ANNUAL ACTIVITY REPORT 2017

FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

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FCH JOINT UNDERTAKING

Publicly available

ANNUAL ACTIVITY REPORT 2017

In accordance with Article 17 of the Statutes of the FCH 2 JU annexed to Council Regulation (EU) No 559/2014 and with Article 20 of the Financial Rules of the FCH 2 JU.

The annual activity report will be made publicly available following its approval by the Governing Board.

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FACTSHEET

NAME	Fuel Cells and Hydrogen 2 Joint Undertaking
OBJECTIVES	a) To contribute to the implementation of Regulation (EU) No. 1291/2013, and in particular the Secure, Clean and Efficient Energy Challenge and the Smart, Green and Integrated Transport Challenge under part III of Annex I of Decision 2013/743/EU; (b) 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.
FOUNDING LEGAL ACT	Council Regulation (EU) No. 559/2014 of 6 May 2014 – OJ L169/108-129 of 7.6.2014
EXECUTIVE DIRECTOR	Bart Biebuyck
GOVERNING BOARD	Chair: Raphaël Schoentgen (until November 2017); Valérie Bouillon-Delporte (effective 6 February 2018) Vice-Chair: Jack Metthey (since June 2017) was Acting Chair until the election of the new Chair Governing Board composition: http://www.fch.europa.eu/page/governing-board
OTHER BODIES	States Representative Group, Scientific Committee, Stakeholder Forum
STAFF	24 temporary agents and 2 contract agents
2017 BUDGET	EUR 126.1 million of which EUR 120.8 million was allocated to operational activities and EUR 5.3 million to administrative expenses
BUDGET IMPLEMENTATION	96 % in terms of commitment appropriations 89 % in terms of payment appropriations
GRANTS	By 31/12/2017, 71 signed for a total value of EUR 395 552 687
STRATEGIC RESEARCH AGENDA	A review of the Multi-Annual Work Plan 2014-2020 was carried out in 2017 and will be finalised in the first quarter of 2018
CALL IMPLEMENTATION	Number of calls launched in 2017: 1 Number of proposals submitted: 70 Number of eligible proposals: 69 Number of proposals funded: 24 Global project portfolio (since setting up): 155 projects under FP7 and 71 signed projects under H2020 (calls 2014-2017) Number and value of tenders (if any): 5 studies from AWP 2017 were contracted in 2017 for a total value of EUR 2 157 774
PARTICIPATION, INCLUDING SMEs	Total number of participations in funded projects: 748 of which: % of SMEs: 26 % % of private for profit/large companies: 37 %

FOREWORD

2017 was an important year for the Hydrogen and Fuel Cells sector in Europe. The launch of the Hydrogen Council in Davos had a big impact worldwide but certainly in Europe where we noticed an increase in the number of industrial players interested in hydrogen and fuel cells and, even more importantly, greater awareness at the political level. Several Member States are drawing up hydrogen roadmaps, using the knowledge acquired through the many FCH JU projects.

Another highlight of the year was the anniversary of the 10th edition of the FCH JU Stakeholder Forum, where Chief Executive Officers (CEOs) and researchers expressed the desire to continue to collaborate with the European Commission (EC) beyond 2020 to realise one of mankind's biggest challenges – the decarbonisation of our society. The commitment from Industry and Research was also illustrated by meeting the additional investments required by the EC well in advance, creating a significant leverage effect. SMEs represent a large part of our programme and, in particular, they are looking to invest heavily through the European Investment Bank (EIB) or other EU financial instruments.

The FCH JU initiative, which involves 88 cities and regions and represents a quarter of European GDP and population, revealed that there is an enormous appetite for FCH technologies locally. In a second phase, regional workshops will be organised to identify their needs in more detail. An EU supply chain study showed that Europe is at the global forefront of several FCH technologies, although fast scaling-up is necessary to benefit locally from job creation and export opportunities.

Internationally, a substantial increase in FCH activity was witnessed mainly in Asia but also in other parts of the world. Therefore, the FCH JU held outreach sessions for the European Parliament, EU Commissioners and Member States presenting European success stories and achievements using real data from our projects. A first result was seen in November 2017 with the EU mobility package proposal which clearly mentions FCH technology as one of the technologies required to decarbonise the European transport sector.

The conclusions from the FCH JU mid-term Horizon 2020 evaluation were very positive. The Independent Expert Group (IEG) has stressed the adequacy of the choice of the Public Private Partnership (PPP) instrument and the continuing relevance of the FCH JU to the societal challenges facing Europe, such as climate change, energy security and its contribution to Europe's status as an international leader in technology.

The success of the FCH 2 JU is due to the hard work and dedication of many people who are making hydrogen and fuel cells an everyday reality. Among them are colleagues in the EC, the members of the FCH 2 JU Governing Board (GB), the States Representative Group (SRG), the Scientific Committee (SC) and the many stakeholders who give input on our plans and activities. Special thanks here goes to Raphael Schoentgen for his guidance and dedication during his chair of the FCH JU.

Finally, I would like to thank my highly efficient and passionate team at the FCH JU programme office whose members work hard to ensure the best results for European citizens.

Enjoy the read

Bart BIEBUYCK
Executive Director FCH 2 JU

EXECUTIVE SUMMARY

2017 was a remarkable year for the FCH 2 JU. It was marked by key events, achievements and activities, including the 10th edition of the Stakeholder Forum (SF), prominent outreach activities, further progress in demonstration and research results, new success stories, significant development of the regions Initiative, the launch of studies essential for the future of the FCH sector, evidence of significant leverage, the highest-ever budget execution, confirmation of the low error rate, promising conclusions from the interim evaluation, and continuation of the FCH 2 JU GB strategic discussions.

1. **The 10th edition of the SF** was held at an exceptional venue, the Steigenberger Wiltcher's Hotel in Brussels. It was a **unique celebratory event** with special highlights, gathering former FCH JU directors and chairs in the presence of former Commissioner Philippe Busquin. The programme outlined the work done so far and provided an opportunity to debate and take stock of the latest developments. The book[1] 'Fuel cells and hydrogen technology: Europe's journey to a greener world', which sets out the story behind both the FCH JU and the technology in Europe, was published for this occasion. The SF was a success, attracting over 360 participants from more than 35 countries, the highest attendance since its creation. Furthermore, over 350 users followed the conference remotely via web streaming. Feedback confirmed that the event was highly appreciated as participants considered that their expectations had been met or fully met regarding the content of the agenda (87 %), the quality of the programme (88 %) and the invited speakers (86 %).

2. During the year, greater effort was put on communication and outreach activities as highlighted by the following events, among others:

- **Test drive** on a fuel cell (FC) car in the HyFive project, which was the opportunity for Commissioner Carlos Moedas[2] to drive the car and witness the benefits of the technology.

- Working lunch in the European Parliament on the theme: '**Collaborating with SMEs to make fuel cells and hydrogen an everyday reality**'[3]. Hosted by Ivan Štefanec MEP, Vice-President of SME Europe, the event featured high-level speakers from the EC, the EP and the industry, including SME representative, Jacob Kroggsgard, founder of H2Logic. Maja Bakran Marcich, Deputy Director-General for Mobility and Transport stated that the Commission sees the European context of fuel cells and hydrogen technology contributing to three priorities mentioned by President Jean-Claude Juncker, energy union, jobs growth and European competitiveness. Furthermore, it fully recognises that FCs and hydrogen could and already are playing an important role in energy transformation by decarbonising the economy.

- The one-week event organised with the six other joint undertakings at the EP in Strasbourg – '**Innovation in Action**'[4] – hosted by MEP Miroslav Poche and with the participation of Commissioners Carlos Moedas and Günther Oettinger. The JUs highlighted their successes and emphasised the benefits of PPPs to boost innovation in Europe. The event was highly appreciated, as evidenced by the positive feedback received.

1 http://www.fch.europa.eu/publications/fch-ju-book-fuel-cell-and-hydrogen-technology-europes-journey-greener-world

2 http://ec.europa.eu/avservices/video/player.cfm?ref=I138359

3 http://www.smeeurope.eu/fch-ju-collaborating-with-smes-to-make-fuel-cells-and-hydrogen-an-everyday-reality/

4 http://www.fch.europa.eu/event/innovation-action-0

3. Further progress in demonstration and research results is described in this report and in more detail in the 2017 Programme Review Report[5]. This information confirms that most targets are being met, such as, for example:

   - In the transport area, availability of FC cars (average availability close to 100 %), tank-to-wheel efficiency (42 %), cost of mid-executive class vehicle (EUR 70 000), availability of hydrogen refuelling stations (HRS) (95.3 %), cost of HRS (EUR 1-2.5 million for capacity of 200-1000 kg/day);

   - In the energy area, electrical efficiency (60 % for some systems), total efficiency (85-95 % for some projects).

   Further efforts are being made to meet targets related to FC bus availability and fuel consumption as well as the cost and sustainability of FC systems.

   It is worth noting that **considerable progress** has been achieved **in manufacturing** projects by using an approach which fosters collaboration between car manufacturers and suppliers, and addressing some of the most critical research, development and cost-efficiency challenges of fuel-cell-stack manufacturing and commercialisation. **Building on the successful outcome of FCH JU projects in this area**[6], in July 2017, Germany launched the 'Autostack Industry'[7] project, a ~EUR 60 million, three-year consortium of leading industrial companies investigating the high-volume production of automotive fuel cell stacks. This project highlights **the role European research projects can play by acting as a framework to empower national initiatives**.

   In the cross-cutting area covering topics related to pre-normative research (PNR), regulation code and standards (RCS), safety, social acceptance and public awareness as well as training and education, results from the project have generated concrete information to improve and develop standards as well as tools and materials used for training a broad range of audiences. It is important to highlight the cross-fertilisation of project results such as, for example, safety-related findings of the PNR projects HySea and HyPactor which are used to formulate safety requirements in RCS.

4. New **success stories** were published (driving-hydrogen-fuel-cell-vehicles-market[8]; improved-hydrogen-tanks-fuel-cell-cars-future[9]; domestic-fuel-cells-power-within[10]; and energy-efficient-fuel-cell-technology[11]) and **closing events** were organised **highlighting the achievements** of a number of projects that ended in 2017, such as **HyFive** in the transport sector and **Ene.Field** in the energy sector. The first event was the opportunity to also present two other FCH-JU-funded ongoing projects H2ME and H2ME2 aiming to demonstrate hydrogen technology as the solution to advancing the EU's air quality and green agenda. The second event, which also included the FCH-funded ongoing project PACE was held in the framework of the European Week of Regions and Cities, and was an opportunity to present the micro-CHP technology's main highlights and how the technology can efficiently generate heat and electricity for homes. FC micro-cogeneration units were on display at the event's exhibition.

5. The **regions initiative** launched in 2016 attracted significant interest both from regions and industry. It gathers **88 regions and cities from 22 countries and more than 55 industry partners**. With the support of an external consultant, a self-assessment of FCH applications was completed by regions; technology introduction dossiers were prepared and distributed among 25 applications; preliminary business analyses were compiled and a funding tool was developed. The work will continue and regional workshops will take place in the first half of 2018 to engage local stakeholders, disseminate results and provide a platform for constructive dialogue from which future activities can emerge.

5 http://www.fch.europa.eu/page/programme-review-2017

6 Such as STACKTEST, AUTO-STACK and AUTO-STACK Core

7 http://www.fch.europa.eu/success-story/fch-ju-research-stack-leads-new-industry-project

8 http://www.fch.europa.eu/success-story/driving-hydrogen-fuel-cell-vehicles-market

9 http://www.fch.europa.eu/success-story/improved-hydrogen-tanks-fuel-cell-cars-future

10 http://www.fch.europa.eu/success-story/domestic-fuel-cells-power-within

11 http://www.fch.europa.eu/success-story/energy-efficient-fuel-cell-technology

6. Four studies were launched – contracted through procurement procedures – on the set-up of an HRS availability system, setting up a stakeholders' platform for a guarantees of origin scheme for green and low-carbon hydrogen, the development of a metering protocol for HRS, and analysis of the value chain and manufacturing competitiveness for HFC. These studies are essential for the future of the sector. Most reports are due in 2018 and are expected to contribute to the implementation of the concerned initiatives, methodologies or actions aiming to strengthen the sector.

7. **Significant leverage** – largely exceeding the legal requirement – was confirmed. The leverage effect from members only reached EUR 1.32 (compared to a requirement of 0.57)[12]. In other words, for every euro of EU contribution for all signed H2020 FCH 2 JU grant agreements as at 31 December 2017, the Members of Hydrogen Europe Industry and Hydrogen Europe Research committed to spend EUR 1.32 either on the FCH 2 JU projects or on additional activities.

   As of 31 December 2017, with committed contributions amounting to EUR 520.9 million, of which EUR 382.2 million certified In-Kind in Additional Activities (IKAA) , **the minimum requirements set for the duration of the programme** at EUR 380 million, of which at least EUR 285 million in additional activities **had already been significantly surpassed at the mid-term.**

   Furthermore, taking into account in-kind contributions in projects from all private partners, the leverage reached EUR 1.95.

8. **Budget execution** reached its **highest level** in FCH 2 JU history with 96 % in terms of commitment appropriations and 89 % in terms of payment appropriations. Budget optimisation through selection of projects from the reserve list, good planning and enforced monitoring contributed to these high rates.

9. The ***ex-post* audit effort was pursued** with the launch of 16 new audits for the FP7 programme, using the RTD Framework Contract with one external audit firm. Results from the closed audits during 2017 contributed further to lowering the cumulative error rates for the FP7 programme. This confirmed stable and even declining trends in the **residual error rates below 2 %** towards the end of the programme. In preparation for the 2018 discharge, 11 new audits for H2020 were launched in 2017 (in cooperation with CAS), ensuring sufficient direct audit coverage of H2020 expenditure, with the results expected in 2018.

10. The FCH 2 JU GB continued its strategic discussions initiated in November 2016 over two sessions, one in January which reached an agreement on the strategic orientation for the future annual work programmes, and one in September that provided an opportunity to discuss the results of the interim evaluation[13] of the FCH 2 JU under H2020. The FCH 2 JU GB welcomed the positive conclusions drawn by the Independent Experts Group (IEG) which considers that the **FCH 2 JU continues to demonstrate the strengths** commended in previous reports, that it has **further reinforced a community of industry and research** bodies around a common long-term research agenda, that **the JU remains relevant and that the choice of a Joint Undertaking as an instrument continues to ensure good alignment** with both policy and industrial objectives. Based on the IEG's **opinion that there is a continued need for support in the field of FCs and hydrogen beyond the FCH 2 JU**, GB members initiated preparatory work to assess the needs and define the options for the future with the aim of ensuring that the FCH sector in Europe can effectively contribute to the decarbonisation of the economy, better air quality and the creation of jobs.

12 Minimal threshold of EUR 380 million (of which at least EUR 285 million is in additional activities) from private members for an EU contribution of EUR 665 million, as defined in Article 4 of Council Regulation (EU) 559/2014 of 6 May 2014

13 http://www.fch.europa.eu/sites/default/files/Interim_Evaluation_FCH2JU.pdf

INTRODUCTION

The Fuel Cells and Hydrogen Joint Undertaking (FCH 2 JU) was set up within the Horizon 2020 Framework Programme by Council Regulation No. 559/2014, as a unique public-private partnership (PPP) supporting research, technological development and demonstration (RTD) activities in these technologies in Europe. This marks Europe's continued confidence and support for FC and hydrogen (FCH) as key technologies for decarbonising our energy system and creating a secure sustainable energy supply capable of generating new jobs.

In July 2014, President Jean-Claude Juncker highlighted in his Political Guidelines[14] the need "to pool our resources, combine our infrastructures (...) and to diversify our energy sources and reduce the high energy dependency of several of our Member States".

Indeed, today, 94 % of EU transport relies on oil products, 90 % of which is imported, while 75 % of the EU's housing stock is largely energy inefficient.

On 25 February 2015, Commissioner Miguel Arias Cañete insisted that: "Our path to real energy security and climate protection begins here at home. That is why I will focus on building our common energy market, saving more energy, expanding renewables and diversifying our energy supply." He launched the Energy Union Framework Strategy[15], one of the 10 Commission priorities, with the following statement: "We have to move away from an economy driven by fossil fuels, an economy where energy is based on a centralised, supply-side approach and which relies on old technologies and outdated business models. We have to empower consumers providing them with information, choice and creating flexibility to manage demand as well as supply."

He was supported in his approach by Commissioner Maroš Šefčovič who, on 21 June 2015, said: "We would like to provide Europeans with energy which is secure, competitive and sustainable".

The Communication from the European Commission[16] on 'A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy' includes all lines of action:

- Energy security, solidarity and trust
- Energy efficiency
- Decarbonising the economy
- Research, innovation and competitiveness.

In particular, Commissioner Carlos Moedas highlighted the importance of supporting European research and innovation, for which Horizon 2020 represents its largest implementation tool to date[17].

Building a resilient Energy Union in Europe with a forward-looking climate-change policy will not be possible without promising technologies. FCH could constitute a triple 'win' for Europe because they have the potential to enhance energy security (through superior efficiency and diversification of energy sources), and environmental sustainability (through reduction of greenhouse gas emissions from both the energy and transport sectors) while simultaneously bringing economic benefits. They contribute to the following key priorities identified by President Juncker:

- A new boost for jobs, growth and investment
- A resilient energy union with a forward-looking climate change policy
- A deeper and fairer internal market with a strengthened industrial base.

14 http://www.eesc.europa.eu/resources/docs/jean-claude-juncker---political-guidelines.pdf

15 http://ec.europa.eu/priorities/energy-union/index_en.htm

16 COM(2015)80, Energy Union Package

17 https://ec.europa.eu/commission/2014-2019/moedas/announcements/european-research-and-innovation-global-challenges_en

In November 2016, the Commission presented the 'Clean Energy for All Europeans' package which aims to put energy efficiency first, achieve global leadership in renewable energies, and to give consumers a fair deal.

The Vice-President for Energy Union Maroš Šefčovič said: "Today's package will boost the clean energy transition by modernising our economy. Having led global climate action in recent years, Europe is now showing example by creating the conditions for sustainable jobs, growth and investment. Today's proposals touch upon all clean energy related sectors: research and innovation, skills, buildings, industry, transport, digital, finance to name but a few. These measures will equip all European citizens and businesses with the means to make the most of the clean energy transition."

Commissioner for Climate Action and Energy Miguel Arias Cañete said: "Our proposals provide a strong market pull for new technologies, set the right conditions for investors, empower consumers, make energy markets work better and help us meet our climate targets. I'm particularly proud of the binding 30 % energy efficiency target, as it will reduce our dependency on energy imports, create jobs and cut more emissions. Europe is on the brink of a clean energy revolution. And just as we did in Paris, we can only get this right if we work together. With these proposals, the Commission has cleared the way to a more competitive, modern and cleaner energy system. Now we count on the European Parliament and our Member States to make it a reality."

This should provide opportunities for FCH technologies. The development of national plans to comply with the Directive for alternative fuels, scheduled for November 2016, was pursued with most of the Member States represented in the States Representatives Group (SRG) confirming the inclusion of hydrogen. The FCH JU continued dialogues with those Member States which appeared to be excluding hydrogen, to make them aware of the latest developments in the technology and the efforts made at European level.

More recently, the European Commission Staff Working Document (SWD) on Energy storage, published on 1 February 2017 as part of the 'Second Report on the State of the Energy Union', outlined the role of energy storage in relation to electricity, presented the advantages of different technologies and innovative solutions in different contexts, and discussed further possible policy approaches. It acknowledged that energy storage, including hydrogen-storage-based solutions, has yet to develop its full potential in the energy markets. Developing affordable and integrated energy-storage solutions is highlighted as a priority to facilitate and enable the transition to a low-carbon energy system based largely on renewables.

Furthermore, the development of hydrogen storage solutions will serve the strategic purpose of strengthening links between the energy and the transport sectors and facilitate the EU's transition towards a low-carbon society. As highlighted in the EC SWD 'Towards clean, competitive and connected mobility: the contribution of transport research and innovation to the mobility package', the expected increase in renewable hydrogen production will help the EU to address its decarbonisation and quality of air challenges linked to the transport system. Thus, the EU is committed to transforming its transport and energy systems as part of a low-carbon economy by 2050, whilst decoupling economic growth from resource and energy use, reducing greenhouse gas (GHG) emissions, increasing energy security and maintaining a strong competitive global position. FCH technologies hold great promise for energy and transport applications from the perspective of meeting Europe's energy, environmental and economic challenges. It has been recognised that FCH technologies have an important role in this transformation and are part of the Strategic Energy Technologies (SET) Plan, adopted by the European Council.

Finally, on 8 November 2017, the European Commission adopted and published the so-called 'Clean Mobility Package' which is taking action to reinforce the EU's global leadership in clean vehicles by proposing new targets for the EU fleet-wide average CO_2 emissions for new passenger cars and vans to help accelerate the transition to low- and zero-emission vehicles. At the same time as the international climate conference in Bonn (COP23 – 6-17 November 2017), the Commission was showing that the EU is leading by example. In this respect, Commission President Jean-Claude Juncker outlined in the State of the European Union speech in September: "I want Europe to be the leader when it comes to the fight against climate change. Last year, we set the global rules of the game with the Paris Agreement ratified here, in this very house. Set against the collapse of ambition in the United States, Europe must ensure we make our planet great again. It is the shared heritage of all of humanity." As part of the package, an action plan and investment solutions for the trans-European deployment of alternative fuels infrastructure has been proposed, which includes hydrogen as one of the clean fuels for transport. The aim is to raise the level of ambition of national plans, to increase investment, and to improve consumer acceptance. In addition, a proposal has been made to amend the Clean Vehicles Directive to promote clean mobility solutions in public procurement tenders and thereby provide a solid boost to the demand for and the further deployment of clean mobility solutions, including FC vehicles.

Against the policy developments described above, in 2017, the FCH 2 JU addressed all concerns through many actions, research and demonstration activities both in line with the above-mentioned EU-wide objectives but also with at least one of the FCH 2 JU objectives as listed in Council Regulation 559/2014 of 6 May 2014.

The following section of the Annual Activity Report (AAR) highlights the main activities and the achievements of the FCH JU in 2017. They reflect the Annual Work Plan (AWP) 2017 adopted by the GB on 20 December 2016.

01
IMPLEMENTATION OF THE ANNUAL WORK PLAN 2017

1.1. KEY OBJECTIVES 2017 AND ASSOCIATED RISKS

The overall objective of FCH JU is to implement an optimal research and innovation programme at EU level to develop a portfolio of clean and efficient solutions that exploit the properties of hydrogen as an energy carrier and FC as energy converters to the point of market readiness. This will lend support to EU policies on sustainable energy and transport, climate change, the environment and industrial competitiveness, as embodied in the Europe 2020 strategy, job creation, and will also help achieve the EU's overarching objective of smart, sustainable and inclusive growth.

The overall direction of the programme is guided by the multi-annual plans: Multi-Annual Implementation Plan (MAIP) for 2008-2014 under FP7 and Multi-Annual Work Plan (MAWP) for 2014-2020 under Horizon 2020. These plans specify targets for the state of FCH technologies in Europe (covering cost, durability and performance) and specific key performance indicators (KPIs). The progress of the programme and therefore scientific/technological achievements are always assessed through the progress towards achieving these targets and KPIs. As the technology has progressed substantially during recent years and new applications have started to emerge, these KPIs (fixed in 2014) are currently under revision (to be reflected during 2018 in an addendum to MAWP document). The main objectives and achievements are presented in section 1.2.

Leverage effect

As per the Council Regulation establishing the FCH 2 JU[18] and in order to acquire a proper overview of the leverage effect, the following contributions from members other than the EU and their constituent entities or their affiliated entities are considered:

- Contributions to the **administrative costs** of the FCH 2 JU;
- Co-financing required to carry out research and innovation actions supported by the FCH 2 JU (i.e. contributions to indirect actions through co-funding in FCH 2 JU projects, the so-called '**IKOP**');
- Contributions towards additional activities by members other than the EU or their constituent entities or their affiliated entities, as specified in an additional activities plan. These additional activities (so-called '**IKAA**') should represent contributions to the broader Fuel Cells and Hydrogen Joint Technology Initiative and the sector as a whole.

As regards the definition of the 'leverage effect', the FCH 2 JU has adopted the approach which refers to the method used in the Staff Working Document (SWD) accompanying the Interim Evaluation of the PPPs[19].

Leverage effect = (Contribution to administrative costs + IKOP + IKAA) / EU contribution

This formula (hereinafter referred to as Formula B) considers in the nominator the financial (cash) contributions of members (other than the EU) to administrative costs of the FCH 2 JU, contributions from all private partners in signed grant agreements (IKOP) and certified IKAA (of the members only), and in the denominator the EU contribution committed in the signed grant agreements.

18 Council Regulation (EU) No. 559/2014 of 6 May 2014 establishing the Fuel Cells and Hydrogen 2 Joint Undertaking

19 http://ec.europa.eu/research/evaluations/pdf/20171009_a187_swd.pdf, page 44, Table 12

As at 31 December 2017, the following data are used:
Contribution to administrative costs: cash contributions to the FCH 2 JU's administrative costs by members (other than the EU), as recognised in the Undertaking's accounts for the period 2014-2017, which amount to a total of EUR 1.30 million; for details, see the table below.

TABLE 1.1.1: FINANCIAL CONTRIBUTIONS OF THE MEMBERS TO FCH 2 JU ADMINISTRATIVE COSTS IN 2014-2017

CONTRIBUTIONS TO RUNNING COSTS RECEIVED BY 31 DECEMBER 2017 / YEAR	INDUSTRY GROUPING	RESEARCH GROUPING	TOTAL
	CASH IN EUR	CASH IN EUR	CASH IN EUR
2014	259 244	42 203	301 447
2015	412 288	67 116	479 404
2016	401 937	65 432	467 369
2017	48 812	7 946	56 758
TOTAL 2014 – 2017	**1 122 281**	**182 697**	**1 304 978**

The lower amount in 2017 results from the reactivation of unused contribution from the previous years

IKOP: committed amounts from private partners, in all signed grant agreements (as at 31 December 2017) from calls 2014-2017 amounting to EUR 386.95 million, of which EUR 137.39 million comes from members only.

TABLE 1.1.2: IN-KIND CONTRIBUTIONS AND EU CONTRIBUTIONS FOR GRANTS UNDER CALLS 2014-2017

CALL YEAR	NUMBER OF PROJECTS	TOTAL EU CONTRIBUTION (A) IN EUR	COMMITTED IN-KIND CONTRIBUTIONS (IKOP) FROM MEMBERS (B) IN EUR	COMMITTED IN-KIND CONTRIBUTIONS FROM NON-MEMBERS (C) IN EUR	TOTAL COMMITTED PRIVATE CONTRIBUTIONS (D = B + C) IN EUR	TOTAL COMMITTED EU + PRIVATE CONTRIBUTIONS (E = A + D) IN EUR
Call 2014	15	82 110 634	29 215 910	14 745.436	43 961 346	126 071 980
Call 2015	15	109 904 751	88 122 900	35 808,998	123 931 898	233 836 649
Call 2016	19	93 974 248	8 318 655	87 812 166	96 130 821	190 105 069
Call 2017	22	109 563 054	11 732 013	111 192 165	122 924 178	232 487 232
TOTAL	**71**	**395 552 687**	**137 389 478**	**249 558 765**	**386 948 243**	**782 500 930**

Considering that funding rates in projects follow H2020 rules (i.e. up to 100 % of direct costs in Research and Innovation Actions (RIAs) and Coordination and Support Actions (CSAs) and up to 70 % in Innovation Actions (IAs), these IKOP amounts are **significantly higher than was initially foreseen**, resulting in an effective co-funding rate of 50% (private contributions of EUR 386.95 million out of total costs amounting to EUR 782.50 million) . This is due to the fact that most of the largest demonstration projects have lower effective funding rates than 70 % (of direct costs), being very close to the market.

IKAA: certified amounts of additional activities from members from the years 2014-2017 available as at 31 December 2017 which amount to EUR 382.21 million plus planned additional activities amounting to EUR 176.29 million (EUR 171.61[20] million from the IKAA Plan 2017, which was adopted by the FCH 2 JU GB on 21 December 2016, and additional IKAA of EUR 4.68 million for 2017[21], subject to certification in 2018 according to the table below).

20 Only activities subject to certification are included; leaving out EUR 2.16 million of 'similar activities' which are below a certification threshold of EUR 325 thousands per member/per year

21 Ref. to http://fch.europa.eu/sites/default/files/FCH%20Docs/AAP%202017%20Interpretation.pdf

TABLE 1.1.3: IN-KIND CONTRIBUTIONS IN ADDITIONAL ACTIVITIES FOR THE PERIOD 2014-2017

IKAA	2014/2015 (A) IN EUR MILLION	2016 (B) IN EUR MILLION	TOTAL IN EUR MILLION
Certified IKAA as at 31 December 2017	217.56	164.65	382.21
IKAA Plan 2017[22]			176.29
TOTAL	**217.56**	**164.65**	**558.50**

For more details on IKAA, see Section 1.11.

EU contribution: corresponding committed amounts from all signed grant agreements as at 31 December 2017 amounting to EUR 395.55 million. These figures are shown in column A in Table 1.1.2. Based on the above data, the leverage effect is calculated as follows:

FORMULA A:
Leverage effect on total EU contribution (in EUR millions) from contributions from members only = (1.30 + 137.39 + 382.21/395.55) = 1.32

In other words, for every euro of EU contribution for all FCH 2 JU signed H2020 grant agreements until 31 December 2017, the members of Hydrogen Europe Industry and Hydrogen Europe Research committed to spend EUR 1.32 either on FCH 2 JU projects or on additional activities[23].

This leverage effect, which only comes from the members from FCH 2 JU projects for 3.5 years and additional activities for 2.5 years alone, already surpasses the minimal threshold of EUR 380[24] million / EUR 665[25] million = 0.57 more than 2 times.

FORMULA B:
Leverage effect on total EU contribution (in EUR million) = (1.30 + 386.95 + 382.21/ 395.55) = 1.95

In other words, for every euro of EU contribution for all FCH 2 JU signed H2020 grant agreements until 31 December 2017, the private partners committed to spend EUR 1.95 either on FCH 2 JU projects or on additional activities.

FORMULA C:
Leverage effect (includes planned IKAA for 2017) on total EU contribution (in EUR million) = (1.30 + 386.95 + 558.50 / 395.55) = 2.39

In other words, for every euro of the EU contribution for all FCH 2 JU signed H2020 grant agreements until 31 December 2017, private partners committed to spend EUR 2.39 on projects or on additional activities.

Risk assessment – 2017

In the annual risk assessment exercise, conducted in October 2016, the FCH 2 JU team identified significant risks and responses to those risks in terms of action plans presented in the AWP 2017.

As part of an annual risk assessment exercise for 2017, which took place on 27 October 2017, the FCH 2 JU team carried out a follow-up exercise on those risks identified in AWP 2017.

During the exercise, all the risks presented in AWP 2017 were assessed for the following aspects:

- Relevance of the risk
- Rating of the risk
- Relevance and fulfilment of the action plan.

22 The preliminary report on estimated amounts effectively implemented in 2017 submitted to the FCH 2 JU GB on 31 January 2018 in accordance with the Council Regulation indicates an amount of EUR 144 million that will be subject to certification, expected by 30 April 2018

23 Only certified amounts of the additional activities for years 2014-2016 are taken into account, as the activities for 2017 will be the subject of certification later in 2018

24 Defined in the Council Regulation as minimum leverage to be achieved by members only

25 Planned EU contribution to FCH 2 JU for the overall H2020 activities

Based on discussions, the risks were either removed (when considered no longer relevant) or modified; and action plans were reviewed for adequacy and completeness.

The table below provides a summary of the outcome of the discussions on risks and fulfilment of the action plans as at 31 December 2017:

TABLE 1.1.4: FULFILMENT IF THE ACTION PLANS

RISK IDENTIFIED	ACTION PLAN	STATUS AS AT 31 DECEMBER 2017
Due to BREXIT, the participation of UK companies (currently representing a significant part of FCH 2 JU funding) in the programme at the state of application and project execution may be adversely affected, including fluctuations in project budgets and commitments from UK-based companies.	Follow up closely on developments; maintain active dialogue with the EC.	Risk and action plan will continue to remain in place for the following year.
Due to untimely payment of the EU contribution to the FCH 2 JU budget of 2017, there is a risk that the pre-financing of call 2016 will not be paid on time.	Liaise with the Commission to ensure the operational capacity to pay the pre-financing in a relatively small window when payment appropriations become available.	Risk to be removed as the conditions no longer exist.
Due to the lean structure of the JU and/or the lack of permanent contracts, rotation of key staff may cause business continuity issues.	Back-up system in place. Introductory workshops/courses organised for new staff and GB members. Training plans are prepared on an individual basis and discussed with the line manager based on the needs identified, new functions, job descriptions and the ability to ensure full business continuity.	Risk and action plan were slightly modified. In case of absence of key staff, FCH 2 JU ensures appropriate back-up solutions in the short-term. In the medium-term, FCH 2 JU is prepared to hire people on temporary contracts to ensure full business continuity.
Due to the growing number of proposals submitted to the FCH 2 JU and of stakeholders involved in FCH 2 JU projects, there is a risk that it will not be possible to find enough experts without a conflict of interest for the evaluation of the proposals and for the mid-term reviews of the projects.	Management of the experts' database is ongoing; provisions for avoiding conflicts of Interests are embedded in the internal procedure. New experts (including non-EUR experts) are considered.	Risk was removed as it is no longer relevant.
Risk concerning timely execution and closure of the *ex-post* audits for H2020 (including less control over H2020 *ex-post* audit process due to transferring the responsibility to the EC's Central Support Service (CSC) which could weaken the assurance of the executive director in his Annual Activity Report in 2017.	For H2020 audits, an active dialogue via regular participation on joint (CLAR) meetings has been established with the CSC Common Audit Support unit. JUs' horizontal issues are addressed via cooperation with other JUs. Monthly status reporting, including proposed actions where necessary, will be done by the internal control and audit manager to the executive director.	Continuous risk and action plan, with small modifications. Timely monitoring and actions are ensured via regular dialogue between the executive director and internal control and audit management function.
Uncertainty of results from 1st interim evaluation of H2020 (and final evaluation of FCH JU programme) which may adversely affect discharge procedure. For the 2016 annual accounts audit, part of the process will be outsourced (for the first time) to an external audit firm – this change might pose some risk for receiving a clean opinion from the European Court of Auditors (ECA), which is duly taken into consideration during the discharge process.	Active dialogue with the EC in preparations for the 1st H2020 interim evaluation, and timely preparations for inputs when requested. Close cooperation with the ECA and new external auditors.	Both risks and related action plans were removed. Results of 1st interim evaluation of H2020 were positive. Outsourcing of part of audit of the annual accounts and transition of the process were successful.

The outcome of the 2017 risk assessment workshop on the new or continuing risks for the year 2018 are included in the AWP 2018.

1.2. RESEARCH AND INNOVATION ACTIVITIES

1.2.1 KNOWLEDGE MANAGEMENT

This year, knowledge management activities have included the launch of a new and more user-friendly data-collection platform named TRUST (Technology Reporting Using Structured Templates). TRUST was developed internally and with external consultant support for the IT platform, to improve the existing data-collection tools and address the requirement for comprehensive data collection and analysis. Thus, the tool will now enable an annual iteration of the data collection and eventually facilitate the development of a time-dependent database of FCH 2 JU project results.

According to the annual planning and in line with contractual obligations, in May 2017, ongoing projects were required to provide data concerning their research and innovation results generated in 2016 and consequently to enable the benchmarking of project progress against the targets defined in the Multi-Annual Work Plan 2014-2020. Each project had answered comprehensive questionnaires according to the type of technologies involved in the specific project and the related activities carried out. During last year, 19 different questionnaires (also called "templates") were created and used. The data acquired in previous year(s) have also been uploaded into TRUST to start enabling data comparison and mainly the technology's progress over time. The templates can be consulted online at http://www.fch.europa.eu/projects/knowledge-management.

In 2017, project data collection was a success: all the projects answered the questionnaires and provided input on most of the queries. This allowed the knowledge management and project officers team to analyse the results and include them as content during the portfolio analysis part of the Programme Review Days 2017 (report currently under finalisation). Any confidential data were appropriately cleaned and anonymised.

Development of an internal database began in 2017, containing overall plans and deployments in Europe. Initially, this database was fed with information from projects and from general/specific press concerning the plans for and deployment of FCH technologies, such as electrolysers, vehicles, hydrogen refuelling stations and stationary units, including detailed information on country, size, technology, etc. Information from other parts of the world can also be included for benchmarking.

In particular, for cars, this will be complemented with reference to FC-car deployment figures (passenger car data only) from the European Automobile Manufacturers Association (ACEA) recorded on a quarterly basis, as obtained from the ACEA directly. Where possible, vehicle sales figures are now being captured every six months from the vehicle manufacturers themselves. The data are treated as confidential and thus only aggregated values have been disclosed.

As part of the Joint Research Centre (JRC) Rolling Plan 2017, in 2017, development also started on an FCH-adapted TIM[26] database. Scientific publications will be mapped according to authors' organisations, and FCH universe will be defined (to isolate information on related literature only), from which to further tag and filter FCH 2 JU beneficiaries and publications related to FCH 2 JU projects. This should enable the tracking of developments in FCH technologies and the related impact of FCH 2 JU funding.

Also in 2017, development began to better integrate the FCH 2 JU-supported projects into a broader European database of projects related to FCs and hydrogen technologies (jointly with by Hydrogen Europe and Hydrogen Europe Research). Information from the supported projects on the FCH 2 JU website will be mirrored on the similar Hydrogen Europe website, which will also contain all national, regional or private supported projects. FCH 2 JU will control the accuracy and correctness of information provided by its supported projects. This should also be ensured by a direct link to the European Commission's Cordis[27] projects webpage (fed with metadata through the EC's project management tools) for each project, including references and links to project patents and publications, public summaries and public deliverables. Additional features include an interactive project map, including the location of both the demonstration units and the leading organisation for the different research themes.

1.2.2 SCIENTIFIC AND TECHNOLOGICAL ACHIEVEMENTS

On the transport side, the planned field-demonstration activities involving cars concern over 1 600 vehicles (341 of which are already in operation, the others being planned for the coming years). As regards the technology achievements, the 220 cars reported in TRUST[28] have accumulated almost 2 million km driven and have consumed over 10 200 kg of hydrogen (average fuel consumption of 1.2 kg hydrogen per 100 km) at an average availability of almost 100 %. By the end of 2016, over 3 800 refuelling operations had been reported and the driving range had increased to 650 km.

26 http://www.timanalytics.eu/

27 http://cordis.europa.eu/

28 Cars running during period of data collection (May 2016-May 2017)

The 2017 targets for tank-to-wheel efficiency (42 %) and availability (98 %), as well as mid-executive class vehicle cost (EUR 70 000) have been already met, while work is ongoing for FC system cost ((150 €/kW for 20 000 units per year) and fuel cell system lifetime (5000 h).

To meet the refuelling requirements for further European uptake, a network of hydrogen refuelling stations (HRS) is currently being created across Europe. To date, the HRS network for car refuelling covers seven countries with 39 deployments under FCH projects. Out of these the 14 HRS that were operating in 2016 reported in TRUST[29] and have delivered 11 800 kg of hydrogen in 4627 refuelling operations at 95.3 % availability. Most of these meet the 2017 targets for station CAPEX of EUR 1-2.5 million (200-1000 kg/day) and the price of hydrogen at the pump of 8 €/kg (from hydrocarbons) to 12€/kg (from renewable sources). These values also reflect the international state of the art.

Through intensive collaboration between partners and the involvement of a large number of EU regions, the car field-demonstration activities have enabled a considerable extension of the number of HRS and vehicles/cars. The experience accumulated in their operation has enabled a reduction in the costs of hydrogen and of vehicles while identifying and addressing many regulatory issues. The ongoing projects H2ME and H2ME2[30] will finally demonstrate a large fleet of FC electric vehicles (FCEVs) operating in real-world customer applications across different countries, with a higher utilisation of HRS operations than exists currently. Together with all previous field demonstrations, these projects are expected to set the worldwide state-of-the-art and the cumulative expertise acquired regarding the legal and permitting aspects and on safety should be then exploited for EU-wide harmonisation of the legislation.

The field demonstrations of **buses** concern approximately 350 vehicles in several cities across Europe (42 vehicles in 8 cities already in operation, of which 41 are reported in TRUST[31]). By the end of 2016, the buses had already accumulated a total driven distance of over 5 million km. They reached 1.6 million km and consumed over 158 800 kg of hydrogen (average fuel consumption 9.8 kg hydrogen per 100 km) at an average availability of 72 %. There were over 8000 refuelling operations and the buses proved able to meet the daily duty cycle.

The 2017 target for FC system lifetime (>1800 h) has been met, as well as the target for FC system cost and vehicle cost (EUR 700 000) based on the latest procurement prices of EUR 650 000, while work is ongoing for availability (90 %) and fuel consumption, as some buses have been unable to operate the planned number of hours.

The necessary hydrogen-refuelling infrastructure for buses has also been deployed: seven stations across five countries, reaching average availability rates of 97 % since the start of their operation. All these stations have supplied a total of 134 000 kg of hydrogen through 7000 refuelling operations.

In terms of customer satisfaction, valuable lessons have been learned in these field demonstration of buses from the feedback from enthusiasts (as well as sceptics) of the demonstrations, mainly in terms of a better understanding of the information needs of bus operators, authorities and the public. All of these issues have already been used to design a better focused knowledge-sharing strategy for both ongoing and forthcoming FC bus deployments. Their success is demonstrated by the fact that bus operators in different cities have joined the projects at the start, by the growing involvement of regions, and by the steadily increasing private contribution to financing the demo projects.

The field demonstrations of **material-handling vehicles** are planned for 283 fork-lifts covering 12 models in 10 cities. Of those, 116 have already been demonstrated and 92 reported in the TRUST exercise for 2016, including 6 models from 3 manufacturers in 10 warehouses.

Overall, beneficiaries participating in transport field-demonstration projects are showing a significant commitment to FCH technology and a clear interest in commercialising the technology. Regulatory issues have been identified and mostly solved for 70 MPa refuelling protocols and for the placement of fuelling points on petrol forecourts. The projects H2ME, CHIC[32], High V.LO-City[33], HYFIVE[34] and HyTransit[35] have also demonstrated excellent relationships/interactions with national and regional programmes. The opportunity for cross-fertilisation of achievements and lessons learned (e.g. hazards analysis and safety assessment) between these field-demonstration projects has been proven.

29 HRS used during period of data collection (May 2016-May 2017)

30 https://h2me.eu/

31 http://www.fch.europa.eu/sites/default/files/TRUST_ExplanationFile_Draft_3.pdf

32 http://chic-project.eu/

33 http://highvlocity.eu/

34 http://www.hyfive.eu/

35 http://hyer.eu/eu-projects/hytransit/

As regards **research-oriented activities**, most of the projects have continued to address improvements in proton exchange membrane (PEM) FC cells and stack components. Some projects have successfully met the 2017 KPIs for electrical efficiency (55 %), power density (1 W/cm^2 at 1.5 A/cm^2), durability (6000 h) and operating temperature (-25 to +95 °C). Work is still ongoing to meet all of these KPIs simultaneously, in addition to the continuous work necessary to reach the KPIs for durability (6000 h) and platinum loading (0.1 g/kW).

Considerable progress has been achieved in **manufacturing activities** as FC component development activities go through scale-up as well as realistic automotive cell and stack testing within all projects. The AUTOSTACK-CORE[36] project has reached most targets, while work is still necessary on power density. The successful implementation of these automotive research and innovation projects also stems from the commitment of automotive OEMs involved either directly as project beneficiaries or indirectly via their active membership in the individual projects' industrial advisory boards.

Novel hydrogen compression and storage systems have been developed to increase **HRS availability and performance**. New materials and improved components have enabled integrated on-board hydrogen-storage-tank systems to meet the targets for volumetric capacity (0.022 kg/l) and gravimetric capacity (4 %). The introduction of low-cost robotic manufacturing methods has managed to bring down the storage system cost at mass production while achieving the 2017 target (800€/kg hydrogen). Further reductions in cost are anticipated through optimisation of the storage-system design for mass production processes.

In general, the focus is on research activities in the transport sector and significant added-value interaction between all projects can be observed. Most partners' consortia benefit from the availability of all the required competences, skills and hardware infrastructure among members while using the harmonised test procedures.

As regards **FCs for power production (stationary FC-CHP)**, to date, close to 1000 m-CHP systems have been installed in 11 countries across the field trials by 10 manufacturers. These have shown that by generating their own electricity homeowners can cut energy costs by EUR 800-1300 per year and reduce their exposure to rising electricity prices. The plan is to have 3000 units installed by 2020, providing a pathway to competitive market offers.

The main volume of these units derives from the flagship project ene.field[37]. The PACE[38] project, which has started recently, should build upon ene.field and aim to reach the final TRL-9 for FC-based m-CHP (Micro-combined heat and power) while planning to demonstrate over 2500 units in the field to help build the commercial market and reduce costs by increasing production volumes through the automation and standardisation of components.

The targets for availability, electrical efficiency (reaching as much as 60 % for some systems) as well as total efficiency as high as 85-95 % have been met. Work is ongoing to achieve the KPIs for 2017 regarding capital cost (14 000€/kW at present manufacturing volumes), although individual models are already claiming lower prices than the 2017 target, and durability (12-year lifetime) performance testing. It is also notable that certain projects (and FC-CHP units) already demonstrate rated durability that exceeds the targets set by FCH 2 JU for 2023. The data reported show that for some units 100 % availability has been reached for one year of operation.

Fuel cells continue to show great promise for residential Micro-CHP generation due to their high electrical efficiency and ability to run on conventional heating fuels. Following extensive field trials, technology leaders in this sector are nearing commercial deployment. Significant cost reductions have been achieved in recent years which indicate that manufacturers are meeting planned cost-reduction curves. Capital costs remain a key challenge to the advancement of this sector and mass market introduction in Europe.

As regards **FC-CHP research-oriented activities**, FC stacks have accumulated over 49 000 h of operation and an average availability of approximately 100 %. Most of the projects have demonstrated stack lifetimes that exceed 30 000 h and degradation rates as low as 3 muV/h for HT PEM and 0.2 % (efficiency)/1000h for SOFC. Significant efforts to improve the lifetime of FC systems have led to an overall increase in FC lifetime by a factor of four from 2013. Most projects have achieved the system efficiency target of 57 % (according to AWP 2014) while stack efficiencies as high as 74 % were recorded (ongoing work is still required to reach total system efficiencies of 82 %). Cost reductions have also been achieved through the development of manufacturing methods, enabling stack costs of <1000€/kW at mass production.

In particular, the CISTEM[39] project developed a modular large-area pressurised HT-PEM FC for 100 kW electric systems that has achieved a degradation rate of 3 muV/h at MEA level, corresponding to 40 000 h lifetime.

36 http://autostack.zsw-bw.de/index.php?id=1&L=1

37 http://enefield.eu/

38 http://www.pace-energy.eu/

39 http://www.project-cistem.eu/

The portfolio of research activities on FC-CHP is well balanced between system design, model development and diagnostics. Significant advances have been achieved in the State Of the Art (SoA) for Solid Oxide Fuel Cells (SOFC), including a better understanding of degradation, and the availability of an effective diagnostic tool. Effective collaboration between industry and research providers is being demonstrated in these projects, along with the effective participation of SMEs. Manufacturing is the secondary focus in most projects, indicating the advances made in previous years in terms of TRL level.

As regards activities on **hydrogen production from electrolysis**, both at the demonstration and research level, the low-temperature PEM research projects have shown that significant improvements in costs and greater efficiency can be achieved by using novel materials. The ongoing work in the HyBalance[40] project shows that the CAPEX of the 1.25 MW system is €4M/(t/d) and, by extrapolation, for systems greater than 3 MW the CAPEX can be around €2.3M/(t/d). The 2017 MAWP target is therefore achievable considering that the production capacity of the deployed system is expected to be around 560 kg/day. This result is supported by another project (MEGASTACK) which shows that a CAPEX of €1.9M/(t/d) can be reached for a MW-sized stack. In addition, the H2Future[41], HyBalance[42] and HPEM2GAS[43] projects are addressing the provision of grid services by PEM electrolysers.

Great progress was shown in 2017 in **opening up hydrogen technology to different industrial applications** by launching the world-first projects of a 6 MW electrolyser in steel applications (H2FUTURE project) and signature of the grant just before 2017 year-end of the largest 10 MW electrolyser in the refinery industry (REFHYNE[44] project). While providing grid support and integrating excess renewables, both projects will prove the feasibility of hydrogen as a carrier for energy storage in energy transition through sector coupling/integration.

The alkaline-technology research projects have shown progress in addressing the minimum operating load capabilities with innovative materials. The Elyntegration[45] project is working to significantly improve the 2017 MAWP targets for CAPEX to €1.3M/(t/d) and electricity consumption to 48 kWh/kg, whereas the Demo4Grid[46] project is addressing the dynamic operation conditions for MW-sized alkaline electrolysers.

The majority of the projects address degradation rates as a proxy for lifetime. A degradation rate of approximately 1 %/1000h is assumed to represent a lifetime of almost 1 year, assuming the system is in continuous operation and that the end of life is a degradation of 10 %. Project achievements range from 0.43 %/1000h (HELMETH[47], steam electrolysis, short stack, 320 hour test) to 4.5 %/1000h (SOPHIA, co-electrolysis, short stack, > 1500 hour test). The GrInHy project aims at a 1 %/1000h degradation rate, which is in line with the 2017 lifetime target of 1 year for high temperature electrolysers. Long term testing at system level at realistic operating conditions is still required to confirm the lifetime target for 2017. Pressurised operation was already validated at cell level (SOPHIA project, 3 bar) and module level (HELMETH project, 15 bar). Another important KPI (the operating current density) is confirmed between 0.6 A/cm^2 (HELMETH project) and 1.0 A/cm^2 (SOPHIA project) at stack level. Considering the relatively low TRL level of the solid-oxide technology (high-temperature), the projects typically do not address cost targets yet.

On the **cross-cutting side**, the pre-normative research (PNR) projects have continued to provide concrete information either to improve or even to develop standards at the international level, thereby contributing to developing an appropriate regulatory framework for FCH technologies. In addition, the Regulations, Codes and Standards Strategy Coordination Group (RCS SCG), set up in 2016, has continued its work on priority areas for the FCH industry (see Section 1.6).

In addition, topics related to safety, social acceptance and public awareness, socio-economic research as well as actions to provide education and training for the FCH sector (including but not limited to scientists, engineers and technicians) have been continuously addressed by the cross-cutting project portfolio.

40 http://hybalance.eu/

41 http://h2future-project.eu/

42 http://hybalance.eu/

43 http://hpem2gas.eu/

44 http://www.fch.europa.eu/project/clean-refinery-hydrogen-europe

45 http://elyntegration.eu/

46 https://www.demo4grid.eu/

47 http://www.helmeth.eu/

Project SUSANA[48] has developed guidelines for best practices in the use of computational fluid-dynamics modelling when applied to the **safety** analysis of FCH systems and infrastructures, as well as related verification and validation procedures. It has delivered a database to be used for verification problems and model validation. Safety-related findings from the projects HySea[49] and HyPACTOR[50] have fed directly into formulating safety requirements in standards and regulations.

In addition, the HyResponse[51] project has developed an operational **hydrogen safety–training platform** which has already been used several times to train first responders called to deal with incidents involving hydrogen; specifically, it has trained 71 firefighters from 15 countries. This training platform is currently being used outside Europe (both training materials, in the form of a web-based course, and training sessions); the project findings are also fed directly into FCH-permitting processes by the approval authorities.

The HyResponse and KnowHy[52] education projects complete a set of educational and training tools made available for a broad range of audiences, from technicians and professional operators to universities, regulators and public safety officials, including emergency responders. In total, more than 600 people were trained and 140 diplomas and certificates were issued during 2016. This set of educational tools will be further completed by the ongoing project NET-Tool[53] which is focusing on e-learning.

As regards **sustainability issues**, the pioneering HyTechCycling[54] project is currently looking at recycling and dismantling technologies and strategies applied to the entire FCH technology chain, paving the way for future advances in legislation. Similarly, the recently completed CERTIFHY[55] project demonstrated a strong regulatory component: it has established a **European framework for guarantees of origin** for green hydrogen and developed a roadmap for its implementation in the EU.

One highlight of the FCH 2 JU research activities concerns the professional and substantial dissemination of results in more than 160 journal publications during 2016 and 2017 (Annex 3).

1.3. CALLS FOR PROPOSALS AND GRANT INFORMATION

The 2017 call for proposals was published on 17 January 2017 and included 24 topics: 7 in the transport pillar, 12 in the energy pillar, and 5 cross-cutting, with an indicative budget of EUR 116 million. The call closed on 20 April 2017.

On 2 February 2017, a public information day, which included a brokerage event, was organised in Brussels. More than 100 participants attended the day, where the call/topics were presented followed by the rules for participation and lessons learned from previous calls. The brokerage event brought significant interest and offered potential applicants a platform for shared ideas and networking.

1.3.1 PROPOSALS

By the deadline, the 2017 call had received 70 proposals; the evaluation results of these proposals are presented in paragraph 1.3.2.

All consortia were informed of the evaluation results at the same time, 96 days time to inform (TTI) (vs. 126 days in 2016) after the closure of the call, well in advance of the H2020 TTI target (153 days). At same time, 22 proposals from main lists received an invitation to start the Grant Agreement Preparation (GAP); all 22 GAs were signed in 2017 in 233 days on average and before the time to grant (TTG) target of 243 days after the closure of the call. For budget optimisation and maximum execution/utilisation, two proposals from the reserve lists were invited later to start grant preparation for an available additional budget (and thus do not count for the TTG target); they were signed in January 2018 (so as to be allowed a similar time for preparation).

48 http://www.fch.europa.eu/project/support-safety-analysis-hydrogen-and-fuel-cell-technologies

49 http://www.hysea.eu/

50 http://www.hypactor.eu/scientific-publications.html

51 http://www.hyresponse.eu/

52 https://knowhy.eu/

53 http://www.fch.europa.eu/project/novel-education-and-training-tools-based-digital-applications-related-hydrogen-and-fuel-cell

54 http://hytechcycling.eu/project/

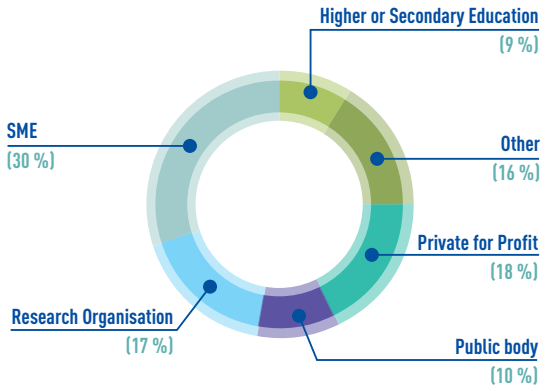
55 http://www.certifhy.eu/

CALL	PROJECT NUMBER	ACRONYM	TTI	TTS	TTG
H2020-JTI-FCH-2017-1	779366	CRESCENDO	96	136	232
H2020-JTI-FCH-2017-1	779481	ComSos	96	137	233
H2020-JTI-FCH-2017-1	779606	EVERYWH2ERE	96	129	225
H2020-JTI-FCH-2017-1	779576	FLHYSAFE	96	130	226
H2020-JTI-FCH-2017-1	779486	GAMER	96	140	236
H2020-JTI-FCH-2017-1	779430	GRASSHOPPER	96	130	226
H2020-JTI-FCH-2017-1	779475	HYDRAITE	96	134	230
H2020-JTI-FCH-2017-1	779469	Haeolus	96	143	239
H2020-JTI-FCH-2017-1	779694	HySTOC	96	134	230
H2020-JTI-FCH-2017-1	779565	ID-FAST	96	134	230
H2020-JTI-FCH-2017-1	779563	JIVE 2	96	146	242
H2020-JTI-FCH-2017-1	779591	MAMA-MEA	96	142	238
H2020-JTI-FCH-2017-1	779537	OxiGEN	96	144	240
H2020-JTI-FCH-2017-1	779613	PRESLHY	96	136	232
H2020-JTI-FCH-2017-1	779478	PRETZEL	96	136	232
H2020-JTI-FCH-2017-1	779579	REFHYNE	96	140	236
H2020-JTI-FCH-2017-1	779577	REFLEX	96	134	230
H2020-JTI-FCH-2017-1	779541	REMOTE	96	134	230
H2020-JTI-FCH-2017-1	779589	REVIVE	96	136	232
H2020-JTI-FCH-2017-1	779644	TAHYA	96	136	232
H2020-JTI-FCH-2017-1	779730	TeacHy	96	143	239
H2020-JTI-FCH-2017-1	779538	ZEFER	96	129	225
H2020-JTI-FCH-2017-1	779540	NEPTUNE*	96	176	272
H2020-JTI-FCH-2017-1	779550	PEGASUS*	96	190	286

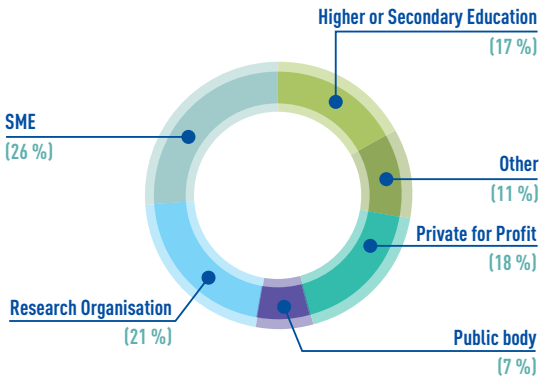
**Projects taken from the reserve list. Grant preparation started 72 days after TTI when they were taken from the reserve list and contracts were signed in January 2018. This corresponds to an actual TTS and TTG of 104 and 200 days for NEPTUNE and 118 and 214 for PEGASUS.*

The 24 projects listed above (which include the two signed in January 2018) represent 217 participations for a total FCH 2 JU contribution of EUR 114 million. The figures below indicate the distribution of the number of participants and the FCH 2 JU contribution by participant category.

Breakdown of contribution by participant category (in %)

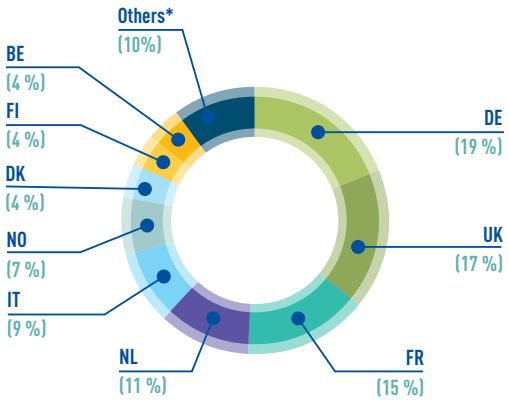


Number of participants category (in %)

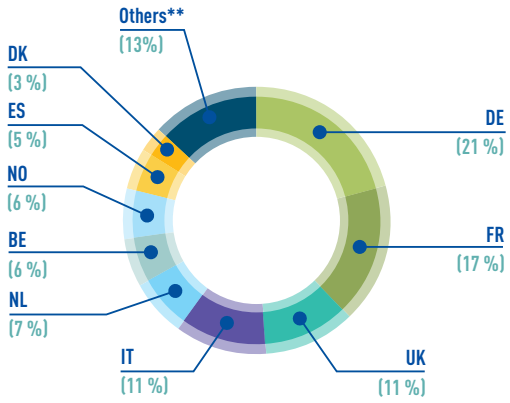


Beneficiaries from 19 EU Member States or Associated Countries are participating and have received funding in the 24 projects. The figures below indicate the distribution of the participants and the FCH 2 JU contribution by country.

Breakdown of FCH contribution by country)



Number of participants per country



** ES 3.6 % – CH 2.1 % – SE 1.6 % – IS 1.0 % – EL 0.8 % – SI 0.6 % – EE 0.2 % – RO 0.2 % – CZ 0.1 %*
*** FI 3.2 % – EL 2.3 % – CH 2.3 % – SE 1.4 % – IS 0.9 % – RO 0.9 % – SI 0.9 % – EE 0.5 % – CZ 0.5 % – UA 0.5 %*

1.3.2. EVALUATION: PROCEDURES AND GLOBAL EVALUATION OUTCOME, REDRESS, STATISTICS (NO. OF EVALUATORS, GENDER, AREA, ETC.) – CALL 2017

The FCH2 JU published the H2020-JTI-FCH-2017-1 call for proposals on 17 January 2017 (Official Journal C015).

Of the 70 proposals received, one was withdrawn as an abusive submission and 69 were evaluated in accordance with the H2020 rules on proposal submission and evaluation. An evaluation report, including all annexes (main list, reserve list, ineligible list, evaluation summary reports (ESRs), statistical information on proposals received, and experts' report, panel report and observer report) was submitted to the FCH 2 JU GB for approval. The distribution of the 69 proposals, according to pillar and call topic, is given below:

TABLE 1.3.2.1: NUMBER OF PROPOSALS EVALUATED

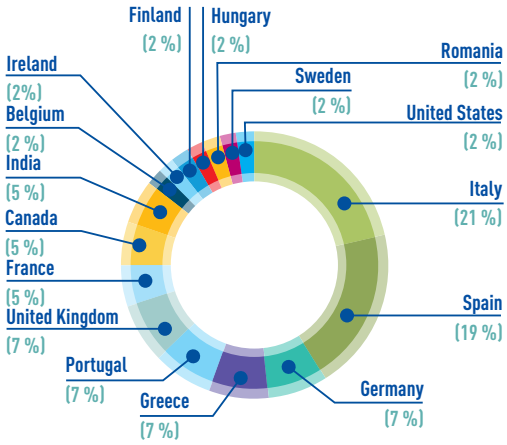
- **Transport** – total 16 proposals
- **Energy** – total 45 proposals
- **Cross-cutting** – total 8 proposals

TRANSPORT PILLAR: 16	ENERGY PILLAR: 45	CROSS-CUTTING: 8
Topic 01-1: 1	Topic 02-1: 10	Topic 04-1: 1
01-2: 6	02-2: 3	04-2: 0
01-3: 3	02-3: 4	04-3: 2
01-4: 2	02-4: 2	04-4: 1
01-5: 1	02-5: 5	04-5: 4
01-6: 1	02-6: 2	
01-7: 2	02-7: 5	
	02-8: 3	
	02-9: 3	
	02-10: 3	
	02-11: 1	
	02-12: 4	

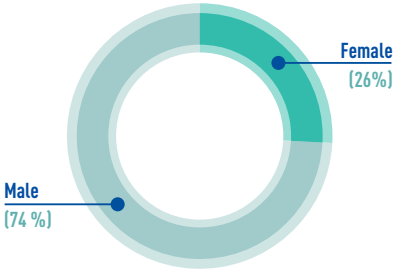
All evaluated proposals were eligible.

The 69 proposals included 562 participations. The proposals were evaluated by 45 independent experts (42 evaluators, 3 chairs and 1 observer), and 43 proposals (62 %) passed all the call thresholds. The figures below provide statistics on the 42 evaluators' evaluations:

Breakdown of experts by country



Breakdown of experts by gender*



**The share of female experts increased significantly compared to 19 % in 2016*

The final ranking list for the call did not deviate from the experts' recommendations.

The distribution of retained proposals and budget per panel is provided in the table hereafter.

TABLE 1.3.2.1: BREAKDOWN OF PROPOSALS PER PILLAR AND ACTIVITY

AREA	PANEL IDENTIFIER	AVAILABLE BUDGET (EUR)	NUMBER OF ELIGIBLE PROPOSALS RECEIVED	NUMBER OF PROPOSALS RETAINED (MAIN LISTS)	NUMBER OF PROPOSALS IN RESERVE LIST	PROPOSED BUDGET (EUR – MAIN LISTS)
Transport	FCH-01-1-2017	5 000 000.00	1	1	0	5 063 023.00
	FCH-01-2-2017	2 750 000.00	6	2	2	5 568 619.00
	FCH-01-3-2017	4 000 000.00	3	1	1	3 996 943.75
	FCH-01-4+FCH-01-5+FCH-01-6+FCH-01-7-2017	42 500 000.00	2	0	0	0.00
			1	1	0	25 000 000.00
			1	1	0	4 998 843.00
			2	1	1	4 993 851.00
Energy	FCH-02-1-2017	2 000 000.00	10	2	2	3 925 310. 00
	FCH-02-2-2017	3 000 000.00	3	1	1	2 998 951.25
	FCH-02-3-2017	3 000 000.00	4	1	2	2 999 575.25
	FCH-02-4-2017	5 000 000.00	2	1	0	4 997 738.63
	FCH-02-5-2017	10 000 000.00	5	1	3	9 998 043.50
	FCH-02-6-2017	2 500 000.00	2	1	0	2 499 921.25
	FCH-02-7-2017	4 000 000.00	5	1	2	4 387 063.75
	FCH-02-8-2017	3 000 000.00	3	1	1	3 189 816.00
	FCH-02-9-2017	3 000 000.00	3	1	1	2 996 873.75
	FCH-02-10-2017 + FCH-02-11-2017	12 500 000.00	3	1	0	4 999 945.76
			1	1	0	7 486 954.75
	FCH-02-12-2017	5 000 000.00	4	1	1	4 995 950.25
Cross-Cutting	FCH-04-1+FCH-04-2+FCH-04-3+FCH-04-4-2017	6 250 000.00	1	1	0	3 499 867.50
			0	0	0	0.00
			2	1	0	1 248 528.75
			1	1	0	1 724 277.00
	FCH-04-5-2017	2 500 000.00	4	1	2	2 748 195.00
TOTAL		**116 000 000.00**	**69**	**24**	**19**	**114 318 292.5**

After giving information to the applicants concerning the outcome of the evaluation, no requests were received for review (redress) which proves yet again the excellent quality of the evaluation process.

1.4. CALL FOR TENDERS

The FCH 2 JU has funded five studies through calls for tender.

On the basis of the AWP 2017, the FCH 2 JU has launched five operational procurements (five open procedures, one of which was followed by a competitive procedure with negotiation) on the following topics:

1. STUDY ON DEVELOPMENT OF BUSINESS CASES FOR FUEL CELLS AND HYDROGEN APPLICATIONS FOR EUROPEAN REGIONS AND CITIES

The coalition of regions and cities, which began in 2016, grew considerably during 2017; 88 regional and municipal public authorities are currently participating in this initiative, accounting for over a quarter of the European population and GDP. Over 50 representatives from industries are also participating.

In April 2017, and further to a public procurement procedure, the FCH 2 JU concluded a framework agreement with a contractor to provide the necessary support for the initiative. As a result, the following was accomplished:

- A comprehensive self-assessment was completed by 74 regions and cities, providing valuable insights into a variety of local, hydrogen-related topics. Notably, the main drivers behind the interest in hydrogen and FC technologies concern both environmental considerations and economic growth.
- Technology introduction dossiers were completed and distributed among 25 applications.
- Similarly, preliminary business analysis were compiled for the same set of applications. Both are available on the FCH JU website.
- A funding tool was developed: it contains information from more than 60 data sets, has a user-friendly search function and is currently in its testing phase.

Preparation of activities to be carried out in 2018 began with the selection of specific applications based on a set of agreed criteria for further, more in-depth study and with the planning and definition of regional workshops to engage local stakeholders, disseminate the results of ongoing work and provide a platform for constructive dialogue from which future activities can emerge.

The study was contracted out on 15 May 2017 for a period of 12 months and a budget of EUR 998 670.00. The final report of the study will available in June 2018.

2. CONCEPT FOR AN HRS AVAILABILITY SYSTEM

In order to provide a satisfactory HRS experience for FCEV users, the FCH 2 JU contracted the services of a consortium of contractors to set up a system for monitoring HRS availability in Europe. The aim of this system is to give access to reliable, up-to-date and standardised data on HRS status. The scope of the contract covers the development of an HRS availability system for HRS located in Europe and demonstration of the system through proof-of-concept.

The study was contracted on 28 July 2017 for a period of six months and a budget of EUR 98 500.00. A demonstration of the proof-of-concept was presented during the FCH 2 JU Programme Review Days in November 2017. The final report of the study will available in February-March 2018.

3. STUDY ON ESTABLISHMENT OF A STAKEHOLDERS' PLATFORM AND IMPLEMENTATION OF A PILOT OPERATION FOR A GUARANTEE OF ORIGIN SCHEME FOR GREEN AND LOW-CARBON HYDROGEN

One of the key objectives of the FCH2 JU programme is to support 'green growth' through the use of FCs and hydrogen technologies while facilitating the integration of renewable energy sources via the hydrogen vector. As with any energy vector, it is crucial that there is a mechanism to ensure its sustainable nature, which also enables a market value for the low-carbon nature of the energy carrier.

Building on previously funded projects which successfully delivered an accepted definition EU-wide for green and low-carbon hydrogen and a corresponding outline of a guarantee of origin scheme, as well as a roadmap for implementing such an initiative, the purpose of this study is to serve as a catalyst for establishing an EU-wide guarantee of origin scheme for hydrogen.

The study also envisages setting up a stakeholders' platform for a guarantees of origin scheme and finalising a scheme design that can be tested in a pilot operation. The knowledge acquired from the pilot run will then be used to further refine the design of the scheme; it is expected that at the end of the study the stakeholders' platform will be ready to initiate its EU-wide roll-out.

The study was contracted out on 27 September 2017 for a period of 12 months and a budget of EUR 598 879.00. The final report of the study will be available in October 2018.

The first objective of the CertifHy2 study was to set up and put into operation a stakeholder platform. On 20 November 2017, this platform was launched during a one-day event.

With over 110 members already signed up, it is clear that the stakeholders' platform has successfully managed to reach out to many diverse stakeholders covering industry, policymakers, regulators, GO experts, hydrogen producers and users.

During this event, working groups were set up to feed information directly to the CertifHy project to ensure that the first EU-wide guarantee of origin scheme for green hydrogen meets all stakeholder expectations, requirements and capability.

Among the many presentations made during this plenary session, one focused on the four pilot plants that will be tested in this study:

1) Air-Liquide – Port Jérôme, France

- It produces hydrogen through steam methane reforming (SMR) with natural gas as a feedstock.
- 50 % of CO_2 in the SMR's exhaust gas is collected using a proprietary carbon capture system.
- Depending on the type of CO_2 utilisation, this can allow part of the hydrogen produced to be considered as low carbon.
- Biomethane (GOs) could be purchased to produce green hydrogen.

2) Colruyt – Halle, Belgium

- It produces hydrogen by means of electrolysis connected to an onshore wind farm via an internal grid.
- The plant produces 190kg/day which is all green hydrogen.
- The hydrogen will be used for fork-lifts and for the public HRS at Colruyt's premises.

3) Akzo Nobel/Air Products – Botlek, Netherlands

- Hydrogen is a by-product of a chlor-alkali process and can be produced at a rate of 40t/hour.
- The plant has a power purchase agreement (PPA) with a wind power producer and also draws power from the grid.
- This pilot is particularly interesting because there are many questions associated with the allocation of CO_2 to the different products – and therefore hydrogen.

4) Uniper – Falkenhagen, Germany

- Hydrogen is produced by electrolysis and afterwards is injected into the natural gas grid with or without methanation.
- They plan to use 100 % green electricity using green electricity GOs.

The stakeholders' platform steering group was also set up following the elections during which working group members were urged to vote for their chairs and co-chairs who would represent them.

With these elections and the nomination of several European Commission Directorate representatives to the steering group, governance of the stakeholders' platform is effectively operational.

Participation at the event was also a huge success with the turnout numbering 100.

4. DEVELOPMENT OF A METERING PROTOCOL FOR HYDROGEN REFUELLING STATIONS

Currently, HRS are able to measure hydrogen to within a 5 % margin of error, approximately. However, the recommendation is to achieve lower margins of error. Specifically, OIML R-139 recommends that "(...) the maximum permissible errors on mass indications, positive or negative at type evaluation, initial verification and subsequent verification, are equal to: • for the meter: 1 % of the measured quantity; • for the complete measuring system: 1.5 % of the measured quantity. (...)."

The FCH 2 JU launched a call for tender to contract the services of one or several contractors to develop an intermediate methodology for the certification and approval of HRS as regards their ability to measure the amount of hydrogen sufficiently accurately.

This study requires that the methodology developed is to be implemented through a specific testing protocol that is accepted and used by the appropriate national authorities in all Member States deploying HRS in Europe and possibly worldwide. Within the duration of the framework contract, this methodology must be validated through the necessary field tests for operating HRS in Europe.

The framework contract was signed on 23 November 2017 for a period of 14 months and a budget of EUR 377 500.00. Two reports are expected at the end of each of the two successive specific contracts implementing the framework contract, one in March 2018 for the first specific contract signed in November 2017 and one in January 2019 for the second specific contract expected to be signed in the spring 2018.

5. STUDY ON VALUE CHAIN AND MANUFACTURING COMPETITIVENESS ANALYSIS FOR HYDROGEN AND FUEL CELLS TECHNOLOGIES

This is a follow-up study to an internal study finished in 2016 on the supply chain for hydrogen and FC technologies.

The study aims to perform an in-depth analysis of the European FCH value chain and manufacturing competitiveness to assess the dimension and contribution that the European FCH sector could make to Europe's economic recovery and sustainable growth, and to recommend specific actions and investments to public and private stakeholders.

The main objectives of the study are:

- To provide a database of actors in the European FCH value chain;
- To provide a view on the most valuable or most fragile parts of the value chain, from an economic and strategic perspective and in a global context, including with respect to important competing alternatives;
- To develop plausible scenarios for the role of the FCH sector in Europe that give all interested parties a common understanding of the opportunities;
- To provide robust analysis of the value that the sector could bring to Europe, high-quality supporting data, and rigorous recommendations that can be used to further develop and support the European FCH sector.

The study was contracted out on 27 November 2017 for a period of eight months and a budget of EUR 379 225.00. It includes provisions for an interim report in February 2018 and a final report in June 2018.

1.5. DISSEMINATION AND INFORMATION ABOUT PROJECTS RESULTS

The FCH 2 JU is also part of the Horizon 2020 DiEPP platform (Dissemination and Exploitation Practitioners' Platform) which was created to support the exchange of information and best practices on dissemination and exploitation at the level of the European Commission research and innovation family.

Closely aligned to daily knowledge-management actions, such activities continued in 2017 as part of the European Commission's initiatives in the field (e.g. invitation to projects to participate in the EC Common Exploitation Booster (CEB) and Common Dissemination Booster (CDB) and monitoring of any activity of FCH 2 JU projects within these initiatives to receive dedicated assistance in either the exploitation or dissemination of results). In addition, the Innovation Radar initiative was started in 2017 (to be launched in 2018 as a pilot) to be associated with mid-term project reviews.

Moreover, FCH 2 JU energy projects were given the possibility to participate in DG RTD's SSERR (Support Services for Exploitation of Research Results) initiative, launched in 2016, whereby projects can receive consultancy-type advice on exploitation aspects.

Continuing on the good experience and practice to date, the seventh annual Programme Review Days was organised on 23-24 November 2017 with the support of the JRC.

1.5.1. PROJECT INFORMATION ON THE FCH 2 JU WEBSITE

The FCH 2 JU website includes a dedicated page for each funded project (227 projects covering calls 2008-2017) including information on dates, duration, funding, beneficiaries, call, topic and abstract. This information is continuously updated with changes resulting from the relevant amendments.

Public project deliverables and publishable summaries are uploaded/updated at each reporting period, once these reports have been approved. The information is searchable in dedicated query pages. Where relevant, additional communication (new projects signed) and dissemination activities (e.g. project achievements at mid-term or end-date) are pushed in the form of news on the FCH 2 JU website, with links to the project pages.

Aiming for better integration of the FCH 2 JU-supported projects into a broader European database of projects related to FCH technologies, preparations began for a new website to be set up jointly with Hydrogen Europe and Hydrogen Europe Research during 2017. The new Hydrogen Europe website will mirror the projects supported on the FCH 2 JU website. In addition, it will contain all national, regional or privately supported projects. FCH 2 JU will control the accuracy and correctness of information provided by the projects being supported.

1.5.2. PROGRAMME REVIEW DAYS

The report of the 2016 PRD was finalised and published on the FCH 2 JU website on 18 April 2017 (http://fch.europa.eu/page/programme-review-days-2016).

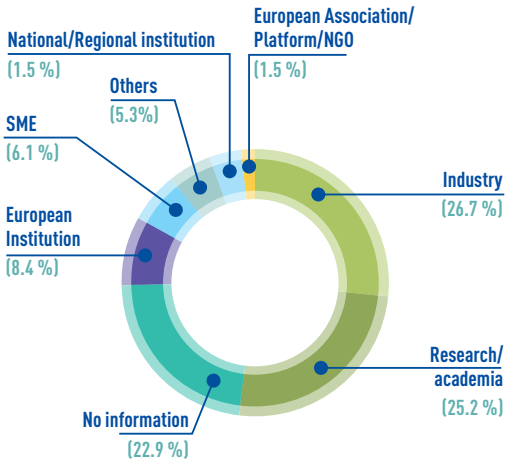
The seventh edition of the PRD was organised on 23-24 November 2017. The event took place at the Steigenberger Wiltcher's Hotel (in conjunction with the 10th anniversary edition of the Stakeholder Forum). The objective was to assess the programme's progress and achievements in relation to the targets set in the MAWP and AWP, as well as in relation to the international state-of-the-art developments. In performing this review, the FCH 2 JU was supported by the JRC (through the activities foreseen in the Rolling Plan 2017).

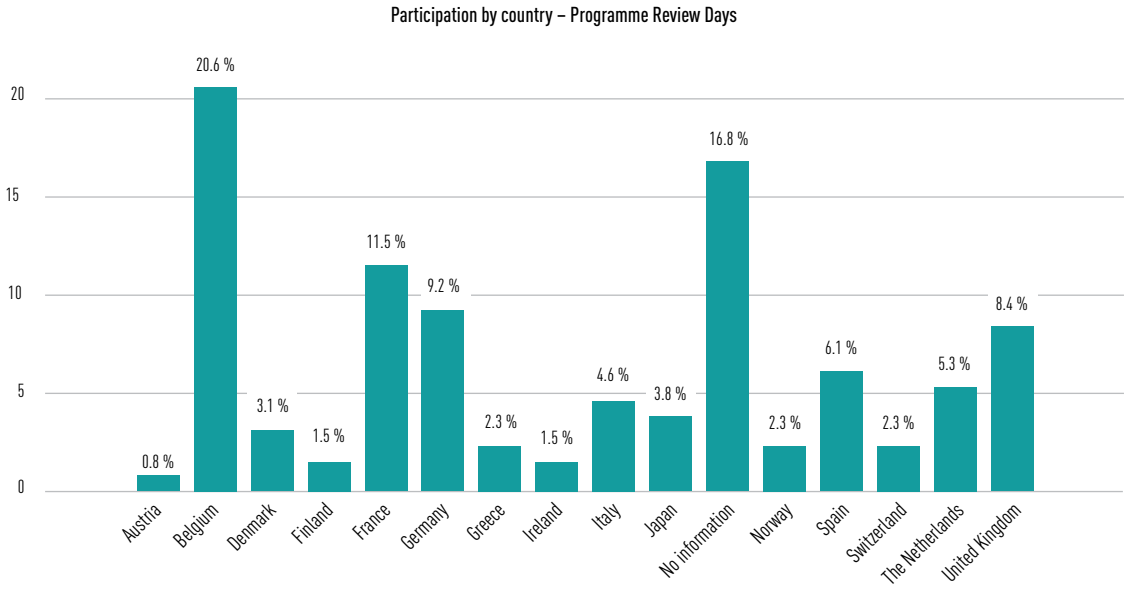
In addition, project posters were produced on a pre-designed template. In total, 87 posters were produced and displayed. Oral presentations were made by 28 projects and 5 tenders/studies, in 6 sessions/panels: 1) research activities for stationary applications; 2) research activities for transport applications; 3) hydrogen production, distribution and storage; 4) technology validation in transport applications; 5) cross-cutting activities; and 6) technology validation in stationary applications.

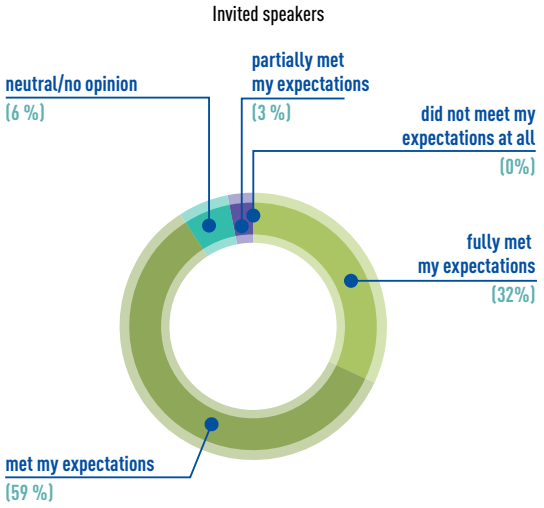
Each session opened with a presentation, including analysis of the projects' portfolios. The JRC experts and the audience were able to clarify various issues (in performing the review) during Q&A sessions.

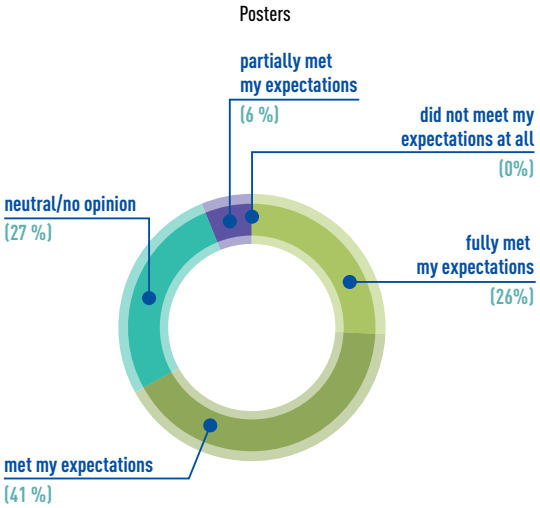
A total of 500 registered participants attended both PRD and the Stakeholder Forum; in addition, based on IP addresses, more than 160 web-streaming viewers followed the two-day PRD2017 event.

Post-event activities, including a survey among participants, and based on 131 attendees' answers, achieved balanced participation by industry and research organisations, as well as EU representation. Participants were very satisfied with both the content of the presentations (and invited speakers) and the posters displayed.









1.6. COLLABORATION WITH JRC – ROLLING PLANS 2016-2017

The Commission's Joint Research Centre (JRC) undertakes high-quality research in the FCH field which is of considerable relevance to implementation of FCH 2 JU activities. During the FP7 period, cooperation between the JRC and FCH 1 JU was structured under a Framework Agreement covering support activities which the JRC provided in-kind to FCH JU, as well as possible funded JRC participation in FCH JU projects.

For the Horizon 2020 period, a Framework Contract between FCH 2 JU and JRC was approved by the Governing Board on 23 December 2015, including the first Rolling Plan 2016 as its annex, and signed by both parties on 18 February 2016. Contrary to the situation under FP7, involvement of the JRC in FCH 2 JU-funded projects outside of the Horizon 2020 Rules for Participation is not possible. Thus, the scope of the Framework Contract does not cover the JRC's participation in FCH 2 JU-funded projects, but does cover the activities the JRC will provide at the level of the FCH 2 JU programme, free of charge and against payment from the FCH 2 JU operational budget. In line with the JRC's mission, these support activities will primarily contribute to the 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 the JRC to perform testing as a service to the FCH 2 JU, providing added value to programme objectives by complementing the activities of FCH 2 JU-funded projects.

During 2017 (as a continuation of the activities started in 2016), the in-kind support mainly concerned regular information to the FCH 2 JU on EU policies such as, for example, on the European green vehicles initiative association (EGVIA), the European Green Vehicles Initiative Public Private Partnership (EGVI-PPP) and the relationship between FCH 2 JU, SETIS and Action 8 of the Integrated SET-Plan, various Energy Union initiatives,

including the Communication on Accelerating Clean Energy Innovation (COM(2016)763), and specifically the enhanced importance attributed to large-scale hydrogen storage. In addition, the JRC has also performed in-kind experimental and modelling activities in the framework of the FCH 2 JU projects HyTransfer and SUSANA. It has also performed in-house research to underpin the modelling benchmarking activity, e.g. of identifying limitations of and difficulties associated with the use of computational fluid dynamics (CFD) in PEM single FC modelling.

In line with the large-scale hydrogen-storage priority, the JRC has been instrumental, together with DG ENER (and based on the Hydrogen Roadmap developed by the Sector Forum Energy Management (SFEM) Working Group (WG) on Hydrogen, to which the FCH 2 JU has contributed), in including the topic of power-to-hydrogen as a strategic priority under the heading of support to the Energy Union in the Annual Union Work Programme for European Standardisation 2017.

JRC has also represented the EC in the IEA Hydrogen Technology Collaboration Programme (TCP). In its Task 38 on power-to-gas, the JRC and FCH 2 JU have worked together with common objectives. In relation to this agreement, the JRC does not participate in the executive committee's strategic activities. Nevertheless, it has developed a working collaboration with Annex 30 and within the framework of test harmonisation. Within the framework of the International Partnership for Hydrogen into the Economy (IPHE), the JRC exchanges views and aligns strategy with the FCH 2 JU.

As regards JRC support in the formulation and implementation of RCS strategy, a mechanism for JRC participation and contribution to the RCS SC group was also put in place during 2017, based on the JRC drafted terms of reference in 2016. It has also updated the report which identifies PNR research topics related to the scope of the FCH2 JU derived from the overall SFEM WG/hydrogen roadmap.

As regards the identification of scientific and technical knowledge gaps in hydrogen safety and the prioritisation of the required research and development (R&D) and PNR, based on a continuous monitoring of European and global developments, a report on international R&D gaps and priorities in hydrogen safety was delivered at the beginning of 2017, based on various sources, but in particular on findings from the international conferences on hydrogen safety (autumn 2015) and the R&D workshop on hydrogen safety priorities organised by the JRC in autumn 2016. The report identifies the safety priorities aligning it to the classifications already adopted by the RCS SC group.

Moreover, in previous Framework Programmes, the JRC built and populated the Hydrogen Incidents and Accidents Database (HIAD), collecting safety-related events on hydrogen technologies applications. HIAD is the optimal tool for a repository of safety information generated by the FCH 2 JU programme, including communication, lessons learned and safety improvement dimensions. The FCH JU project CHIC has interfaced with HIAD in recent years to generate development needs. One of these relates to HIAD data input, implying a front-end interface update. Another issue covers the tailoring of the HIAD structure and focus, implying a reprogramming of the database back-end. Both issues were the focus of JRC work on safety during 2016-2017.

As for the JRC's direct contribution to implementing RCS strategy, the overarching goal was to ensure inter-project comparable results and to facilitate the assessment of technology progress. To this purpose, the JRC has embarked on establishing industry-consented harmonised test approaches for PEMFC to assess the performance of fuel cells and electrolysers. The following deliverables were provided in February 2017: a final report on a harmonised protocol for automotive applications (including procedures, stressors, cycles, reporting templates, identification of 'Reference MEA'), and a report on validation of the 'harmonised protocols' by making use of specific testing hardware.

Finally, the JRC has supported on technology benchmarking by providing the international state-of-the-art indicators for comparison with the project data collected by the knowledge-management team.

For 2017, a maximum budget of EUR 1 million was foreseen from the FCH2 JU operational budget. The JRC support activities for the FCH 2 JU programme covered by the Framework Contract were discussed and agreed in 2016 between the JRC and the programme office, with the involvement of a representative from Hydrogen Europe and Hydrogen Europe Research.

The annual Rolling Plan 2017 constituted part of the AWP 2017 and described the annual activities and their related deliverables provided against payment by the JRC to the FCH 2 JU (heading B of Article 2 in the Framework Contract). Additional activities which the JRC performs without payment (heading A in Article 2) were not listed. JRC activities in 2017 followed the plan and will be reported before the end of February 2018.

1.7. REGULATIONS, CODES AND STANDARDS STRATEGY COORDINATION (RCS SC) GROUP

The RCS SC group, comprising Hydrogen Europe and Hydrogen Europe Research representatives supported by the European Commission's Joint Research Centre and the FCH 2 JU programme office, coordinates the strategy on RCS. The three main tasks of the RCS SC group are to:

1. Identify and prioritise RCS needs of strategic importance for the EU, by following RCS developments and updating and prioritising RCS needs of the sector through a continuous global monitoring function;

2. Identify PNR activities to support the RCS priorities, tailor PNR and other RCS-related activities in the FCH 2 JU programme to ensure that safety issues and standardisation and regulation needs are appropriately addressed and validated;

3. Define a strategy to be put in place to pursue the priority RCS issues.

In 2017, the RCS SC group's activities continued in line with the above-mentioned tasks. Four meetings were held during the year and the group's main achievements are listed below:

- Definition of four main action areas in which priorities have been identified: public use of hydrogen; hydrogen interoperability; hydrogen valorisation; and competitive industry
- Definition of the RCS SC group's implementation strategy
- Mapping of RCS around FCH technologies (ongoing activity)
- Monitoring and assessment of PNR activities and the main project results
- Proposal of topics for the next AWP
- Follow up of activities concerning the EC's Annual Union Work Programme for European Standardisation (AUWP)
- Continued cooperation and exchange of information with CEN-CENELEC SFEM WG H2
- Establishment of liaison with CEN-CENELEC TC 6 'Hydrogen systems'.

1.8. EUROPEAN HYDROGEN SAFETY PANEL (EHSP)

The mission of the European Hydrogen Safety Panel (EHSP) is to assist the FCH 2 JU both at the programme and project level in assuring that hydrogen safety is adequately managed, and to promote and disseminate H2 safety culture within and outside of the FCH 2 JU programme.

During 2017, the scope, structure and preliminary activities of the EHSP were defined.

The EHSP is composed of a multi-disciplinary pool of experts (15-20 approximately) grouped in small ad-hoc working groups (task forces) according to the tasks to be performed and to expertise. The experts are contracted on an ad-hoc basis according to the number of days required per task (based on a previous estimation), including travel costs if needed.

In this respect, a call was launched in 2017for expressions of interest to set up a list of independent experts to assist the FCH 2 JU in tasks related to the EHSP; 17 experts were selected and appointed as EHSP members for 2018.

The next step is to start implementing the proposed activities, based on the AWP 2018.

1.9. SUPPORT TO POLICIES AND FUNDING/FINANCIAL ENGINEERING ACTIVITIES OF THE FCH 2 JU

The FCH 2 JU is contributing to the activities of a number of EC services. Contributions vary in content and format, but they all share the common goal of providing fact-based information on the state of art of FCH technologies and the contribution they can make to EU initiatives and policies, especially in the energy, transport and industry sectors as well as to competitiveness and growth.

In practical terms, during 2017, this meant taking part in a number of technical groups organised by the EC and other international bodies, taking an active role during the meetings, providing written technical input and ensuring that FCH technologies are represented properly in the relevant sectors.

Supporting DGs ENER, RTD, MOVE and CLIMA, the FCH 2 JU actively followed and contributed to the European Strategic Energy Technology Plan (SET-Plan) activities during 2017, in particular Action 5 'Energy Efficiency in Buildings', Action 6 'Energy Efficiency for Industry' and Action 8 on 'Renewable Fuels'. Since the second half of 2017, the FCH 2 JU has also been participating as an observer in several of the sub-groups of the ART Fuels Forum[56] established under the project 'Support for alternative and renewable liquid and gaseous fuels forum (policy and market issues)'. Still in the domain of transport, in 2017, the FCH 2 JU continued to play an active role in the 'Sustainable Transport Forum' and became a member of its 'Clean Bus Expert Group' from its inception (October 2017). Under the Clean Bus Initiative launched by DG MOVE, the latter group provides support to the Clean Bus Deployment Platform, working on specific policy recommendations and financing topics related to the deployment of clean buses, with the aim of providing clear inputs by the summer 2018. Still in the transport sector, in September and December 2017, the FCH 2 JU actively participated in DG MOVE's informal experts workshops on 'increasing the impact of financing alternative fuels infrastructure (AFI) in the EU and on generating an 'Alternative Fuels Flagship Project' for several TEN-T corridors. During the first half of the year, the FCH 2 JU also took part in the Emission Trading System (ETS) Innovation Fund activities and technical round tables to better frame the successor of the NER300, supporting the inclusion of FCH technologies in the scope of this new financial tool, as explicitly acknowledged at DG CLIMA's summary report of the expert consultations entitled 'Finance for innovation: Towards the ETS Innovation Fund', published in June 2017[57].

The FCH 2 JU is also supporting the JRC by taking part in the activities of the International Energy Agency Hydrogen Implementing Agreement (see the JRC and International cooperation chapters).

FCH 2 JU support to EC policymakers goes beyond energy and transport policies. Supporting the EU objectives of sustainable growth and innovation, the FCH 2 JU Study on Value Chain and Manufacturing Competitiveness Analysis for Hydrogen and Fuel Cells Technologies (see also Section 1.4 point 5) has been used to DG GROW an evidence base on how the FCH sector could contribute to strengthening and reinforcing the competiveness of EU industry.

Exchanges by the FCH 2 JU also extend to the executive agencies charged with managing other parts of Horizon 2020 in areas relevant to FCH technologies. For example, in the transport sector, the FCH 2 JU has worked with **Innovation and Networks Executive Agency** (INEA) on activities related to FC buses and HRS. In the energy sector, the FCH 2 JU discussed with the Executive Agency for Small and Medium-sized Enterprises (EASME) potential points of intersection and collaboration that should be further developed in the year ahead.

The FCH 2 JU also attended the joint CleanSky JU and the JRC workshop on 'Regions, EU funding's smart specialisation strategies' in July 2017. Collaboration with JRC on these matters was intensified during the second half of 2017, with the preparation of a joint JUs workshop for sharing experiences regarding each JU's initiatives towards creating synergies with European Structural and Investment Funds (ESIF) in chosen research areas and industrial activities being planned for the first quarter of 2018. Supporting synergies between funding sources should deliver additional gains in terms of innovation results, closing the innovation gap in Europe and promoting economic growth. The examples above are just a few of the activities involving the FCH 2 JU in 2017.

With the aim of accelerating the market introduction and deployment of the technologies stemming from the projects FCH 2 JU supports, funding/financial engineering activities have recently been integrated into the FCH 2 JU. The Undertaking has been working with and establishing a close relationship with several EIB departments, namely the InnovFin EDP/ InnovFin Advisory hub; Equity, New products and Special transactions; Growth Capital and Innovation Finance; and Transport operations. The programme office has participated in regular conference calls between the BeNeLux bus cluster and the EIB's InnovFin Advisory hub staff on the creation of a special purpose vehicle (SPV) to aggregate demand and raise the bankability of FC buses and related infrastructure.

56 http://artfuelsforum.eu/

57 https://ec.europa.eu/clima/sites/clima/files/events/docs/0115/20170612_report_en.pdf

Building on the momentum created by Hydrogen Europe's workshop on 'Hydrogen awareness raising' at the EIB headquarters, which took place in June 2017, the FCH 2 JU organised a face-to-face meeting between the EIB and an FCH 2 JU project beneficiary to explore pathways for financing their plans for industrial plant expansion. In addition, financing SPVs that may aggregate demand and enable the development of more market-driven and aggressive business models for deploying technology directly related to demonstration projects supported by the FCH 2 JU was explored. Later in the year, another meeting was held widening the attendants' list to those at the same level of maturity to access their willingness to join forces for a pan-European multi-brand m-CHP SPV. Although focused on the most mature m-CHP products, this potentially new SPV and business model path also has the potential to be applied to other technologies supported by the FCH 2 JU.

There are several funding and financing schemes for complimentary projects to those directly supported by the FCH 2 JU. Reaching out to alternative funding and financing sources leverages the impact of FCH 2 JU projects and enhances the achievement of its objectives. The FCH 2 JU has been addressing these funding sources on a case-by-case basis[58]. Learning from and leveraging on past experiences, it will now initiate a structured approach to this activity. During 2017, the FCH 2 JU started working on a sub-web page dedicated to this topic to enable better communication and to systematise the approach in this area, to be published during the first quarter of 2018. It will include the lessons learned from projects already being supported and benefiting from the combination of funds, highlighting specific requirements that potential beneficiaries must address to ensure EU fund blending is fully compatible with EU rules (e.g. compliance with the non-cumulative principle and the co-financing principle). The site will also provide web access to the IT funding tool being developed under the 'Regions and Cities' initiative', enabling detailed analysis of existing grant funding opportunities on a simple and user-friendly platform. While this tool is designed to provide support for the deployment of FCH technologies projects by regions and cities, it is also expected to benefit the beneficiaries of FCH 2 JU calls for proposals, enabling them to better navigate the array of EU funds available in different regions and Member States.

1.10. INTERNATIONAL COOPERATION

Given the importance of international cooperation in science and technology, explicitly recognised in the EU's Innovation Union flagship initiative and the Horizon 2020 programme, and described in the Communication 'Enhancing and focusing EU international cooperation in research and innovation: a strategic approach'[59], the FCH 2 JU has continued to be active at the international level, in order to align with, facilitate and accelerate the worldwide market introduction of FCH technologies.

As the deployment of FCH technology is carried out globally and key partners of the FCH 2 JU are involved in these developments, the Undertaking has continued to develop links with the major deployment programmes globally, mainly through the IPHE but also through bilateral periodic discussions with the US Department of Energy, Japan METI/NEDO (Ministry of Energy and Transport), etc. to harmonise standards and regulations and to accelerate market preparation. FCH 2 JU has continued to exchange best practice with the US DoE among reviewers during both the US DoE Annual Merit Review and FCH 2 JU proposal evaluations (both in June 2017).

In particular, FCH 2 JU has collaborated closely with EC representatives on the IEA Hydrogen Technology Collaboration Programme (TCP) executive committee to optimise and share the effort and participation. In particular on the new IEA tasks related to power-to-x and maritime applications, FCH 2 JU has provided scientific and technical expertise aligned with Member State representatives and FCH 2 JU-funded projects.

Contacts were maintained and further expanded with non-EU and Associated Country (AC) states with significant and sustained involvement in the development and deployment of FCH technologies, with a special focus in 2017 on Canada, South Africa and China (in addition to Japan and the USA mentioned above) mainly via the IPHE but also through bilateral discussions. Of special interest in these discussions were regulatory and policy frameworks, socio-economic and environmental assessments, LCA, RCS, safety, development of common methodologies for monitoring large-scale demonstrations and alternative technical solutions, and/or options considered for measuring hydrogen purity, hydrogen cooling and hydrogen dispensing.

Synergies are now being explored with the Climate Technology Centre and Network (CTCN), which is the implementing body to the COP, ensuring that developing countries adopt the right climate technologies to reach the 2o C target. Moreover, collaboration with and support for the Mission Innovation activities were encouraged, especially through project collaborations with similar worldwide activities under specific innovation challenges.

58 Example combined projects JIVE/MEHRLIN

59 COM(2012)497

1.11. OPERATIONAL BUDGET EXECUTION

The total budget available in 2017 (taking into account internal assigned revenues) reached EUR 127 826 472 in terms of commitment appropriations and EUR 198 588 904 in terms of payment appropriations.

In more detail:

FP7 budget

At the end of 2017, 46 payments for interim and mainly final periodic reports were made for a total of EUR 27.1 million. The budget execution (in terms of payment appropriations) reached 73.8 % (73.7 % in 2016).

H2020 budget

In terms of payment appropriations, 17 payments were made for 16 interim and 1 final periodic reports. In addition, 40 pre-financings were paid (for all 19 projects from call 2016 and 21 from call 2017), 8 payments to studies and 2 payments to the JRC.

The budget execution in terms of payment appropriations reached 93.3 % (98 % in 2016).

In terms of commitment appropriations, the execution rate reached 99.8 %, significantly higher than in 2016 (78.6 %) due to the decision to take 2 additional projects from the call 2017 reserve list, thereby committing nearly all the available budget.

For further details on budgets, see Section 2.3.

1.12. IN-KIND CONTRIBUTIONS

FP7 programme

The FCH JU founding regulation (Council Regulation 521/2008 as amended by Regulation 1183/2011) states that the operational costs of the FCH JU shall be covered through the financial contribution of the European Union and through in-kind contributions from the legal entities participating in the activities.

Calculation of the level of in-kind contributions follows a methodology approved by the FCH JU GB on 10 February 2012. Verification of these costs includes: 1) *ex-ante* controls before validation of the cost claims submitted by the beneficiaries (either based on desk-review assessment by the PO and/or certificates on financial statements provided by independent auditors); and 2) *ex-post* audits after validation of the cost claims, carried out by independent auditors appointed by FCH JU, in line with the FCH JU *ex-post* audit strategy.

In addition, in accordance with the methodology, the aggregated level of in-kind contributions is assessed every year by an independent external auditor.

In 2017, KPMG carried out the assessment and confirmed the amount of the aggregated level of in-kind contributions certified by the FCH 2 JU ED (cut-off date 31 December 2016) at EUR 485.5 million.

The full publishable report can be found under:

http://www.fch.europa.eu/page/annual-activity-reports

The 2017 audit assessment will be performed by KPMG from February 2018.

As at 31 December 2017, details of the aggregated level of in-kind contributions are as follows (in EUR):

FP7 YEAR 2017	ACCUMULATED VALIDATED IKC CONTRIBUTIONS AT 01/01/2017	VALIDATED IKC CONTRIBUTIONS IN YEAR 2017	IKC CONTRIBUTIONS RECEIVED BUT NOT VALIDATED AT 31/12/2017	IKC CONTRIBUTION ESTIMATE (PRO-RATA) AT 31/12/2017	IKC CONTRIBUTION ESTIMATE TO BE VALIDATED AS FROM 01/01/2018	FORECAST OF AGGREGATED LEVEL OF IN-KIND CONTRIBUTIONS
Industry Grouping	183 584 262	70 098 904	2 181 028	35 055 588	15 200 869	306 120 651
Research Grouping	99 831 472	24 790 832	3 057 474	15 858 818	8 968 499	152 507 095
TOTAL	**283 415 734**	**94 889 736**	**5 238 502**	**50 914 406**	**24 169 368**	**458 627 746**

H2020 programme

The FCH 2 JU legal framework for in-kind contributions[60] is defined in Council Regulation 559/2014 of 6 May 2014 establishing the FCH 2 JU, in which Article 4 provides that:

"The Members of the FCH 2 Joint Undertaking other than the Union shall make or arrange for their constituent entities or their affiliated entities to make a total contribution of at least EUR 380 million over the period defined in Article 1."

When assessing the level of contributions according to the above-mentioned article, the FCH 2 JU distinguishes between different types of contributions:

- Cash contributions
- In-kind contributions in operational activities (IKOP)
- In-kind contributions in additional activities (IKAA)

Thus, the overall minimum threshold of EUR 380 million for the H2020 programme refers to the sum of all three types of contributions.

As at 31 December 2017, FCH 2 JU members other than the EU were able to demonstrate that the **threshold of EUR 380 million was surpassed**, mainly thanks to the high level of IKAA certifications received for the first two reporting periods.

The table below gives a breakdown of private contributions under FCH 2 JU in light of the achievement of the EUR 380 million threshold.

Period covered: 2014-2017: cash and certified amounts only – as at 31 December 2017:

Cash contributions to FCH 2 JU running costs	**in EUR million**
Industry	1.12
Research	0.18
TOTAL	**1.30**
Indirect actions – in-kind contributions 'IKOP'	**in EUR million**
Total certified IKOP as of 31 December 2017[62]	0.63
Additional activities – certified 'IKAA'	**in EUR million**
Plan 2014/2015 – certified in 2016 and in 2017[63]	217.56
Plan 2016 – certified in 2017[64]	164.65
Total certified IKAA (2014-2016) as of 31 December 2017	**382.21**
Total: Cash + IKOP + IKAA as of 31 December 2017	**384.14**

60 This legal framework was complemented by a methodology for IKOP and a methodology for IKAA agreed by the FCH 2 JU GB on 18 November 2015 and 9 December 2016, respectively

61 Project DEMOSOFC, beneficiary CONVION, based on first finalised H2020 *ex-post* audit

62 IKAA certified report 2014/2015 and IKAA certified report 2016

63 IKAA certified report 2016 and additional certificates received by 31 December 2017

In-kind contributions in operational activities (IKOP)

IKOP are costs incurred in implementing indirect actions minus the contribution of the FCH 2 JU and any other EU contribution to those costs (Statutes, Art 13.3.b).

To be considered as IKOP, these costs must be incurred by members of Hydrogen Europe or Hydrogen Europe Research or their affiliates participating in FCH 2 JU indirect actions.

The Regulation provides that IKOP should be valued according to members' usual accounting practices and applicable national and international accounting standards (Regulation, Art 4.4).

The Council Regulation allows the members to base their declaration of IKOP on the basis of their "total costs" (according to their usual accounting practices) which may be slightly higher than their "eligible costs" (according to H2020 rules). On a proposal from the Industry and Research Groupings, the GB decided to limit IKOP to eligible costs for cost-efficiency and simplification reasons.

As a result, the IKOP in H2020 projects for FCH 2 JU are limited to the amount of eligible costs as per H2020 rules, less the EU contribution.

Calculation of the level of in-kind contributions is based on the methodology endorsed by the GB on 18 November 2015. Ex-ante controls for the IKOP under H2020 follow the harmonised practice in line with the common strategy of the rest of the RTD family, with the aim of simplifying and easing the controls performed when the payment is approved.

Ex-post certification of IKOP is provided by the *ex-ante* certificate of financial statements (CFS) which, compared to the FP7 programme, are only applicable for the final project period where the amount of FCH contribution to direct costs is higher than EUR 325 000.

Validation of the amount of IKOP is provided at the level of the executive director, upon receipt of the CFS certificate and/or based on the result of the *ex-post* audits.

The amount of IKOP reflected in the FCH 2 JU accounts is based on all signed running projects as of 31 December 2017, considering mainly the estimated costs (pro-rata), as well as 10 costs claims which were received but had not been validated at the cut-off date.

As of 31 December 2017, the estimated in-kind contributions for the 71 projects signed for the H2020 programme (2014, 2015, 2016 and 2017 calls) were as follows (in EUR):

H2020 IN 2017	ACCUMULATED VALIDATED IKOP AT 01/01/2017	VALIDATED IKOP IN 2017	IKOP RECEIVED BUT NOT VALIDATED AT 31/12/2017	IKOP ESTIMATE (PRO – RATA) AT 31/12/2017	IKOP ESTIMATE TO BE VALIDATED	FORECAST OF AGGREGATED LEVEL OF IKOP
Industry grouping	-	627 961	-	24 498 057	103 544 991	128 671 009
Research grouping	-	-	-	1 262	2 239	3 501
TOTAL	**-**	**627 961**	**–**	**24 499 319**	**103 547 229**	**128 674 510**

Most of the IKOPs were not certified, as this will happen later in the course of the H2020 programme, at the final payment of the projects when the CFS are due.

In-kind contributions in additional activities (IKAA)

According to the FCH 2 JU regulation, additional activities (AA) are defined as activities carried out by members of Hydrogen Europe and Hydrogen Europe Research and their affiliates contributing to the FCH 2 JU programme's objectives but undertaken outside of its work plan, which are not funded by the EU or the JU.

The regulation provides that determination of the costs taken into account for the valuation of the in-kind contributions shall be in accordance with the usual cost accounting practices of the entities concerned, the applicable accounting standards of the country where the entity is established, and the applicable international accounting standards and international financial reporting standards (Article 4.4).

The FCH 2 JU regulation establishes a minimum level of IKAA at EUR 285 million over the period defined in Article 1 of the regulation.

In 2017, the following important activities took place:

- Additional certification of 2016 & 2017 IKAA, whereby the threshold of EUR 380 million of overall in-kind contributions was reached
- IKAA of non-members – first reporting

1. (Preliminary) Reporting of the values of the IKAA contributions for 2016 by Hydrogen Europe and Hydrogen Europe Research Members as at 31 January 2017

As per the Council Regulation, members of the FCH 2 JU other than the EU shall report each year by 31 January to the FCH 2 JU GB on the value of the contributions in additional activities made in each of the previous financial years.

In accordance with the Regulation, the 2016 IKAA preliminary report was submitted on 31 January 2017 to the FCH 2 JU GB for information. Estimated IKAA of EUR 180.10 million were reported as achieved compared to the initial 2016 IKAA plan of EUR 207.24 million[64] adopted by the FCH 2 JU GB on 28 October 2016.

A trend to report lower amounts in the preliminary reporting is normal since the initial PLAN is created based on long-term estimates of possible activities which are adjusted at the time of reporting.

2. Second round of IKAA certifications for the period 2016 and additional certification of activities covered in 2014/2015 IKAA Plan[65]

The 2016 IKAA report on certified figures was inherently derived from the 2016 IKAA Plan, which encapsulated planned activities declared by the members at the beginning of the period. To ensure strict continuity and compliance with the adopted Plan, no new activities (for the 2016 reporting period) compared to the adopted 2016 IKAA Plan, were included in that report.

The final 2016 IKAA report included EUR 140.35 million of certified activities from the IKAA 2016 Plan. Differences between the planned and realised figures were mainly due to projects postponed or not executed to the full extent as initially planned.

In addition, a few members provided certificates for the period 2014-2015 for additional activities not previously reported, totalling EUR 31.14 million, resulting in an increase in the total certified IKAA amount to EUR 217.56 million for the period 2014-2015 (EUR 186.42 million certified in the previous year).

A full publically available version of the 2016 IKAA report can be found on the FCH 2 JU website at:
http://www.fch.europa.eu/page/in-kind-additional-activities

3. Achieving the minimum amount of EUR 285 million of IKAA

The FCH 2 JU Regulation, Article 4, requires all members of Hydrogen Europe and Hydrogen Europe Research and their affiliated entities to jointly deliver contributions of at least EUR 380 million until 31 December 2024, of which at least EUR 285 million will be in the form of additional activities.

We emphasise the fact that the final certified figures for the first two periods, of EUR 217.56 million and EUR 140.35 million, amounting to a cumulative certified amount of EUR 357.91 million, demonstrate a strong commitment by the FCH sector as a whole. For its first and second reporting period 2014-2015 and 2016, or less than three years after the adoption of the FCH 2 JU programme, the FCH sector has actually exceeded the set minimum certified IKAA amount until 2024 by 26 %.

4. Establishing the IKAA 2018 Plan and its adoption by the FCH 2 JU GB on 15 December 2017

The fourth Additional Activities Plan covering the period 1 January 2018 – 31 December 2018, including certifiable additional activities for EUR 250.16 million, was adopted by the FCH 2 JU GB on 15 December 2017.

The public version of the 2018 IKAA Plan is available on the FCH 2 JU website at:
http://www.fch.europa.eu/page/in-kind-additional-activities

64 The 2016 IKAA Plan's final figures of EUR 207.24 million did not include contributions of EUR 2.8 million from 17 small members which did not reach a cumulative certification threshold of EUR 325 000 introduced in 2016 as a major simplification, relieving small members, in particular, of additional administrative burdens, while ensuring coverage of over 98 % of the total amount of the planned activities with obligation to certify

65 Planning, reporting and certification process of IKAA in 2017 followed a formal FCH 2 JU IKAA methodology, describing a robust control process to ensure the planned, reported and certified IKAA figures are reasonable (the methodology was agreed by the FCH 2 JU GB on 9 December 2016)

5. Additional certifications for 2016 & 2017, corrections to the IKAA 2016 Plan, and interpretation of the IKAA 2017 Plan

In 2017, additional certificates for IKAA for a total of EUR 60.12 million were obtained for 2016 and 2017, fulfilling all eligibility criteria. These amounts come from additional activities not previously certified in their respective periods.

For further details, see: http://www.fch.europa.eu/page/in-kind-additional-activities.

6. Additional activities for non-members – first reporting

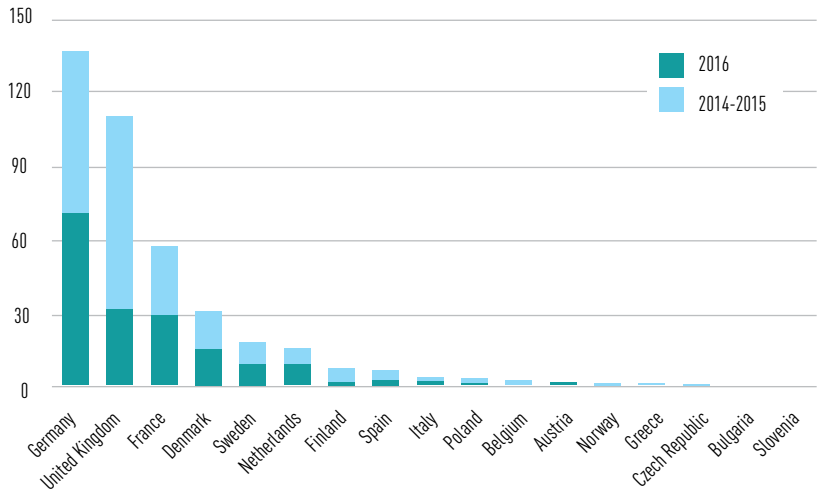
In 2017, the first H2020 project NewBusFuel was finalised, in which a significant amount of IKAA (EUR 59 million) from non-members was reported. Since these reported values are not subject to any certification, the total amount is provided for information only.

7. General overview of additional activities

This section provides an overview of the cumulative amount of IKAA:

- Certified IKAA for the period 2014-2016 (based on the certificates received and validated by 31 December 2017 totalling EUR 382.11 million);
- Planned IKAA for the period 2017-2018 (based on the official approved IKAA Plans adopted by the FCH 2 JU GB on 21 December 2016 and 15 December 2017 totalling EUR 426.45 million).

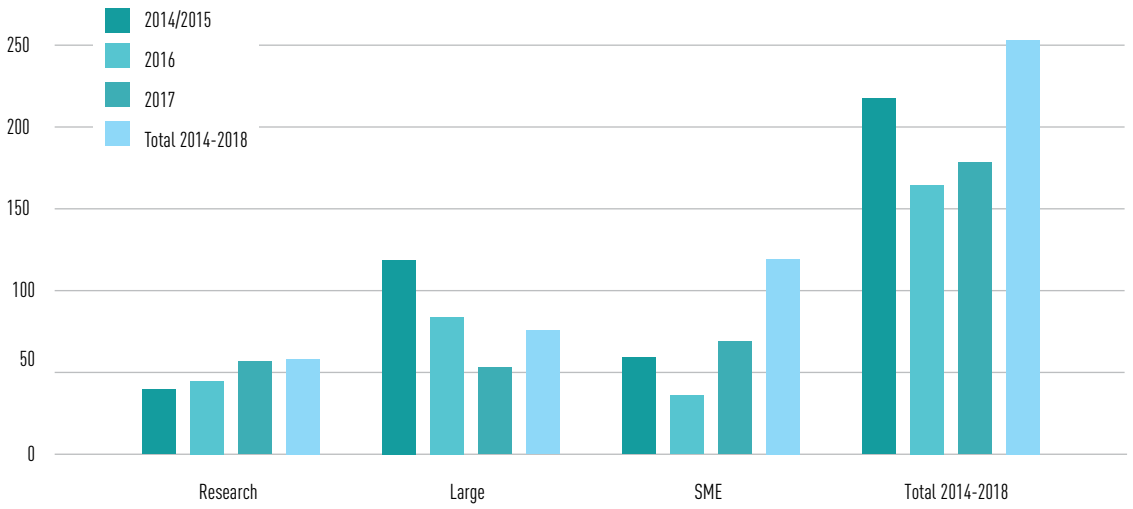
Certified and planned IKAA per countries of the members for 2014-2018 (in EUR million)



As shown in the figure above, the strongest investment in hydrogen technologies occurs mainly in Germany, UK, France, Denmark and Sweden. At the same time, it is notable that there is also a wide range of countries other than the top five investing in additional activities.

The figure below shows the certified and planned IKAA per sector (either industry or research), with the industry sector being broken down further by the size of the industry – a large company or SME.

Certified IKAA for 2014-2018 per sector (in EUR million)

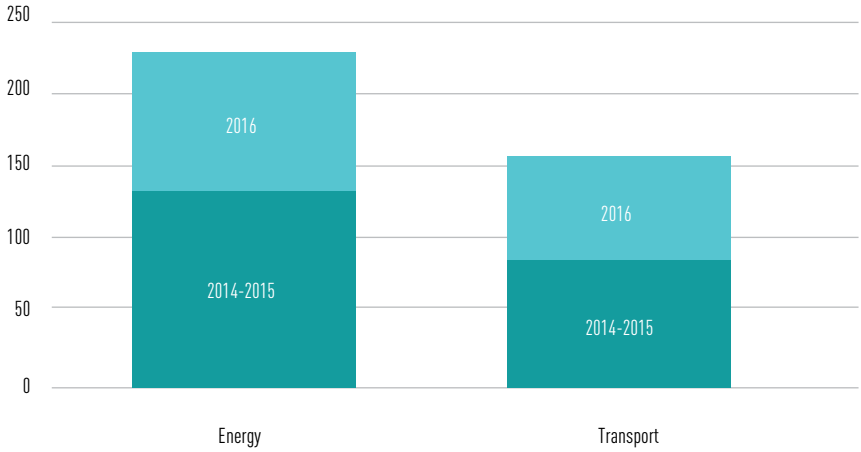


While IKAA contributions in the first two reporting periods were driven by large companies, SMEs have increased their forecast contributions in 2017 and 2018. For their part, research institutions continue to increase steadily.

In particular, SME contributions in planned additional activities, as an integral part of the hydrogen technology sector and with a strong level of participation in FCH 2 JU-funded projects, are increasing to amounts similar to those of large industries and research combined.

As observed in the figure below, most of the certified IKAA came from the energy sector (59 %), with the transport sector contributing 41 %.

Certified IKAA for 2014-2016 per application area (in EUR million)



The following table presents an overview of the cumulative amount of certified activities for Hydrogen Europe Industry and research members for 2014-2016, including the overall amounts planned for 2017-2018 and estimated for 2014-2024:

PERIOD IN WHICH ACTIVITIES ARE PERFORMED	PLANNED ADDITIONAL ACTIVITIES IN EUR MILLION	CERTIFIED VALUES OF ADDITIONAL ACTIVITIES IN 2016 IN EUR MILLION	CERTIFIED VALUES OF ADDITIONAL ACTIVITIES IN 2017 IN EUR MILLION	OVERALL AMOUNT OF CERTIFIED ADDITIONAL ACTIVITIES AS OF 31/12/2017 IN EUR MILLION	OVERALL AMOUNT OF ADDITIONAL ACTIVITIES CERTIFIED/ ESTIMATED (IF NOT YET CERTIFIED) FOR 2014-2024 IN EUR MILLION[67]
2014/2015	243.20	186.42	31.14	217.56	217.56
2016	222.07		164.55	164.55	164.55
2017	176.29				176.29
2018	250.16				250.16
2019-2024[68]					469.87
TOTAL	**891.72**	**186.42**	**195.69**	**382.11**	**1 278.43**

The FCH 2 JU believes that the scope of investments captured in the IKAA plans 2017-2018, together with data already certified for 2014-2016, is a clear testimony of the FCH sector members' strong commitment, the continued progress of these technologies towards the market, and the strong leverage of FCH 2 JU investment. The Undertaking believes that these investments in additional activities embody a robust contribution towards achieving joint objectives set in the FCH 2 JU regulation.

66 Only activities > EUR 325 000 per year/ per member are considered

67 Non-binding outlook based on activities in the IKAA Plans 2014-2018

02
SUPPORT TO OPERATIONS

2.1. COMMUNICATION ACTIVITIES

2.1.1 COMMUNICATION OBJECTIVES 2017

The FCH JU continued operating its communication activities in the frame of the communication strategy adopted in 2015, raising awareness around the FCH JU programme itself and about the technology. 2017 marked the 10th edition of the FCH JU Stakeholder Forum, the mid-term evaluation of the FCH 2 JU as well as the outcome of many additional project results. This special context brought communication activities to another level, stimulating the production of multiple substantial material and initiatives.

As part of the target audiences, the FCH JU ensured key actors from the European institutions were kept informed about the Joint Undertaking's activities and outcomes. This translated into regular meetings and events with the European Commission, the European Parliament, and the EU Member States. Reaching out to potential participants and to new players in order to enhance knowledge of the FCH JU and of the benefits of the technology itself, was also prioritised. With specific results being announced more frequently, communication activities focused on demonstrating the concrete advantages of the technology and its potential to address environmental and decarbonisation targets. This was also the occasion to highlight the growing engagement of SMEs and the socio-economic benefits of the FCH JU programme.

The FCH JU communication team continued to work closely both with the EC's communication teams as well as its project partners to increase synergies and amplify the outcome of the communication activities. The FCH JU also took into account the Horizon 2020 yearly communication strategy by reflecting on it with the production and publication of material matching specific monthly themes.

2.1.2. PUBLIC OUTREACH ACTIVITIES – EVENTS

Presentation at the Committee of Regions (Brussels) – 24 March

The FCH 2 JU presented the FCH JU regional initiative at the Conference on Innovative Energy Solutions for European Regions and Cities organised by the Committee of Regions as part of the Knowledge Exchange Platform[68].

68 http://cor.europa.eu/en/events/Pages/kep-energy.aspx

FCH JU presentation at DG MOVE (Brussels) – 5 April

Organised together with DG Move, this lunch conference enabled the FCH 2 JU to present its transport applications and portfolio. Two hydrogen cars were also available for test drives and triggered plenty of interest from transport policy- and decision-makers.

Commissioner Moedas' FCEV test drive (Brussels) – 11 May

Prepared in collaboration with DG RTD and the Commissioner's Cabinet, a test drive was organised in an FC vehicle provided by the FCH JU project HyFive. Commissioner Moedas drove the vehicle and witnessed the benefits of the technology, thanks to this live experience. The short trip included refuelling at the Air Liquide Zaventem hydrogen station where the FCH 2 JU executive director gave more insight into the actual status of FCH transportation deployment in Europe. The film was mainly used on social media and online platforms, generating strong public engagement.

SME Europe – Event at the European Parliament Brussels - 26 September

On the initiative of the FCH JU, this meeting was organised to raise awareness among members of the European Parliament about the FCH JU's added value for and support to SMEs. A working lunch was organised and hosted by MEP Ivan Štefanec. Several speakers took the floor, including Maja Bakran Marcich, Deputy Director-General for Mobility and Transport and Patrick Anthony Child, Deputy Director-General for Research and Innovation. The FCH JU joined the event together with one of its programme's SME representatives (H2Logic) to present a good case study.

Innovation in Action, Joint Undertakings at the European Parliament (Strasbourg) – 23-26 October

The six Joint Undertakings gathered to organise a one-week event at the European Parliament in Strasbourg. The purpose was to present the different activities and successes while emphasising the benefits of PPPs to boost innovation in Europe. The JUs also put on an exhibition around the theme of 'Innovation in Action' in the Espace Emilio Colombo. The official opening of the event included a speech by Commissioner Carlos Moedas, Günther Oettinger, European Commissioner for Budget and Human Resources, as well as around 14 Members of the European Parliament (MEPs). Two Directors-General (from the EP, Ribera d'Alcala and from the EC, Roberto Viola) were also present. This was the occasion for all JUs to streamline social media activities around Joint Undertakings with one single hashtag enabling positive messages from all JUs to be centralised online.

The FCH JU booth displayed the brand new FCH JU video produced for the occasion. The JUs also held a working breakfast with MEPs, during which representatives of the respective industries explained the added value of the JUs to their sectors. The event, which was hosted by MEP Miroslav Poche, was a big success (more than 50 MEPs visited the exhibition).

FCH JU events and projects launch

Project JIVE launch (Cologne) – 24-25 January

Coming from the FCH JU call 2016, bus project JIVE is the biggest project, planning a deployment of more than 140 FC buses in Europe. The launch took place on the occasion of the project kick-off in Cologne, Germany, in a joint event with EU project MERHLIN, supported by the Connecting Europe Facility (CEF) which aims to deploy the infrastructure (hydrogen refuelling stations) complementarily to the JIVE bus deployment. Because of the importance of the scope (and budget), the start of this project was brought to attention of the public via a press release and coordinated actions with communication teams from the EC. The news was also relayed on social media by EC Vice-President Maroš Šefčovič and Commissioner Moedas.

FCH JU Info Day (Brussels) – 3 February

Following the publication of its yearly call for proposals, the FCH JU held an info day to give potential participants further insight into the call details. The 2017 edition was particularly successful as special efforts had been made to attract a larger and more diversified audience. The event, which was organised in the White Atrium premises, followed a new format, including brokerage sessions, and was broadcast live. More than 130 participants joined on- site while over 50 followed the event online.

Launch of project H2FUTURE (Vienna) – 7 February

Like JIVE, 2017 also marked the start of another large project in the ENERGY pillar: H2FUTURE. The launch event was held in presence of local press and specific public relations personnel, and actions were prepared in advance to amplify media and public coverage. The FCH JU worked together with EC communication teams to have the information relayed as it also tapped into the February 'Industry' theme as part of the Horizon 2020 strategy. The entire event resulted in significant media fallout, with an article in the UK's *Financial Times* as well as coverage in many other national and local media outlets.

Maritime and port applications joint workshop (Valencia) – 15–16 June

Organised together with the Valencia port Foundation and the EC's JRC, this two-day workshop followed the previous edition held in 2013, taking a closer look at maritime and port applications. As this is an area of growing interest, the purpose of this event was to address the main challenges and issues, such as: how can the technology be concretely deployed; what costs are involved and what are the possible financing opportunities; what is the deployment time frame and which actors should be involved and, finally, is the regulatory framework favourable for the deployment of these technologies. Over 100 participants attended the event and speakers included industry, the European Commission and regional authorities.

Hydrogen for Clean Transport, (HyFive final event, H2ME) (Brussels) – 22 September

As HyFIVE (one of FCH JU main transport projects) was coming to its end in 2017, the FCH JU focused on organising an event with a much larger scope outlining the benefits of hydrogen mobility and the status of the different growing initiatives in Europe. Joined by another transport project, H2ME, this event was the first of its kind for Europe's transport industry, gathering leading original equipment manufacturers (OEM) and infrastructure representatives as well as institutional and political actors. Clara de la Torre, Director of Transport at DG Research and Innovation, opened the conference.

For the first time, seven OEM brought their FC vehicles to create a unique exhibition in front of the Charlemagne building in Brussels. Around 300 participants attended the event, which was also broadcast live. It also attracted important media coverage, and high-level publications, such as the UK's *Daily Telegraph*, published an extensive article about the event.

ene.field final event at Autoworld (Brussels) – 11 October

Another landmark project was also coming to an end in 2017: ene.field, the FCH JU project working on deploying FC micro-CHP units throughout Europe. The event highlighted the project findings and outlined the next steps for the sector as regards reaching mass commercialisation. It was held in the framework of the European Week of Regions and Cities and welcomed a speaker from the Committee of the Regions as part of the opening session. Eight units were on display at the entrance.

New hydrogen station at Orly airport (France) – 7 December

For the first time in France, a new hydrogen station opened in an airport area. This Orly station is a public refuelling station built under the FCH JU project H2ME. An important event was organised in presence of CEOs and FCH JU representatives, which generated significant media output.

Stakeholder Forum 2017

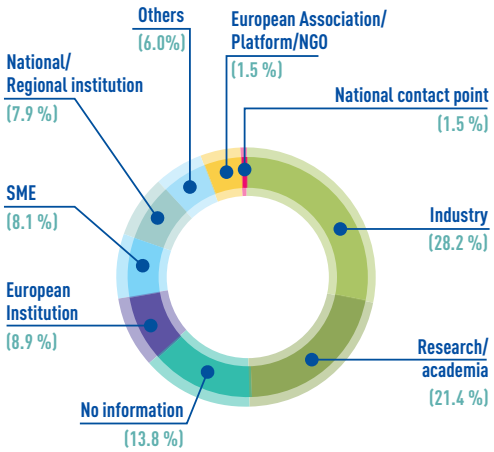
The 10th edition of the FCH JU Stakeholder Forum was the occasion to hold a unique celebratory event and special highlights. Held in a new and exceptional venue, the programme outlined the work done so far and provided an opportunity to debate and take stock of the latest developments.

Former FCH JU directors and chairs were invited to a special tribute session and former EC Commissioner Philippe Busquin also attended the event as well. For the occasion, a unique FCH JU book was produced and distributed to all participants.

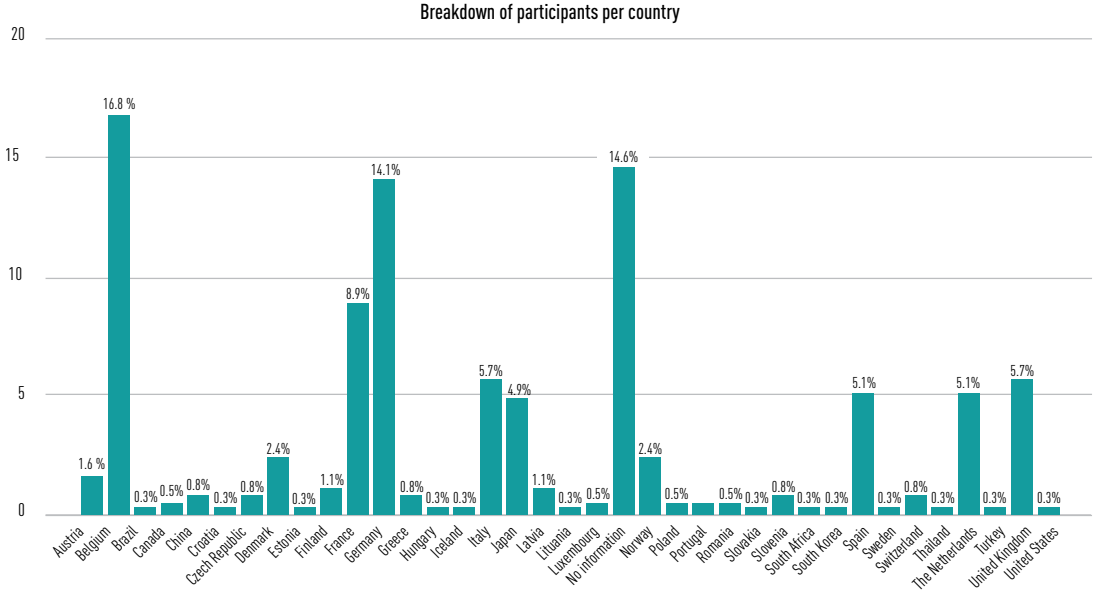
The event participation reached a level not previously seen, with the 10th edition attracting over 360 participants from more than 35 countries, while more than 350 users followed the conference remotely via web streaming. A video will be produced as post-event material featuring interviews from key speakers and participants.

Following a post-event survey and based on 369 attendees, participation at the event was very balanced in terms of types of organisation, with almost a third coming from industry and 8 % representing NGOs, from more than 30 countries, including those from outside the EU (international stakeholders).

Breakdown of participants by type of organisation



Breakdown of participants per country



3. Material promoting FCH JU projects and successes

In 2017, the FCH JU produced new visual material to further increase brand awareness and to communicate key information effectively for both wide-reach and strategic/targeted publics. The focus was to initiate the first phase of the production of high-quality tools that will be further disseminated in a second phase (foreseen for 2018).

A. FCH JU video

The FCH JU produced a new awareness-raising video clip focusing on the benefits of the technology and featuring inspiring footage of FCH JU projects. The educational storyline gathered together appealing images and constructive interviews to present the potential of FCH applications as sustainable and clean technologies for transport and energy. The content of the video addresses a very wide audience, from the general public to policymakers, giving information on both the benefits of the technology and the work being done by the FCH JU. Initially produced to be presented at the 'Innovation in Action' event in Strasbourg, it will be further disseminated in 2018 through social media and specific actions. It is accessible on the FCH JU website and the FCH JU YouTube channel.

B. FCH JU slide package

Extensive work was done in 2017 to develop brand new PowerPoint material for FCH 2 JU. The exercise included translating existing supports using clear and catchy visuals, as well as producing new slides from scratch, including new content, graphics, visuals and infographics. The result is a consolidated package of over 200 interchangeable slides designed to serve as a strong basis to support any presentation about the FCH JU and its activities. Used for the first time during the Programme Review Days 2017, the FCH JU will work at using this package in the future and progressively adapting the content. It will help the FCH 2 JU to convey its messages to the different audiences in a uniform and harmonised way.

C. FCH JU book

For the 10th edition of its Stakeholder Forum, the FCH JU looked into producing new and special material. Highlighting the history of the FCH JU, from planting the seed of a European PPP in 2000 up to today, the FCH JU book entitled 'Fuel cells and hydrogen technology: Europe's journey to a greener world' sets out the story behind both the FCH JU and the technology in Europe. It reviews the events that have enabled Europe to take a leading role in FCH excellence while highlighting concrete developments taking place under the FCH JU. Strategic actors shared their experiences to help in the drafting of historical aspects in the book. In addition, the content outlines the most recent achievements extracted from FCH JU projects. Interviews with project partners highlighted the FCH JU's contribution to SMEs and the JU's role in stimulating socio-economic changes. The book will be further distributed and its content further exploited.

4. Digital communication: FCH JU website and social media

Online activities continued at a greater pace and regularity to relay fresh and timely information, and drive traffic towards the FCH JU website.

As regards social media, the number of FCH JU Twitter account followers has almost tripled compared to 2016, passing the 1000 mark and unlocking new outreach opportunities. With intense online activity and advanced preparations, the FCH JU also triggered additional collaborations with high-level players, helping to multiply its initial messages and leading to greater engagement and interactions with new actors.

The news flow on the FCH JU website continued to grow while taking advantage of its latest 'news-sending' functionality. The content remained focused on project achievements and special events, in constant collaboration with partners and stakeholders. In 2017, more than 40 news items were written and disseminated. Close to a thousand people registered as FCH JU news subscribers, which demonstrates an increasing interest in FCH JU activities. Overall, the website recorded more activity and a higher number of visits. The number of website sessions[69] in 2017 rose by 27.3 % compared to 2016 while the number of users[70] grew by 30.8 %. During the same period, the website session period[71] fell slightly, by 3.6 %, which can be considered as negligible, representing just a few seconds.

5. Media relations

As several important events took place in 2017, press announcements occurred at a greater rhythm and resulted in high-quality coverage for specific occasions. Project-focused events, such as the H2FUTURE launch, Hydrogen for Clean transport, and the opening of Orly hydrogen station triggered significant press interest and resulted in important news reporting mentioning the FCH JU in many high-level mainstream media, such as Reuters, *Financial Times*, *France3/regions*, *L'Echo*, *Le Moniteur Automobile*, *Daily Telegraph*, *Le Parisien*, etc.

In addition, the FCH JU maintained direct contact with the Brussels-based international media representatives to keep them informed of specific FCH JU announcements and to share project press releases.

69 Session refers to the period time a user is actively engaged on the website

70 Users who have initiated at least one session during the date range

71 Session period is the average length of a session

All the press clippings are available on the FCH JU website: http://www.fch.europa.eu/press-clippings.

DES VOITURES À HYDROGÈNE PRÉSENTÉES À ORLÉANS

Comment réduire ses émissions de CO_2 lors de ses déplacements? Ces dernières années, la voiture éléctrique est montée en puissance mais qu'en est-il de la voiture à pile combustible... le véhicule hydrogène censé remplacer le moteur thermique... où en est on de cette technologie? Direction la CNRS d'Orléans qui travaille sur le sujet et où un colloque européen réunissait chercheurs et industriels européens sur la question – France 3 Centre – RB, VL.

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2.2. LEGAL AND FINANCIAL FRAMEWORK

1. Revision of the FCH 2 JU Model Grant Agreement:

In accordance with Article 6 of the Delegation Agreement No. FCH JU 2014 D2793 signed by the FCH 2 JU with the EU represented by the EC, the FCH 2 JU must use the H2020 Model Grant Agreement (MGA) adopted by the EC.

On 18 October 2017, the EC adopted the Decision C(2017)6912 amending Horizon 2020 MGA. The revised MGA (version 5) provides – amongst others – clarifications, corrections, a new category of third parties and new rules in favour of beneficiaries.

The FCH 2 JU reviewed the proposed changes and modified its MGA accordingly. It is expected that the revised MGA will be implemented in the H2020 IT tools in the first half of 2018 and will not have a retroactive effect. It will apply to all future grants signed starting with the FCH 2 JU call for proposals 2018.

2. Rules on the prevention and management of conflict of interests

On the basis of a recommendation from the discharge authorities and a recommendation from an audit performed by the FCH 2 JU internal auditor, the Undertaking prepared internal rules which specify in a more comprehensive manner the obligations in terms of conflict of interests.

Following a recommendation from the Directorate-General for Human Resources and Security (DG HR), the FCH 2 JU redrafted the rules and prepared two separate sets:

- FCH 2 JU Decision adopting rules on the prevention and management of conflicts of interests of the staff members of the Fuel Cells and Hydrogen 2 Joint Undertaking;
- FCH 2 JU Decision adopting rules on the prevention and management of conflicts of interests of the Bodies of the Fuel Cells and Hydrogen 2 Joint Undertaking.

The EC gave its agreement pursuant to Article 110 (2) of the Staff Regulations by Commission Decision C(2017) 5509 of 1 August 2017.

Both Decisions adopting the rules on conflicts of interest were adopted by the FCH 2 JU GB on 10 November 2017.

3. Other rules and procedures

Other rules were adopted by the FCH 2 JU GB, mainly implementing rules on staff regulations (see Section 2.6), and a number of procedures were updated and adopted by the executive director (procedure for the Programme Review, financial circuits).

2.3. BUDGETARY AND FINANCIAL MANAGEMENT

2.3.1. BUDGET

The FCH 2 JU budget comprises both the revenue and expenditure. On the expenditure side, the budget is divided into three titles:

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

Overall, commitment appropriations increased marginally (0.1 %), however the payment appropriations show a significant increase (72.3 %) due to the fact that the pre-financings for two calls (call 2016 and 2017) were foreseen to be paid in the year.

There were two amendments and two budget transfer in 2017. The first amendment, which was adopted by the Decision of the Governing Board of 18 April 2017, introduced administrative payments carried over from 2016 and unused commitment and payment appropriations for operational costs. The second amendment was approved by the Governing Board on 17 August and resulted in the budget inscription of liquidated damages cashed in previous years.

An overview of the initial budget, the amendments and transfers is presented below:

TABLE 2.3.1.1: 2017 BUDGET EVOLUTION

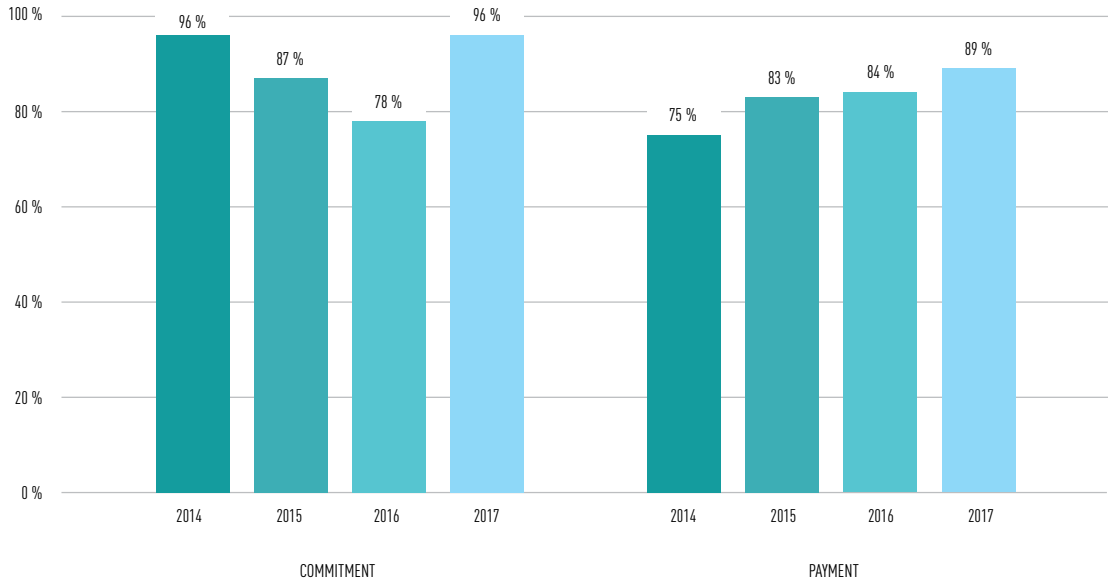
BUDGET 2017 (EUR)								
	VOTED BUDGET		AMENDMENTS		TRANSFERS		FINAL BUDGET	
	CA*	PA**	CA*	PA**	CA*	PA**	CA*	PA**
Revenue								
EU operational FP7		32 178 026		-11 813 853			0	20 364 173
EU operational H2020	94 234 786	142 933 563		11 813 853			94 234 786	154 747 416
EU administrative	1 801 377	1 801 377					1 801 377	1 801 377
Hydrogen Europe	2,058,391	2 058.391					2 058.391	2 058 391
Hydrogen Europe Research	342 877	342 877					342 877	342 877
Reactivations from previous years	26 773 694	912 443	2 128 756	17 875 636			28 902 450	18 788 079
JTI revenues inscribed in budget			109 484	109 484			109 484	109 484
Total revenue	**125 211 125**	**180 226 677**	**2 238 240**	**17 985 120**	**0**	**0**	**127 449 365**	**198 211 797**
Expenditure								
Title 1	3 382 494	3 382 494	-35 494	26 833	-69 300	-69 300	3 277 700	3 340 027
Title 2	1 732 594	1 732 594	164 978	907 920	69 300	69 300	1 966 872	2 709 814
Title 3 – FP7		32 178 026	2 108 756	4 256 714			2 108 756	36 434 740
Title 3 – H2020	120 096.037	142 933 563		12 793 653			120 096 037	155 727 216
Total expenditure	**125 211 125**	**180 226 677**	**2 238 240**	**17 985 121**	**0**	**0**	**127 449 365**	**198 21 797**

* **Commitment appropriations (CA)**
** **Payment appropriations (PA)**

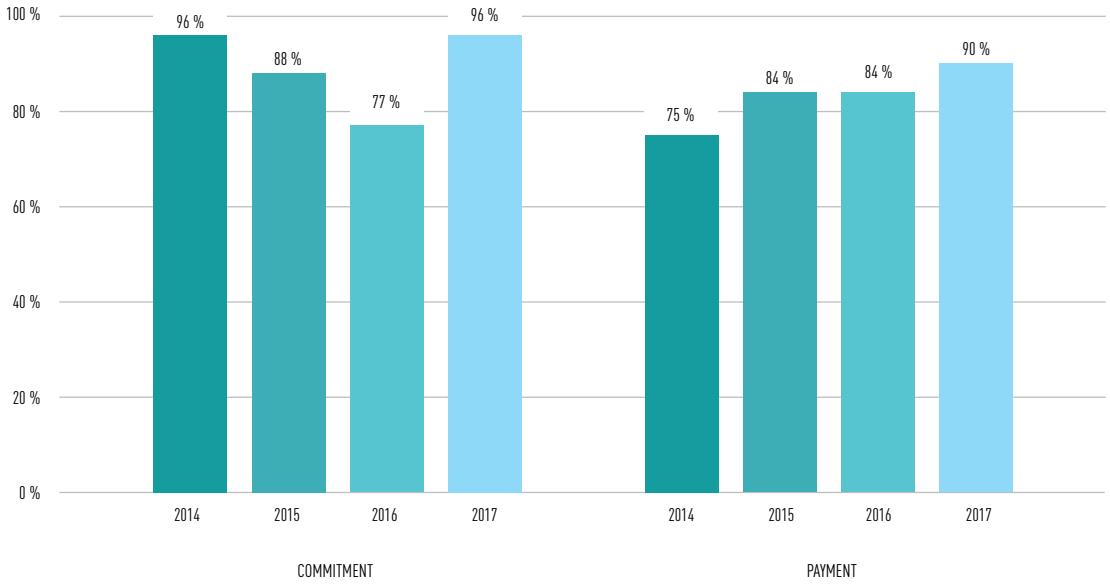
2.3.2 BUDGET EXECUTION

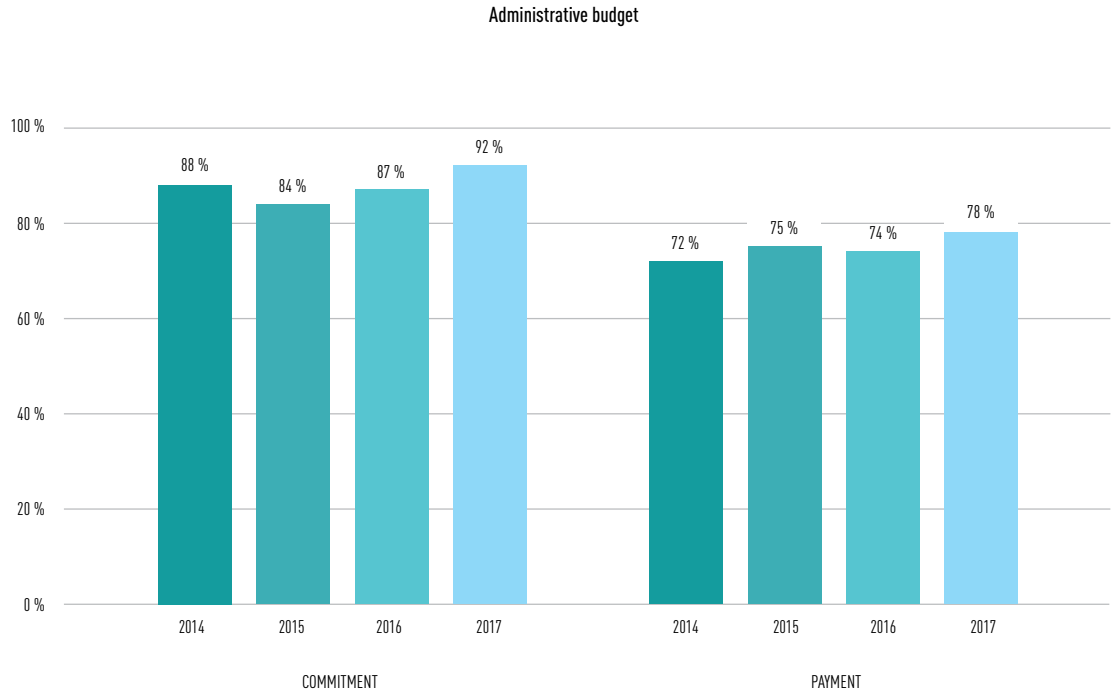
In 2017, the FCH JU achieved the highest budget execution in its history (96 % in terms of commitments and 89 % in terms of payments). The high commitment rate was achieved thanks to the use of the reserve list for funding two additional projects from the 2017 call, thereby consuming the entire budget for the call. Good planning, enforced monitoring and compliance with the TTG contributed to the high payment rate.

Total budget execution



Oprational budget





Record-breaking rates were also achieved for all the budget lines: operational expenses had an execution rate of 96 % and 90 % in terms of commitments and payments, respectively, whereas the administrative budget recorded 92 % and 78 % of use for commitment and payment appropriations, respectively, all of them being considered as top performances.

More details on budget execution:

Revenues

FCH 2 JU revenue for 2017:

TABLE 2.3.2.1: IMPLEMENTATION OF REVENUES

REVENUES (IN EUR)		
Heading	**Income appropriation (budgeted)**	**Cashed in 2017**
Operational expenditure, EU	175 111 589	175 111 589
Administrative expenditure, EU	1 801 377	1 801 377
Administrative expenditure, IG	2 058 391	2 058 391
Administrative expenditure, RG	342 877	342 877
Recoveries	0	653 191
Reactivation of appropriations	912 443	
Inscription of liquidated damages and bank interest	109 484	
TOTAL	**180 336 161**	**179 967 425**

Expenditure

Administrative expenditure

FCH 2 JU's administrative costs recorded the highest rate of use (92 %). Unused 2017 appropriations amount to EUR 430 218 of which EUR 412 032 come from H2020 and will be reactivated in the 2018 or 2019 budget.

The following table summarises the breakdown between the two programmes (FP7/H2020) for implementation of the administrative budget. Commitments refer to 2017 appropriations excluding any carry forwards from previous years, whereas payments refer to all available payment appropriations and payments executed during the year.

Payment execution rate (73.6%) was slightly lower than in 2015.

The following table summarises the breakdown between the 2 programmes (FP7/H2020) for the implementation of administrative budget. Commitments refer to 2016 appropriations excluding any carry forwards from previous years, whereas payments refer to all payments made during the year.

TABLE 2.3.2.2: IMPLEMENTATION OF ADMINISTRATIVE BUDGET

ADMINISTRATIVE EXPENDITURE (IN EUR)						
	Commitment appropriations (CA)	**Committed**	**Execution**	**Payment appropriations (PA)**	**Paid**	**Execution**
FP7	4 089 129	4 070 943	99.6%	4 089 129	3 029 950	74.1%
H2020[73]	253 768	0	0.0%	253 768		0.0%
carry-overs and reactivations	932 443	774 179	83.0%	1 737 712	1 737 235	100.0%
TOTAL	**5 275 340**	**4 845 122**	**91.8%**	**6 080 609**	**4 767 185**	**78.4%**

In addition, EUR 83 090 of administrative commitments made before 2017 and carried forward to 2017 were de-committed this year, thereby becoming available for future use. A sum of EUR 43 354 has already been included in the initial 2018 budget whereas EUR 39 736 will be reactivated in the 2018 or 2019 administrative budget according to requirements.

Operational expenditure

As regards the **H2020 operational costs** (call, studies, JRC), the commitment execution rate reached 96.4 %. The total unused appropriations amount to EUR 2 023 470 which is mainly due to the outcome of the call and implementation of the procurement plan, where some studies were awarded less than the amount initially budgeted and others were not awarded at all. An amount of EUR 1 752 086 has already been reintroduced in the voted 2018 budget.

The payment appropriations were mainly used to pay the pre-financings for two calls and a total of 40 projects (19 from call 2016 and 21 from call 2017). The execution rate of payments reached 93.3 % as: (1) the entire pre-financing for call 2017 was not allocated during the year (three projects will only start after 01/02/2018); and (2) the first interim reports claimed less than was anticipated. Unused payment appropriations (EUR 10.5 million) will be re-entered in the 2018 budget by an amendment.

As regards **FP7 operational costs**, the execution rate on the payment appropriations reached 73.8 %. Unused payment appropriations (EUR 9.3 million) will also be reintroduced in the 2017 budget through an amendment.

72 Includes members' contributions to H2020 administrative expenses (EUR 113 516), revenues from previous years that were inscribed in the budget through the second amendment (EUR 109 484) and internal assigned revenues for the year (EUR 30 768)

An overview of the execution of the operational costs budget is given in the table below:

TABLE 2.3.2.3: IMPLEMENTATION OF OPERATIONAL BUDGET

OPERATIONAL EXPENDITURE (IN EUR)						
Heading	**Commitment**					**Payment**
	Commitment appropriations (CA)	**Commitments made**	**Execution**	**Payment appropriations (PA)**	**Paid**	**Execution**
FP7	2 455 095	91 167	3.7%	36 781 079	27 127 621	73.8%
H2020	120 096 037	118 072 567	99.8%	155 727 216	145 253 937	93.3%
TOTAL	**122 551 132**	**118 163 734**	**96.4%**	**192 508 295**	**172 381 558**	**89.5%**

Overview of programme implementation

The following tables provide an overview of FP7 and H2020 implementation.

Operational costs

For **FP7**, the execution rate has reached 86.9 %. The commitments under operational costs refer to individual commitments. The amounts shown in 2018 and subsequent years represent the remaining obligations under the open Grant Agreements. From a total of 155 signed Grant Agreements, one project was cancelled, final payments were made for 119 projects and 35 projects remain open. In addition, 12 operational studies were conducted.

For **H2020**, the amount committed until the end of 2017 covers the 71 individual commitments under the first four H2020 calls and the balance for the global commitments for the 2017 call (at the end of 2017, two projects from the reserve list were still to be signed[73]). In addition, this includes 11 individual commitments for the studies, the balance of the global commitment for the studies in AWP 2017, and the two individual commitments for JRC's contribution.

As regards the **administrative costs**, an amount of EUR 800 116 was committed in 2017 but not paid (as services are ongoing and/or invoices pending) – therefore it will be carried forward to meet remaining obligations.

The following tables give an overview of implementation of FP7 and H2020 programmes:

TABLE 2.3.2.4: IMPLEMENTATION OF FP7 PROGRAMME

FP7 (IN EUR)				
Type	**Execution until 31/12/2017**	**2018**	**Subsequent years**	**Total**
Commitments (operational costs)	450 874 253		-	450 874 253
Payments (operational costs)	388 077 677	25 686 390	17 379 328.68	431 143 396
Cumulative execution (operational costs)	**86.1%**	**91.8%**	**95.6%**	**95.6%**
Commitments (administrative costs)	30 788 410		-	30 788 410
Payments (administrative costs)	30 388 352	400 058	-	30 788 410
Cumulative execution (administrative costs)	**98.7%**	**100.0%**	**100.0%**	**100.0%**
Overall FP7 execution	**86.9%**	**92.2%**	**95.6%**	**95.9%**

73 The two corresponding individual commitments were made in January 2018 before signature of the Grant Agreements

TABLE 2.3.2.5: IMPLEMENTATION OF H2020 PROGRAMME

H2020 (IN EUR)				
Type	**Execution until 31/12/2017**	**2018**	**Subsequent years**	**Total**
Commitments (operational costs)	405 915 132		240 084 868	646 000 000
Payments (operational costs)	222 547 770	95 296 147	328 156 083	646 000 000
Cumulative execution (operational costs)	**54.8%**	**78.3%**	**100.0%**	**100.0%**
Commitments (administrative costs)	1 202 744	5 461 900	31 335 356	38 000 000
Payments (administrative costs)	802 686	5 861 958	31 335 356	38 000 000
Cumulative execution (administrative costs)	**66.7%**	**100.0%**	**100.0%**	**100.0%**
Overall H2020 execution	**54.9%**	**78.7%**	**100.0%**	**100.0%**

2.3.3 TIME TO PAY

Operational payments

In 2017, 72 FP7 and H2020 reports (interim and final) were assessed (76 in 2016). The overall time-to-pay (TTP) for FP7 and H2020 reports reached 68 days (71 days in 2016). The gross TTP (including any suspensions due to requests for clarifications, amendments and mid-term reviews) further improved by 18 % compared to 2016, mainly due to the significantly faster assessment time for H2020 reports.

In more detail:

FP7

In 2017, 55 reports were assessed (76 in 2016), of which 40 were final and 15 interim.

The average TTP for these reports was 68 days (71 days in 2016). The gross time to pay further improved by 9 % compared to 2016, as the suspension time was shorter.

H2020

The average time-to-grant (TTG) for the 22 signed projects from call 2017 reached 233 days, an improvement of nearly 6 % compared to the time taken for call 2016.

The first 17 reports were assessed in 2017 (16 interim and 1 final). The average TTP of these reports is comparable to FP7 (64 days). However, the gross time to assess is significantly shorter (100 days) since the suspension time is nearly four times shorter than FP7, reflecting the more targeted checks and therefore faster responses from consortia.

Administrative payments

In 2017, the average TTP for administrative payments (invoices from suppliers of goods and service providers and cost claims from experts/staff) reached 16.7 days (marginally faster than 2015 and 2016). The number of late payments (3.8 % of the total number of invoices/claims) showed significant improvement on 2015 (12.5 %) and 2016 (8 %), reflecting the various rigorous controls put in place. Most of the late payments concern staff mission claims

2.4. PROCUREMENT AND CONTRACTS

The tender and contract management has been simplified as far as possible by joining the inter-institutional procurement procedures launched by the EC, and using the resulting multi-annual Framework Contracts. FCH 2 JU also cooperates with other Joint Undertakings in tendering needs in order to minimise the administrative effort. These Framework Contracts have been concluded mainly in the field of IT services and interim staff provision.

Most of FCH 2 JU's contracting in 2017 was done under existing multi-annual Framework Contracts, except for operational procurement activities (see procurement studies under Section 1.4 Call for tenders). In terms of volume, the procurement of studies was the most significant procedure launched, followed by various audit engagements and IT and communication services.

The table below gives an overview of the contracts awarded in 2017, including the procedure used in each case and the name of the contractor(s). Only those contracts with a value exceeding EUR 15 000 are listed below:

TABLE 2.4.1: CONTRACTS AWARDED IN 2017 (> EUR 15 000)

TYPE OF CONTRACT	AREA OR TITLE OF STUDY	SELECTION PROCEDURE (IF APPLICABLE FOR CONTRACT AWARDS)	NAME OF CONTRACTOR	AMOUNT (EUR)
Framework Contract	Operational study (regions)	Open procedure	Roland Berger GmbH	998 670.00
Direct service contract	Operational study (green hydrogen)	Open procedure	Hinicio	598 879.00
Specific contract	Operational study (regions)		Roland Berger GmbH	500 160.00
Specific contract	Operational study (regions)		Roland Berger GmbH	498 510.00
Direct service contract	Operational study (value chain)	Open procedure	E4tech (UK) Ltd	379 225.00
Framework Contract	Operational study (metering)	Open procedure	Air Liquide Advanced Technologies SA	377 500.00
Specific contract	Event organisation		TeamWork S.A.S.	277 263.80
Specific contract	Audit		Lubbock Fine Chartered Accountants	194 949.00
Direct service contract	Operational study (HRS availability system)	Open procedure	Spilett New Technologies GmbH	98 500.00
Direct service contract	Refurbishment of kitchen area	Negotiated procedure	Codabel Management SA	85 225.81
Specific contract	Operational study (metering)		Air Liquide Advanced Technologies SA	82 500.00
Direct service contract	Communication activities (book)	Negotiated procedure	EU Turn	48 750.00
Specific contract	IT services		Realdolmen S.A.	46 724.77
Specific contract	Interim services		Start People N.V.	42 080.00
Specific contract	Interim services		Start People N.V.	37 438.00
Specific contract	Interim services		Start People N.V.	37,438.00
Specific contract	IT services		Realdolmen S.A.	21 253.18
Direct service contract	Communication activities (film)	Negotiated procedure	87 Seconds SA	20 310.00
Specific contract	IT services		T-Systems International GmbH	18 342.72
Direct service contract	Communication activities (slide pack)	Negotiated procedure	AdGrafics Design Studio SPRL	18 100.00

2.5. IT AND LOGISTICS

The year 2017 was driven by the replacement of ageing end-user equipment (laptops, printers, copiers) and the migration of the infrastructure shared by the JUs to the cloud technology Infrastructure as a Service (IaaS). The year was also marked by the continuous deployment of the grant management tool COMPASS/SYGMA with new functionalities being made available to the FCH 2 JU.

Support to FCH core business

As in previous years, FCH staff were ensured adequate access to the complete set of EC applications for grant management, with an improved monitoring system of access rights, in line with prior audit recommendations. The role of the single point of contact (SPOC) was further extended with the routing functionality to deal with workload and blocking situations in work flows. Close contacts were maintained with the CSC to ensure the successful implementation of the H2020 calls. New work flows and functionalities were introduced by the CSC and made available to the FCH 2 JU, including the following:

- The expert contract and payment modules were integrated in the COMPASS work flow together with the existing expert management tool (EMI) and were used for the first time in January;
- The Legal Entities Status Update (LESU) work flow was released in August;
- The amendment work flow was adapted to the business practices and actors for the admissibility and assessment steps;
- The release of the Guarantee Fund became fully automated in the finalisation work flow (FINA);
- The GA Termination – EU Services Initiated (GTEU) work flow became available at the end of December;
- Two first phases of the Audit Report Implementation (AURI) work flow were made available during the second semester up to the integration with the REPA work flow. The third implementation phase, with full support for implementation of negative audits in closed projects, is foreseen for the first quarter of 2018.

Business support tools

In June, the IT TRUST platform became operational for the coordinators to enter their project results. The knowledge management officer now has a more efficient tool able to generate data quickly and easily to produce the effective dissemination of information and results of FCH technologies.

In 2017, the FCH 2 JU website hosting was renewed with the same supplier to ensure the stability and continuity of this essential tool for external communication and visibility of the FCH programme.

Following the initiative of Hydrogen Europe and Hydrogen Europe Research to develop a website of EU H_2 projects, the project was defined jointly with the aim of ensuring consistency and quality of data as well as greater interactivity. The database is under development and following successful testing will be integrated into the FCH website in 2018 (see also Section 1.5).

Support was also provided for more events using video broadcasting (such as info day, the financial workshop and general assemblies for the regions initiative).

FCH internal support

An assessment of the possibility of adopting the EC tool ABAC Assets led to the conclusion that it was not cost efficient. Consequently, the FCH 2 JU decided to continue to use its own internal tools.

The FCH 2 JU continued to use the shared Innovative Medicines Initiative Joint Undertaking JU (IMI JU) cloud application platform (for time management and selection procedures). An internal application 'missions tool' was developed and tested in Q4, 2017 in preparation for the full launch on 1 January 2018; and the online booking tool (OBT) provided by the travel agency finally became available for the FCH JU. The missions tool combines a paperless work flow with an improved monitoring function.

The FCH 2 JU decided to adopt ARES, the registration and document management system used by the EC. The preparatory work started at the end of the year and will be continued in 2018 with migration expected by the end of June 2018.

The specific contract under the EC FwC TESTA NG II for the provision of the secured telecommunication line was signed during the last quarter to allow for the continuation of the services in 2018 for all the Joint Undertakings.

Preparation of the next call for tender for a FwC to be launched in February 2018 and to replace the existing IT services contract which expires in November 2018 was initiated in the framework of the update of the common JU IT strategy and work plan with an assessment of needs and an analysis of the various options available to cover an on-site and off-site service desk as well as service management. The list of services to be covered by the call for tender was agreed and it was decided that other services (cloud hosting) will be contracted through existing interinstitutional Framework Contracts.

Logistics

A new lunch corner was built in the PO offices with the aim of optimising the available space, improving the working environment, and facilitating staff interactions

2.6. HUMAN RESOURCES

By the end of 2017, the FCH 2 JU programme office comprised 26 team members (24 temporary agents and 2 contract agents) representing 11 different EU Member States.

The organisation chart is provided in Annex 1. There was one amendment, which was approved by the FCH 2 JU GB on 18 April 2017 to include changes to the grades in order to better take into account the needs of the FCH 2 JU and the annual reclassification exercise.

The staff establishment plan (shown in Annex 2) was filled by completing one external selection procedure for the recruitment of a project officer CA FG IV (who took up duties on 16/04/2017) to replace the post that had become vacant in 2016.

The knowledge management officer resigned with effect on 31 December 2017 and a selection procedure was launched in 2017 in order to fill the post at the beginning of 2018[74].

Selection procedures were carried out for two seconded national experts (SNE) in the fields of knowledge management and communication; however, they were unsuccessful. To cover the needs and provide support to the PO in the areas of communication and knowledge management, three short-term contracts for interim services were used in 2017. It was decided to consider options for a longer-term solution possibly by transforming the posts into CA posts[75].

74 The selection procedure was completed and the new staff member will take up duties on 1 March 2018

75 A proposal to that effect will be submitted to the FCH 2 JU GB in the first quarter of 2018

Two trainees joined the PO for a six-month traineeship in the Operations and Communication unit and in the Finance and Administration Unit.

The annual **team-building** event was organised on 20-21 June 2017 with a study visit to the Delft University of Technology, Stedin HQ in Rotterdam and P2G site visit in Rozenburg.

The programme office depends on the expertise and motivation of its staff to achieve its goals. In 2017, emphasis was continually placed **on learning and development** by identifying training needs and promoting professional development through training opportunities.

Knowledge gaps and needs for individual training were identified during the annual appraisal exercise at the beginning of the year in order to manage talents and ensure consistency in professional and personal development of all staff in line with the PO mission and tasks. Different training options – classroom or online training, as well as various training material, have been made available in the training tool **EU Learn** introduced by the EC in 2017. In addition, three in-house training sessions were organised for all staff, including a two-day training session on public speaking and presentation skills which had been identified as an area requiring improvement.

The **Reclassification Exercise 2017** was carried out and the decision on staff reclassified (four temporary agents) was adopted with reclassifications taking effect retroactively on 1 January 2017 (for three staff members) and 1 February 2017 (for one staff member).

Following up on the **Implementing Rules** in the revised staff regulations, the following decisions were adopted through written procedures by the FCH 2 JU GB during 2017:

- On non-application of the Commission Decision on the maximum duration for the recourse to non-permanent staff in the Commission services (09/06/2017)
- On protecting the dignity of the person and preventing psychological harassment and sexual harassment (31/07/2017)
- On the probation period and appraisal of the executive director (10/11/2017)
- On the prevention and management of conflicts of interests of the staff members (10/11/2017)
- Guide to missions and authorised travel (14/12/2017).

03
GOVERNANCE

3.1. GOVERNING BOARD

The FCH 2 JU GB is composed of three representatives of the EC representing the EU, six representatives of Hydrogen Europe and one representative of Hydrogen Europe Research. In 2017, the vice-chair left and Jack Metthey, Deputy Director-General of DG RTD was elected as the new vice-chair. In June, one representative of Hydrogen Europe also left and was replaced by Didier Stevens from Toyota Motors Europe. The chair resigned in November and a new representative of Hydrogen Europe, Aliette Quint of Air Liquide Group, was appointed as a board member. The vice chair was acting chair until the election of the new chair Valérie Bouillon-Delporte on 6 February 2018.

During the year, the FCH 2 JU GB had three formal meetings on 24 March, 29 June and 26 October, respectively, and two other sessions on 26 January and 8 September. Following the initiation of strategic discussions at the end of 2016, on 26 January, the FCH 2 JU GB discussed and agreed on the strategic orientations and priorities which should frame the AWP. On 8 September, an ad-hoc session was held to agree on the selection of additional projects from the reserve list, taking into account priorities and ensuring budget optimisation while respecting H2020 rules. Furthermore, a discussion was held on the results of the FCH 2 JU interim evaluation under H2020. Meetings focused on strategic issues and discussions on progress of the programme, projects and initiatives (such as the studies or the regions initiative).

The FCH 2 JU GB also adopted major decisions by written procedure, including the following:

- assessment and approval of the 2016 Annual Activity Report;
- opinion on the 2016 annual accounts;
- approval of the assessment of the level of aggregated IKOP (FP7);
- adoption of the amendment to the 2017 budget and staff establishment plan;
- approval of the list of proposals from call 2017 selected for funding;
- approval of the two proposals selected from the reserve list for funding;
- adoption of the 2018 annual work plan, budget and staff establishment plan;
- approval of the 2018 additional activities plan;
- appointment of eight new members to the FCH 2 JU Scientific Committee;
- adoption of implementing rules concerning staff regulations (see Section 2.6).

More information on the role and composition of the Governing Board is available at:
http://www.fch.europa.eu/page/governing-board

3.2. EXECUTIVE DIRECTOR

According to Article 9 of the FCH 2 JU Statutes, the Executive Director is the legal representative and the chief executive responsible for the day-to-day management of the FCH 2 JU in accordance with the decisions of the Governing Board.

Bart Biebuyck was appointed as Executive Director by the FCH 2 JU Governing Board and took up his duties on 16 May 2016.

3.3. STATES REPRESENTATIVES GROUP

During 2017, the SRG met on 30 May and 21 November. Amongst others, its activities focused on monitoring the achievements and results of the FCH 2 JU, with particular attention being paid to the following:

1. Industry representatives were invited to make presentations at both meetings. In the first, the status and vision for the transport sector were presented. The second meeting underlined the overall need for hydrogen and the commitment by industry to continue along this path. Industry further emphasised the need to transmit this vision to the relevant policymakers in each respective Member State.

2. Development of national plans to comply with the Alternative Fuels Directive: an update was provided by the EC (DG MOVE) on the status of the national policy frameworks (NPFs) submitted to date by the Member States. An EC Communication[76] states that 14 Member States have included hydrogen in their NPFs.

3. National activities were presented, in particular in Belgium. These updates served to inform all Member States about the actors, initiatives, funding schemes and projects currently in place.

4. Further collaboration was started within the SET Plan, in particular, Action 8 (Renewable Fuels and Bioenergy) to enable the inclusion of hydrogen. EC representatives provided updated information on the work within this group. This raised their awareness about hydrogen as a renewable fuel and work is under way to ensure that it is included in working documents as far as possible along with the need for the participating Member States to their coordinate efforts internally.

During 2017, the SRG was consulted on developing call topics and documents and on the AWP 2018. In December, the Governing Board validated a set of answers provided by the Coordinators' Group to the questions/comments raised by the SRG.

At the 21 November meeting, elections were held for the positions of chair and vice-chair. The new chair is Frano Barbir (Croatia), and Ioan Iordache (Romania) and Dirk Schaap (the Netherlands) hold the vice-chair positions.

Regions initiative

The coalition of regions and cities which started in 2016 grew considerably during 2017: 88 regional and municipal public authorities are currently participating in this initiative, accounting for over a quarter of the European population and GDP. Over 50 representatives from industry are also participating.

Since April 2017, the FCH 2 JU has contracted an external consultant to provide the necessary support for the initiative. As a result, the following has been accomplished:

- A comprehensive self-assessment was completed by 74 regions and cities, providing valuable insights into a variety of local, hydrogen-related topics. Notably, the main drivers behind the interest in FCH technologies concern environmental considerations and economic growth;
- Technology introduction dossiers were completed and distributed to 25 applications;
- Similarly, preliminary business analyses were compiled for the same set of applications. Both of these are available at the FCH JU website;
- A funding tool was developed which contains information from more than 60 data sets, has a user-friendly search function and is in its testing phase.

76 Detailed Assessment of the National Policy Frameworks, SWD(2017) 365 final

Planning for activities in 2018 was advanced. Specific applications were selected based on a set of agreed-upon criteria for further in-depth study. These were cars, buses, trains, delivery vans, garbage trucks, and the corresponding green hydrogen production. In addition, maritime applications, commercial buildings and heavy-duty transport were selected for further discussion on technology development needs.

Regional workshops will take place in the first half of 2018 to engage local stakeholders, disseminate the results of ongoing work, and provide a platform for constructive dialogue from which future activities can emerge.

3.4. SCIENTIFIC COMMITTEE

The Scientific Committee (SC) is an advisory body to the Governing Board and comprises a maximum of nine members. These members reflect a balanced representation of worldwide recognised expertise from academia, industry and regulatory bodies.

The role of the SC is to provide: (a) advice on scientific priorities to be addressed in the annual work plans; and (b) advice on scientific achievements described in the annual activity reports.

The SC held two meetings in the first-half 2017 in order to provide the Governing Board with advice on both of the above-mentioned actions. The chairperson attended the board meetings (in March and June 2017) and took part in its deliberations, but without voting rights.

In June 2017, the mandate of eight of its nine members expired (appointed in 2015 for two years). At the beginning of year, the board assessed their competences to determine whether or not the composition of the SC still reflected the programme's strategic orientation (taking into account the evolution of technology and openness to new markets, including sector coupling). Subsequently, the board decided not to renew them but to appoint new members. A competition was opened for these eight positions: 15 applications were received during summer 2017 and the selection procedure took place in October 2017. Eight new members were appointed (including three from a previous composition who had re-applied) and the first informal meeting of the new SC was held during the PRD event in Brussels (November 2017).

3.5. STAKEHOLDERS FORUM

The Stakeholder Forum is one of the FCH 2 JU key governance bodies, which ensures the transparency and openness of the FCH 2 JU programme. It is also the occasion to enhance FCH 2 JU communication activities as it gathers a large number of policymakers and EU stakeholders. It recently provided an opportunity to tap into key communication objectives and to enlarge its target audiences to newcomers while addressing new topics.

In 2017, the 10th edition of the FCH JU Stakeholder Forum was the occasion to hold a unique celebratory event and special highlights. Held in a new and exceptional venue, the programme outlined the work done to date and provided an opportunity to debate and take stock of the latest developments. For more information on the SF in 2017, please see Section 2.1.2.

04
INTERNAL CONTROL FRAMEWORK

The foundation of the FCH 2 JU Internal Control Framework is provided for by a set of 16 internal control standards (ICS) which were adopted by the Governing Board on 15 June 2010.

In 2017, the EC moved to a principle-based system with the aim of ensuring robust internal controls through consistent assessment by the Commission, while providing the necessary flexibility to allow departments to adapt to their specific characteristics and circumstances. The new Internal Control Framework comprises five internal control components and 17 principles based on the COSO 2013 Internal Control-Integrated Framework.

In the context of preparing the transition to this new Internal Control Framework, which will be submitted to the FCH 2 JU for approval in the first half 2018, an awareness session was held on 29 November 2017 explaining the relevance of these five components to the FCH 2 JU activities.

This session focused mainly on the principles governing a well-functioning control environment, providing practical examples and case studies.

In addition, the FCH 2 JU Internal Control Framework provides for handover reports, briefings, monthly reporting on specific topics (such as budget execution, financial management and monitoring of key performance indicators) and reporting at weekly management meetings. The heads of unit review of the year and declaration of assurance are covered in their input into the AAR and in a review by the internal control coordinator on the state of the internal control system (see Sections 4.6 and 5.2).

4.1. FINANCIAL PROCEDURES

The financial procedures guide FCH 2 JU operations and set out how the JU uses and manages its funds and resources.

An update of the financial circuits was carried out in 2017 to provide for electronic workflows in the financial transactions.

In 2017, the activities included the following:

- Effective implementation of the newly developed COMPASS work flows (beneficiary termination assessment, audit input file validation, legal entity status update, changes in the amendment work flow);
- Active communication and cooperation with the CSC, through participation in various working groups, with the aim of enhancing a common understanding and interpretation of the requirements of newly developed work flows for H2020 in the context of the FCH 2 JU environment;
- FCH 2 JU ensured implementation of the research family's common anti-fraud strategy, adopted on 18 March 2015 by the CSC, by attending regular meetings of the Fraud and Anti Irregularity Committee (FAIR) coordinated by DG RTD. In 2017, two meetings took place on 12 July and 6 October to follow up on the action plan derived from the strategy and to discuss the update to be carried out in the context of the European Anti-Fraud Office (OLAF) review of the strategy. The FCH 2 JU has an anti-fraud correspondent and encourages its employees to take part in the anti-fraud trainings organised by DG RTD.

4.2. *EX-ANTE* CONTROLS ON OPERATIONAL EXPENDITURE

Ex-ante controls are essential to prevent errors and avoid the need for *ex-post* corrective action. In 2017, the FCH 2 JU continued to apply the provisions of 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*".

Therefore, the main objective of *ex-ante* controls is to ascertain that the principle of sound financial management has been applied.

The JU has developed and continued to apply well-developed procedures defining the controls to be performed by project and finance officers for every cost claim, invoice, commitment and payment, taking into account risk-based and cost-effectiveness considerations.

In 2017, specific attention was paid to:

- Participation of project and finance officers at H2020 project kick-off meetings in order to clearly communicate the financial reporting requirements;
- Increased financial checks during the grant agreement preparation (GAP) phase;
- Reinforced monitoring and targeted checks during *ex-ante* controls for interim and final payments in accordance with the H2020 *ex-ante* control strategy, as published by the CSC Steering Board on 8 June 2017. FCH actively participated in the relevant workshops.
- On 30 March 2017, the FCH 2 JU organised the second financial workshop on H2020 financial rules and prevention of errors, focusing on the specificities and business models that are pertinent for FCH 2 JU projects. All successful participants from the 2014, 2015 and 2016 calls were invited to the session. The workshop, which was recorded and web streamed at the same time, was attended by 80 people (including online participants). The presentations were made available on the FCH 2 JU website: http://www.fch.europa.eu/page/h2020-financial-workshops.

4.3. *EX-POST* CONTROL OF OPERATIONAL EXPENDITURE AND ERROR RATES IDENTIFIED

Ex-post controls are defined as the controls executed to verify the financial and operational aspects of finalised budgetary transactions in accordance with Article 19 of the FCH 2 JU Financial Rules.

The controls are the last stage of the JU's control strategy in a project life cycle. This stage includes *ex-post* audits as well as the recovery/correction of any amounts found to have been paid in excess of the sum due.

The main objectives of the *ex-post* controls are to ensure that legality, regularity and sound financial management (economy, efficiency and effectiveness) have been respected and to provide the basis for corrective and recovery activities, if necessary.

FP7 programme

FCH 2 JU *ex-post* controls of FCH FP7 grants included financial audits carried out by external audit firms.

The main activities of *ex-post* controls include management of FP7 *ex-post* audits of beneficiaries via a contract with external audit firms, and implementation of the FP7 *ex-post* audit strategy to ensure appropriate audit coverage of the cost claims validated.

At the same time, a primary goal of FP7 *ex-post* controls was to achieve performance efficiency – i.e. trying to minimise the costs of audits while maintaining targeted and appropriate audit coverage.

In 2017, in line with the multi-annual FP7 *ex-post* audit strategy of the FCH JU, the following new audits were launched:

- 16 representative audits, covering the FCH JU's top beneficiaries not previously audited under the FP7 programme, and randomly selected beneficiaries to ensure representative results.

For execution of the FP7 audits in 2017, the FCH 2 JU used an RTD FP7 Framework Contract for the second time (cascade system).

After conflict of interest and capacity checks, it signed a specific contract for batch audits with the external audit firm (EAF) Lubbock Fine.

Because of its multi-annual nature, 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, and systematic errors have been detected and corrected.

During this stage, the main legality and regularity indicator is the 'error rate' detected by *ex-post* audits. The following two aspects must be considered when providing information on error rates and inferring conclusions from such errors:

- Due to the multi-annual perspective of *ex-post* audits, their effectiveness must be measured by presenting '**cumulative**' information on the errors detected;

- **Two types of *ex-post* audits** must be distinguished with **two different objectives**: 'representative' audits with a goal of producing a representative estimate of the error rate present in the population, and 'corrective' audits (e.g. risk-based audits) with the objective of detecting and correcting as many errors as possible.

Bearing in mind these two aspects, three types of cumulative error rates are calculated to provide a comprehensive overall view of the results of *ex-post* audits (see Table 4.3.3.). For each type of error, the rate is calculated at both the 'total cost' and at the 'FCH JU contribution' level. This distinction is necessary as not all errors detected at total cost have a financial impact on the FCH JU contribution[77].

Overall error rate

This is the error rate derived from all audits, comprising both 'representative' and 'risk-based' audits. It is calculated as a percentage of the value[78] of the errors detected divided by the value of total costs accepted by the JU.

It provides information on the importance of the errors detected, but it cannot be used as a reference for inferring conclusions on the expected error in the non-audited population, for the following reasons: 1) it is the result of 'representative' and 'risk-based' audits with two different objectives; and 2) as it is based on values, it is easily influenced by the error rates resulting from the individual audits of the cost claims of the highest values, which may not necessarily be those most representative for inferring conclusions.

Residual error rate

This is the level of error remaining in the population after corrections and recoveries made by the FCH JU. This includes the extrapolation of audit results to non-audited contracts and the correction of errors. The formula for the calculation of the residual error rate, in line with the *ex-post* strategy and shown in Annex 9, is based on the following assumptions: 1) all the errors detected will be corrected; and 2) the residual error rate for participations subject to extrapolation is estimated to be equal to the non-systematic error rate.

Ex-post audit resources

The lean structure of the FCH JU does not allow for the setting up of an internal *ex-post* audit section, therefore all *ex-post* audits are outsourced to external audit firms.

Whereas the execution of the audit work is externalised, some of the JU's staff ('*ex-post* audit team') are responsible for managing *ex-post* audits, in particular the following three processes:

1. Planning (i.e. selection of 'representative' and 'risk-based' audits, coordination with EC audits and preparation of audit input files);

2. Monitoring (i.e. regular follow-up of audit status, interaction with audit firms on technical questions, and more importantly, quality checks of audit reports);

3. Evaluation/implementation of audit results (i.e. inferring conclusions on the basis of identified error rates, extrapolation procedures and initiation of recovery orders/offsetting with future payments to correct errors detected).

77 For example, an error detected on indirect costs (at total cost level) for a beneficiary using the 'actual' indirect cost method but with a maximum reimbursement rate of 20 % could have no impact in the FCH JU contribution if 'declared' and 'eligible' indirect costs are above the 20 % reimbursed by the JU.

78 When considering the value of errors detected, three calculations are provided: 1) with only the errors in favour of the JU (i.e. ineligible costs detected by the auditors; the JU has to recover the unduly paid funds, and these errors are expressed in negative values); 2) with only the errors in favour of the beneficiary (i.e. additional eligible costs identified by the auditors and not declared by the beneficiary, who can submit an additional cost claim, and additional payment by the JU is subject to certain conditions; these errors are expressed in positive values); and 3) with the total net value of errors (in favour of both the JU and the beneficiary).

The following table gives an overview of the resources devoted to *ex-post* audits:

TABLE 4.3.1: RESOURCES DEVOTED TO *EX-POST* AUDITS

	2011	2012	2013	2014	2015	2016	2017
Internal resources *ex-post* audits[80]	1 FTE	1.5 FTE	2 FTE	2 FTE	1.5 FTE	2 FTE	2 FTE
Cost of externalised audits (commitments, in EUR)	EUR 77 820	EUR 208 665	EUR 161 082	EUR 245 081	EUR 315 716	EUR 206 762	EUR 194 949

Ex-post audits – coverage

The FCH JU FP7 *ex-post* audit strategy was adopted by the Governing Board on 6 January 2011, and its implementation began in September 2011.

The following table gives an overview of the number of *ex-post* audits and their audit coverage:

TABLE 4.3.2: NUMBER OF AUDITS AND AUDIT COVERAGE CUMULATIVE

BATCH	YEAR	TO BE LAUNCHED	ON-GOING	FINALISED	TOTAL	OF WHICH	
						REPRESENTATIVE	RISK-BASED
1st batch	2011	0	0	5	5	5	0
2nd batch	2011	0	0	7	7	6	1
3rd batch	2012	0	0	9	9	7	2
4th batch	2012	0	0	12	12	12	0
5th batch	2013	0	0	15	15	11	4
6th batch	2014	0	0	20	20	15	5
7th batch	2014	0	0	2	2	0	2
8th batch	2015	0	0	29	29	27	2
9th batch	2016	0	0	18	18	16	2
10th batch	2017	0	6	10	16	12	4
Total (audits)		**0**	**6**	**127**	**133**	**111**	**22**

Total (cost claims)	**534**
Total costs accepted by FCH JU (*cumulative*) (in EUR) **(A)**	714 764 282
Total costs of audits launched (*cumulative*) (in EUR) **(B)**	159 861 410
Total costs of audits finalised (*cumulative*) (in EUR) **(C)**	149 401 264
Direct audit coverage of total audits (in %) **(B/A)**	22 %
Direct audit coverage of finalised audits (in %) **(C/A)**	21 %
Total FCH JU beneficiaries **(D)**	583
FCH JU beneficiaries audited **(E)**	131
Audit coverage (number of benef.) of total audits (in %) **(E/D)**	22 %

The first cost claims were received by the FCH JU in the spring of 2011 and the first *ex-post* audits were launched immediately after the JU's validation of the first claims. In the calendar year 2011, two batches were launched: the first (five audits) in September 2011 and the second (seven audits) in December 2011. During 2012, two additional batches were launched: the third (nine audits) in February 2012 and the fourth (12 audits) in December 2012. In 2013, one batch was launched: the fifth (15 audits) in May 2013. In the calendar year 2014, two additional batches were launched: the sixth (20 audits) in May 2014 and the seventh (two audits) in October 2014. In 2015, the eighth batch (29 audits) was launched, of which 27 were considered as representative audits and two were launched on request as part of the risk-based strategy.

79 Due to the lean structure of the FCH JU, and for cost-efficiency reasons, there is no single function in the JU fully dedicated to the management of *ex-post* audits. The reported figure in 'FTE: full-time equivalent' is therefore an estimation of the time devoted by various members of JU staff to *ex-post* audits to manage the three processes under the JU's responsibility (i.e. planning, monitoring/quality checks, and evaluation/implementation of audit results).

In 2016, batch 9 was launched with 16 representative and two corrective audits, with the aim of optimising the total cost of audits while maintaining appropriate audit coverage (resulting in overall direct audit coverage of 24 % in 2016 compared to 22 % in 2015). For corrective audits, the FCH 2 JU selected two beneficiaries, previously audited at the very beginning of the FP7 audit campaign, for a follow-up audit to ensure proper implementation of the previous audit findings and recommendations.

In 2017, it launched the tenth batch of 16 FP7 audits, 10[80] of which were closed by 31 December 2017 and considered for the error-rate calculation.

By 31 December 2017, all previous batches had been finalised.

In conclusion, since launching the FP7 *ex-post* audits, 133[81] audits have been launched of which 111 were 'representative' and 22 'risk-based', covering in total EUR 159.38 million of accepted costs declared by the beneficiaries, with an average sum of EUR 1.2 million of accepted costs per individual audit.

This resulted in direct audit coverage of 22 %, from all validated costs claims by the FCH for all 155 projects totalling EUR 715 million since the beginning of the FP7 Programme (until 31 December 2017).

Ex-post audits – error rates

The error rates resulting from the 127 finalised audits (of which 107 are representative and 20 are risk-based) are as follows:

TABLE 4.3.3: INDICATORS OF ERROR

	ACHIEVED CUMULATIVE PERIOD (AS AT 31/12/2017)	
	TOTAL COST	FCH JU CONTRIBUTION
Costs accepted by FCH JU Financial Officers (FO) (in €) (**A**)	116 567 885	53 260 169
Overall errors (in €) in favour of the FCH JU (**B**)	-4 503 122	-1 879 549
'Overall Error rate' (only in favour of the FCH JU) (**B/A**)	**-3.86%**	**-3.53 %**
Overall errors (in €) in favour of the beneficiary (**C**)	3 589 356	1 110 980
'Overall Error rate' (only in favour of the beneficiary) (**C/A**)	**3.08%**	**2.09 %**
Total Overall errors (in €) (in favour of the FCH JU and in favour of the beneficiary (**D**)	-913 767	-768 569
'Overall Error rate' (netting off errors in favour of the JU and of the beneficiary (**D/A**)	**-0.78%**	**-1.44 %**
'Representative error rate' (formula in Annex 9) (%)	**-2.73%**	**-2.14 %**
'Residual error rate' (formula in Annex 9) (%)	**-1.13%**	**-1.09 %**

The difference between the 'representative error rate' and the 'residual error rate' is the result of the following: 1) the correction of errors in an important part of the population due to the high audit coverage; and 2) the effect of extrapolation of audit results to non-audited cost claims of audited beneficiaries.

In 2017, an overall 'net error rate'[82] on costs fell to -0.78 % (compared to -1.05 % in 2016) and, more significantly, an overall 'net error rate' on FCH contribution (directly affecting the EC budget) remained stable in 2017, amounting to -1.44 % compared to -1.34 % in 2016.

Based on the calculation formula (derived from the FP7 *ex-post* audit strategy, and coherent with the overall RTD FP7 *ex-post* audit strategy – see Annex 9), on the representative error rates, where all positive audit adjustments (i.e. adjustments in favour of the beneficiaries) appear as zero adjustments, whereas all negative audit adjustments appear as their exact value, the representative error rate on total costs audited fell from -2.89 % (in 2016) to -2.73 % in 2017. The representative error rate on the FCH contribution (following the same calculation formula) decreased from -2.19 % (in 2016) to -2.14 % in 2017.

80 By 31 December 2017, there were six open audits from Batch 10, launched in 2017. The FCH 2 JU did not finalise these audits due to ongoing discussions with the beneficiaries that also required coordination with other DG RTD services (under FP7) to ensure coherent audit results across different stakeholders vis-à-vis the same beneficiary.

81 In 2016, for the first time FCH 2 JU launched an audit on two previously audited beneficiaries (from Batch 1); therefore, the total number of beneficiaries audited is lower than the total number of audits launched under the FP7 audit campaign.

82 Net error rate: an error rate taking into account the net amount of positive and negative adjustments on the total audited costs/total audited FCH contribution.

In 2017, due to sufficient audit coverage and a 'cleaning' effect, the FCH was able to achieve a most decisive '**residual error rate**' (following the materiality criteria of 2 % threshold for AAR reservation) **of –1.13 % on the total costs audited** (compared to -1.24 % in 2016) **and of –1.09 % on the FCH** contribution (compared to -1.19 % in 2016).

Further analysis of the error rates and whether or not a reservation is necessary in the declaration of assurance concerning the accuracy of the cost claims is addressed in Section 5.3.

Most common audit findings

For the direct costs, most of the findings in the audits related to an incorrect calculation of the hourly rates applied by the beneficiaries to calculate personnel costs.

The FCH 2 JU has learnt lessons from the most common audit errors and, as part of the preventive measures, during the *ex-ante* process the FCH team is focusing on proper explanations of correct interpretations of the applicable financial rules towards the beneficiaries.

For the indirect costs, the findings related mainly to incorrect calculations (inclusion of ineligible costs) or to the use of budgeted rather than actual indirect cost figures. These errors should be completely avoided in the H2020 programme, which introduces a 25 % flat rate on indirect costs.

Implementation of audit results

As a result of errors identified during the FCH 2 JU *ex-post* audits, JU funds paid unduly must be recovered. The FCH 2 JU has implemented the necessary controls and monitoring mechanisms to ensure that all errors detected in favour of the JU are corrected in due course (either through a recovery order or by offsetting a future payment).

The detailed situation on the implementation (at project level) of *ex-post* audit results is given below:

TABLE 4.3.4: IMPLEMENTATION OF *EX-POST* AUDIT RESULTS IN FAVOUR OF THE FCH JU (EUR)

SUMMARY OF NEGATIVE AUDIT ADJUSTMENTS. BENEFICIARIS WITH PFAR APPROVED BY 31/12/2017						
AUDIT LAUNCHING YEAR	AUDIT ADJUSTMENT (IN FAVOUR OF FCH JU)		ADJUSTMENTS PENDING IMPLEMENTATION		ADJUSTMENTS IMPLEMENTED	
	ON TOTAL COSTS	ON FCH JU CONTRIBUTION	ON TOTAL COSTS	ON FCH JU CONTRIBUTION	ON TOTAL COSTS	ON FCH JU CONTRIBUTION
2011	824 960	214 492			824 960	214 492
2012	629 111	346 512			629 111	346 512
2013	138 734	66 592			138 734	66 592
2014	1 096 153	486 361			1 096 153	486 361
2015	1 359 941	314 708	140 051	23 233	1 219 890	291 475
2016	324 005	102 066	22 145	12 149	301 860	89 917
2017	192 217	75 419	179 614	74 854	12 603	565
	4 565 122	**1 606 150**	**341 810**	**110 235**	**4 223 312**	**1 495 915**
NOTE:	The total amount of negative adjustments (4 565 122) doesn't match with the same total in table 4.3.3 (4 503 122) because in this table the information is at the level of project (in order to indicate afterwards the amount implemented, which is always by project), whereas in table 4.3.3 the informationis given at the level of beneficiary.					

At the cut-off reporting date (i.e. 31 December 2017), the percentages of total adjustments effectively implemented are over 90 % at both total cost and FCH 2 JU contribution level. These percentages prove the continuous timely implementation of audit results, and consequently the effective correction of errors detected by the FCH 2 JU. Indeed, the vast majority of the adjustments with pending implementations are not due to JU delays, but can be simply explained by the fact that the audits have been finalised recently and implementation will follow shortly. This is the case for most of the audits launched in 2017 for which letters of conclusion have been sent very recently.

As can be seen in the table above, the FCH 2 JU has implemented results from all the audits launched before 2015.

To date, the FCH 2 JU has focused its *ex-post* audit effort on finalising a representative number of audits in order to have sufficient information for the calculation of a 'representative error rate' in preparation for the 2017 AAR.

Implementation of extrapolation/"extension of audit findings"

Extension of the audit findings (formerly known as 'extrapolation') is the process whereby 'systematic' errors detected in audited cost claims are 'extrapolated' to all other non-audited FCH 2 JU claims from the same audited beneficiary. The timely implementation of 'extension of audit findings' relies on beneficiaries preparing and submitting revised cost claims from which the effect of any systematic error(s) detected in audits has been eradicated.

The overall situation on the implementation of extension of audit findings is given below:

TABLE 4.3.5: IMPLEMENTATION OF "EXTENSION OF AUDIT FINDINGS" OF *EX-POST* AUDIT RESULTS

	BENEFICIARIES	COST CLAIMS
Audits finalised	127	
Letters of conclusion sent as of reporting date	123	
Of which potentially concerned by extrapolation	43	
Extrapolation feedback not received from beneficiary	0	
Extrapolation feedback received from beneficiary	43	153
Of which projects not affected		72
Of which projects affected		81
Of which non-implemented		4
Of which implemented		77

At the cut-off reporting date (31 December 2017), 41 of the 127 finalised audits were potentially affected by extrapolation. Feedback was received from all the beneficiaries where they provided the necessary information covering 153 cost claims. Of these, 81 were affected by an extension of audit findings, and the FCH 2 JU implemented the extrapolation in 77 of these (95 %). This represents a significant increase compared to last year when the FCH 2 JU reported an 85 % implementation rate.

Liquidated damages[83]

Liquidated damages are applied systematically by the FCH 2 JU under FP7. In some cases, they do not result in a recovery order due to application of the *de minimis* rule.

At the cut-off reporting date (31 December 2017), 33 of the 127 finalised audits were assessed as requiring liquidated damages for a total amount of EUR 130 760. Pre-information letters (i.e. letters of conclusion) were sent to beneficiaries in all 33 cases, and recovery orders have already been issued and cashed for 30 cases, for a total value of EUR 101 087.

H2020 programme – *ex-post* controls, H2020 audit strategy and cooperation with the CSC

Ex-post controls of operational expenditures for H2020 are designed and implemented in line with the Horizon 2020 *Ex-Post* Audit Strategy[84]. The Horizon 2020 Common Support Centre (CSC) developed this audit strategy in cooperation with all of its clients (i.e. the entities that implement the Horizon 2020 budget: European Commission Services, Executive Agencies and Joint Undertakings).

The Common Audit Service (CAS), unit RTD.J.2 of the Common Support Centre (CSC) ensures the harmonised implementation of H2020 *Ex-Post* Audit Strategy for the EU's R&I expenditure, serving all 20 different H2020 stakeholders. The CAS uses the IT tool AUDEX for audit process management.

Its mission is to deliver a corporate approach for the audit cycle: audit selection, planning, application of rules, relations with beneficiaries, and management information on the audit process.

The main objective of the audit strategy is to provide the individual authorising officers with the necessary elements of assurance in a timely manner, thereby allowing them to report on the budget expenditure for which they are responsible. *Ex-post* controls on operational expenditure contribute in particular to:

83 Liquidated damages will only be applied where the unjustified contribution exceeds 2 % of the total contribution claimed for the given period

84 Ref. Ares(2016)981660 - 25/02/2016, endorsed by the CSC Steering Board

- assessing the legality and regularity of expenditure on a multi-annual basis;
- providing an indication of the effectiveness of the related *ex-ante* controls;
- providing the basis for corrective and recovery mechanisms, if necessary.

The FCH 2 JU is effectively integrated in this control chain: it participates in the audit process definition and in the monitoring of its implementation in continuous cooperation with the CAS and its clients. The main objectives of this cooperation are to align operations and exploit synergies on the common audit effort. The efficiency gains will reduce the audit costs and the administrative burden on auditees, always in line with the specific objectives explained above for *ex-post* controls.

The implementation of all *ex-post* audit results remains the responsibility of the FCH 2 JU.

The FCH 2 JU also ensures the implementation of the research community's common anti-fraud strategy. The main actions derived from the strategy include the organisation of awareness-raising sessions within the JU and cooperation with OLAF (in the case of risk-based audits conducted by the CAS or outsourced contractors). Implementation of the action plan derived from the strategy is monitored by the FAIR – see also Section 4.1.

In 2017, the FCH 2 JU continued close cooperation with the CAS, mainly on the following topics:

- selection and launch of the first specific FCH 2 JU H2020 audits;
- application of the sampling methodology for Joint Undertakings;
- discussions on working arrangements for Article 10 audits;
- reaching agreement on the procedure for handling sensitive audit cases[85];
- development of the AUPR (AUdit PRocess) work flow in Sygma;
- finalisation of the AURI (audit implementation process) work flow in Sygma.

Cooperation in the area of *ex-post* audits with CAS was also one of the main elements in the scope of the IAS audit for 2017 on 'Coordination with the CSC and implementation of CSC tools and services in the Fuel Cells and Hydrogen 2 Joint Undertaking' where IAS recognised *"a proactive approach taken by FCH 2 JU in relation to the coordination with the CAS for the ex-post audits, including its contribution to CLAR meetings and bilateral meetings with the CSC"*[86].

In 2017, as a result of the cooperation between the CAS and FCH 2 JU, the following milestones were achieved:

- launch of the first two rounds of H2020 audits with FCH 2 JU cost claims;
- application of the JUs' sampling methodology for the first specific representative sample for FCH 2 JU;
- agreement on the Working Arrangements for H2020 Processes: Art. 10[87];
- endorsement of the Commission Guidance on Handling of Contentious/Sensitive Audit Cases in H2020 by the CSC Executive Committee on 23 November 2017;
- modification of a draft SYGMA-COMPASS work flow for *ex-post* audits to encompass consultations on sensitive audit cases, which is expected to be finalised in 2018;
- successful launch of the AURI workflow for implementation of the audit results.

85 An audit is considered sensitive and/or contentious if at least one of the following criteria is met: important contestations either before or after the closure of the audit; systemic or recurrent errors above materiality threshold identified by the audit and with high financial impact; high error rate (errors with negative impact > 10 %

86 Ref. Ares(2017)5996962 – 07/12/2017

87 Document was adopted by the CSC Executive Committee by written procedure on 31 January 2018

H2020 *ex-post* audit methodology and error rates – corporate approach

The H2020 audit strategy builds upon different layers of audits:

- a corporate layer consisting of a common representative sample (CRS)[88] complemented by risk-based samples;
- an additional sample for entities with specific grant agreements or a separate discharge procedure and Article 10 audits on the demand of the JUs.

Based on the H2020 audit strategy, the CRS provides an estimate, via a representative sample of cost claims across the whole R&I family, of the overall level of error in the research Framework Programmes, across all services involved in its management.

In H2020, all 20 implementing entities are expected to follow the same homogeneous overall *ex-ante* control system[89].

In 2017, given the stage of the programme life cycle, a limited number of cost claims totalling EUR 4.1 billion of requested funding had been received by the services by the end of 2017 (as compared to the overall H2020 budget of EUR 63.6 billion). The first Horizon 2020 audits were launched in the middle of 2016 and further audits were launched in 2017. The first CRS and an additional sample were selected. In total, by December 2017, 625 participations had been selected for audit, covering all the services signing grants in Horizon 2020.

In total, the audit of 392 participations was finalised (385 on the 2017 selection of 625 participations and 7 on the 2018 selection). This includes 110 out 142 selected in the first CRS.

On 31 December 2017, the error rate for the H2020 programme as a whole was:

- Overall detected error rate based on 392 participations: 1.54 %.
- The detected error rate based on 110 out of 142 participations selected in the first CRS was 1.6 %. However, if the draft audit reports are taken into account the expected representative error rate for the full sample would be around 2.82 %.
- Residual error rate for the research family: 1.44 %, expected to rise to around 2.24 % when taking into account the draft audit reports.

FCH 2 JU specific detected error rate for H2020

Given the relatively small share of the FCH 2 JU's budget (EUR 665 million: 1 %) compared to the overall H2020 budget (EUR 63.584 million[90]: 100 %), the number of projects selected for *ex-post* audit by the CAS via the common representative sample is limited.

Therefore, FCH 2 JU in line with Annex 1 to the H2020 audit strategy, planned for additional audit sampling (i.e. JUs' specific sample) in order to ensure sufficient *ex-post* audit coverage and allow a representative error rate on FCH 2 JU expenditure to be calculated over time. This is necessary to provide reasonable assurance to the JU executive director in view of his declaration of assurance and the separate discharge procedure for the JU.

For the first CRS, selected by the CAS in 2016, there were no cost claims pertinent to FCH 2 JU in the auditable population, as the first H2020 cost claims for FCH 2 JU grants were only validated in 2017.

In 2017, the FCH 2 JU validated cost claims for 16 different projects (calls 2014 and 2015) of the total amount of EUR 54 million (cost), of which EUR 37 million represented the EU contribution.

In 2017, the Undertaking selected (in cooperation with the CAS) six risk-based audits and nine representative audits, covering EUR 13.5 million of costs and EUR 8.1 million of EU contributions (direct audit coverage of 25 % on costs and 22 % on the EC contribution[91]).

88 Taken biannually for 162 participations; MUS sampling is applied; population is determined by the costs declared and paid by the beneficiaries through financial statements which are the basis for calculating the EU contribution.

89 Guidance H2020 *ex-ante* controls on interim and final payments, version 1.0

90 H2020 operational budget of EUR 70.280 million less EUR 6.696 million related to EIT, financial instruments and others

91 In line with the draft JUs' sampling methodology which provides for a target audit coverage of 20 %

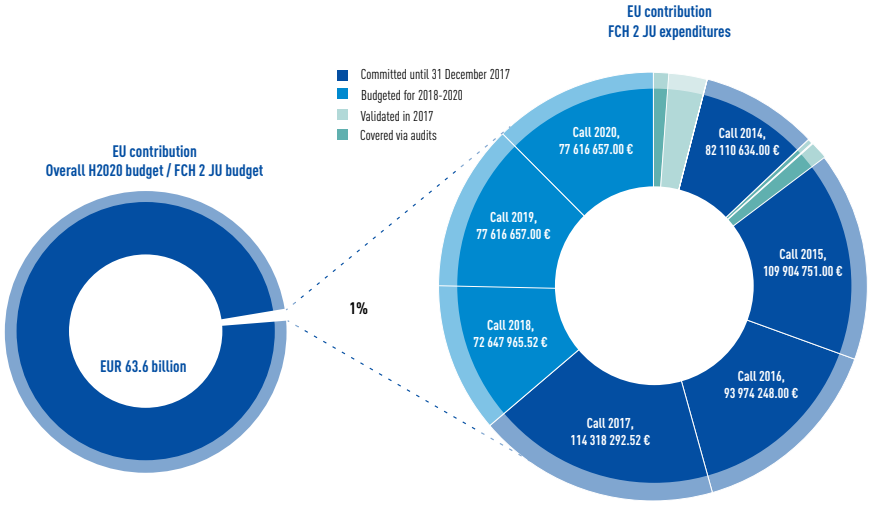
The following table and graphs provide a comprehensive view of the H2020 operational budget[92] (per call) assigned to the FCH 2 JU compared to the overall H2020 budget together with an overview of the validated expenditure in 2017 for FCH 2 JU grants from calls 2014 and 2015 and the related audit coverage by FCH 2 JU specific audit sample:

TABLE 4.3.6: H2020 EXPENDITURE – VALIDATED IN 2017 AND COVERED VIA H2020 *EX-POST* AUDITS

EU CONTRIBUTION	IN EUR	PERCENTAGES	NUMBER OF COST CLAIMS SELECTED FOR AUDITS
Validated via cost claims in 2017	37 089 451	100 %	
Covered by representative audits	3 160 885	9 %	10
Covered by risk-based audits	4 982 869	13 %	6
Total direct audit coverage	**8 143 755**	**22 %**	**16**

Representative audits were selected following a common JU sampling methodology[93]. The methodology is built on the principles of stratified random sampling (which is similar to the method used by the FCH JU in FP7) with the following objectives:

- efficient use of resources;
- focusing on large value cost claims;
- providing an overview of the full range of projects and beneficiaries in the FCH 2 JU programme;
- ensuring representability of the results, as per the International Standards on Auditing.



Out of 15 audits, 11 audits were launched in 2017 and one audit was closed as at 31 December 2017, with zero audit adjustments.

Risk-based audits were selected following a bottom-up approach, based on assessment and knowledge of the projects by the operational services.

Conclusions

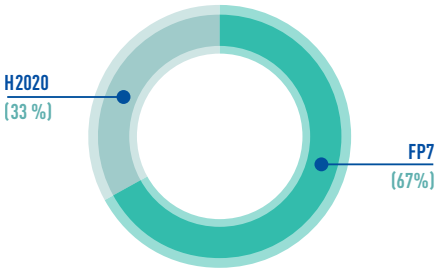
Expenditure in 2017 related to both the FP7 programme and to H2020 (see the table below), in a ratio of 2:1 (i.e. EUR 74.8 million for FP7[94] and EUR 37.1 million for H2020).

92 In line with the draft JUs' sampling methodology which provides for a target audit coverage of 20 %

93 Endorsement of the methodology by the CSC executive committee is planned for 2018

94 Including payments, clearing the pre-financing and recoveries from the implementation of the audit findings in 2017 for the FP7 programme

Overview of the EU contribution validated via cost claims in 2017 for the FP7 and H2020 programmes



Therefore, conclusions on error rates as the basis for the declaration of assurance for 2017 are built mainly on *ex-post* controls and their results from the FP7 programme.

Cumulative FP7 error rates show a stable but declining trend, especially in residual error rates constantly below 2 %, providing a strong-hold indicator of the legality and regularity of the underlying transactions.

For the H2020 programme, sufficient audit coverage was ensured via the selection of the *ex-post* audits in 2017 to be completed in 2018. As only one audit result for H2020 was available at 31 December, no conclusion on the trends in error rate can be established yet.

However, as part of internal control, all lessons learnt and observations from the *ex-post* audits (applicable for both the FP7 and H2020 programmes) feed back into the system of *ex-ante* checks in order to improve their effectiveness and efficiency.

This is an ongoing process, where close cooperation between FCH 2 JU operational units is facilitating the achievement of synergies between technical and financial knowledge, applied in practice.

4.4. AUDIT BY THE EUROPEAN COURT OF AUDITORS

In 2017, the FCH 2 JU:

- Continued its cooperation with an independent auditor to audit FCH 2 JU accounts, as required by the FCH 2 JU financial rules;
- Provided support to the ECA auditors in the framework of their audit on 2016 accounts and the first visit related to their audit of 2017 accounts;
- Followed up and implemented the recommendations made in the ECA reports on the FCH 2 JU annual accounts;
- Held an initial preliminary interview with ECA on a performance audit planned to be executed in 2018.

4.5. INTERNAL AUDIT

Based on Council Regulation (EU) No 559/2014 of 6 May 2014 establishing the FCH 2 JU, the internal audit operation is under the authority and responsibility of the EC's Internal Audit Service (IAS), succeeding the previous role taken on by the FCH JU's Internal Audit Capability (IAC).

Within the FCH 2 JU, a new role as internal control and audit manager was established in 2015 to act as a main contact point for IAS and coordinate the execution and follow-up of the annual internal audits carried out by IAS.

In 2017, the FCH 2 JU finalised implementation of all action plans addressing recommendations on the IAS audit on the FCH 2 JU's performance management undertaken by the IAS in 2016, with an exception of one action on revision of the MAWP. At the same time as the AAR was finalised, this strategic document was being prepared for the FCH 2 JU's endorsement in Q1 of 2018.

In 2017, the IAS undertook a new audit on coordination with the CSC and implementation of CSC tools and services in the FCH 2 JU.

On 7 December 2017, the FCH 2 JU received a final audit report from the IAS on this audit, which resulted in three recommendations, stemming from two important and one desirable finding.

The FCH 2 JU agreed with all the recommendations and sent an action plan to the IAS on 15 January 2018. This plan was prepared jointly and validated in cooperation with the CSC, and subsequently accepted by the IAS in January 2018.

4.6. RISK MANAGEMENT AND CONFLICT OF INTEREST

Risk management

During the annual risk assessment workshop, held on 27 October 2017, the FCH 2 JU team reflected on the status of the significant risks and action plans that had been identified in the previous year and assessed their adequacy and relevance for 2018.

In addition, consolidated input was gathered and discussed in order to establish a list of new significant risks for 2018, and the respective action plans were drawn up.

The full list of important risks and related action plans identified are presented in the AWP 2018.

A complete risk matrix for 2018 (including lower priority risks) is regularly assessed and discussed within management as part of an ongoing risk-assessment process, to reflect on any changes in the organisation's internal and external environment. This exercise, part of internal control, is designed to capture, in a timely manner, any new and emerging risks that could potentially influence the achievement of the FCH 2 JU's objectives, as well as providing timely reflection on the rating and relevance of the existing risks to ensure that appropriate actions and mitigating measures are put in place.

The FCH 2 JU will report on the fulfilment of the action plans and relevance of these risks in the AAR 2018.

Conflict of interest

Rules on prevention and management of conflict of interest covering staff and bodies were adopted on 10 November 2017 (see Section 2.2) and are being implemented. Declarations are signed by the persons concerned and updated as necessary (members of the FCH 2 JU and other bodies, observers, staff taking part in selection committees or evaluation panels, etc.). At the start of each FCH 2 JU GB meeting, potential conflicts of interest are checked.

4.7. COMPLIANCE AND EFFECTIVENESS OF INTERNAL CONTROL

Priority is given to implementing and maintaining an effective internal control system so that reasonable assurance can be given that:

(1) resources assigned to the activities are used according to the principles of sound financial management; and

(2) the control procedures in place give the necessary guarantees concerning the legality and regularity of transactions.

In line with the objectives and priorities described in the AWP 2017, the robustness of the internal control system was monitored throughout the year. Internal control topics were also regularly discussed during weekly management and unit meetings or ad-hoc meetings (when preparing new processes or revising existing operating procedures). Risks identified through the annual risk assessment exercise (see Sections 1.1 and 4.6), which might pose a threat to achieving the FCH 2 JU's mission and objectives, were also systematically assessed and managed through appropriate controlling and mitigating actions.

Throughout the year, particular efforts were made to monitor KPIs. The time to pay, time to grant and budget execution were followed closely, which led to improvements compared to previous years. The financial circuits were updated at the end of the year as regards describing electronic work flows that will increase the efficiency of internal procedures for financial transactions.

In conclusion, it can be confirmed that the FCH 2 JU is in compliance with all the ICS, the controls in place are working as intended, and the internal control system is providing an effective framework for managing any risks to the JU's ability to achieve its objectives.

The FCH 2 JU has started updating the internal control framework to align with the principles adopted by the Commission. The new internal control principles will be submitted for adoption to the FCH 2 JU Governing Board in 2018.

05
MANAGEMENT ASSURANCE

5.1. ASSESSMENT OF THE ANNUAL ACTIVITY REPORT BY THE GOVERNING BOARD

This section will be provided separately.

5.2. ELEMENTS SUPPORTING ASSURANCE

Reasonable assurance is the personal judgement of the JU's Executive Director – as the JU's authorizing officer at the date of signature of this Annual Activity Report – based on all the information at his disposal.

The main elements supporting the assurance are based on the JU's management assessment of the robustness of the JU's Internal Control Framework, the results of audits from the ECA and the IAS, the reporting from the internal control and audit manager, and the reporting from the heads of unit.

No significant weaknesses were identified or reported under sections 2 ('Support to operations') and section 4 ('Internal Control Framework'). Furthermore, based on their review, the heads of unit consider that, given the scope of the statement of assurance and taking into account the controls and monitoring system in place, there are no weaknesses that could call into question the reasonable assurance as to the use of resources for their intended purpose, in accordance with the principles of sound financial management, and the fact that the control procedures implemented provide the necessary guarantees on the legality and regularity of the underlying transactions.

5.3. RESERVATIONS

FP7 programme

The **representative error rate** resulting from the 107 representative audits finalised is **–2.73%** (2016: -2.89 %) at total cost level and **–2.14%** (2016: -2.19 %) at FCH JU contribution level.

The **residual error rate** (i.e. error remaining in the population after corrections and recoveries) calculated at this point is **–1.13%** (2016: -1.24 %) at total cost level and **–1.09%** (2016:-1.19 %) at FCH JU contribution level. This rate should develop as more audits are closed and more corrections and recoveries undertaken.

Taking into consideration:

- the residual error rates below 2 % at this point in time;
- the adequate audit coverage, comprising a representative number of finalised audits;
- the experience gained by JU staff in the *ex-ante* validation of costs claims;
- the JU's strong *ex-ante* controls;
- the improved quality of beneficiaries' cost claims as a result of the communication campaigns carried out by the FCH JU in 2012-2015;

no reservation is necessary. In the opinion of the ED, considering the aspects above and with the information available at this stage, it is possible to state with reasonable assurance that by the end of the programme the residual error rate will be below the materiality threshold (i.e. 2 %) established in Annex 9 ('Materiality criteria').

H2020 programme

- the positive result from the first H2020 audit closed;
- lessons learnt from first H2020 audits (including those launched by other services) via participation in EC meetings feeding back into *ex-ante* controls;
- communication campaigns;
- participation in project kick-off and progress meetings;
- sufficient audit coverage of the expenditure ensured by *ex-post* audits launched in 2017.

FCH JU actions towards an acceptable level of 'residual error rate'

The declaration of assurance in 2016 did not include a reservation, as is the case this year (2017). This is the result of the FCH 2 JU's firm commitment to maintain a robust internal control system in which *ex-post* audits play a significant role. The residual error rate is a key indicator of the legality and regularity of JU transactions. In this context, in 2012, the FCH JU set out an action plan with the aim of achieving an acceptable level of residual error rate, which should provide sufficient assurances to the ED while, at the same time, respecting cost-benefit principles (i.e. the cost of controls have to be measured against the benefits that those additional controls can bring to the organisation – auditing 100 % of the cost claims is not cost-efficient).

The FCH JU action plan includes a combination of **preventive, detective and corrective measures** and is closely monitored. The measures/actions can be grouped around three main axes as follows:

For FP7

- Organisation of **communication campaigns** to prevent financial errors in cost reporting by improving awareness among the beneficiaries of the regulatory framework. In total, seven campaigns were organised by the FCH JU (three in 2012; two in 2013, one in 2014 and one in 2015). The campaign set-up was reviewed in 2013 to maximise its impact, with the possibility to participate 'onsite' and 'online', a targeted audience (including auditors responsible for the preparation of the CFS and *ex-post* auditors), and a focus on the most recurrent issues. The 2015 campaign continued with onsite and online participation, with particular emphasis on the eligibility aspects of 'demonstration' projects. In total, 146 beneficiaries involved in 129 projects attended the communication campaigns. This represents approximately 27 % and 83 % of FCH JU beneficiaries and projects, respectively. The communication campaigns were highly appreciated by the participants and their positive impact has been visible since 2013, via improvements in the quality of beneficiaries' cost reporting.
- Maintaining strong FCH JU ***ex-ante* controls** to enable greater detection and correction of errors before validating cost claims (e.g. JU's scrutiny of the CFS, and its thorough *ex-ante* checklists).
- Continuation of the FCH JU *ex-post* audit efforts. As at 31 December 2017, 133 audits were launched for FCH-FP7 grants, of which 127 were finalised and the remaining are expected to be finalised in the first quarter of 2018, representing a cumulative audit coverage of 22 % of the value of validated cost claims and 22 % in terms of the number of beneficiaries. The combination of appropriate audit coverage and a relatively low detected error rate has resulted in a residual error rate below 2 %.

The positive feedback loop generated by the combination of the three actions above is of particular importance. For example, the (preventive) communication campaigns provided a very useful platform on which to share experiences between beneficiaries and JU actors. In addition, *ex-post* audits have a multiplying effect: lessons learned from the results of *ex-post* audits provide very valuable information not only for the audited beneficiary but also for the JU's *ex-ante* controllers for future cost claims and other beneficiaries of the same project.

For H2020

- Organisation of financial workshops to explain key aspects of the financial provisions of H2020 MGA and of financial reporting, with a focus on specificities and business models pertinent for FCH 2 JU and aiming to prevent errors. After the first workshop in 2016, a second one was organised in March 2017 (see also Section 4.2).

- Greater involvement of financial officers during the grant agreement preparations and in project kick-off meetings in order to check financial aspects and clarify financial reporting requirements.

- *Ad-hoc* financial webinars for individual projects depending on the complexity of the project and needs of the beneficiaries.

- *Ex-ante* controls consistent with the Guidelines on *ex-ante* controls in H2020, adopted by the CSC, which are predominantly risk-based and/or justified by deviations from the budget.

- *Ex-post* audits: as indicated in the sections on H2020 *ex-post* audits above, the FCH 2 JU will ensure that, in line with Annex 1 to the H2020 Audit Strategy, the audit effort is sufficient to allow for adequate coverage and calculation of a representative error rate on FCH 2 JU expenditure.

The FCH JU has a clear control strategy which is multi-annual in nature and combines *ex-ante* and *ex-post* controls and takes cost-efficiency into consideration. Since this strategy has proved its effectiveness from an assurance point of view, the FCH JU is fully committed to continuing its work following the same control principles.

5.4. OVERALL CONCLUSIONS

The purpose of this section is to provide overall conclusions on the declaration of assurance as a whole (Section 6).

It is important to note that only material weaknesses/risks lead to a reservation concerning the assurance in Section 6. The concept of 'materiality' provides the Executive Director with a basis for assessing the importance of the weaknesses/risks identified. Deciding whether something is material involves making a judgement in both qualitative and quantitative terms (see details on the 'Materiality criteria' in Annex 9).

Based on the information provided in the sections above, the following conclusions can be drawn:

- Concerning the FCH2 JU's policy activities, no qualification is to be made. Likewise, there is no reservation in the procedures relating to the selection of contractors and beneficiaries for FCH2 JU projects and their underlying financial operations (legal and financial commitments). This is also the case for JU's payments related to administrative expenditure and procurement, as well as for pre-financing payments in the case of grants.

- Those amounts with a greater risk of being affected by errors are the expenditure incurred against cost statements. Based on the analysis of error rates and the effectiveness of the preventive, detective and corrective actions presented in Section 5.3, no reservation is necessary in this area either.

In conclusion, the JU's management has reasonable assurance that, overall, suitable controls are in place and are working as intended, risks are being properly monitored and mitigated, and the necessary improvements noted by the auditors (i.e. Commission's IAS and the ECA) are being implemented. Therefore, the Executive Director, in his capacity as authorising officer, has signed the declaration of assurance presented in Section 6.

06
DECLARATION OF ASSURANCE

I, the undersigned,

Executive Director of the FCH 2 JU

In my capacity as authorising officer

Declare that the information contained in this report gives a true and fair view[95].

State that I have reasonable assurance that the resources assigned to the activities described in this report have been used for their intended purpose and in accordance with the principles of sound financial management, and that the control procedures put in place give the necessary guarantees concerning the legality and regularity of the underlying transactions.

This reasonable assurance is based on my own judgement and on the information at my disposal, such as the results of the self-assessment, *ex-post* controls, the work of the internal control and audit manager, the observations of the Internal Audit Service and the lessons learnt from the Court of Auditors' reports for the years prior to the year of this declaration.

Confirm that I am not aware of anything not reported here which could harm the interests of the Joint Undertaking.

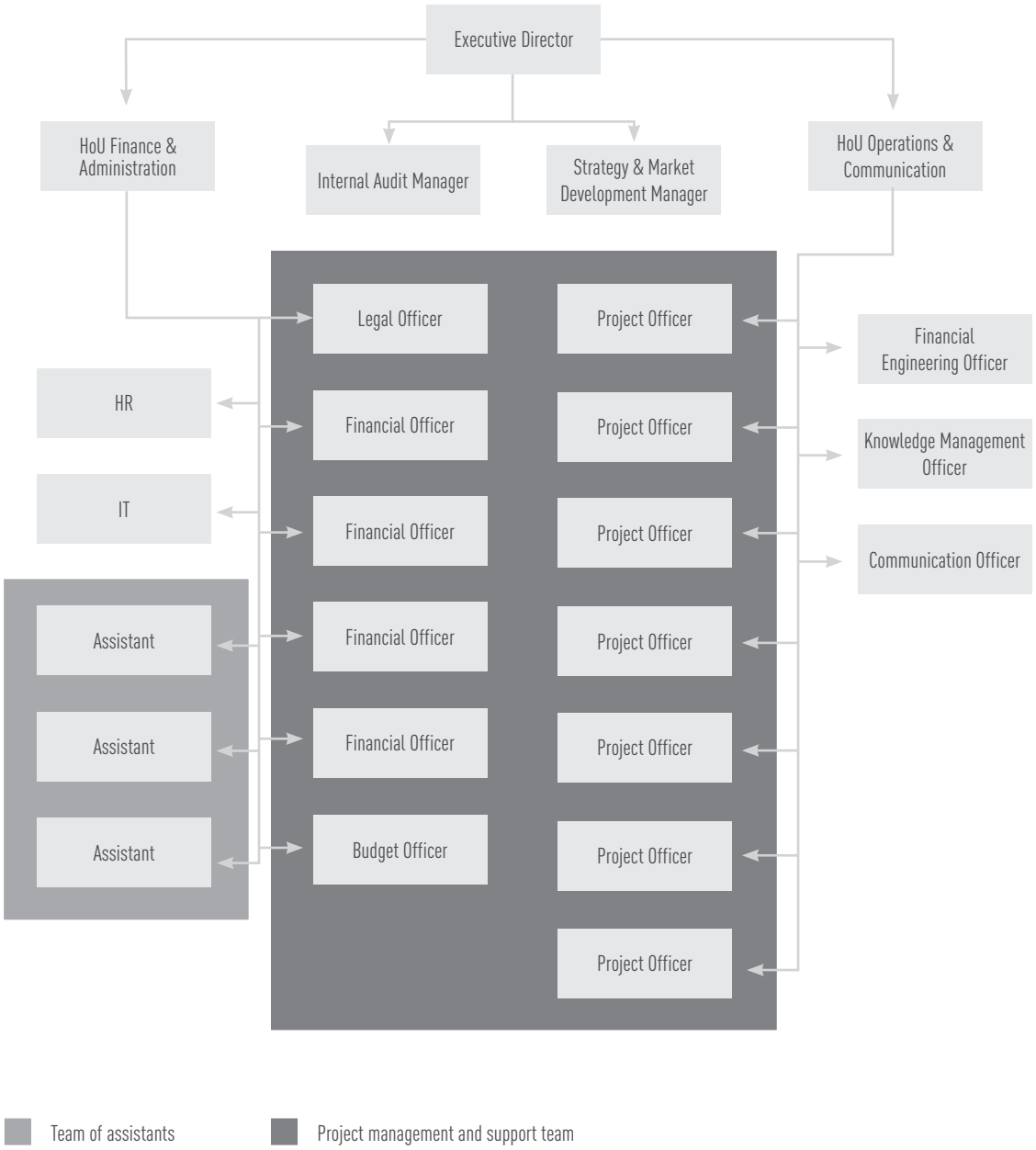
Brussels, 28 February 2018

Bart Biebuyck
Executive Director FCH 2 JU

95 True and fair in this context means a reliable, complete and correct view on the state of affairs in the Joint Undertaking.

07
ANNEXES

ANNEX 1
Organisation chart



ANNEX 2
Staff establishment plan

GRADE	2016 AUTHORISED	2016 FILLED	2017 BUDGET	2017 AMENDED
AD 16				
AD 15				
AD 14	1	1	1	1
AD 13				
AD 12				
AD 11	2	2	2	2
AD 10				
AD 9	3	2	4	2
AD 8	5	6	4	6
AD 7				
AD 6				1
AD 5	4	4	4	3
Total AD*	**15**	**15**	**15**	15
AST 11				
AST 10				
AST 9				
AST 8	2	1	2	2
AST 7		1	1	1
AST 6	2	2	1	1
AST 5				
AST 4	3	3	3	4
AST 3	2	2	2	1
AST 2				
AST 1				
Total AST**	**9**	**9**	**9**	**9**
Total	**24**	**24**	**24**	**24**

Statutory staff also include 2 contract agents: 1 in Function Group (FG) III and 1 in FG IV.
In addition, staff resources include 2 Seconded National Experts (SNE).

* AD stands for administrator
** AST stands for assistant

ANNEX 3
Publications from projects

The list of publications related to both FCH JU and FCH 2 JU projects is given below***:

Project number	Project acronym	Publication title	Main author	Title of the periodical
256834	MobyPost	Fuel cell systems reliability and availability enhancement by developing a fast and efficient power switch open-circuit fault detection algorithm in interleaved DC/DC boost converter topologies	D. Guilbert, A. N'Diaye, A. Gaillard, A. Djerdir	International Journal of Hydrogen Energy
278257	METSAPP	The Oxidation of Coated SOFC Interconnects in Fuel Side Environments	R. Sachitanand, M. Sattari, J.-E. Svensson, J. Froitzheim	Fuel Cells
278525	MMLRC=-SOFC	Glass-ceramic seals in the system MgO-BaO-B_2O_3-SiO_2 operating under simulated SOFC conditions	S. Rodríguez-López, V.A.C. Haanappel, A. Durán, F. Muñoz, G.C. Mather, M.J. Pascual, S.M. Gross-Barsnick	International Journal of Hydrogen Energy
278997	ReforCELL	Technical assessment of a micro-cogeneration system based on polymer electrolyte membrane fuel cell and fluidized bed autothermal reformer	G. Di Marcoberardino, L. Roses, G. Manzolini	Applied Energy
279075	CoMETHy	Catalyst development for steam reforming of methane and model biogas at low temperature	S.D. Angeli, L. Turchetti, G. Monteleone, A.A. Lemonidou	Applied Catalysis B: Environmental
279075	CoMETHy	Approximate models of concentration-polarisation in Pd-membrane separators. Fast numerical analysis	O. Nekhamkina, M. Sheintuch	Journal of Membranes Science
279075	CoMETHy	Transport-permeation regimes in an annular membrane separator for hydrogen purification	M.A. Murmura, S. Cerbelli, L. Turchetti, M.C. Annesini	Journal of Membranes Science
299732	UNIfHY	Steam/oxygen biomass gasification at pilot scale in an internally circulating bubbling fluidized bed reactor	D. Barisano, G. Canneto, F. Nanna, E. Alvino, G. Pinto, A. Villone, M. Carnevale, V. Valerio, A. Battafarano, G. Braccio	Fuel Processing Technology
299732	UNIfHY	Catalytic gasification of biomass (Miscanthus) enhanced by CO_2 sorption	I. Zamboni, M. Debal, M. Matt, P. Girods, A. Kiennemann, Y. Rogaume, C. Courson	Environmental Science and Pollution Research
299732	UNIfHY	High quality syngas production via steam-oxygen blown bubbling fluidised bed gasifier	S. Stendardo, P. Ugo Foscolo, M. Nobili, S. Scaccia	Energy
299732	UNIfHY	Influence of the main gasifier parameters on a real system for hydrogen production from biomass	M. Moneti, A. Di Carlo, E. Bocci, P.U. Foscolo, M. Villarini, M. Carlini	International Journal of Hydrogen Energy
303418	PHAEDRUS	Evaluation of Pt/carbon aerogels as electrode material in an electrochemical hydrogen compressor	S. Berthon-Fabry, R. Vie, M. Koeman, P. Bouwman, R. Metkemeijer	Journal of Power Sources
303419	PUMA MIND	Capturing solvation effects at a liquid/nanoparticle interface: AIMD investigation of Pt201 immersed in water	R. Ferreira de Morais, T. Kerber, F. Calle-Vallejo, P. Sautet, D. Loffreda	Small
303419	PUMA MIND	Concave sites enhance the catalytic activity of platinum for the oxygen reduction reaction	F. Calle-Vallejo, M. Pohl, D. Reinisch, D. Loffreda, P. Sautet, A. S. Bandarenka	Energy and Environmental Science

*** The table has been devised from the patents query in the SESAM and CORDA databases for H2020 and FP7 projects. As part of the TRUST annual exercise collecting data from the year-minus 1, the list contains publications covering both 2016 and 2017. For the full list of previous publications, please refer to the Annual Activity Report 2016.

**** Publication frequency is applicable to FP7 projects, and the ISSN (International Standard Serial Number) to H2020 projects.

***** Open Access includes both Green and Gold.

	Relevant pages	Publication frequency/ ISSN****	Publisher	Publication year	Open Access*****
	13	Vol. in press	Elsevier Limited	2016	No
	32-38	Vol. 16/Issue 1	John Wiley and Sons Ltd	2016	No
	15335-15345	41	Elsevier Limited	2016	Yes
	231-244	Vol. 162	Elsevier BV	2016	No
	34-46	Vol. 181	Elsevier	2016	
	136-150	Vol. 500	Elsevier	2016	No
	199-211	Vol. 503	Elsevier	2016	No
	74-81	Vol. 141	Elsevier	2016	No
	1-14	0	Ecomed Publishers	2016	No
	697-708	Vol. 103	Elsevier Limited	2016	No
	11965-11973	Vol. 41/Issue 28	Elsevier Limited	2016	No
	001-012	TBD	Elsevier	2016	
	?	Submitted	Wiley-VCH Verlag	2016	
	?	Submitted	Royal Society of Chemistry	2016	

Project ID	Project acronym	Publication title	Main author	Title of the periodical
303419	PUMA MIND	A multi-paradigm modelling investigation of membrane chemical degradation in PEM fuel cells	M.A. Quiroga, K. Malek, A.A. Franco	Journal of the Electrochemical Society
303419	PUMA MIND	Fuel cell modelling strategic roadmap: a systematic approach	C. Kompis, K. Malek	Fuel Cells
303419	PUMA MIND	Performance and degradation of Proton Exchange Membrane Fuel Cells: State of the art in modelling from atomic to system scale	T. Jahnke, G. Futter, A. Latz, T. Malkow, G. Papakonstantinou, G. Tsotridis, P. Schott, M. Gérard, M. Quina	Journal of Power Sources
303429	Evolve	The permeability of Boolean sets of cylinders	F. Willot, B. Abdallah, D. Jeulin	Oil and Gas Science and Technology
303429	Evolve	Evaluation of performance and degradation profiles of a metal supported solid oxide fuel cell under electrolysis operation	A. Nechache, F. Han, R. Semerad, G. Schiller, R. Costa	ECS Transactions
303429	Evolve	Performances and limitations of metal supported cells with strontium titanate based fuel electrode	R. Costa, F. Han, P. Szabo, V. Yurkiv, R. Semerad, S.K. Cheah, L. Dessemond	Fuel Cells
303429	Evolve	On the manufacturing of low temperature activated Sr 0.9 La 0.1 TiO 3-δ -Ce 1-x Gd x O 2-δ anodes for solid oxide fuel cell	A. Gondolini, E. Mercadelli, G. Constantin, L. Dessemond, V. Yurkiv, R. Costa, A. Sanson	Journal of the European Ceramic Society
303435	ArtipHyction	Evaluation of the charge transfer kinetics of spin-coated $BiVO_4$ thin films for sun-driven water photoelectrolysis	S. Hernández, G. Gerardi, K. Bejtka, A. Fina, N. Russo	Applied Catalysis B: Environmental
303446	IMPALA	Characterisation of liquid water saturation in gas diffusion layers by X-ray tomographic microscopy	A. Lamibrac, F. Buchi	Journal of the Electrochemical Society
303446	IMPALA	Benefits of membrane electrode assemblies with asymmetrical GDL configurations for PEM fuel cells	R. Schweiss	Fuel Cells
303446	IMPALA	Surface analytical methods for the development of electrochemical components of polymer electrolyte fuel cells microporous and catalyst layers	I. Biswas, M. Schulze	ECS Transactions
303452	IMPACT	Polydimethylsiloxane treated cathode catalyst layer to prolong hydrogen fuel cell lifetime	M. Choun, D. Nauryzbayev, D. Shin, J. Lee	Catalysis Today
303452	IMPACT	Evaluation of reversible and irreversible degradation rates of polymer electrolyte membrane fuel cells tested in automotive conditions	P. Gazdzick, J. Mitzel, D. Garcia Sanchez, M. Schulze, K. Andreas Friedrich	Journal of Power Sources
303452	IMPACT	Quantitative in situ analysis of ionomer structure in fuel cell catalytic layers	T. Morawietz, M. Handl, C. Oldani, K. Andreas Friedrich, R. Hiesgen	ACS Applied Materials and Interfaces
303452	IMPACT	Liquid Invasion from multiple inlet sources and optimal gas access in a two-layer thin porous medium	N. Belgacem, T. Agaësse, J. Pauchet, M. Prat	Transport in Porous Media
303461	LiquidPower	Fuel cell systems and hydrogen supply for early markets	K. F. Juelsgaard	Prologue
303466	IMMEDIATE	Development of tailored high-performance and durable electrocatalysts for advanced PEM fuel cells	4. M. J. Larsen, I. Jiménez Morales, S. Cavaliere, J. Zajac, D.J. Jones, J. Rozière, L. Kaluža, D. Gulková, M. Odgaard	International Journal of Hydrogen Energy
303466	IMMEDIATE	Synthesis of Pt/C fuel cell electrocatalysts: residual content of chlorine and activity in oxygen reduction	L. Kaluža, M.J. Larsen, I. Jiménez Morales, S. Cavaliere, D.J. Jones, J. Rozière, A. Kallistová, P. Dytrych, D. Gulková, M. Odgaard	Electrocatalysis
303484	NOVEL	Membrane degradation in PEM water electrolyser: numerical modelling and experimental evidence of the influence of temperature and current density	M. Chandesris	International Journal of Hydrogen Energy
303484	NOVEL	Stability and degradation mechanisms of radiation-grafted polymer electrolyte membranes for water electrolysis	A. Albert, T. Lochner, T.J. Schmidt, L. Gubler	ACS Applied Materials and Interfaces

	Relevant pages	Publication frequency/ ISSN****	Publisher	Publication year	Open Access*****
	F59	2	Electrochemical Society, Inc.	2016	
	?	Submitted	John Wiley and Sons Ltd	2016	
	207-233	304	Elsevier	2016	
	52	Vol. 71/Issue 4	Editions Technip	2016	
	3039-3047	Vol. 78/Issue 1	The Electrochemical Society	2017	No
	Submitted	Submitted	John Wiley and Sons Ltd	2017	
	in press	in press	Elsevier BV	2017	
	66-74	190	Elsevier	2016	No
	F202-F209	163	Electrochemical Society, Inc.	2016	
	1	1	John Wiley and Sons Ltd	2016	Yes
	1429-1435	58	The Electrochemical Society	2016	Yes
	155-160	Vol. 262	Elsevier	2016	No
	86-95	Vol. 327	Elsevier	2016	No
	27044-27054	Vol. 8/Issue 40	American Chemical Society	2016	No
	449-472	Vol. 115/Issue 3	Springer Netherlands	2016	No
	51	Spring 2016	National Archives and Records Administration	2016	Yes
	Submitted	Submitted	Elsevier Limited	2016	Yes
	Submitted	2016	Springer Publishing Company	2016	
	1353-1366	40	Elsevier Limited	2016	
	15297-15306	Vol. 8/Issue 24	American Chemical Society	2016	No

Project number	Project acronym	Publication title	Main author	Title of the periodical
303484	NOVEL	Investigation on the degradation of MEAs for PEM water electrolysers part I: Effects of testing conditions on MEA performances and membrane properties	F. Fouda-Onana, M. Chandesris, V. Medeau, S. Chelghoum, D. Thoby, N. Guillet	International Journal of Hydrogen Energy
303492	CathCat	Chemical and electrochemical stability of nitrogen and sulphur-doped mesoporous carbons	V. Perazzolo, E. Gradzka, C. Durante, R. Pilot, N. Vicentini, G.A. Rizzi, G. Granozzi, A. Gennaro	Electrochimica Acta
303492	CathCat	Tuning the activity of Pt alloy electrocatalysts by means of the lanthanide contraction	M. Escudero-Escribano, P. Malacrida, M.H. Hansen, U.G. Vej-Hansen, A. Velazquez-Palenzuela, V. Tripkovic, J. Schiotz, J. Rossmeisl,	Science
303492	CathCat	Enhanced oxygen reduction reaction stability on platinum nanoparticles photo-deposited on to oxide-carbon composites	L.A. Estudillo-Wong, Y. Luo, J.A. Díaz-Real, N. Alonso-Vante	Applied Catalysis B: Environmental
303492	CathCat	An easy and cheap chemical route using an MOF precursor to prepare Pd–Cu electrocatalyst for efficient energy conversion cathodes	Y. Luo, L.A. Estudillo-Wong, L. Cavillo, G. Granozzi, N. Alonso-Vante	Journal of Catalysis
303492	CathCat	A highly efficient and stable oxygen reduction reaction on Pt/CeOx/C electrocatalyst obtained via a sacrificial precursor based on a metal-organic framework	Y. Luo, L. Calvillo, C. Daiguebonne, M.K. Daletou, G. Granozzi, N. Alonso-Vante	Applied Catalysis B: Environmental
325262	CISTEM	Composite titanium silicon carbide as a promising catalyst support for high-temperature proton-exchange membrane fuel cell electrodes	J. Lobato, H. Zamora, J. Plaza, M.A. Rodrigo	ChemCatChem
325262	CISTEM	Improved electrodes for high temperature proton exchange membrane fuel cells using carbon nanospheres	H. Zamora, J. Plaza, P. Cañizares, J. Lobato, M.A. Rodrigo	ChemSusChem
325262	CISTEM	Primary energy savings of a modular combined heat and power plant based on high temperature proton exchange membrane fuel cells	E. Pohl, P. Meier, M. Maximini, J. vom Schloß	Applied Thermal Engineering
325262	CISTEM	Ultralow degradation rates in HT-PEM fuel cells	M. Rastedt, F.J. Pinar, P. Wagner, H.R. Garcia, T. Steenberg, H.A. Hjuler, M. Paidar, K. Bouzek	ECS Transactions
325262	CISTEM	Effect of operation strategies on phosphoric acid loss in HT-PEM fuel cells	M. Rastedt, F.J. Pinar, N. Pilinski, A. Dyck, P. Wagner	ECS Transactions
325262	CISTEM	Effect of idling temperature on high temperature polymer electrolyte membrane fuel cell degradation under simulated start/stop cycling conditions	F.J. Pinar, M. Rastedt, N. Pilinski, P. Wagner	International Journal of Hydrogen Energy
325262	CISTEM	Enhancement of high temperature PEMFC stability using catalysts based on Pt supported on SiC-based materials	J. Lobato, H. Zamora, J. Plaza, P. Cañizares, M.A. Rodrigo	Applied Catalysis B: Environmental
325320	SOL2HY2	Performance of electrocatalytic gold coating on bipolar plates for SO_2 depolarised electrolyser	A. Santasalo-Aarnio, A. Lokkiluoto, J. Virtanen, M.M. Gasik	Journal of Power Sources
325320	SOL2HY2	Modelling and scaling analysis of a solar reactor for sulphuric acid cracking in a hybrid sulphur cycle process for thermochemical hydrogen production	N. Bayer Botero, D. Thomey, A. Guerra-Niehoff, M. Roeb, C. Sattler, R. Pitz-Paal	International Journal of Hydrogen Energy
325320	SOL2HY2	SO_2 carry-over and sulphur formation in an SO_2-depolarised electrolyser	A. Santasalo-Aarnio, J. Virtanen, M. Gasik	Journal of Solid State Electrochemistry
325320	SOL2HY2	Modelling of a solar receiver for superheating sulfuric acid	J.L. Lapp, A. Guerra-Niehoff, H.-P. Streber, D. Thomey, M. Roeb, C. Sattler	Journal of Solar Energy Engineering, Transactions of the ASME
325329	FireComp	Determination of the tensile residual properties of a wound carbon/epoxy composite first exposed to fire	T.H.Y. Quach, A. Benelfellah, B. Batiot, D. Halm, T. Rogaume, J. Luche, D. Bertheau	Journal of Composite Materials

	Relevant pages	Publication frequency/ ISSN****	Publisher	Publication year	Open Access*****
	16627-16636	41/38	Elsevier Limited	2016	No
	???	???	Elsevier Limited	2016	No
	73-76	Vol. 352/Issue 6281	American Association for the Advancement of Science	2016	No
	291-300	Vol. 187	Elsevier	2016	No
	135-142	Vol. 338	Academic Press Inc.	2016	No
	39-50	Vol. 189	Elsevier	2016	No
	848-854	Vol. 8/Issue 4	Wiley – VCH Verlag GmbH & CO. KGaA	2016	No
	1187-1193	Vol. 9/Issue 10	Wiley-VCH Verlag	2016	No
	54-63	Vol. 104	Elsevier Limited	2016	No
	301-315	Vol. 75/Issue 14	The Electrochemical Society	2016	
	455-469	Vol. 75/Issue 14	The Electrochemical Society	2016	
	19463-19474	Vol. 41/Issue 42	Elsevier Limited	2016	No
	516-524	Vol. 198	Elsevier	2016	No
	1-7	Vol. 306	Elsevier	2016	Yes
	8008-8019	Vol. 41/Issue 19	Elsevier Limited	2016	Yes
	1655-1663	Vol. 20/Issue 6	Springer New York	2016	Yes
	041013	Vol. 138/Issue 4	American Society of Mechanical Engineers (ASME)	2016	Yes
	na	na	SAGE Publications Ltd	2016	No

Project number	Project acronym	Publication title	Main author	Title of the periodical
325358	IRMFC	Performance evaluation of a proof-of-concept 70W internal reforming methanol fuel cell system	G. Avgouropoulos, S. Schlicker, K-P. Schelhaas, J. Papavasiliou, K. Papadimitriou, E. Theodorakopoulou, N. Gourdoupi, A Machocki, T. Ioannides, J. Kal	Journal of Power Sources
325358	IRMFC	Chromium modified zinc oxides	W. Gac, W. Zawadzki, G. Słowik, M. Greluk, J. Pawlonka, A. Machocki	Journal of Thermal Analysis and Calorimetry
325368	DeMStack	H_3PO_3 electrochemical behaviour on a bulk Pt electrode: adsorption and oxidation kinetics	M. Prokop, T. Bystron, M. Paidar, K. Bouzek	Electrochimica Acta
325383	BioRobur	Deactivation mechanism of Ni supported on Mg-Al spinel during auto-thermal reforming of model biogas	M. Luneau, E. Gianotti, F.C. Meunier, C. Mirodatos, E. Puzenat, Y. Schuurman, N. Guilhaume	Applied Catalysis B: Environmental
325383	BioRobur	LCA evaluation for hydrogen production through the innovative BioRobur project concept	S. Pris Hernandez Ribullon, F. Battista, S. Bensaid, B. Ruggeri, D. Fino	International Journal of Hydrogen Energy
325383	BioRobur	Early-stage oxidation behaviour at high temperatures of SiSiC cellular architectures in a porous burner	A. Ortona	Ceramics International
325383	BioRobur	Biogas robust processing with combined catalytic reformer and trap. Part 1: Catalysts and support design	All BioRobur partners	International Journal of Hydrogen Energy
325383	BioRobur	Biogas robust processing with combined catalytic reformer and trap. Part 2: Tests on demonstration plant	All BioRobur partners	International Journal of Hydrogen Energy
325383	BioRobur	Techno-economic analysis of green hydrogen production from biogas auto-thermal reforming	All BioRobur partners	Clean Technologies and Environmental Policy
621181	FERRET	N_2, He and CO_2 diffusion mechanism through nanoporous YSZ/γ-Al_2O_3 layers and their use in a pore-filled membrane for hydrogen membrane reactors	A. Arratibel, U. Astobieta, D. Alfredo, P. Tanaka, M. van Sint Annaland, F. Gallucci	International Journal of Hydrogen Energy
621181	FERRET	Definition of validated membrane reactor model for 5 kW power output CHP system for different natural gas compositions	G. Di Marcoberardino, F. Gallucci, G. Manzolini, M. van Sint Annaland	International Journal of Hydrogen Energy
621181	FERRET	Recent advances in Pd-based membranes for membrane reactors	A. Arratibel Plazaola, D. Pacheco Tanaka, M. van Sint Annaland, F. Gallucci	Molecules
621181	FERRET	Investigation of a 5 kW micro-CHP PEM fuel-cell-based system integrated with membrane reactor under diverse EU natural gas quality	G. Di Marcoberardino, G. Manzolini	International Journal of Hydrogen Energy
621181	FERRET	Achievements of European projects on membrane reactor for hydrogen production	G. Di Marcoberardino, M. Binotti, G. Manzolini, J.L. Viviente, A. Arratibel, L. Roses, F. Gallucci	Journal of Cleaner Production
621181	FERRET	Palladium-based membranes and membrane reactors for hydrogen production and purification: An overview of research activities at Tecnalia and TU/e	E. Fernandez, A. Helmi, J.A. Medrano, K. Coenen, A. Arratibel, J. Melendez, N.C.A. de Nooijer, V. Spallina, J.L. Viviente, J. Zuñiga	International Journal of Hydrogen Energy
621194	HYPACTOR	The sensitivity of the burst performance of impact damaged pressure vessels to material strength properties	K Lasn, N.P. Vedvik, A.T. Echtermeyer	IOP Conference Series: Materials Science and Engineering
621207	Endurance	Accessible triple-phase boundary length: A performance metric to account for transport pathways in heterogeneous electrochemical materials	A. Nakajo, A.P. Cocco, M.B. DeGostin, A.A. Peracchio, B.N. Cassenti, M. Cantoni, J. Van Herle, W.K.S. Chiu	Journal of Power Sources
621207	Endurance	Role of microstructure on electrode operating mechanisms for mixed ionic electronic conductors: From synchrotron-based 3D reconstruction to electrochemical modelling	M. Hubert, J. Laurencin, P. Cloetens, J.C. Da Silva, F. Lefebvre-Joud, P. Bleuet, A. Nakajo, E. Siebert	Solid State Ionics

	Relevant pages	Publication frequency/ ISSN****	Publisher	Publication year	Open Access*****
	875-882	307	Elsevier	2016	
	1205-1215	125/3	Springer Netherlands	2016	
	465-472	Vol. 212	Elsevier Limited	2016	
	289-299	Vol. 203	Elsevier	2017	
	Manuscript No. HE-D-16-01536	WHEC2016	Elsevier Limited	2017	
	CERI-D-16-03767R2	Ceramics	Elsevier Limited	2017	
		Catalysts and Support Design	Elsevier Limited	2017	Yes
		Tests on demonstration plant	Elsevier Limited	2017	Yes
	CTEP-S-16-00757-2	Green hydrogen production from biogas auto-thermal reforming	Springer Verlag	2017	Yes
	8732-8744	Vol. 41/Issue 20	Elsevier Limited	2016	No
	19141-19153	Vol. 41/Issue 42	Elsevier Limited	2016	No
	51	Vol. 22/Issue 1	Molecular Diversity Preservation International	2017	Yes
	13988-14002	Vol. 42/Issue 19	Elsevier Limited	2017	
	1-12	11	Elsevier Limited	2017	Yes
	13763-13776	Vol. 42/Issue 19	Elsevier Limited	2017	No
	012029	Vol. 139	Institute of Physics	2016	Yes
	786	325	Elsevier	2016	No
	90	294	Elsevier	2016	No

Project number	Project acronym	Publication title	Main author	Title of the periodical
621207	Endurance	Multi-scale analysis of the diffusion barrier layer of gadolinia-doped ceria in a solid oxide fuel cell operated in a stack for 3000 h	M. Morales, V. Miguel-Pérez, A. Tarancón, A. Slodczyk, M. Torrell, B. Ballesteros, J.P. Ouweltjes, J.M. Bassat, D. Montinaro, A. Morata	Journal of Power Sources
621207	Endurance	Effect of YSZ coatings as diffusion barrier between glass sealing and steel	R. Spotorno, E. Fracchia, G. Schiller, P. Piccardo	ECS Transactions
621207	Endurance	LaNi 0.6 Fe 0.4 O 3 as cathode contacting material: effect on anode supported cell performances	R. Spotorno, P. Piccardo, R. Costa, F. Han, G. Schiller	ECS Transactions
621207	Endurance	Parametrical coordinates and microsamples to investigate real SOFCs in operating stacks	P. Piccardo, R. Spotorno, J.P. Ouweltjes, Z. Stoynov, D. Vladikova	ECS Transactions
621207	Endurance	Degradation mechanism of La0.6Sr0.4Co0.2Fe0.8O3-δ/Gd0.1Ce0.9O2-δ composite electrode operated under solid oxide electrolysis and fuel cell conditions	J. Laurencin, M. Hubert, D. Ferreira Sanchez, S. Pylypko, M. Morales, A. Morata, B. Morel, D. Montinaro, F. Lefebvre-Joud, E. Siebert	Electrochimica Acta
621207	Endurance	Influence of surface finishing on high-temperature oxidation of AISI Type 444 ferritic stainless steel used in SOFC stacks	V. Bongiorno, P. Piccardo, S. Anelli, R. Spotorno	Acta Metallurgica Sinica (English Letters)
621227	NELLHI	Aggravated test of IT-SOFC fed with tar-contaminated syngas	D. Pumiglia, S. Vaccaro, A. Masi, S.J. McPhail, M. Falconieri, S. Gagliardi, L. della Seta, M. Carlini	Journal of Power Sources
621228	HYACINTH	A psychology of expectations in sociotechnical systems: the case of hydrogen fuel cell electric vehicles in Europe	P. Upham, P. Bögel, E. Dütschke, U. Schneider, C. Oltra, R. Sala, M. Lores, R. Klapper	Technological Forecasting and Social Change
621228	HYACINTH	Agency and structure in a sociotechnical transition: Hydrogen fuel cells, conjunctural knowledge and structuration in Europe	P. Upham, E. Dütschke, U. Schneider, C. Oltra, R. Sala, M. Lores, P. Bögel, R. Klapper	Energy Research and Social Science
621228	HYACINTH	The public acceptance of hydrogen fuel cell applications in Europe	C. Oltra	Revista Internacional de Sociologia
621228	HYACINTH	The role of prior attitudes in technology acceptance: reflections on the case of hydrogen fuel cells	P. Bögel, C. Oltra, P. Wiemann, R. Sala, M. Lores, P. Upham, E. Dütschke, U. Schneider	Journal of Cleaner Production
621244	ELECTRA	Ba 0.5 Gd 0.8 La 0.7 Co 2 O 6-δ Infiltrated in Porous BaZr 0.7 Ce 0.2 Y 0.1 O 3 backbones as electrode material for proton ceramic electrolytes	R. Strandbakke, E. Vøllestad, S.A. Robinson, M.-L. Fontaine, T. Norby	Journal of the Electrochemical Society
621244	ELECTRA	Relating defect chemistry and electronic transport in the double perovskite Ba 1-x Gd 0.8 La 0.2+x Co 2 O 6-δ (BGLC)	E. Vøllestad, M. Schrade, J. Segalini, R. Strandbakke, T. Norby	Journal of Materials Chemistry A
621244	ELECTRA	Development of composite steam electrodes for electrolysers based on barium zirconate	N. Bausá, C. Solís, R. Strandbakke, J.M. Serra	Solid State Ionics
621245	SOCTESQA	An analysis of the effects of test bench architecture on solid oxide fuel cell and electrolysis characterisation and the role of international standards	M. Graziadio, B. Conti, A. Giannini, C. Boigues Munoz, S.J. McPhail, M. Carlini	ECS Transactions
621252	PECDEMO	High solar flux concentration water splitting with hematite (α-Fe_2O_3) photoanodes	G. Segev, H. Dotan, K.D. Malviya, A. Kay, M.T. Mayer, M. Grätzel, A. Rothschild	Advanced Energy Materials
621252	PECDEMO	Cu_2O nanowire photocathodes for efficient and durable solar water splitting	J. Luo, L. Steier, M.-K. Son, M. Schreier, M.T. Mayer, M. Grätzel	Nano Letters
621252	PECDEMO	Extremely stable bare hematite photoanode for solar water splitting	P. Dias, A. Vilanova, T. Lopes, L. Andrade, A. Mendes	Nano Energy
621252	PECDEMO	The effect of electrolyte re-utilisation in the growth rate and morphology of TiO_2 nanotubes	J.D. Costa, P. Quitério, A. Apolinário, C.T. Sousa, J. Azevedo, J. Ventura, L. Andrade, A. Mendes, J.P. Araújo	Materials Letters

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	141-151	344	Elsevier	2017	No
	1749-1758	Vol. 78/Issue 1	The Electrochemical Society	2017	No
	1689-1699	Vol. 78/Issue 1	The Electrochemical Society	2017	No
	2087-2098	Vol. 78/Issue 1	The Electrochemical Society	2017	No
	459-476	241	Elsevier Limited	2017	No
	697-711	Vol. 30/Issue 8	Chinese Society for Metals	2017	Yes
	150-159	340	Elsevier	2017	No
	xx-xx (in review)	xx-xx (in review)	Elsevier Inc.	2017	
	xx-xx (accepted)	xx-xx (accepted)	Elsevier	2017	
	To be published	xx-xx (to be published)	CSIC Consejo Superior de Investigaciones Cientificas	2017	Yes
	xx-xx (submitted)	xx-xx (submitted)	Elsevier Limited	2017	
	F196-F202	Vol. 164/Issue 4	Electrochemical Society, Inc.	2017	
	15743 – 15751	5	Royal Society of Chemistry	2017	
	62-68	Vol. 306	Elsevier	2017	
	15-22	Vol. 75/Issue 37	The Electrochemical Society	2017	Yes
	1500817	Vol. 6/Issue 1	Wiley	2016	No
	1848-1857	Vol. 16/Issue 3	American Chemical Society	2016	No
	70-79	Vol. 23	Elsevier	2016	Yes
	224-227	Vol. 171	Elsevier	2016	No

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621252	PECDEMO	Tin oxide as stable protective layer for composite cuprous oxide water-splitting photocathodes	J. Azevedo, S.D. Tilley, M. Schreier, M. Stefik, C. Sousa, J.P. Araújo, A. Mendes, M. Grätzel, M.T. Mayer	Nano Energy
621252	PECDEMO	Bipolar membrane-assisted solar water splitting in optimal pH	J. Luo, D.A. Vermaas, D. Bi, A. Hagfeldt, W.A. Smith, M. Grätzel	Advanced Energy Materials
621252	PECDEMO	Architectures for scalable integrated photo-driven catalytic devices-A concept study	S. Kirner, P. Bogdanoff, B. Stannowski, R. van de Krol, B. Rech, R. Schlatmann	International Journal of Hydrogen Energy
621252	PECDEMO	Wafer surface tuning for a-Si:H/μc-Si:H/c-Si triple junction solar cells for application in water splitting	S. Kirner, H. Sarajan, A. Azarpira, T. Schedel-Niedrig, B. Stannowski, B. Rech, R. Schlatmann	Energy Procedia
621252	PECDEMO	Hetero-type dual photoanodes for unbiased solar water splitting with extended light harvesting	J. Hyun Kim, J.-W. Jang, Y.H. Jo, F.F. Abdi, Y.H. Lee, R. van de Krol, J.S. Lee	Nature Communications
621252	PECDEMO	A copper nickel mixed oxide hole selective layer for Au-free transparent cuprous oxide photocathodes	M.-K. Son, L. Steier, M. Schreier, M.T. Mayer, J. Luo, M. Grätzel	Energy and Environmental Science
621252	PECDEMO	Photocurrent of $BiVO_4$ is limited by surface recombination, not surface catalysis	C. Zachäus, F.F. Abdi, L.M. Peter, R. van de Krol	Chemical Science
621252	PECDEMO	Beating the efficiency of photovoltaics-powered electrolysis with tandem cell photoelectrolysis	A. Rothschild, H. Dotan	ACS Energy Letters
621252	PECDEMO	Photoelectrochemical water splitting in separate oxygen and hydrogen cells	A. Landman, H. Dotan, G.E. Shter, M. Wullen-kord, A. Houaijia, A. Maljusch, G.S. Grader, A. Rothschild	Nature Materials
671396	AutoRE	Pd-based membranes as key-enabling technology for H_2 production, recovery and purification	T.A. Peters, M. Stange, R. Bredesen	Presentation at World Hydrogen Energy Conference 2016
671396	AutoRE	Palladium (Pd) membranes as key enabling technology for pre-combustion CO_2 capture and hydrogen production	T.A. Peters, P.M. Rørvik, T.O. Sunde, M. Stange, F. Roness, T.R. Reinertsen, J.H. Ræder, Y. Larring, R. Bredesen	Presentation at 13th International Conference on Greenhouse Gas Control Technologies, 14-18 November 2016
671396	AutoRE	AutoRE (Automotive deRivative Energy system)	R. Bove	Poster at Programme Review Days 2016 of FCH JU
671396	AutoRE	Palladium (Pd) membranes as key enabling technology for pre-combustion CO_2 capture and hydrogen production	T.A. Peters, P.M. Rørvik, T.O. Sunde, M. Stange, F. Roness, T.R. Reinertsen, J.H. Ræder, Y. Larring, R. Bredesen	Presentation at EERA AMPEA workshop on "Materials for membranes in energy applications: gas separation membranes, electrolysers and fuel cells
671396	AutoRE	Palladium membranes – from innovation to industrial application	T.A. Peters, P.M. Rørvik, T.O. Sunde, M. Stange, F. Roness, T.R. Reinertsen, J.H. Ræder, Y. Larring, R. Bredesen	Presentation at CLIMIT SUMMIT 2017
671396	AutoRE	Membranes in energy systems with CO_2 capture	T.A. Peters	Presentation at Dr. HiperGas workshop
671396	AutoRE	Scale-up and demonstration of inorganic mem-branes for gas separation and membrane reactors	M. Stange, M.L. Fontaine, T.A. Peters, R. Bredesen	Presentation at Third European Workshop on Membrane reactors: Membrane Reactors for Process Intensification
671396	AutoRE	Numerical assessment of an automotive derivative CHP fuel cell system	A.L. Facci, G. Loreti, S. Ubertini, F. Barbir, T. Chalkidis, R.-P. Eßling, T. Peters, E. Skoufa, R. Bove	Energy Procedia/Proceedings of the 8th International Conference on Applied Energy ICAE2016
671403	INNO-SOFC	Life-cycle sustainability of solid oxide fuel cells: from methodological aspects to system implications	A. Mehmeti, S.J. McPhail, D. Pumiglia, M. Carlini	Journal of Power Sources
671403	INNO-SOFC	Determination of temperature and fuel utilisation distributions in SOFC stacks with EIS	J. Tallgren, C. Muñoz, J. Mikkola, O. Himanen, J. Kiviaho	ECS Transactions
671459	BIONICO	Effect of Au addition on hydrogen permeation and the resistance to H_2S on Pd-Ag alloy membranes	J. Melendez, N. de Nooijer, K. Coenen, E. Fernandez, J.L. Viviente, M. van Sint Annaland, P.L. Arias, D.A. Pacheco Tanaka, F. Gallucci	Journal of Membrane Science

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	10-16	Vol. 24	Elsevier	2016	No
	1600100	Vol. 6/Issue 13	Wiley	2016	No
	20823-20831	Vol. 41/Issue 45	Elsevier Limited	2016	Yes
	126-135	Vol. 102	Elsevier BV	2016	Yes
	13380	Vol. 7	Nature Publishing Group	2016	Yes
	912-918	Vol. 10/Issue 4	Royal Society of Chemistry	2017	No
	3712-3719	Vol. 8/Issue 5	Royal Society of Chemistry	2017	Yes
	45-51	Vol. 2/Issue 1	American Chemical Society	2017	No
	N/A	N/A	Nature Publishing Group	2017	No
			Spanish Hydrogen Association	2016	Yes
			IEA Greenhouse Gas R&D Programme	2016	Yes
			Fuel Cells and Hydrogen Joint Undertaking	2016	Yes
			SINTEF	2017	Yes
			Norwegian Research Council	2017	No
			Dr. HiperGas	2017	No
			EU projects BIONICO, FERRET, FluidCELL, MEMERE, and ROMEO	2017	Yes
		1876-6102	Elsevier	2017	No
	772-785	0378-7753	Elsevier BV	2016	Yes
		1938-5862	Electrochemical Society, Inc.	2017	Yes
	329-341	03767388	Elsevier BV	2017	No

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671459	BIONICO	Achievements of European projects on membrane reactor for hydrogen production	G. Di Marcoberardino, M. Binotti, G. Manzolini, J.L. Viviente, A. Arratibel, L. Roses, F. Gallucci	Journal of Cleaner Production
671459	BIONICO	Palladium-based membranes and membrane reactors for hydrogen production and purification: an overview of research activities at Tecnalia and TU/e	E. Fernandez, A. Helmi, J.A. Medrano, K. Coenen, A. Arratibel, J. Melendez, N.C.A. de Nooijer, V. Spallina, J.L. Viviente, J. Zuñiga, M. van Sint Annaland, D.A. Pacheco Tanaka, F. Gallucci	International Journal of Hydrogen Energy
671461	HySEA	Validating, documenting and qualifying models used for consequence assessment of hydrogen explosion scenarios	H. Hisken, G. Atanga, T. Skjold, S. Lakshmipathy, P. Middha	Proceedings of the Eleventh International Symposium on Hazards, Prevention, and Mitigation of Industrial Explosions
671470	DEMOSOFC	Sulfur poisoning in Ni-anode solid oxide fuel cells (SOFCs): deactivation in single cells and a stack	D. Papurello, A. Lanzini, S. Fiorilli, F. Smeacetto, R. Singh, M. Santarelli	Chemical Engineering Journal
671470	DEMOSOFC	Biogas trace compound removal with ashes using proton transfer reaction time-of-flight mass spectrometry as innovative detection tool	D. Papurello, L. Tomasi, S. Silvestri, I. Belcari, M. Santarelli, F. Smeacetto, F. Biasioli	Fuel Processing Technology
671470	DEMOSOFC	Limiting factors for planar solid oxide fuel cells under different trace compound concentrations	D. Papurello, A. Lanzini, D. Drago, P. Leone, M. Santarelli	Energy
671470	DEMOSOFC	Evaluation of the Wheeler-Jonas parameters for biogas trace compounds removal with activated carbons	D. Papurello, L. Tomasi, S. Silvestri, M. Santarelli	Fuel Processing Technology
671470	DEMOSOFC	A comparative study of two SOFC-based coge neration systems fed by municipal solid waste by means of either the gasifier or digester	M. Yari, A.S. Mehr, S.M.S. Mahmoudi, M. Santarelli	Energy
671470	DEMOSOFC	The effect of heavy tars (toluene and naphtha-lene) on the electrochemical performance of an anode-supported SOFC running on bio-syngas	D. Papurello, A. Lanzini, P. Leone, M. Santarelli	Renewable Energy
671470	DEMOSOFC	Solar-assisted integrated biogas solid oxide fuel cell (SOFC) installation in wastewater treatment plant: energy and economic analysis	A.S. Mehr, M. Gandiglio, M. Mosayeb Nezhad, A. Lanzini, S.M.S. Mahmoudi, M. Yari, M. Santarelli	Applied Energy
671470	DEMOSOFC	Dealing with fuel contaminants in biogas-fed solid oxide fuel cell (SOFC) and molten carbonate fuel cell (MCFC) plants: degradation of catalytic and electrocatalytic active surfaces and related gas purification methods	A. Lanzini, H. Madi, V. Chiodo, D. Papurello, S. Maisano, M. Santarelli, J. Van Herle	Progress in Energy and Combustion Science
671470	DEMOSOFC	Dynamic model with experimental validation of a biogas-fed SOFC plant	G. D'Andrea, M. Gandiglio, A. Lanzini, M. Santarelli	Energy Conversion and Management
671470	DEMOSOFC	Carbon recovery and re-utilisation (CRR) from the exhaust of a solid oxide fuel cell (SOFC): analysis through a proof-of-concept	M. Santarelli, L. Briesemeister, M. Gandiglio, S. Herrmann, P. Kuczynski, J. Kupecki, A. Lanzini, F. Llovell, D. Papurello, H. Spliethoff, B. Swiatkowski, J. Torres-Sanglas, L.F. Vega	Journal of CO_2 Utilisation
671470	DEMOSOFC	Life Cycle Assessment (LCA) of biogas-fed solid oxide fuel cell (SOFC) plant	E. Rillo, M. Gandiglio, A. Lanzini, S. Bobba, M. Santarelli, G. Blengini	Energy
671470	DEMOSOFC	Reporting degradation from different fuel contam-inants in Ni-anode SOFCs	A. Lanzini, D. Ferrero, D. Papurello, M. Santarelli	Fuel Cells
671481	SElySOs	Is steam an oxidant or a reductant for nickel/doped-ceria cermets?	V. Papaefthimiou, D.K. Niakolas, F. Paloukis, T. Dintzer, S. Zafeiratos	ChemPhysChem
671481	SElySOs	Modified NiO/GDC cermets as possible cathode electrocatalysts for H_2O electrolysis and H_2O/CO_2 co-electrolysis processes in SOECs	E.T. Ioannidou, C.S. Neofytides, S.G. Neophytides, D.K. Niakolas	ECS Transactions
671481	SElySOs	Operando observation of nickel/ceria electrode surfaces during intermediate temperature steam electrolysis	V. Papaefthimiou, D.K. Niakolas, F. Paloukis, D. Teschner, A. Knop-Gericke, M. Haevecker, S. Zafeiratos	Journal of Catalysis

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	1442-1450	09596526	Elsevier BV	2017	No
	13763-13776	03603199	Pergamon Press Ltd.	2017	No
	1069-1086	ISBN 978-7-89437-165-2	Dalian University of Technology Electronic & Audio-visual Press	2016	Yes
		13858947	Elsevier BV	2016	No
		03783820	Elsevier BV	2016	No
		03605442	Pergamon Press Ltd.	2016	No
		03783820	Elsevier BV	2016	No
		03605442	Pergamon Press Ltd.	2016	No
	747-753	09601481	Pergamon Press Ltd.	2016	Yes
	620-638	03062619	Pergamon Press Ltd.	2017	Yes
	150-188	03601285	Pergamon Press	2017	Yes
	21-34	01968904	Pergamon Press Ltd.	2017	Yes
	206-221	22129820	Elsevier BV	2017	Yes
	585-602	03605442	Pergamon Press Ltd.	2017	Yes
	423-433	16156846	John Wiley & Sons Ltd.	2017	No
	164-170	14394235	John Wiley & Sons Ltd.	2017	Yes
	3267-3274	19385862	Electrochemical Society, Inc.	2017	No
	305-313	00219517	Academic Press	2017	No

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671481	SElySOs	In-situ X-ray photoelectron spectroscopy study of complex oxides under gas and vacuum environments	F. Paloukis, K.M. Papazisi, S.P. Balomenou, D. Tsiplakides, F. Bournel, J.-J. Gallet, S. Zafeiratos	Applied Surface Science
671481	SElySOs	High-temperature co-electrolysis of CO_2 and water on doped lanthanum chromites	K.-M. Papazisi, D. Tsiplakides, S. Balomenou	ECS Transactions
671481	SElySOs	Ceramic fuel electrodes for reversible solid oxide cells operating on carbon dioxide	S. Balomenou, K.-M. Papazisi, D. Tsiplakides	ECS Transactions
671481	SElySOs	LSC infiltrated LSCF oxygen electrode for high-temperature steam electrolysis	V. Vibhu, S. Yildiz, S.R. Foit, K. Schiemann, I. C. Vinke, R.-A. Eichel, L.G.J. de Haart	ECS Transactions
671481	SElySOs	Insights into the surface reactivity of cermet and perovskite electrodes in oxidising, reducing and humid environments	F. Paloukis, K.M. Papazisi, T. Dintzer, V. Papaefthimiou, V.A. Saveleva, S.P. Balomenou, D. Tsiplakides, F. Bournel, J.-J. Gallet, S. Zafeiratos	ACS Applied Materials & Interfaces
671486	HEALTH-CODE	A Kalman-filter-based approach to PEM fuel cell fault detection	G. Buonocunto, G. Spagnuolo, W. Zamboni	Proceedings of the 2017 IEEE ISIE-International Symposium on Industrial Electronics
699892	ECo	Integrated system design of a small-scale power-to-methane demonstrator	L. Wang, A. Mian, L.C.R. de Sousa, S. Diethelm, J. Van Herle, F. Maréchal	Chemical Engineering Transactions
699892	ECo	Effects of pressure on high- temperature steam and carbon dioxide co-electrolysis	L. Bernadet, J. Laurencin, G. Roux, D. Montinaro, F. Mauvy, M. Reytier	Electrochimica Acta
699892	ECo	Long-term testing of solid oxide electrolysis cells under co-electrolysis conditions	M. Rao, X. Sun, A. Hagen	ECS Transactions
700008	HPEM2GAS	Enhanced performance and durability of low catalyst loading PEM water electrolyser based on a short-side chain perfluorosulfonic ionomer	S. Siracusano, V. Baglio, N. Van Dijk, L. Merlo, A.S. Aricò	Applied Energy
700008	HPEM2GAS	Sulfated titania as additive in Nafion membranes for water electrolysis applications	S. Siracusano, V. Baglio, I. Nicotera, L. Mazzapioda, A.S. Aricò, S. Panero, M.A. Navarra	International Journal of Hydrogen Energy
700008	HPEM2GAS	The influence of iridium chemical oxidation state on the performance and durability of oxygen evolution catalysts in PEM electrolysis	S. Siracusano, V. Baglio, S.A. Grigoriev, L. Merlo, V.N. Fateev, A.S. Aricò	Journal of Power Sources
700008	HPEM2GAS	New insights into the stability of a high-performance nanostructured catalyst for sustainable water electrolysis	S. Siracusano, N. Hodnik, P. Jovanovic, F. Ruiz-Zepeda, M. Šala, V. Baglio, A.S. Aricò	Nano Energy
700101	Giantleap	Rejuvenation of fuel cells	F. Zenith, J. Tjønnås, I.J. Halvorsen	European Fuel Cell Car Workshop
700101	Giantleap	Model-based strategy oriented to PEMFC system prognostic for bus transportation applications based on EMR formalism	R. Petrone, N. Yousfi Steiner, S. Jemeï, F. Harel, D. Hissel, M.-C. Péra	7th International Conference on Fundamentals and Development of Fuel Cells
700101	Giantleap	Experimental diagnostics and modelling of inductive phenomena at low frequencies in impedance spectra of proton exchange membrane fuel cells	I. Pivac, B. Šimić, F. Barbir	Journal of Power Sources
700190	Hytechcycling	Hytechcycling project: analysis of recycling and dismantling strategies and techniques for fuel cells and hydrogen technologies	A. Ferriz – Foundation for the Development of New Hydrogen Technologies in Aragon	FuturENVIRO
700190	Hytechcycling	Assessment of critical materials and components in FCH technologies to improve LCIA in end-of-life strategy	A. Lotrič, R. Stropnik, B. Drobnič, B. Jurjevčič, M. Sekavčnik, M. Mori, A.-M. Férriz Quílez	10th International Conference on Sustainable Energy and Environmental Protection (27-30 June 2017, Bled, Slovenia) (Conference Proceedings)
700266	Cell3Ditor	Three-dimensional printing of components and functional devices for energy and environmental applications	J. C. Ruiz-Morales, A. Tarancón, J. Canales-Vázquez, J. Méndez-Ramos, L. Hernández-Afonso, P. Acosta-Mora, J. R. Marín Rueda, R. Fernández-González	Energy and Environmental Science

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	1176-1181	01694332	Elsevier BV	2017	No
	3197-3204	19385862	Electrochemical Society, Inc.	2017	No
	3237-3245	19385862	Electrochemical Society, Inc.	2017	No
	3283-3295	19385862	Electrochemical Society, Inc.	2017	No
	25265-25277	19448244	American Chemical Society	2017	No
	934-939		IEEE ISIE-International Symposium on Industrial Electronics	2017	No
	1339-1344	978-88-95608-51-8	The Italian Association of Chemical Engineering – AIDIC Servizi	2017	Yes
	114-127	00134686	Pergamon Press Ltd.	2017	No
	57-69	19385862	Electrochemical Society, Inc.	2017	Yes
	477-489	03062619	Pergamon Press Ltd.	2017	No
	In press	03603199	Pergamon Press Ltd.	2017	No
	105-114	03787753	Elsevier BV	2017	No
	618-632	22112855	Elsevier BV	2017	No
			EFCW 2017	2017	No
			FDFC 2017	2017	No
	240-248	03787753	Elsevier BV	2017	No
	71-74	2340-2628	Saguenay, S.L.	2016	No
	100-111		University of Maribor Press	2017	No
	846-859	1754-5706	The Royal Society of Chemistry	2017	No

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700300	GrInHy	Performance characterisation of glass-ceramic sealants in dual atmosphere environment for reversible solid oxide cell (R-SOC) applications	D. Ferrero, A.G. Sabato, H. Javed, A. Lanzini, K. Herbrig, C. Walter, M. Santarelli, F. Smeacetto	ECS Meeting Abstracts
700300	GrInHy	Green industrial hydrogen via reversible high-temperature electrolysis	K. Schwarze, O. Posdziech, S. Kroop, N. Lapeña-Rey, J. Mermelstein	ECS Transactions
700355	HyGrid	Recent advances on carbon molecular sieve membranes (CMSMs) and reactors	M. Llosa Tango, D. Pacheco Tanaka	Processes
700355	HyGrid	Flexible hybrid separation system for hydrogen recovery from natural gas grids	M. Nordio, F. Gallucci, M. Sint Annaland, V. Spallina	Dutch National Membrane Day, Arnhem (Netherlands), 28 June 2016 – Poster
700355	HyGrid	The need for high-temperature proton exchange membranes for electrochemical hydrogen purification and compression	M.J.J. Mulder, P.J. Bouwman	EMEA workshop 2016, Bad Zwischenahn, Germany (27-29 June 2016)
700355	HyGrid	Development of carbon molecular sieve membranes for the use of renewable gases, biomethane and hydrogen in natural gas networks	A.M. Gutierrez, J.R. Arraibi, M.A. Llosa Tanco, J. Zúñiga, J.L. Viviente, L. García Gómez	Proceedings of the International Gas Union Research Conference 2017 (IGRC2017), Rio de Janeiro, Brazil (24-26 May 2017)
700355	HyGrid	Flexible hybrid separation system for H_2 recovery from natural gas grids (HyGrid)	A.M. Gutierrez	GERG Meeting with DG Energy, Brussels, Belgium (6 February 2017)
700355	HyGrid	Flexible hybrid separation system for H_2 recovery from NG grids	F. Gallucci, J.L. Viviente	Third European Workshop on Membrane reactors: Membrane Reactors for Process Intensification (MR4PI2017), Villafranca di Verona, Italy (9-10 March 2017); poster
700355	HyGrid	Pd supported membrane hydrogen purifier: a comparison with other technologies	M. Succi, G. Macchi	Third European Workshop on Membrane reactors: Membrane Reactors for Process Intensification (MR4PI2017), Villafranca di Verona, Italy (9-10 March 2017); poster
700355	HyGrid	Hidrógeno en redes de gas natural	A.M. Gutierrez	Fronteras Tecnológicas en Generación de Electricidad, Energías Renovables e Hidrógeno Whorshop. Madrid, Spain (26 April 2017); oral presentation
700355	HyGrid	Advancement in palladium membranes hydrogen purification	M. Succi, G. Macchi, E. Fernandez, J. Melendez, J. L. Viviente, D.A. Pacheco Tanaka	6th European PEFC and Electrolyser Forum. Lucerne, Switzerland (4-7/07/2017). Poster
700355	HyGrid	Preparation and hydrogen permeation studies of ultra-thin palladium (≈1 micrometre) and carbon membranes from mixtures containing low concentration of hydrogen (< 30%)	D.A. Pacheco Tanaka, M.A. Llosa Tanco, J. Medrano, J. Melendez, E. Fernández, M. Nordio, F. Gallucci	13th International Conference on Catalysis in Membrane Reactors (ICCMR13), Houston (Texas), USA (10-13 July 2017); oral presentation: keynote
700355	HyGrid	Electrochemical compressor for hydrogen separation in a small-scale hybrid system	M. Nordio, M. Van Sint Annaland, F. Gallucci, V. Spallina, M. Mulder, L. Raymakers, P. Bouwman	13th International Conference on Catalysis in Membrane Reactors (ICCMR13), Houston (Texas), USA (10-13 July 2017); oral presentation
700355	HyGrid	Ultra-thin palladium-silver membranes for pure hydrogen production and separation: modelling and effect of sweep gas	M. Nordio, J. Meléndez, E. Fernández, M. Van Sint Annaland, D.A. Pacheco Tanaka, F. Gallucci	13th International Conference on Catalysis in Membrane Reactors (ICCMR13), Houston (Texas), USA (10-13 July 2017); oral presentation
700355	HyGrid	Hybrid separation system for hydrogen recovery from natural gas grids	M. Nordio, J. Meléndez, D.A. Pacheco Tanaka, M. Mulder, P. Bouwman, L. Raymakers, M. Van Sint Annaland, F. Gallucci	10th World Congress of Chemical Engineering (WCCE10), Barcelona, Spain (1-5 November 2017); oral presentation

	Relevant pages	Publication frequency/ ISSN****	Publisher	Publication year	Open Access*****
		2151-2043	ECS – The Electrochemical Society	2017	Yes
	2943-2952	19385862	Electrochemical Society, Inc.	2017	Yes
	29	22279717	MDPI	2016	No
			Dutch National Membrane Association	2016	No
			EMEA	2016	No
			International Gas Union	2017	No
			DG Energy	2017	No
			na	2017	No
			na	2017	No
			na	2017	No
			na	2017	No
			ICCMR	2017	No
			ICCMR	2017	No
			ICCMR	2017	No
			WCCE	2017	No

ANNEX 4
Patents from projects

No further patents from 2016-2017; for the full list of previous patents related to FCH JU projects please refer to the Annual Activity Report 2016.

ANNEX 5
Scoreboard of Horizon 2020 common KPIs[97]

H2020 priority	H2020 KPI number	Key Performance Indicator	Type of data required	Results H2020 until 31/12/2017 (calls 2014-2017)
INDUSTRIAL LEADERSHIP	12	SME – Share of participating SMEs introducing innovations new to the company or the market (covering the period of the project plus three years)	Number of SMEs that have introduced innovations	16 SMEs
	13	SME – Growth and job creation in participating SMEs	Turnover of company, number of employees	Turnover of SMEs at most recent reporting: EUR 112 946 221 No. of employees at SMEs at most recent reporting: 1 349
SOCIETAL CHALLENGES	14	Publications in peer-reviewed high-impact journals	Publications from relevant funded projects (DOI: digital object identifiers); journal impact benchmark (ranking) data to be collected by commercially available bibliometric databases	50 publications in peer-reviewed high-impact journals
	15	Patent applications and patents awarded in the area of the JTI	Patent application number	0
	16	Number of prototype testing activities and clinical trials	Reports on prototypes, and testing activities, clinical trials	No. of prototypes: 15 No. of testing activities: 24 No. of clinical trials: N/A
	17	Number of joint public-private publications in projects	Properly flagged publications data (DOI) from relevant funded projects	N/A
	18*	New products, processes and methods launched on the market	Project count and drop-down list enabling choice of the type of processes, products, methods	No. of projects with: New products: 8 New processes: 8 New methods: 5

* This indicator is not a legally compulsory one, but it covers several additional specific indicators requested for more societal challenges by the services in charge

96 (based on Annex II to Council Decision 2013/743/EU)

H2020 priority	H2020 KPI number	Key Performance Indicator	Type of data required	Results H2020 until 31/12/2017 (calls 2014-2017)
EVALUATIONS	N/A	Time to inform (TTI) all applicants of the outcome of the evaluation of their application from the final date for submission of completed proposals	Number and % of information letters sent to applicants within target Average TTI (calendar days) Maximum TTI (calendar days)	73 information letters with an average of 108 days (100 % within target)
	N/A	Redress after evaluations	Number of redresses requested	11
GRANTS	N/A	Time to grant (TTG) measured (average) from call deadline to signature of grants	Number and % of grants signed within target Average TTG in calendar days Maximum TTG in calendar days	71 GA signed (72 % within target) Average TTG: 240 days Maximum TTG: 589 days
	N/A	Time to sign (TTS) grant agreements from the date of informing successful applicants (information letters)	Number and % of grants signed within target Average TTG in calendar days Maximum TTG in calendar days	71 GA signed (93 % within target) Average TTS: 132 days Maximum TTG: 463 days
PAYMENTS	N/A	Time to pay (TTP) (% made on time): - pre-financing - interim payment -final payment	Average number of days for grants pre-financing, interim payments and final payments Average number of days for administrative payments Number of experts appointed	Average number of days for pre-financing: 11 (87 %[98] on time) Average number of days for interim payments: 63 (100 % on time) Average number of days for final payments: 75 (100 % on time) Average number of days for administrative payments in 2017: 17
HR	N/A	Vacancy rate (%)	% of posts filled, composition of the JU staff	100 %
JU EFFICIENCY	N/A			
	N/A	Budget implementation/ execution: 1. % CA to total budget 2. % PA to total budget	% of CA and PA	In 2017 CA: 98 % PA: 89 %
	N/A	Administrative budget: Number and % of total of late payments	Number of delayed payments % of delayed payments (of the total)	In 2017 43 late payments 5.7 % late payments (of the total)

97 Nine out of 70 pre-financings (all from call 2016) were paid at 32 days (with a target at 30) due to technical issues.

ANNEX 6
Indicators for monitoring cross-cutting issues[99]

NUMBER	DEFINITION/RESPONDING TO QUESTION	TYPE OF DATA REQUIRED	AAR 2017 (CALLS 2014-2017)
2,1	Total number of participants by EU-28 Member State	Nationality of Horizon 2020 applicants and beneficiaries (number)	Applications: 1901 applications, 866 applicants from EU-28 Grants: 685 participations, 392 participants from EU-28
2.2	Total amount of EU financial contribution by EU-28 Member State (EUR millions)	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution	In EUR per country: AT 16 917 880.32; BE 13 329 421.75; BG 190 500; CZ 1 001 206.25; DE 114 384 025.53; DK 16 285 780.75; EE 400 425; EL 3 434 947.50; ES 12 153 041.83; FI 13 465 109.75; FR 55 072 399.41; HR 380 000; HU 21 000; IT 33 326 669.30; LT 130 530.28; LV 2 727 311.25; MT 32 999; NL 20 053 241.85; PL 21 000; PT 416 085; RO 243 250; SE 6 985 854.56; SI 1 205 356.25; UK 65 477 948.50 Grand total: 377 655 984.08
N/A	Total number of participants by Associated Countries	Nationality of Horizon 2020 applicants and beneficiaries (number)	Applications: 183 applications, 88 applicants from Associated Countries Grants: 61 participations, 36 participants from Associated Countries
N/A	Total amount of EU financial contribution by Associated Country (EUR millions)	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution	In EUR per country: IS 1 845 075; NO 16 816 497.88; CH 3 935 242.81; UA 55 125 Grand total: 22 651 940.69
3.1	Share of EU financial contribution going to SMEs (Enabling and industrial tech and Part III of Horizon 2020)	Number of Horizon 2020 beneficiaries flagged as SMEs % of EU contribution going to beneficiaries flagged as SMEs	SME participations: 191/748 (26 %) SME participants: 105/430 (24 %) SME funding: 110 414 362.40 / 400 307 924.77 (28 %)
6.1	Percentage of women participants in Horizon 2020 projects	Gender of participants in Horizon 2020 projects	According to continuous reporting: 8050 / 22 812 (35.3 %)
6.2	Percentage of women project coordinators in Horizon 2020	Gender of MSC fellows, ERC principle investigators and scientific coordinators in other Horizon 2020 activities	Women coordinators: 22/73 (30 %)
6.3	Percentage of women in EC advisory groups, expert groups, evaluation panels, individual experts, etc.	Gender of membership in advisory groups, panels, etc.	Scientific com. 3/9 (33.3 %) on 31/12/2017 SRG: 7/29 (30 %) on 31/12/2017 Evaluators: 28/127 (22 %)
7.1	Share of third-country participants in Horizon 2020	Nationality of Horizon 2020 beneficiaries	2 participants from third countries in 2 different grant agreements without EU fundings
7.2	Percentage of EU financial contribution attributed to third-country participants	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution	0

99 (based on Annex III to Council Decision 2013/743/EU)

NUMBER	DEFINITION/RESPONDING TO QUESTION	TYPE OF DATA REQUIRED	AAR 2017 (CALLS 2014-2017)
9.1	Share of projects and EU financial contribution allocated to Innovation Actions (IAs)	Number of IA proposals and projects properly flagged in the WP; follow-up at grant level	No: 19/73 (26 %) Funding EUR: 241 779 725.08 / 400 307 924.77 (60 %)
9.2	Within the IAs, share of EU financial contribution focused on demonstration and first-of-a-kind activities	Topics properly flagged in the WP; follow-up at grant level	N/A – none of the FCH 2 JU projects were flagged
N/A	Scale of impact of projects (High Technology Readiness Level)	Number of projects addressing TRL between (2-3, 4-6, 5-7)	Based on TRL specified in the topic (project start) TRL 2-3: 2 topic – 1 grant; TRL <3: 1 topic – 1 grant; TRL 3: 17 topics – 16 grants; TRL 3-4: 4 topics – 3 grants; TRL 4: 20 topics – 15 grants; TRL 4-5: 1 topic – 3 grants; TRL 5: 5 topics – 5 grants; TRL 4-6: 1 topic – 0 grants; TRL 5-6: 1 topic – 1 grant; TRL 6: 9 topics – 4 grants; TRL >6: 1 topic – 0 grants; TRL 6-7: 5 topics – 5 grants; TRL 7: 8 topics – 5 grants; TRL >7: 1 topic – 1 grant; TRL 8: 1 topic-1 grant; na: 14 topics -10 grants (cross-cutting projects); TRL 8-9 for FCVs and TRL 7-8 for HRS: 1 topic – 1 grant
11.1	Percentage of Horizon 2020 beneficiaries from the private-for-profit sector	Number of and % of the total Horizon 2020 beneficiaries classified by type of activity and legal status	Participations: 274/748 (37 %) Participants: 185/430 (43 %)
11.2	Share of EU financial contribution going to private-for profit-entities (Enabling and industrial tech and Part III of Horizon 2020)	Horizon 2020 beneficiaries classified by type of activity; corresponding EU contribution	EUR 189 927 195.39 / EUR 400 307 924.77 (47 %)
12.1	EU financial contribution for PPP (Art. 187)	EU contribution to PPP (Art. 187)	Cumulative EU contribution to administrative and operational budget for the period 2014-2017: CA: 408 971 967 PA: 234 326 027
12.2	PPPs leverage: total amount of funds leveraged through Art. 187 initiatives, including additional activities, divided by the EU contribution	Total funding made by private actors involved in PPPs - in-kind contribution already committed by private members in projects selected for funding - additional activities (i.e. research expenditure/investment by industry in the sector, compared to previous year)	1.95 (see section 1.1, Formula B)
13.3	Dissemination and outreach activities other than peer-reviewed publications – [conferences, workshops, press releases, publications, flyers, exhibitions, training, social media, websites, communication campaigns (e.g. radio, TV)]	A drop-down list allows the type of dissemination activity to be selected. Number of events, funding amount and number of people reached thanks to the dissemination activities	Based on manual extraction for 19 projects which had reported: 16 websites, 3 Twitter accounts, 3 Facebook accounts, 4 LinkedIn profiles, 2 accounts on other social medial, 4 videos, 7 slide-shares, 12 press releases, 15 newsletters, 3 brochures, 8 posters, 3 flyers, 1 newspaper interview, 68 presentations at conferences or seminars, 2 exhibitions, 2 trade fairs, 21 events (scientific, dissemination, showcase, etc.), 13 workshops, 3 public handover ceremonies of vehicles, 2 HRS opening ceremonies, 1 TV film, 2 radio interviews, 1 award received

NUMBER	DEFINITION/RESPONDING TO QUESTION	TYPE OF DATA REQUIRED	AAR 2017 (CALLS 2014-2017)
14.2	Proposal evaluators by country	Nationality of proposal evaluators	Austria (5), Belgium (1), Finland (2), France (11), Germany (15), Greece (5), Hungary (2), Ireland (1), Italy (21), Lithuania (1), Netherlands (1), Portugal (6), Spain (16), Romania (3), Sweden (2), Poland (1), United Kingdom (13), Turkey (3), India (2), Switzerland (2), United States (10), Russia (1), Canada (3)
14.3	Proposal evaluators by organisations' type of activity	Type of activity of evaluators' organisations	Type of activity: No of expert participations (%) • Consultancy firms (24) – 16 % • Higher education establishments (43) – 28 % • International research centres (2) – 1 % • Non-research commercial sector including SMEs (19) – 12 % • Non-research international organisations (Association of States) (3) – 2 % • Non-research private non-profit (3) – 2 % • Non-research public sector (6) – 4 % • Others/not defined (15) – 10 % • Private/commercial research centres (12) – 8 % • Private non-profit research centres (7) – 5 % • Public research centres (19) – 12 %
N/A	Participation of RTO[3]s and universities in PPPs (Art. 187 initiatives)	Number of RTOs participating in funded projects and % of the total	135/748 (18 %)
		Number of universities participating in funded projects and % of the total	103/748 (14 %)
		% of budget allocated to RTOs and to universities	RTO: EUR 50 442 338.81 (13 %) HES: EUR 24 825 832.13 (6 %)
N/A	The objective is to ensure that research projects funded are efficiently compliant with provisions on ethics	% of proposals not granted because non-compliance with ethical rules/ proposals invited to grant (target 0 %); time to ethics clearance (target 45 days)[4]	N/A
N/A	Error rate	% of common representative error; % residual error	see section 4.3
N/A	Implementation of *ex-post* audit results	Number of cases implemented; in total EUR million; of cases implemented/ total cases	see section 4.3

ANNEX 7
Scoreboard of KPIs specific to FCH 2 JU

#	Key Performance Indicator	Results
1	Share of the fund allocated to the following research activities: - renewable energy - end-user energy efficiency - smart grids - storage	Renewable energy: EUR 62.5 million (16 %) End-user energy efficiency: EUR 98 million (25 %) Smart grids: EUR 28 million (6 %) Storage: EUR 13 million (3 %)
2	Demonstrator projects hosted in MSs and regions benefiting from EU Structural Funds	The FCH 2 JU has made considerable progress towards the KPI of having demonstrator projects hosted in MS and regions benefiting from EU Structural and investment Funds[100]: projects HyBalance, JIVE, JIVE 2 and DEMOSOFC have used additional EU funding schemes in parallel with that of the FCH 2 JU

99 https://ec.europa.eu/info/funding-tenders-0/european-structural-and-investment-funds_en
FCH JU projects work mainly with the following funds: European regional development fund (ERDF), European social fund (ESF), Cohesion fund (CF)

ANNEX 8
Draft annual accounts

BALANCE SHEET

		EUR '000
	31.12.2017	31.12.2016
NON-CURRENT ASSETS		
Intangible assets	59	2
Property, plant and equipment	128	52
Pre-financing	98 535	60 017
	98 722	**60 071**
CURRENT ASSETS		
Pre-financing	75 408	41 975
Exchange receivables and non-exchange recoverables	25 856	20 921
	101 264	**62 896**
TOTAL ASSETS	**199 986**	**122 967**
CURRENT LIABILITIES		
Payables and other liabilities	(96 602)	(170 205)
Accrued charges and deferred income	(70 496)	(59 634)
	(167 098)	**(229 840)**
TOTAL LIABILITIES	**(167 098)**	**(229 840)**
NET ASSETS		
Contribution from members	1 037 590	763 386
Accumulated deficit	(870 259)	(700 941)
Economic result for the year	(134 443)	(169 317)
NET ASSETS	**32 888**	**(106 873)**

STATEMENT OF FINANCIAL PERFORMANCE

		EUR '000
	2017	2016
REVENUE		
Revenue from non-exchange transactions		
Recovery of expenses	3 778	2 808
Other	4	37
Total	**3 782**	**2 846**
Revenue from exchange transactions		
Financial income	1	2
Other exchange revenue	0	17
Total	**1**	**19**
	3 782	**2 864**
EXPENSES		
Operating costs	(133 393)	(167 743)
Staff costs	(2 760)	(2 552)
Finance costs	(37)	(103)
Other expenses	(2 036)	(1 783)
	(138 225)	**(172 182)**
ECONOMIC RESULT FOR THE YEAR	**(134 443)**	**(169 317)**

ANNEX 9
Materiality criteria

The '**materiality**' concept provides the executive director with a basis for assessing the importance of the weaknesses/risks identified and thus whether those weaknesses should be subject to a formal reservation to his declaration. The same materiality criteria apply to FP7 and the H2020 programme.

When deciding whether or not something is material, **qualitative and quantitative** terms have been considered.

In **qualitative** terms, when assessing the significance of any weakness, the following factors have been taken into account:

- The nature and scope of the weakness;
- The duration of the weakness;
- The existence of compensatory measures (mitigating controls which reduce the impact of the weakness);
- The existence of effective corrective actions to correct the weaknesses (action plans and financial corrections) which have had a measurable impact.

In **quantitative** terms, in order to make a judgement on the significance of a weakness, the potential maximum (financial) impact is quantified.

Whereas the FCH JU control strategy is of a multi-annual nature (i.e. the effectiveness of the JU's control strategy can only be assessed at the end of the programme, when the strategy has been fully implemented and errors detected have been corrected), the executive director is required to sign a declaration of assurance for each financial year. To determine whether to qualify his declaration of assurance with a reservation, the effectiveness of the JU's control system must be assessed, not only for the year of reference, but more importantly, with a multi-annual outlook.

The **control objective** for FCH JU is to ensure that the '**residual error rate**', i.e. the level of errors which remains undetected and uncorrected, does not exceed 2 % by the end of the JU's programme. Progress towards this objective is to be (re)assessed annually, in view of the results of implementing the *ex-post* audit strategy. As long as the residual error rate is not (yet) below 2 % at the end of a reporting year within the programme's life cycle, a reservation would (still) be made. Nevertheless, apart from the residual error rate, the executive director may also take into account other management information at his disposal to identify the overall impact of a weakness and determine whether or not it leads to a reservation.

If an adequate calculation of the residual error rate is not possible, for reasons not involving control deficiencies, the consequences are to be assessed quantitatively by estimating the likely exposure for the reporting year. The relative impact on the declaration of assurance would then be considered by analysing the available information on qualitative grounds and considering evidence from other sources and areas (e.g. information available on error rates in more experienced organisations with similar risk profiles).

Considering the crucial role of *ex-post* audits within the JU's control system, its effectiveness needs to check whether the scope and results of these audits are sufficient and adequate to meet the control objectives.

EFFECTIVENESS OF CONTROLS

The **starting point** to determine the effectiveness of the controls in place is the 'representative error rate' expressed as a percentage of errors in favour of the FCH JU detected by *ex-post* audits measured with respect to the amounts accepted after *ex-ante* controls.

According to the FCH JU *ex-post* audit strategy approved by the GB, the representative error rate will be based on the simple average error rate (AER) for a stratified population, from which a judgemental sample has been drawn according to the following formula:

$$AER\% = \frac{\Sigma\ (err)}{n} = RepER\%$$

Where:

Σ (err) = sum of all individual error rates of the sample (in %). Only those errors in favour of the JU will be taken into consideration.

n = sample size

Second step: calculation of **residual error rate**:

To take into account the impact of the *ex-post* controls, this error level is to be adjusted by subtracting:

- errors detected and corrected as a result of the implementation of audit conclusions;
- errors corrected as a result of the extrapolation of audit results to non-audited contracts with the same beneficiary.

This results in a residual error rate which is calculated by using the following formula:

$$ResER\% = \frac{(RepER\% * (P-A) - (RepERsys\% * E)}{P}$$

Where:

ResER% = residual error rate, expressed as a percentage.

RepER% = representative error rate, or error rate detected in the representative sample, in the form of the AER, expressed as a percentage and calculated as described above (AER%).

RepERsys% = systematic portion of the RepER% (the RepER% is composed of complementary portions reflecting the proportion of 'systematic' and 'non-systematic' errors detected) expressed as a percentage.

P = total amount in EUR of the auditable population.

A = total of all audited amounts, expressed in EUR.

E = total non-audited amounts of all audited beneficiaries. This will comprise the total amount, expressed in EUR, of all non-audited validated cost statements for all audited beneficiaries, excluding those for which an extrapolation is ongoing.

This calculation will be performed on a point-in-time basis, i.e. all the figures will be provided as of a certain date.

ANNEX 10
List of acronyms

AAR	Annual Activity Report
ABAC	Accrual-Based Accounting
ARES	Advanced REcord System
AWP	Annual Work Plan
CA	Commitment appropriations
CAPEX	Capital expenditure
CAS	Common Audit Service
CFS	Certificate of Financial Statements
CHP	Combined heat and power
CORDA	Common Research Data Warehouse
COSO	Committee of Sponsoring Organizations of the Treadway Commission
CSC	Common Support Centre
DG	Directorate- General
DG Research and Innovation	Directorate-General for Research and Innovation
EC	European Commission
ECA	European Court of Auditors
ED	Executive Director
EMIT	Experts Management Tool
EP	European Parliament
ESR	Evaluation Summary Report
ESS	Electronic Submission System
EU	European Union
EUSEW	European Sustainable Week

FCH 2 JU	Fuel Cells and Hydrogen 2 Joint Undertaking
FP7	Seventh Framework Programme
FTE	Full-Time Equivalent
GA	Grant Agreement
GB	Governing Board
H2020	Horizon 2020
HR	Human Resources
HRS	Hydrogen Refuelling Station
IAS	Internal Audit Service
ICS	Internal Control Standard
IG	Industry Grouping
IKAA	Contributions in Kind in Additional Activities
IKOP	Contributions in Kind in Operational Activities
IT	Information Technology
JRC	Joint Research Centre
JTI	Joint Technology Initiative
KPI	Key Performance Indicator
MAIP	Multi-Annual Implementation Plan
MAWP	Multi-Annual Work Programme
MEA	Membrane Electrode Assembly
MGA	Model Grant Agreement
MoU	Memorandum of Understanding
PA	Payment Appropriation
PO	Programme Office
PEM	Proton Exchange Membrane
PNR	Pre-Normative Research
PPP	Public–Private Partnership
PRD	Programme Review Days

RCS	Regulation Code and Standards
RE	Renewable Energy
RG	Research Grouping
RTD	Research and Technology development
SC	Scientific Committee of the Fuel cells and Hydrogen Joint Undertaking
SET Plan	Strategic Energy Technology Plan
SF	Stakeholder Forum
SME	Small and Medium-sized Enterprise
SOFC	Solid Oxide Fuel Cell
SPOC	Single Point of Contact
SRG	States Representatives Group
SYSPER	SYStème de Gestion du PERsonnel
TRL	Technology Readiness Level
TTG	Time To Grant
TTI	Time To Inform
UK	United Kingdom
US	United States

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