Funded Projects under Horizon 2020

Secure, clean and efficient energy

Fuel Cells and Hydrogen Calls 2015

FCH 2 JU, institutional PPP

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This document gives information on calls and funded projects of the EU Framework Programme for Research and Innovation Horizon 2020 for the Societal Challenge – Secure, clean and efficient energy for the year 2015.
The data used in this document was extracted from the tables available at the website of the Cordis Information Service. More data is available in those tables.

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Topic FCH-01.1-Projects

Topic: FCH-01.1-2015 (Transport)	**Acronym:** INSPIRE
Call: H2020-JTI-FCH-2015-1	**Type of Action:** RIA
Title: Integration of Novel Stack Components for Performance, Improved Durability and Lower Cost	
Starting date: 01.05.2016	**End date:** 30.04.2019
Total Cost: 6,878,070.01 €	**EU max. contribution:** 6,877,869.75 €
Coordinator: JOHNSON MATTHEY PLC	

Participants:

- PRETEXO
- JOHNSON MATTHEY FUEL CELLS LIMITED
- TECHNISCHE UNIVERSITAET MUENCHEN
- CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS
- BAYERISCHE MOTOREN WERKE AKTIENGESELLSCHAFT
- SGL CARBON GMBH
- REINZ-DICHTUNGS GMBH
- TECHNISCHE UNIVERSITAET BERLIN
- ALBERT-LUDWIGS-UNIVERSITAET FREIBURG
- Teknologian tutkimuskeskus VTT Oy
- UNIVERSITE DE MONTPELLIER

Countries: DE;FI;FR;UK

Objectives:

The objective is to develop and integrate the most advanced critical PEMFC stack components, many from recent FCH JU programmes, into an automotive stack showing BOL performance of 1.5 W/cm2 at 0.6V, <10% power degradation after 6,000 hours, with a technical and economic assessment showing a cost of less than €50/kW at a 50,000 annual production scale.

This will be achieved by leading industrial and academic partners with expertise in the design and manufacture of PEMFC stacks, their components and materials. They will select and build on components which can achieve key target metrics, e.g. catalyst materials showing mass activities of 0.44 A/mg Pt. There will be focus on integration of the key components and optimisation of the interfaces regarding the electrochemistry, mass and heat transport, and mechanical interactions. Several iterations of an advanced stack design will be evaluated. Work is organised to optimise the flow of development, which begins with catalysts being advanced and down-selected, scaled then fed into the design and development of catalyst layers, integration with membranes and the demonstration of CCM performance. The CCMs feed into stack component development where they will be integrated with GDLs to form MEAs; and where bipolar plates will be designed and developed and supplied with the MEAs for iterative stack design, assembly and testing.

All mandatory and optional objectives of the FCH 2 JU Work Plan are addressed. Performance and durability are evaluated from small single cell to stack level using standardised test protocols. Degradation is addressed by stability testing, structural visualisation and modelling. Interfaces and specification alignment is an important focus, being integrated with the evaluation of new architectures and synthesis methods and informing balance of plant component specifications. Dismantling and recycling for the recovery and re-use of all critical MEA components is included in the costing evaluation.

Topic FCH-01.2-Projects

Topic: FCH-01.2-2015 (Transport)	**Acronym:** Giantleap
Call: H2020-JTI-FCH-2015-1	**Type of Action:** RIA
Title: Giantleap Improves Automation of Non-polluting Transportation with Lifetime Extension of Automotive PEM fuel cells	
Starting date: 01.05.2016	**End date:** 30.04.2019
Total Cost: 3,260,297.50 €	**EU max. contribution:** 3,260,297.50 €
Coordinator: STIFTELSEN SINTEF	
Participants: ▪ SVEUCILISTE U SPLITU, FAKULTET ELEKTROTEHNIKE, STROJARSTVA I BRODOGRADNJE ▪ UNIVERSITE DE FRANCHE-COMTE ▪ BOSCH ENGINEERING GMBH ▪ ELRINGKLINGER AG ▪ VDL BUS & COACH BV ▪ VDL ENABLING TRANSPORT SOLUTIONS BV	
Countries: FR;HR;DE;NL;NO	

Objectives:

Fuel-Cell Electric Buses (FCEBs) have been deployed in multiple demonstrations in Europe, Canada and the USA, but they still suffer from high costs and low availability. Oddly enough, the low availability has almost always been due to control issues and hybridisation strategies rather than problems in the fuel cells themselves.

Giantleap aims to increase the availability and reduce the total cost of ownership of FCEBs by increasing the lifetime and reliability of the fuel cell system; this will be achieved with advanced online diagnostics of the fuel cells and the balance-of-plant components of the system, coupled with prognostics methods to calculate the system's residual useful life, and advanced control algorithms able to exploit this information to maximise the system's life. The same control system will also be engineered for robustness, in order to increase availability to the level of diesel buses or better.

Giantleap will improve the understanding of degradation in fuel-cell systems with extensive experimentation and analysis; diagnostic and prognostic methods will focus on exploitation of current sensors to make the novel control approach cost-effective. Giantleap includes the demonstration of a prototype in relevant environment, allowing the project to reach technology readiness level 6.

The prototype will be a trailer-mounted fuel-cell based range extender meant for battery city buses. The ability to swap out the range extender in case of malfunctions greatly increases the availability of the bus, while the large battery capacity allows the bus to complete its route should malfunctions occur during usage. Furthermore, the large battery capacity will give the control system ample opportunity to optimise fuel-cell usage via hybridisation management strategies.

Topic FCH-01.5-Projects

Topic: FCH-01.5-2015 (Transport)	**Acronym:** COMPASS
Call: H2020-JTI-FCH-2015-1	**Type of Action:** RIA
Title: Competitive Auxiliary Power Units for vehicles based on metal supported stack technology	
Starting date: 01.10.2016	**End date:** 30.09.2019
Total Cost: 3,920,302.50 €	**EU max. contribution:** 3,920,302.50 €
Coordinator: AVL LIST GMBH	
Participants: ▪ Nissan Motor Manufacturing (UK) Limited ▪ FORSCHUNGSZENTRUM JULICH GMBH ▪ PLANSEE SE	
Countries: AT;DE;UK	

Objectives:

The COMPASS project is a collaborative effort of AVL, Plansee, Nissan and Research Center Jülich to develop advanced SOFC APU systems for range extender applications in passenger cars. The consortium is perfectly integrated from powder-, cell-, stack-, APU system technology providers to vehicle manufacturer and an academic partner. The project will use innovative metal supports SOFC stack technology, which enables key features like rapid start up and mechanic robustness for this application. Within the project advanced APU systems will be developed with electrical efficiency above 50%, a start up time below 15min and a small packaging size suitable for integration into battery electrical vehicles. Under the lead of NISSAN also a prototype vehicle will be build up, where an APU system will be completely integrated into the electrical powertrain. A major focus of the project is technology validation and systematic durability/reliability development. Therefore in a specific workpackage all validation activities are concentrated. The validation testing includes tests on stack, APU system and vehicle level. The APU system will furthermore undergo automotive testing like vibration, altitude, climate chamber and salt spray. In an additional dedicated workpackage manufacturing cost and business case analyses will be performed. These analyses will help to reduce the technology cost by design-to-cost and design-to-manufacture measures and show the business case of this new powertrain concept compared to other alternative and conventional propulsion concepts. This project is worldwide the first approach to integrate SOFC APU systems into electrical powertrains and will help to significantly improve APU systems also for other applications like heavy duty trucks, marine and leisure/camping.

Topic FCH-02.1-Projects

Topic: FCH-02.1-2015 (Energy)	**Acronym:** ELY4OFF
Call: H2020-JTI-FCH-2015-1	**Type of Action:** RIA
Title: PEM ElectroLYsers FOR operation with OFFgrid renewable installations	
Starting date: 01.04.2016	**End date:** 31.03.2019
Total Cost: 2,315,217.50 €	**EU max. contribution:** 2,315,217.50 €
Coordinator: FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON	
Participants: ▪ ITM POWER (TRADING) LIMITED ▪ COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES ▪ INSTRUMENTACION Y COMPONENTES SA ▪ EPIC POWER CONVERTERS SL	
Countries: FR;ES;UK	

Objectives:

Hydrogen production by PEM water electrolysers (PEMWE) has the potential of becoming a key enabling technology in the deployment of FCH technologies in the future energy market as an energy storage system able to deliver hydrogen to different applications and enabling a high penetration of renewable energy sources (RES). PEMWE has showed capabilities in the emerging hydrogen scenarios to be a valid alternative to previously developed technologies, especially considering the dynamic and versatile operation expected of hydrogen production methods when integrated with RES.

Despite the advances and improvements experienced to date with these systems, the technology needs to be further improved if it is to be installed as a competitive solution for energy markets and even more so in the case of off-grid configurations due to their particularities. The development of an autonomous off-grid electrolysers as an energy storage or backup solution (e.g. replacing diesel engines) is an unusual and challenging goal because it needs to have the capability of being directly coupled to RES in locations where the electricity grid is not deployed or weak.

The main goal of the ELY4OFF proposal is the development and demonstration of an autonomous off-grid electrolysis system linked to renewable energy sources, including the essential overarching communication and control system for optimising the overall efficiency when integrated in a real installation

Topic FCH-02.2-Projects

Topic: FCH-02.2-2015 (Energy)	**Acronym:** HPEM2GAS
Call: H2020-JTI-FCH-2015-1	**Type of Action:** RIA
Title: High Performance PEM Electrolyzer for Cost-effective Grid Balancing Applications	
Starting date: 01.04.2016	**End date:** 31.03.2019
Total Cost: 2,654,250.00 €	**EU max. contribution:** 2,499,999.00 €
Coordinator: CONSIGLIO NAZIONALE DELLE RICERCHE	
Participants: ▪ ITM POWER (TRADING) LIMITED ▪ EWII FUEL CELLS A/S ▪ HOCHSCHULE EMDEN/LEER ▪ UNIRESEARCH BV ▪ SOLVAY SPECIALTY POLYMERS ITALY SPA ▪ STADTWERKE EMDEN GMBH	
Countries: IT;UK;DE;NL;DK	

Objectives:

The next generation water electrolysers must achieve better dynamic behaviour (rapid start-up, fast response, wider load and temperature ranges) to provide superior grid-balancing services and thus address the steep increase of intermittent renewables interfaced to the grid. The HPEM2GAS project will develop a low cost PEM electrolyser optimised for grid management through both stack and balance of plant innovations, culminating in a six month field test of an advanced 180 (nominal)-300 kW (transient) PEM electrolyser. The electrolyser developed will implement an advanced BoP (power tracking electronics, high efficiency AC/DC converters, high temperature ion exchange cartridges, advanced safety integrated system, new control logic) and improved stack design and components (injection moulded components, flow-field free bipolar plates, Aquivion® membranes, core-shell/solid solution electrocatalysts). Several strategies are applied to lower the overall cost, thus enabling widespread utilisation of the technology. These primarily concern a three-fold increase in current density (resulting in the proportional decrease in capital costs) whilst maintaining cutting edge efficiency, a material use minimisation approach in terms of reduced membrane thickness whilst keeping the gas cross-over low, and reducing the precious metal loading. Further, improving the stack lifetime to 10 years and a reduction of the system complexity without compromising safety or operability. All these solutions contribute significantly to reducing the electrolyser CAPEX and OPEX costs. HPEM2GAS develops key technologies from TRL4 to TRL6, demonstrating them in a 180-300 kW PEM electrolyser system in a power-to-gas field test; delivers a techno-economic analysis and an exploitation plan to bring the innovations to market. The consortium comprises a system integrator, suppliers of membranes, catalysts and MEAs, a stack developer, an independent expert on standardization and an end-user.

Topic FCH-02.3-Projects

Topic: FCH-02.3-2015 (Energy)	**Acronym:** ECo
Call: H2020-JTI-FCH-2015-1	**Type of Action:** RIA
Title: Efficient Co-Electrolyser for Efficient Renewable Energy Storage - ECo	
Starting date: 01.05.2016	**End date:** 30.04.2019
Total Cost: 3,239,138.75 €	**EU max. contribution:** 2,500,513.75 €
Coordinator: DANMARKS TEKNISKE UNIVERSITET	

Participants:

- COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES
- ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE
- BELGISCH LABORATORIUM VAN DE ELEKTRICITEITSINDUSTRIE
- ENAGAS, S.A.
- EIFER EUROPAISCHES INSTITUT FUR ENERGIEFORSCHUNG EDF KIT EWIV
- FUNDACIO INSTITUT DE RECERCA DE L'ENERGIA DE CATALUNYA
- HTceramix SA
- VDZ gGmbH

Countries: DE;DK;FR;CH;ES;BE

Objectives:

The overall goal of ECo is to develop and validate a highly efficient co-electrolysis process for conversion of excess renewable electricity into distributable and storable hydrocarbons via simultaneous electrolysis of steam and CO2 through SOEC (Solid Oxide Electrolysis Cells) thus moving the technology from technology readiness level (TRL) 3 to 5.

In relation to the work program, ECo will specifically:

• Develop and prove improved solid oxide cells (SOEC) based on novel cell structure including electrode backbone structures and infiltration and design of electrolyte/electrode interfaces to achieve high performances and high efficiencies at ~100 oC lower operating temperatures than state-of-the-art in order to reduce thermally activated degradation processes, to improve integration with hydrocarbon production, and to reduce overall costs.

• Investigate durability under realistic co-electrolysis operating conditions that include dynamic electricity input from fluctuating sources with the aim to achieve degradation rates below 1%/1000 h at stack level under relevant operating conditions.

• Design a plant to integrate the co-electrolysis with fluctuating electricity input and catalytic processes for hydrocarbon production, with special emphasis on methanation (considering both external and internal) and perform selected validation tests under the thus needed operating conditions.

• Test a co-electrolysis system under realistic conditions for final validation of the obtained results at larger scale.

• Demonstrate economic viability for overall process efficiencies exceeding 60% using results obtained in the project for the case of storage media such as methane and compare to traditional technologies with the aim to identify critical performance parameters that have to be improved.

Perform a life cycle assessment with CO2 from different sources (cement industry or biogas) and electricity from preferably renewable sources to prove the recycling potential of the concept.

Topic FCH-02.4-Projects

Topic: FCH-02.4-2015 (Energy)	**Acronym:** GrInHy
Call: H2020-JTI-FCH-2015-1	**Type of Action:** RIA
Title: Green Industrial Hydrogen via Reversible High-Temperature Electrolysis	
Starting date: 01.03.2016	**End date:** 28.02.2019
Total Cost: 4,498,150.00 €	**EU max. contribution:** 4,498,150.00 €
Coordinator: Salzgitter Mannesmann Forschung GmbH	

Participants:

- Salzgitter Mannesmann Forschung GmbH
- SUNFIRE GMBH
- EIFER EUROPAISCHES INSTITUT FUR ENERGIEFORSCHUNG EDF KIT EWIV
- POLITECNICO DI TORINO
- BOEING RESEARCH & TECHNOLOGY EUROPE S.L.U.
- Teknologian tutkimuskeskus VTT Oy
- Ustav fyziky materialu, Akademie Ved Ceske republiky, v.v.i.

Countries: CZ;DE;ES;FI;IT

Objectives:

High-temperature electrolysis (HT electrolysis) is one of the most promising technologies to address the European Commission´s Roadmap to a competitive low-carbon economy in 2050. Because a significant share of the energy input is provided in the form of heat, HT electrolysis achieves higher electrical system efficiency compared to low temperature electrolysis technologies. Therefore, the main objectives of the GrInHy project focus on:

• Proof of reaching an overall electrical efficiency of at least 80 %LHV (ca. 95 %HHV);
• Scaling-up the SOEC unit to a DC power input (stack level) of 120 kWel;
• Reaching a lifetime of greater 10,000 h with a degradation rate below 1 %/1,000 h;
• Integration and operation for at least 7,000 h meeting the hydrogen quality standards of the steel industry;

Additional project objectives are:
• Elaboration of an Exploitation Roadmap for cost reducing measures;
• Development of dependable system cost data;
• Integration of a reversible operation mode (fuel cell mode);

The objectives are congruent with the call FCH-02.4-2015 and the Multi Annual Work Plan of the FCH JU.

The proof-of-concept will take place in the relevant environment of an integrated iron and steel works. Its existing infrastructure and metallurgical processes, which provide the necessary waste heat, increase the project´s cost-effectiveness and minimize the electrical power demand of auxiliaries. As a result, the electrical efficiency of 80 % will be achieved by operating the HT electrolyser close to the thermal-neutral operation point. The installation will consist of an optimized multi-stack module design with 6 stacks modules in parallel (total capacity: 120 kWel). The last project year is dedicated to the testing of 7,000 h and more. This will be achieved due to a high degree of existing knowledge at system level. Lifetime and degradation targets have already been fulfilled at cell level and will be verified by testing an enhanced stack.

Topic FCH-02.5-Projects

Topic: FCH-02.5-2015 (Energy)	**Acronym:** HyGrid
Call: H2020-JTI-FCH-2015-1	**Type of Action:** RIA
Title: Flexible Hybrid separation system for H2 recovery from NG Grids	
Starting date: 01.05.2016	**End date:** 30.04.2019
Total Cost: 2,847,710.00 €	**EU max. contribution:** 2,527,710.00 €
Coordinator: TECHNISCHE UNIVERSITEIT EINDHOVEN	

Participants:

- FUNDACION TECNALIA RESEARCH & INNOVATION
- SAES GETTERS S.P.A.
- QUANTIS
- NATURGAS ENERGIA DISTRIBUCION SA
- HYGEAR TECHNOLOGY AND SERVICES BV
- HYDROGEN EFFICIENCY TECHNOLOGIES (HYET) BV

Countries: NL;ES;IT;CH

Objectives:

The key objective of the HyGrid project is the design, scale-up and demonstration at industrially relevant conditions a novel membrane based hybrid technology for the direct separation of hydrogen from natural gas grids. The focus of the project will be on the hydrogen separation through a combination of membranes, electrochemical separation and temperature swing adsorption to be able to decrease the total cost of hydrogen recovery. The project targets a pure hydrogen separation system with power and cost of < 5 kWh/kgH2 and < 1.5 €/kgH2. A pilot designed for 25 kg/day of hydrogen will be built and tested.

To achieve this, HyGrid aims at developing novel hybrid system integrating three technologies for hydrogen purification integrated in a way that enhances the strengths of each of them: Membrane separation technology is employed for removing H2 from the “low H2 content” (e.g. 2-10 %) followed by electrochemical hydrogen separation (EHP) optimal for the “very low H2 content” (e.g. <2 %) and finally temperature swing adsorption (TSA) technology to purify from humidity produced in both systems upstream. The objective is to give a robust proof of concept and validation of the new technology (TRL 5) by designing, building, operating and validating a prototype system tested at industrial relevant conditions for a continuous and transient loads. To keep the high NG grid storage capacity for H2, the separation system will target the highest hydrogen recovery.

The project will describe and evaluate the system performance for the different pressure ranges within 0.03 to 80 bar (distribution to transmission) and test the concept at pilot scale in the 6-10 bar range.

HyGrid will evaluate hydrogen quality production according to ISO 14687 in line not only with fuel cell vehicles (Type I Grade D) but also stationary applications (Type I Grade A) and hydrogen fueled ICE (Type I grade E category 3).

A complete energy and cost analysis will be carried out in detail.

Topic FCH-02.6-Projects

Topic: FCH-02.6-2015 (Energy)	**Acronym:** Cell3Ditor
Call: H2020-JTI-FCH-2015-1	**Type of Action:** RIA
Title: Cost-effective and flexible 3D printed SOFC stacks for commercial applications	
Starting date: 01.07.2016	**End date:** 31.12.2019
Total Cost: 2,191,133.75 €	**EU max. contribution:** 2,180,662.50 €
Coordinator: FUNDACIO INSTITUT DE RECERCA DE L'ENERGIA DE CATALUNYA	
Participants: ▪ DANMARKS TEKNISKE UNIVERSITET ▪ UNIVERSIDAD DE LA LAGUNA ▪ HyGear Fuel Cell Systems B.V. ▪ FRANCISCO ALBERO SA ▪ 3DCERAM ▪ PROMETHEAN PARTICLES LTD ▪ SAAN ENERGI AB	
Countries: ES;DK;FR;UK;SE;NL	

Objectives:

A Solid Oxide Fuel Cell (SOFC) is a ceramic-based multilayer device that involves expensive and time-consuming multi-step manufacturing processes including tape casting, screen printing, firing, shaping and several high-temperature thermal treatments. In addition, these cells are manually assembled into stacks resulting in extra steps for joining and sealing that difficult the standardization and quality control of the final product while introducing weak parts likely to fail. Since current ceramics processing presents strong limitations in shape and extremely complex design for manufacturing (more than 100 steps), industrially fabricated SOFC cells and stacks are expensive and present low flexibility and long time to market. This is particularly relevant for the commercial segment of the stationary fuel cells market (5-400kW) that is highly heterogeneous in terms of the overall power and heat requirements and requires customization of the final product.

The main goal of the Cell3Ditor project is to develop a 3D printing technology for the industrial production of SOFC stacks by covering research and innovation in all the stages of the industrial value chain (inks formulation, 3D printer development, ceramics consolidation and system integration). All-ceramic joint-free SOFC stacks with embedded fluidics and current collection will be fabricated in a two-step process (single-step printing and sintering) to reduce in energy, materials and assembly costs while simplifying the design for manufacturing and time to market.

Compared to traditional ceramic processing, the Cell3Ditor manufacturing process presents a significantly shorter time to market (from years to months) and a cost reduction estimated in 63% with an initial investment below one third of an equivalent conventional manufacturing plant (production of 1000 units per year). The project is product-driven and involves SMEs (with proved technologies) in the entire value chain to ensure reaching TRL>6.

Topic: FCH-02.6-2015 (Energy)	**Acronym:** HEATSTACK
Call: H2020-JTI-FCH-2015-1	**Type of Action:** RIA
Title: Production Ready Heat Exchangers and Fuel Cell Stacks for Fuel Cell mCHP	
Starting date: 01.04.2016	**End date:** 31.03.2019
Total Cost: 2,899,760.00 €	**EU max. contribution:** 2,899,760.00 €
Coordinator: SENIOR UK LTD	
Participants: ▪ SENIOR FLEXONICS CZECH S.R.O. ▪ ICI CALDAIE SPA ▪ PNO CONSULTANTS LIMITED ▪ VAILLANT GMBH ▪ THE UNIVERSITY OF BIRMINGHAM ▪ SUNFIRE GMBH	
Countries: UK;CZ;DE;IT;	

Objectives:

Fuel cells have shown great promise for residential micro-Combined Heat and Power (mCHP) generation due to their high electrical efficiency and ability to run on conventional heating fuels. Technology leaders in this sector are nearing commercial deployment following extensive field trials but high capital costs remain a key challenge to the advancement of this sector and mass market introduction in Europe. The HEATSTACK project focuses on reducing the cost of the two most expensive components within the fuel cell system; the fuel cell stack and heat exchanger, which together represent the majority of total system CAPEX. Cost reductions of up to 60% for each component technology will be achieved by:

- Advancing proven component technologies through the optimisation of design, materials and production processes for improved performance and quality;

- Developing and applying novel tooling for laser welding and automated production lines to remove manual processing steps;

- Improving cycle times and reducing time to market;

- Demonstrating design flexibility and production scalability for mass manufacturing (10.000 units per annum); and

- Developing core supply chain relationships to allow for competitive sourcing strategies.

The HEATSTACK project represents a key step towards achieving commercial cost targets for fuel cell mCHP appliances, bringing together leading technology providers in the fuel cell mCHP supply chain with extensive industrial expertise to accelerate the development towards volume production of the fuel cell stacks and heat exchangers. Cost reductions will be achieved through advanced design, development and industrialisation of core manufacturing processes. Improvements to component performance with advanced materials will reduce system degradation and improve overall system efficiency and lifetime.

Topic: FCH-02.6-2015 (Energy)	**Acronym:** SOSLeM
Call: H2020-JTI-FCH-2015-1	**Type of Action:** RIA
Title: Solid Oxide Stack Lean Manufacturing	
Starting date: 01.04.2016	**End date:** 31.03.2019
Total Cost: 2,944,176.25 €	**EU max. contribution:** 1,994,301.25 €
Coordinator: SOLIDPOWER SPA	
Participants: ▪ AVL LIST GMBH ▪ ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE ▪ HTceramix SA ▪ Athena S.p.a ▪ GREENLIGHT INNOVATION GMBH	
Countries: IT;AU;CH;DE	

Objectives:

The proposed SOSLeM project will contribute to the call objectives by improving production processes as well as developing and applying novel manufacturing technologies for FC stacks. The improvements proposed by the project will sum up to a reduction of manufacturing costs of about 70%, leading to decreased capital cost of about 2.500 €/kW.

Besides these outstanding economical and technical improvements, production material will be spared and environmental benefits will be realized. Specifically, the project will:

- Develop new and optimized processes for cassettes production, by avoidance brushing of cassettes, improved sealing adhesion on cassettes, automation of welding, lean manufacturing processes and anode contact layer laser welding,

- Improve stack preparation, by advanced glass curing and stack conditioning and improved gas stations,

- Enable environmental benefits by Cu-based instead of Co-based powder and evaluation of On-site Nickel removal from waste water

- Reduce production time and costs and improve flexibility, by large furnace arrangement, introduction of a multi-stack production station, examination of substituting Co-based powder by Cu-based power,

Examination of partially substituting Co-based powder by enamel coating and simultaneous sintering.

Topic FCH-02.9-Projects

Topic: FCH-02.9-2015 (Energy)	**Acronym:** PACE
Call: H2020-JTI-FCH-2015-1	**Type of Action:** IA
Title: Pathway to a Competitive European FC mCHP market	
Starting date: 01.06.2016	**End date:** 28.02.2021
Total Cost: 90,307,094.50 €	**EU max. contribution:** 33,932,752.75 €
Coordinator: THE EUROPEAN ASSOCIATION FOR THE PROMOTION OF COGENERATION VZW	
Participants: ▪ ELEMENT ENERGY LIMITED ▪ SOLIDPOWER SPA ▪ VIESSMANN WERKE GMBH & CO KG ▪ DANMARKS TEKNISKE UNIVERSITET ▪ BOSCH THERMOTECHNIK GMBH ▪ VAILLANT GMBH ▪ EWE AKTIENGESELLSCHAFT ▪ BDR THERMEA GROUP BV	
Countries: BE;UK;DE;IT;DK;NL	

Objectives:

PACE is a major initiative aimed at ensuring the European mCHP sector makes the next move to mass market commercialisation. The project will deploy a total of 2,650 new fuel cell microCHP units with real customers and monitor them for an extended period. This will:

- Enable fuel cell mCHP manufacturers to scale up production, using new series techniques, and increased automation. By 2018, four leading European manufacturers (Bosch, SOLIDpower, Vaillant and Viessmann) will have installed capacity for production of over 1,000 units/year (each will install over 500 units in PACE). These production lines will test the manufacturing techniques which will allow for mass market scale up and the reductions in unit cost which will come from associated economies of scale.

- Allow the deployment of new innovations in fuel cell microCHP products, which reduce unit cost by over 30%, increase stack lifetime to over 10 years (by end of the project) and improve the electrical efficiency of all units.

- Create a large dataset of the performance of the units, which will demonstrate the readiness of fuel cell mCHP as a mass market product. This will prove that fuel cell mCHP can be a leading contributor to reducing primary energy consumption and GHG emissions across Europe.

- Allow the units in the trial to be pooled in a large scale test of the concept of aggregating and controlling the output from mCHP to act as a virtual power plant. This will be achieved in a project run by EWE on a section of the German grid earmarked for smart grid trials.

- Act as the basis for an effort to standardise mCHP products in Europe, helping create a more efficient market for both installers and component suppliers.

The project will provide an evidence base which will be used in a dissemination campaign targeting policy makers (who can provide supportive policies for the next wave of mCHP roll-out) and increasing awareness of the technology within the domestic heating sector (main route to market).

Topic FCH-03.1-Projects

Topic: FCH-03.1-2015 (Overarching)	**Acronym:** H2ME 2
Call: H2020-JTI-FCH-2015-1	**Type of Action:** IA
Title: Hydrogen Mobility Europe 2	
Starting date: 01.05.2016	**End date:** 30.06.2022
Total Cost: 102,181,578.84 €	**EU max. contribution:** 34,999,548.50 €
Coordinator: ELEMENT ENERGY LIMITED	
Participants: ▪ CENEX - CENTRE OF EXCELLENCE FOR LOW CARBON AND FUEL CELL TECHNOLOGIES ▪ EIFER EUROPAISCHES INSTITUT FUR ENERGIEFORSCHUNG EDF KIT EWIV ▪ DAIMLER AG ▪ AUDI AKTIENGESELLSCHAFT ▪ HONDA R&D EUROPE (DEUTSCHLAND) GMBH ▪ HYDROGENE DE FRANCE ▪ HYOP AS ▪ ITM POWER (TRADING) LIMITED ▪ ISLENSKA VETNISFELAGID EHF ▪ STEDIN DIENSTEN BV ▪ AREVA H2GEN ▪ McPhy Energy SA ▪ ICELANDIC NEW ENERGY LTD ▪ THE UNIVERSITY OF MANCHESTER ▪ H2 MOBILITY DEUTSCHLAND GMBH & CO KG ▪ Nissan Motor Manufacturing (UK) Limited ▪ SOCIETE DU TAXI ELECTRIQUE PARISIEN ▪ MINISTERIE VAN INFRASTRUCTUUR EN MILIEU ▪ SYMBIOFCELL SA ▪ AGA AB ▪ AIR LIQUIDE ADVANCED BUSINESS ▪ AIR LIQUIDE ADVANCED TECHNOLOGIES SA ▪ COMPAGNIE NATIONALE DU RHONE SA ▪ GNVERT SAS ▪ COMMUNAUTE URBAINE DU GRAND NANCY ▪ H2 Logic A/S ▪ SOCIETE D'ECONOMIE MIXTE DES TRANSPORTS EN COMMUN DE L'AGGLOMERATION NANTAISE (SEMITAN) ▪ OPEN ENERGI LIMITED ▪ KOBENHAVNS KOMMUNE ▪ hySOLUTIONS GmbH ▪ BAYERISCHE MOTOREN WERKE AKTIENGESELLSCHAFT ▪ MANUFACTURE FRANCAISE DES PNEUMATIQUES MICHELIN ▪ RENAULT SAS ▪ RENAULT TRUCKS SAS ▪ BRINTBRANCHEN	
Countries: UK;DE;FR;SE;DK;NO;IS;NL	

Objectives:

Hydrogen Mobility Europe 2 (H2ME 2) brings together action in 8 European countries to address the innovations required to make the hydrogen mobility sector truly ready for market. The project will perform a large-scale market test of hydrogen refuelling infrastructure, passenger and commercial fuel cell electric vehicles operated in real-world customer applications and demonstrate the system benefits generated by using electrolytic hydrogen solutions in grid operations.

H2ME 2 will increase the participation of European manufacturers into the hydrogen sector, and demonstrate new vehicles across a range of platforms, with increased choice: new cars (Honda, and Daimler), new vans (range extended vehicles from Renault/Symbio and Renault/Nissan/Intelligent Energy) and a new medium sized urban delivery truck (Renault Trucks/Symbio). H2ME 2 develops an attractive proposition around range extended vehicles and supports a major roll-out of 1,000 of these vehicles to customers in France, Germany, Scandinavia and the UK. 1,230 new hydrogen fuelled vehicles will be deployed in total, trebling the existing fuel cell fleet in Europe.

H2ME 2 will establish the conditions under which electrolytic refuelling stations can play a beneficial role in the energy system, and demonstrate the acquisition of real revenues from provision of energy services for aggregated electrolyser-HRS systems at a MW scale in both the UK and France. This has the further implication of demonstrating viable opportunities for reducing the cost of hydrogen at the nozzle by providing valuable energy services without disrupting refuelling operations.

H2ME 2 will test 20 new HRS rigorously at high level of utilisation using the large vehicle deployment. The loading of stations by the end of the project is expected to average 20% of their daily fuelling capacity, with some stations exceeding 50% or more. This will test the HRS to a much greater extent than has been the case in previous projects.

Topic FCH-03.2-Projects

Topic: FCH-03.2-2015 (Overarching)	**Acronym:** BIG HIT
Call: H2020-JTI-FCH-2015-1	**Type of Action:** IA
Title: Building Innovative Green Hydrogen systems in an Isolated Territory: a pilot for Europe	
Starting date: 01.05.2016	**End date:** 30.04.2021
Total Cost: 7,246,102.50 €	**EU max. contribution:** 5,000,000.00 €
Coordinator: FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON	

Participants:

- ITM POWER (TRADING) LIMITED
- CALVERA MAQUINARIA E INSTALACIONES SL
- DANMARKS TEKNISKE UNIVERSITET
- SYMBIOFCELL SA
- GIACOMINI SPA
- MINISTRY FOR TRANSPORT AND INFRASTRUCTURE
- ORKNEY ISLANDS COUNCIL
- SHAPINSAY DEVELOPMENT TRUST
- COMMUNITY ENERGY SCOTLAND LIMITED
- THE EUROPEAN MARINE ENERGY CENTRE LIMITED
- THE SCOTTISH HYDROGEN AND FUEL CELL ASSOCIATION LTD

Countries: ES;UK;DK;FR;IT;MT

Objectives:

BIG HIT will create a replicable hydrogen territory in Orkney (Scotland) by implementing a fully integrated model of hydrogen production, storage, transportation and utilisation for heat, power and mobility. BIG HIT will absorb curtailed energy from two wind turbines and tidal turbines on the islands of Eday and Shapinsay, and use 1.5MW of PEM electrolysis to convert it into ~50 t pa of hydrogen. This will be used to heat two local schools, and transported by sea to Kirkwall in 5 hydrogen trailers, where it will be used to fuel a 75kW fuel cell (which will provide heat and power to the harbour buildings, a marina and 3 ferries when docked), and a refuelling station for a fleet of 10 fuel cell vehicles.

The project employs a novel structure to manage the hydrogen trading, and dissemination that includes a follower territory and associations of over 1640 isolated territories.

Topic FCH-04.1-Projects

Topic: FCH-04.1-2015 (Cross-cutting)	**Acronym:** HYTECHCYCLING
Call: H2020-JTI-FCH-2015-1	**Type of Action:** CSA
Title: New technologies and strategies for fuel cells and hydrogen technologies in the phase of recycling and dismantling	
Starting date: 01.05.2016	**End date:** 30.04.2019
Total Cost: 497,666.25 €	**EU max. contribution:** 497,666.25 €
Coordinator: FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON	
Participants: ▪ UNIVERZA V LJUBLJANI ▪ PARCO SCIENTIFICO E TECNOLOGICO PER L'AMBIENTE - ENVIRONMENT PARK SPA ▪ Fundacion IMDEA Energia ▪ INDUSTRIAS LOPEZ SORIANO SA	
Countries: ES;IT;SL	

Objectives:

High deployment of fuel cells and hydrogen technologies is expected in the near term in the EU to decarbonize energy and transport sectors. The idea is to generate vast amounts of green hydrogen from the expected surplus of renewable energy sources (implemented policies are going towards 65% of electricity from renewable energy sources by 2050) to be used in transport (moving fuel cell electric vehicles), energy (feeding stationary fuel cells for cogeneration, injecting hydrogen into the gas grid) and industries (hydrogen generation for chemical industries).

However, the expected commercial FCH technologies (mainly PEM and alkaline electrolysers as well as PEM and Solid Oxide fuel cells) are not prepared for full deployment in what regards to recycling and dismantling stage.

The main goal of proposal is to deliver reference documentation and studies about existing and new recycling and dismantling technologies and strategies applied to Fuel Cells and Hydrogen (FCH) technologies, paving the way for future demonstration actions and advances in legislation.

To achieve this goal, the following key steps will be followed considering the involvement and validation of relevant FCH value chain actors and the HYTECHCYCLING Advisory Board of manufacturers:

1. Pre-study and techno-economic, environmental, RCS assessment related to dismantling & recycling of FCH technologies to detect future needs and challenges

2. Development of new technologies and strategies applied to FCH technologies in the phase of recycling & dismantling and LCA analysis considering critical, expensive and scarce materials inventory

3. Proposal of new business model, implementation roadmap and development of reference recommendations and guidelines to focus the sector and pave the way for future demonstrations and introduction of the concept among FCH stakeholders

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List of Calls Fuel Cells and Hydrogen

CALL: H2020-JTI-FCH-2015-1 Deadline: 27.08.2015			
Topic	**Title**	**Number of funded projects**	**Total EU-contribution [€]**
FCH-01.1	Low cost and durable PEMFCs for transport applications	1	6,877,869.75 €
FCH-01.2	Diagnostics and control for increased fuel cell system lifetime in automotive applications	1	3,260,297.50 €
FCH-01.5	Develop technologies for achieving competitive solutions for APU transport applications based on existing technology	1	3,920,302.50 €
FCH-02.1	Improved electrolysis for Off-grid Hydrogen production	1	2,315,217.50 €
FCH-02.2	Improved electrolysis for Distributed Hydrogen production	1	2,499,999.00 €
FCH-02.3	Development of co-electrolysis using CO2 and water	1	2,500,513.75 €
FCH-02.4	Proof-of-concept of HT electrolysers at a scale > 70 kW	1	4,498,150.00 €
FCH-02.5	Development of technology to separate hydrogen from low-concentration hydrogen streams	1	2,527,710.00 €
FCH-02.6	Development of cost effective manufacturing technologies for key components or fuel cell systems	3	7,074,723.75 €
FCH-02.9	Large scale demonstration of µCHP fuel cells	1	33,932,752.75 €
FCH-03.1	Large scale demonstration of Hydrogen Refuelling Stations and FCEV road vehicles - including buses and on site electrolysis	1	34,999,548.50 €
FCH-03.2	Hydrogen territories	1	5,000,000.00 €
FCH-04.1	Recycling and Dismantling Strategies for FCH Technologies	1	497,666.25 €
Total		15	109,904,751.25 €

List of Abbreviations

Type of Action

CSA:	Coordination and Support Action
IA:	Innovation Action
RIA:	Research and Innovation Action

Others

FCH:	Fuel Cells and Hydrogen
H2020:	Horizon 2020
JTI:	Joint Technology Initiative
JU:	Joint Undertaking
NCP	National Contact Point