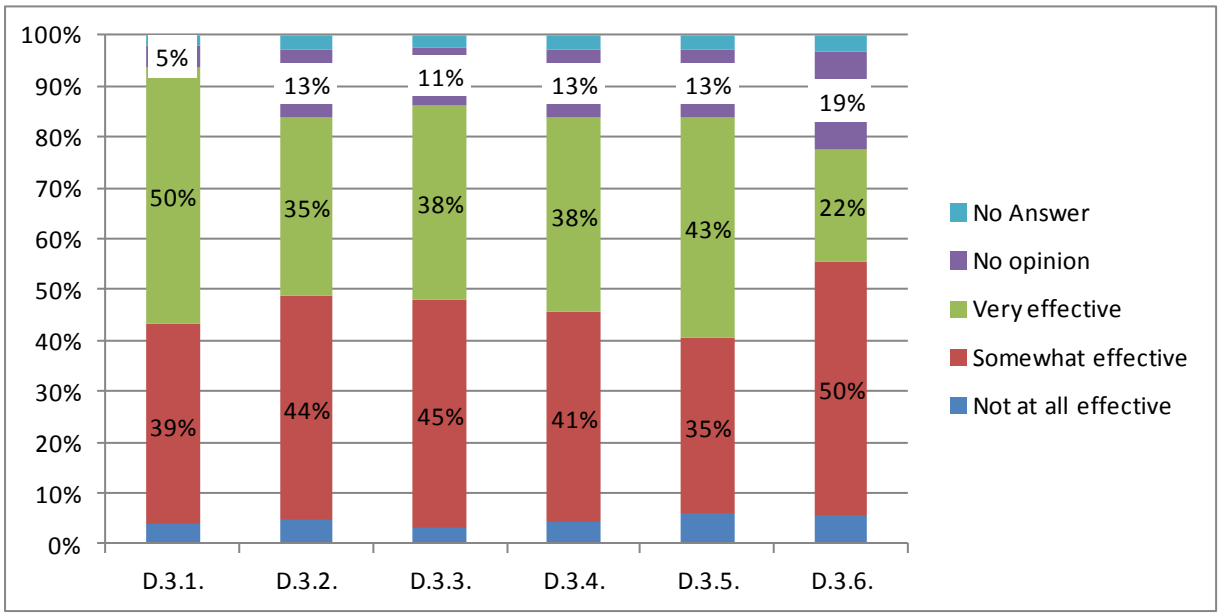
The level of agreement with the proposal evaluation system is poor, only 57% of the participants evaluated this being sound and fair proposal evaluation system based on both scientific and technological excellence and industrial relevance The poor rating on the current way of communicating the evaluation results and providing feedback to the applicants (55% agreement) could be one reason for the doubts on the evaluation process. Fair proposal application processes are a key aspect of the funding programme. Reasons and measures to improve the situation need to be evaluated carefully by the PO and the EC. A benchmark with the results of the other JTIs should be carried out.

The priorities addressed by the FCH 2 JU are set in the Multi-Annual Work Plan (MAWP). 79% of the respondents agree that the MAWP is relevant and coherent with European transport and energy policies and priorities. However, 42% of the respondents consider other research and innovation areas not mentioned in the MAWP as important to be addressed by the FCH 2 JU. As this is a very high rating, PO should carefully consider the inclusion of more interested groups in the elaboration of the MAWP. Respondents named the following other research and innovation areas as currently not addressed.This

is a sample list, however, the better inclusion of low TRL research topics to the MAWP was addressed repeatedly in the comments:

Sample list of comments related with other research and innovation areas as currently not addressed.
• Advanced fuel cell technologies and biomass-integrating chain.
• R &D for investments on pilot lines.
• In general, low TRL activities.
• Fault tolerant control of fuel cell systems.
• The MAWP should keep a certain amount of open activities for issues becoming clear during the execution of projects.
• More socio-economic aspects (+ effect of national tariff and tax policies on deployment)
• Basic research (TRL < 3) is necessary to stay in the race with RIA actions devoted to Gen2 innovations.
• Better tools for the virtual design of FC and hydrogen systems.
• Too dedicated to demonstration and low place for mid-term or long-term research on the field.
• The growing interest for FCH solutions in new applications like train, trucks, maritime and even aeronautical applications was not sufficiently anticipated.
• The growing interest for FCH solutions in new applications like train, trucks, maritime and even aeronautical applications was not sufficiently anticipated.
• The lack of KPIs for materials, MEA and more generally at components level is important.
• Smart Grid area focusing on FCH as demand side integrated technologies.

The respondents certify a good performance of the FCH 2 JU in developing a strong, sustainable and globally competitive fuel cells and hydrogen sector in the EU (89%). The achievement of technical KPIS is rated less (72-83% agreement on effectiveness), see questions D.3.2. – D.3.6. However, 80% of the respondents consider that FCH 2 JU projects have resulted in specific scientific and/or technological successes.



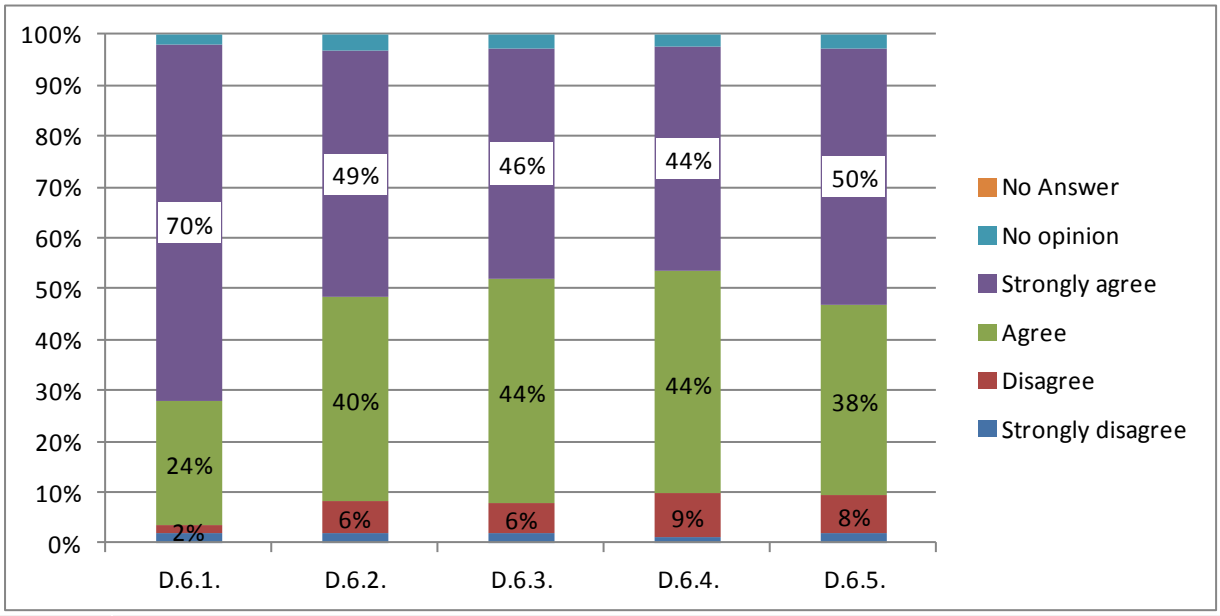
D.3.1.	Developing a strong, sustainable and globally competitive fuel cells and hydrogen sector in the EU
D.3.2.	Reducing the production cost of FC systems to be used in transport applications, while increasing their lifetime to levels which can compete with conventional technologies
D.3.3.	Increasing the electrical efficiency and durability of FC for power production to levels competitive with conventional technologies, while reducing costs
D.3.4.	Increasing the energy efficiency of production of hydrogen mainly from water

	electrolysis and renewable sources while reducing operating and capital costs, so that the combined system of the hydrogen production and the conversion using the fuel cell system can compete with the alternatives for electricity production available on the market
D.3.5.	Demonstrating on a large scale the feasibility of using hydrogen to support integration of renewable energy sources into the energy systems, including through its use as a competitive energy storage medium for electricity produced from renewable energy sources
D.3.6.	Reducing the use of Critical raw materials, for instance through low-platinum or platinum-free resources and through recycling or reducing or avoiding the use of rare earth elements

Figure 52 In your view how effective has the FCH 2 JU been in terms of ...

82% of the respondents support the statement that the FCH 2 JU can contribute towards improving the competitiveness and industrial leadership of Europe in the transport and energy sector in the medium term (over the next ten years). This is an excellent prove of the confidence of the FCH community in the work of the FCH 2 JU.

Respondents agree on various advantages resulting from the participation in a FCH 2 JU project among the direct financial support. Greater visibility, access to knowledge, markets, opportunities etc. rank approximately on the same high level of agreement (88-90%).



D.6.1.	Direct financial support for innovative research and development
D.6.2.	Greater visibility across Europe for your entity/Reputation
D.6.3.	Enhanced access to knowledge and technologies
D.6.4.	Enhanced access to new markets, business opportunities and funding sources
D.6.5.	Inclusion in open innovation networks, with direct contact to leading researchers in universities and the industry

Figure 53 Which would you consider as major benefits of participating in a FCH 2 JU project?

Respondents consider the extent of coherence of the activities of the FCH 2 JU with other activities of the Horizon 2020 programme on an acceptable level (somewhat coherent (34%), very coherent (37%). The relation of the FCH 2 JU with other Union funding programmes and/or with similar international, national or intergovernmental programmes is evaluated to be complementary (20%), providing synergies (41%) or overlapping (10%). Only 39% of the respondent had any experience in combining different sources of EU funds and/or with national funds for research and over the innovation value chain.

10.7 Annex 7: Project portfolio of the FCH 2 JU

The below table has been structured according to the specific objectives assigned to the JU in the regulation

Table 17 Project portfolio of the FCH 2 JU.

Project acronym	Purpose	Coordinator	Budget (M€)	Grant from JU (M€)	Call
Reduce the production cost of fuel cell systems for transport, while increasing their lifetime to levels which can compete with conventional technologies					
NewBusFuel	Technologies and engineering solutions required for the refuelling of many buses at a single bus depot	Element Energy	2.5	2.4	2014
H2REF	Develop a cost effective and reliable hydrogen fuel cell vehicle refuelling system	Centre Technique Des Industries Mecaniques	6.5	6.0	2014
VOLUMETRIQ	Develop a supply base for automotive PEM fuel cell components with high power density and with volume production capability	CNRS	5.0	5.0	2014
Giantleap	Increase the availability and reduce the total cost of ownership of fuel cell electric buses	Stiftelsen Sintef	3.3	3.3	2015
INSPIRE	Develop and integrate advanced critical PEMFC stack components	Johnson Matthey Plc	6.9	6.9	2015
HYTECHCYCLING	New technologies and strategies for fuel cells and hydrogen technologies in the phase of recycling and dismantling	FHA (Aragon)	0.5	0.5	2015
COMPASS	Competitive Auxiliary Power Units for vehicles	Avl List Gmbh	3.9	3.9	2015
H2ME	Start the creation of a pan-European hydrogen fuelling station network	Element Energy Limited	71.9	32	2014
INLINE	A flexible, scalable, high quality production line for PEMFC manufacturing	Profactor Gmbh	3.3	3.3	2016
JIVE	Large scale validation of fuel cell bus fleets	Element Energy Limited	106.0	32.0	2016

Project acronym	Purpose	Coordinator	Budget (M€)	Grant from JU (M€)	Call
MARANDA	Marine application of a fuel cell powertrain in arctic conditions	Teknologian Tutkimuskeskus VTT Oy	3.7	2.9	2016
INN-BALANCE	A development platform for Balance of Plant components to improve efficiency and reliability and reduce costs	Fundacion Ayesa	6.2	5.0	2016
COSMHYC	Development of compressor technology for small-scale hydrogen refuelling or storage	Eifer Europaisches Institut Fur Energieforschung Edf Kit Ewiv	2.5	2.5	2016
DIGIMAN	Improve manufacturing technologies for PEMFC stack components	CEA	3.5	3.5	2016
Increase the electrical efficiency and the durability of the different fuel cells used for power production to levels which can compete with conventional technologies, while reducing costs					
AutoRe	Commercialise an automotive derivative fuel cell system in the 50 to 100 kW range, for combined heat and power (CHP) applications	Alsthom	4.5	3.5	2014
INNO-SOFC	Develop an innovative 50 kW SOFC system and related value chain	VTT	4.0	4.0	2014
DEMOSOFC	Demonstration of large SOFC system fed with biogas	Politecnico Di Torino	5.9	4.5	2014
D2Service	Simplify fuel cell systems for easier system service and maintenance	EWE-Forschungszentrum Für Energie-technologie E. V.	3.6	3.0	2014
HEALTH-CODE	Advanced monitoring and diagnostic tool for µ-CHP and backup PEM fuel cell systems	Universita Degli Studi Di Salerno	2.4	2.4	2014
Cell3Ditor	Cost-effective and flexible 3D printed SOFC stacks	Fundacio Institut De Recerca De L'energia De Catalunya	2.2	2.2	2015
PACE	Large scale demonstration of µCHP fuel cells: scale-up production	The European Association for The	.3	33.9	2015

Project acronym	Purpose	Coordinator	Budget (M€)	Grant from JU (M€)	Call
		Promotion of Cogeneration Vzw			
HEATSTACK	Development of cost effective manufacturing technologies for key components or fuel cell systems	Senior UK Ltd	2.9	2.9	2015
SOSLeM	Reduce manufacturing costs by about 70%, and decrease capital cost by about 2.500 €/kW	Solidpower Spa	2.9	2.0	2015
qSOFC	Automated mass-manufacturing and quality assurance of SOFC stacks	Teknologian Tutkimuskeskus VTT Oy	2.1	2.1	2016
INSIGHT	Monitoring, Diagnostic and Lifetime Tool for SOFC stacks	CEA	3.1	2.5	2016
Increase the energy efficiency of production of hydrogen mainly from water electrolysis and renewable sources while reducing operating and capital costs					
BIONICO	Develop, build and demonstrate a bio-gas reactor integrating H2 production and separation in a single vessel	Politecnico Di Milano	3.4	3.1	2014
SElySOs	New electrode materials and understanding of degradation mechanisms on Solid Oxide High Temperature Electrolysis Cells	Foundation for Research and Technology Hellas	2.9	2.9	2014
Eco	Develop and validate an efficient co-electrolysis process to convert excess renewable electricity to hydrocarbons	Danmarks Tekniske Universitet	3.2	2.5	2015
HPEM2GAS	Develop a low-cost PEM electrolyser optimised for grid management	Consiglio Nazionale Delle Ricerche	2.	2.5	2015
GrInHy	Green Industrial Hydrogen via Reversible High-Temperature Electrolysis	Salzgitter Mannesmann Forschung Gmbh	4.5	4.5	2015
ELY4OFF	Improved electrolysis for Off-grid Hydrogen production	FHA (Aragon)	2.3	2.3	2015

Project acronym	Purpose	Coordinator	Budget (M€)	Grant from JU (M€)	Call
PECSYS	Demonstration of large-scale photo-electrochemical system for solar hydrogen production	Helmholtz-Zentrum Berlin Fur Materialien Und Energie Gmbh	2.5	2.5	2016
CH2P	Cogeneration of Hydrogen and Power using solid oxide based system fed by methane rich gas	Fondazione Bruno Kessler	6.9	4.0	2016
BIOROBURplus	Advanced direct biogas fuel processor	Politecnico Di Torino	3.8	3.0	2016
Demonstrate on a large scale the feasibility of using hydrogen to support integration of renewable energy sources					
HyBalance	Demonstrates the use of hydrogen in energy systems	Air Liquide	15.6	8.0	2014
HY4ALL	Improve public awareness of FCH technologies	Air Liquide	2.0	2.0	2014
ELYntegration	Design and engineer a robust, flexible, efficient and cost-competitive High Pressure Alkaline Water Electrolysis	FHA (Aragon)	3.3	1.9	2014
HySEA	Pre-normative research on vented deflagrations in enclosures and containers for hydrogen energy applications	Gexcon	1.5	1.5	2014
H2ME 2	Large-scale market test of hydrogen refuelling infrastructure	Element Energy Limited	106.2	35.0	2015
HyGrid	Develop technology to separate hydrogen from low-concentration hydrogen streams		2.8	2.5	2015
BIG HIT	Create a replicable hydrogen territory in Orkney (Scotland)	Fha (Aragon)	7.2	5.0	2015
H2ME 2	Large-scale market test of hydrogen refuelling infrastructure, passenger and commercial fuel cell electric vehicles	Element Energy Limited	106.2	35.0	2015
QualyGridS	Establish standardized tests for electrolysers performing electrical grid services	Deutsches Zentrum Fuer Luft - Und Raumfahrt Ev	2.8	2.0	2016

Project acronym	Purpose	Coordinator	Budget (M€)	Grant from JU (M€)	Call
H2Future	Demonstrate large-scale rapid response electrolysis for grid balancing and hydrogen supply	Verbund Solutions Gmbh	17.8	12.0	2016
MEMPHYS	Develop hydrogen purification technology using membrane systems	Duale Hochschule Baden-Wurttemberg	2.1	2.0	2016
HyLAW	Identify legal-administrative barriers to the installation and operation of FCH technologies	Hydrogen Europe	1.1	1.1	2016
Demo4Grid	Demonstrate a Pressurized Alkaline Electrolyser for grid balancing services	Diadikasia Symvouloi Epicheiriseon Ae	7.7	2.9	2016
NET-Tools	Novel Education and Training Tools related to FCH	Karlsruher Institut Fuer Technologie	1.6	1.6	2016
Reduce the use of the EU defined "Critical raw materials"					
INSPIRE	Develop and integrate advanced critical PEMFC stack components	Johnson Matthey Plc	6.9	6.9	2015

10.8 Annex 8: List of Stakeholders Interviewed

Table 18 List of Stakeholders Interviewed.

Interviewer (group, individual member)	Interviewee	Role in FCH JU
Group	Bart Biebuyck	FCH 2 JU Executive Director (from May 2016)
Group	Eden Mamut	Chair of Scientific Committee
Group	Laurent Antoni	Chair of the N.ERGHY Research Grouping FCH 2 JU Governing Board
Group	Vannson Philippe	Recent FCH 2 JU Interim Executive Director (till May 2016)
Group	Strohmeier Rudolf	Deputy Director General, DG Research and Innovation
Group	Raphaël Schoentgen	Chair of Governing Board of FCH 2 JU
Group	Ruxandra Draghia-Akli	Deputy Director-General of DG RTD
Group	Georg Menzen	Chair of SRG
Group	Bert De Colvenaer	(Former FCH JU Executive Director and actual ECSEL Executive Director)
Group	Marc Steen	Head of Unit: Energy Conversion and Storage Technologies, JRC
Group	Nicolas Brahy	Operating Director, Hydrogen Europe
Group	Herald Ruijters	(Acting) Director Transport Networks, DG MOVE)
Ana Sofia Branco	Eunice Ribeiro	Portuguese representative in SRG
Ana Sofia Branco	Maria Jaen Carrapós	Manager of the Hydrogen National Centre in Spain (Centro Nacional del Hidrógeno)
Ana Sofia Branco	Maria Luisa Revillo	Spanish National Representative in the SRG
Ana Sofia Branco	Africa Castro	Director of the hydrogen production by electrolysis working group of the Spanish Technology Platform on Hydrogen and Fuel Cells (PTE-HPC)
Ana Sofia Branco	Antonio González	President of the Spanish Technology Platform on Hydrogen and Fuel Cells
Ana Sofia Branco	Fernando Palacin	General director of Foundation for the Development of New Hydrogen Technologies in Aragon
Annelie Carlson	Lennart Andersen	Senior advisor Innovation fund Denmark, Denmark's representative SRG in 2015
Annelie Carlson	Björn Aronsson	Executive director Hydrogen Sweden, member of the board in Scandinavian Hydrogen Highway Partnership
Annelie Carlson	Kristina Difs	Swedish Energy Agency. Swedish representative in the SRG.

Annelie Carlson	Ulrika Lindahl	Development Strategist, Mariestad Municipality
Annelie Carlson	Harald Bouma	Environment- and Work environment Coordinator, Väner Energi
John Loughhead	Graham Cooley	CEO ITM Power
John Loughhead	Nigel Brandon	Director UK HFC Supergen Hub/Imperial College
Nigel Lucas[68]	Robert Steinberger	Head of the FC research programme at Birmingham University. Member of the Scientific Committee
Nigel Lucas[68]	Nigel Holmes	Scottish Hydrogen and Fuel Cell Association
Piotr Bujło	Jakub Kupecki	Head of Fuel Cell Group, N.ERGHY Research Grouping member
Piotr Bujło	Janina Molenda	ViceChair of Polish Hydrogen and Fuel Cell Association, Polish representative in the SRG
Piotr Bujło	Konrad Swierczek	President of Polish Hydrogen and Fuel Cell Association, Polish representative in the SRG
Piotr Bujło	Guntars Vaivars	Latvian representative in the SRG
Piotr Bujło	Zbigniew Turek	Polish National Contact Point for Research Programmes of the European Union
Renate Lemke	Markus Bachmeyer	Head of Hydrogen Solutions, Linde
Renate Lemke	Klaus Bonhoff	Chief Executive, NOW, Germany
Renate Lemke	Michael Eichhorn	h2-mobility
Renate Lemke	Michael Kreuz	Deutsches Zentrum für Luft - und Raumfahrt
Renate Lemke	Frank Meijer	Head of Fuel Cell Electric Vehicles, Hyundai,

[68] Nigel Lucas was a member of the IEG until April 2017, when he decided to withdraw

10.9 Annex 9: Documents received and studied

- *Legislation pertaining to the FCH JU*

Proposal for a Council Regulation setting up the Fuel Cells and Hydrogen Joint Undertaking, Brussels, COM(2007) 571, 9.10.2007

Accompanying document to the Proposal for a Council Regulation setting up the Fuel Cells and Hydrogen Joint Undertaking, Impact Assessment, SEC(2007) 1272, Brussels, 9.10.2007

Council Regulation (EC) No 521/2008 of 30 May 2008 setting up the Fuel Cells and Hydrogen Joint Undertaking, O.J., L 153/1, 12.6.2008

Commission Staff Working Document. Executive Summary of the Impact Assessment accompanying the document Proposal for a COUNCIL REGULATION on the Fuel Cells and Hydrogen 2 Joint Undertaking, COM(2013) 506. Brussels, 10.7.2013

Proposal for a Council Regulation on the Fuel Cells and Hydrogen 2 Joint Undertaking, COM(2013) 506 Brussels, 10.7.2013

Council Regulation (EU) No 559/2014 of 6 May 2014 establishing the Fuel Cells and Hydrogen 2 Joint Undertaking. J.O. L 169/108 7.6.2014

Regulation (EU) No 1291/2013 Of The European Parliament And Of The Council of 11 December 2013 establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) and repealing Decision No 1982/2006/EC, O.J. 347/104 20.12.2013

Decision No 1982/2006/EC of The European Parliament and of The Council of 18 December 2006 concerning the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007-2013) O.J. L 412/1 30.12.2006

Council Decision of 19 December 2006 concerning the Specific Programme "Cooperation" implementing the Seventh Framework Programme of the European Community

Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions, Energy 2020 - A strategy for competitive, sustainable and secure energy, COM(2010) 639 , Brussels, 10.11.2010

Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions, Clean Power for Transport: A European alternative fuels strategy, COM(2013) 17, Brussels, 24.1.2013

Regulation (EU) No 1291/2013 of the European Parliament and of the Council of 11 December 2013 establishing Horizon 2020 — The Framework Programme for Research and Innovation (2014-2020) and repealing Decision No 1982/2006/EC O.J. L 347, 20.12.2013

Commission Staff Working Document accompanying the Proposal for a Council Regulation defining the objectives, legal status, operational rules and statutes of the Fuel Cells and Hydrogen Joint Undertaking for the period 2014-2024

Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions. A Roadmap for moving to a competitive low carbon economy in 2050, COM (2011)112, Brussels 8.3.2011

European Commission, Europe 2020 — A strategy for smart, sustainable and inclusive growth, COM(2010) 2020 final, Brussels, 2010

A New Start for Europe: My Agenda for Jobs, Growth, Fairness and Democratic Change. Political Guidelines for the next European Commission, Opening Statement in the European Parliament Plenary Session 15 July 2014

Communication from the Commission, Energy Union Package: A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy, COM(2015), Brussels, 25.2.2015

Regulation (EU) No 1290/2013 of the European Parliament and of the Council of 11 December 2013 laying down the rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)" and repealing Regulation (EC) No 1906/2006

Proposal for a Council Regulation on the Fuel Cells and Hydrogen 2 Joint Undertaking, Brussels, COM(2013) 506 final, 10.7.2013

EC DG for Research and Innovation, Directorate K – Energy, K.2 - Energy conversion and distribution systems, Extension of the Fuel Cells & Hydrogen Joint Technology Initiative under Horizon 2020, Results of the public consultation

REGULATION (EU) No 1299/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 December 2013 on specific provisions for the support from the European Regional Development Fund to the European territorial cooperation goal, L 347/259, Brussels 20.12.2013

Regulations Commission delegated regulation (EU) No 275/2014 of 7 January 2014 amending Annex I to Regulation (EU) No 1316/2013 of the European Parliament and of the Council establishing the Connecting Europe Facility

Hydrogen Infrastructure for Transport, http://www.hit-tent.eu/category/about-hit/

- *Documents on relevant funding options*

Operations Evaluation. Second Evaluation of the Risk Sharing Finance Facility (RSFF), June 2013

Pan-European Venture Capital Fund(s)-of-Funds programme, link

- *Documents on Better Regulation*

Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Better regulation for better results - An EU agenda. Strasbourg, 19.5.2015

Communication From The Commission To The European Parliament And The Council, Proposal for an Interinstitutional Agreement on Better Regulation**.** Strasbourg, COM(2015) 216 19.5.2015

Communication From The Commission To The European Parliament, The European Council And The Council Better Regulation: Delivering better results for a stronger Union**.** Brussels, COM(2016) 615 14.9.2016

The Better Regulation Toolbox, European Commission.

- *H2020 Documents*

H2020 Online Manual http://ec.europa.eu/research/participants/docs/h2020-funding-guide/index_en.htm

Horizon 2020 Work Programme, 2016 – 2017. Secure, Clean and Efficient Energy. European Commission Decision C(2016)4614 of 25 July 2016

Horizon 2020 Work Programme, 2016 – 2017. Smart, green and integrated transport. European Commission Decision C(2016)4614 of 25 July 2016

- *European Policy and Sectoral Documents*

Energy policy:

Communication From The Commission, Clean Energy For All Europeans, COM(2016) 860. Brussels, 30.11.2016

Strategic Energy Technology (SET): Towards an Integrated Roadmap and Action Plan, JRC, December 2014

Communication from the Commission, Energy Union Package: A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy, COM(2015), Brussels, 25.2.2015

Communication from the Commission. Towards an Integrated Strategic Energy Technology (SET) Plan: Accelerating the European Energy System Transformation, C(2015) 6317, Brussels, 15.9.2015

Transport policy:

WHITE PAPER: Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM(2011) 144. Brussels, 28.3.2011

Clean Power for Transport: A European alternative fuels strategy SWD(2013) 4. Brussels 24.1.2013

DIRECTIVE 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure

ERTRAC Strategic Research Agenda Towards a 50% more efficient road transport system by 2030. Executive Summary, October 2010

ERTRAC Research and Innovation Roadmaps - Implementation of the ERTRAC Strategic Research Agenda 2010, September 2011

Environment and climate policy:

Horizon 2020 Work Programme 2016 – 2017, 12. Climate action, environment, resource efficiency and raw materials, European Commission Decision C(2016)4614 of 25 July 2016

Horizon 2020 Work Programme, 2016 – 2017. Cross-cutting activities. European Commission Decision C(2016)4614 of 25 July 2016

COMMISSION STAFF WORKING DOCUMENT, Energy storage – the role of electricity, SWD(2017) 61. Brussels, 1.2.2017

- *Material from the FCH JU*

Reports of Programme Review Days, 2014, 2015, 2016

FCH, Annual Activity Reports 2011, 2012, 2013, 2014, 2015, 2016

Final Annual Accounts, Financial year 2012

Final Annual Accounts, Financial year 2013

Annual accounts of the Fuel Cells and Hydrogen Joint Undertaking, Financial year 2014

Annual accounts of the Fuel Cells and Hydrogen Joint Undertaking, Financial year 2015

European Court of Auditors Report on the annual accounts of the Fuel Cells and Hydrogen Joint Undertaking for the financial year 2012

European Court of Auditors Report on the annual accounts of the Fuel Cells and Hydrogen Joint Undertaking for the financial year 2013

European Court of Auditors Report on the annual accounts of the Fuel Cells and Hydrogen Joint Undertaking for the financial year 2014

European Court of Auditors Report on the annual accounts of the Fuel Cells and Hydrogen Joint Undertaking for the financial year 2015

FCH 2 JU Communication Strategy 2014-2020. Promoting Fuel Cells and Hydrogen Joint Undertaking activities and objectives

Hydrogen Europe, Annual Report, 2015.

The Ultimate guide to fuel cells and hydrogen technology, Hydrogen Europe

FCH JU Industry Grouping Financial and Technology Outlook 2014-2020

Multi - Annual Implementation Plan 2008 – 2013, FCH JU

Annual Implementation Plan 2011, 2012, 2013

Multiannual Work Plan, 2010-2014, FCH JU

Annual Work Plan, 2014, 2015, 2016

Document FCH JU 2009.8, Grant Agreement FCH JU, Adopted by the FCH JU Governing Board on 10 September 2009

Fuel Cells and Hydrogen 2 Joint Undertaking (FCH 2 JU) Multi-beneficiary Model Grant Agreement, Version: 3.0, 18 October 2016

- *Impact assessments and previous evaluations*

First Interim Evaluation of the Fuel Cell & Hydrogen Joint Undertaking, Expert Group Report, Directorate-General for Research and Innovation, May 2011

Second Interim Evaluation of the Fuel Cell & Hydrogen Joint Undertaking, Expert Group Report, European Commission, 2013

The Council Regulation (EU) No 559/2014 establishing the Fuel Cells and Hydrogen 2 Joint Undertaking stipulates in Art.11(1) that by 30 June 2017 the Commission shall conduct an interim evaluation of the FCH 2 JU with the assistance of independent experts.

The current evaluation of the operation of the FCH 2 JU covers the period from July 2014 to 31 December 2016. Its main objective is to assess the performance of the FCH 2 JU and its progress towards the objectives set out in the Council Regulation (EU) No 559/2014.

The evaluation was carried out by a Commission Expert Group registered in the EC Register of Expert Groups under Nr E021499, from November 2016 to June 2017. It is accompanied by a final report of the FCH JU, published under EUR 28612 EN.

Le règlement du Conseil (UE) N° 559/2014 portant établissement de l'entreprise commune Piles à combustible et Hydrogène 2 stipule au paragraphe 1 de l'Article 11 que la Commission procède, avec l'aide d'experts indépendants, à une évaluation intermédiaire de l'entreprise commune FCH 2 au plus tard le 30 juin 2017.

L'évaluation actuelle du fonctionnement de l'entreprise commune FCH 2 couvre la période allant de juillet 2014 au 31 décembre 2016. Son principal objectif est d'évaluer la performance de l'entreprise commune FCH 2 et ses progrès vers les objectifs énoncés dans le règlement du Conseil (UE) N° 559/2014.

L'évaluation a été effectuée par un 'Groupe d'Experts de la Commission' enregistré dans le registre des groupes d'experts de la CE sous le N° E021499, de novembre 2016 à juin 2017. Elle est accompagnée d'un rapport final de l'entreprise commune FCH, publié sous la référence EUR 28612 EN.

Studies and reports

Publications Office