Funded Projects under Horizon 2020

Secure, clean and efficient energy

Fuel Cells and Hydrogen Calls 2014

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 2014.
The data used in this document was extracted from the tables available at the website of the European Union Open Data Portal. More data is available in those tables.

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Topic FCH-01.2– Projects

Topic: FCH-01.2-2014 (Energy)	**Acronym:** VOLUMETRIQ
Call: H2020-JTI-FCH-2014-1	**Type of Action:** FCH2-RIA
Title: Volume Manufacturing of PEM FC Stacks for Transportation and In-line Quality Assurance	
Starting date: 01.09.2015	**End date:** 01.09.2018
Total Cost: 4,988,450.25 €	**EU max. contribution:** 4,961,950.00 €
Coordinator: INTELLIGENT ENERGY LIMITED	
Participants: ▪ PRETEXO ▪ BAYERISCHE MOTOREN WERKE AKTIENGESELLSCHAFT ▪ JOHNSON MATTHEY FUEL CELLS LIMITED ▪ ELRINGKLINGER AG ▪ CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS ▪ SOLVAY SPECIALTY POLYMERS ITALY S.P.A.	
Countries: IT;FR;DE;UK	
Objectives: The principal aim of the project is to develop an EU-centric supply base for key automotive PEM fuel cell components that achieve high power density and with volume production capability along with embedded quality control as a key focus - to enable the establishment of a mature Automotive PEM fuel cell manufacturing capability in Europe. It will exploit existing EU value adding competencies and skill sets to enhance EU employment opportunities and competitiveness while supporting CO2 reduction and emissions reduction targets across the Transport sector with increased security of fuel supply (by utilising locally produced Hydrogen).	

Topic FCH-01.5– Projects

Topic: FCH-01.5-2014 (Transport)	**Acronym:** H2REF
Call: H2020-JTI-FCH-2014-1	**Type of Action:** FCH2-RIA
Title: DEVELOPMENT OF A COST EFFECTIVE AND RELIABLE HYDROGEN FUEL CELL VEHICLE REFUELLING SYSTEM	
Starting date: 01.09.2015	**End date:** 01.09.2018
Total Cost: 6,453,858.75 €	**EU max. contribution:** 5,968,554.00 €
Coordinator: CENTRE TECHNIQUE DES INDUSTRIES MECANIQUES	
Participants: ▪ Ludwig-Boelkow-Systemtechnik GmbH ▪ HEXAGON RAUFOSS AS ▪ H2NOVA ▪ THE CCS GLOBAL GROUP LIMITED ▪ HASKEL FRANCE	
Countries: UK;NO;FR;DE	

Objectives:

H2Ref addresses the compression and buffering function for the refuelling of 70 MPa passenger vehicles and encompasses all the necessary activities for advancing a novel hydraulics-based compression and buffering system that is very cost effective and reliable from TRL 3 (experimentally proven concept) to TRL 6 (technology demonstrated in relevant environment), thereby proving highly improved performance and reliability in accordance with the following targets that have been defined considering the intrinsic characteristics of this new solution:

- Throughput: 70 MPa dispensing capacity of 6 to 15 vehicles per hour (i.e. 30 to 75 kg/hr) - depending on the inventory level in source storage of the compressed hydrogen - with a 75 kW power supply;

- Robustness and Reliability: 10 years of operation without significant preventive maintenance requirement, demonstrated through intensive lab test simulating 20 refuellings per day during 10 years, i.e. 72,000 refuellings;

- CAPEX: Manufacturing cost of 300 k€ for the compression and buffering module (CBM) assuming serial production (50 systems/yr). This level of cost for the CBM allows to target a cost of 450 k€ for the complete HRS (including pre-cooling and dispensing), assuming application of the optimized approaches for pre-cooling and dispensing control being developed in the HyTransfer project, far below the current HRS cost of approximately 900 k€;

- Energy efficiency: average consumption for compression below 1.5 kWh/kg of dispensed hydrogen, i.e. 50% below the energy consumption of current systems, in fuelling stations supplied by trailers, which is and will likely remain the most common form of supply.

The knowledge gained will allow subsequent development to focus on optimization of components, of design for manufacturing and maintenance, further demonstration, and the development of a product range for different refuelling station sizes, thus taking this innovation to the market.

Topic FCH-01.6– Projects

Topic: FCH-01.6-2014 (Transport)	**Acronym:** NewBusFuel
Call: H2020-JTI-FCH-2014-1	**Type of Action:** FCH2-RIA
Title: New Bus ReFuelling for European Hydrogen Bus Depots	
Starting date: 01.06.2015	**End date:** 01.01.2017
Total Cost: 2,471,144.75 €	**EU max. contribution:** 2,438,919.27 €
Coordinator: ELEMENT ENERGY LIMITED	
Participants: ▪ WSW MOBIL GMBH ▪ Vattenfall Europe Innovation GmbH ▪ SIEMENS AKTIENGESELLSCHAFT ▪ THINKSTEP AG ▪ LONDON BUS SERVICES LIMITED ▪ LINDE AG ▪ ITM POWER (TRADING) LIMITED ▪ INGENIEURTEAM BERGMEISTER SRL ▪ HYDROGENICS GMBH ▪ H2 Logic A/S ▪ EMPRESA MUNICIPAL DE TRANSPORTES DE MADRID SA ▪ BIRMINGHAM CITY COUNCIL ▪ AIR PRODUCTS PLC ▪ ABENGOA HIDROGENO SA	▪ VIP VERKEHRSBETRIEB POTSDAM GMBH ▪ STUTTGARTER STRASSENBAHNEN AG ▪ RIGAS SATIKSME SIA ▪ McPhy Energy Deutschland GmbH ▪ KUNNSKAPSBYEN LILLESTROM FORENING ▪ ISTITUTO PER INNOVAZIONI TECNOLOGICHE BOLZANO SCARL ▪ HYOP AS ▪ HAMBURGER HOCHBAHN AG ▪ EVOBUS GMBH ▪ Vlaamse Vervoersmaatschappij De Lijn ▪ AKERSHUS FYLKESKOMMUNE ▪ ABERDEEN CITY COUNCIL*
Countries: IT;DE;NO;UK;ES;DK;BE;LV	

Objectives:

The overall aim of NewBusFuel is to resolve a significant knowledge gap around the technologies and engineering solutions required for the refuelling of a large number of buses at a single bus depot. Bus depot scale refuelling imposes significant new challenges which have not yet been tackled by the hydrogen refuelling sector:

• Scale – throughputs in excess of 2,000kg/day (compared to 100kg/day for current passenger car stations)

• Ultra-high reliability – to ensure close to 100% available supply for the public transport networks which will rely on hydrogen

• Short refuelling window – buses need to be refuelled in a short overnight window, leading to rapid H2 throughput

• Footprint – needs to be reduced to fit within busy urban bus depots

• Volume of hydrogen storage – which can exceed 10 tonnes per depot and leads to new regulatory and safety constraints

A large and pan-European consortium will develop solutions to these challenges. The consortium involves 10 of Europe's leading hydrogen station providers. These partners will work with 12 bus operators in Europe, each of whom have demonstrated political support for the deployment of hydrogen bus fleets.

In each location engineering studies will be produced, by collaborative design teams involving bus operators and industrial HRS experts, each defining the optimal design, hydrogen supply route, commercial arrangements and the practicalities for a hydrogen station capable of providing fuel to a fleet of fuel cell buses (75-260 buses).

Public reports will be prepared based on an analysis across the studies, with an aim to provide design guidelines to bus operators considering deploying hydrogen buses, as well as to demonstrate the range of depot fuelling solutions which exist (and their economics) to a wider audience.

These results will be disseminated widely to provide confidence to the whole bus sector that this potential barrier to commercialisation of hydrogen bus technology has been overcome.

Topic FCH-01.7– Projects

Topic: FCH-01.7-2014 (Transport)	**Acronym:** H2ME
Call: H2020-JTI-FCH-2014-1	**Type of Action:** FCH2-IA
Title: Hydrogen Mobility Europe	
Starting date: 01.06.2015	**End date:** 31.05.2020
Total Cost: 67,884,421.29 €	**EU max. contribution:** 32,000,000.00 €
Coordinator: ELEMENT ENERGY LIMITED	
Participants: ▪ BAYERISCHE MOTOREN WERKE AKTIENGESELLSCHAFT ▪ Nissan Motor Manufacturing (UK) Limited ▪ INTELLIGENT ENERGY LIMITED ▪ OMV REFINING & MARKETING GMBH ▪ WATERSTOFNET VZW ▪ HYUNDAI MOTOR EUROPE GMBH ▪ BOC LIMITED ▪ AREVA H2GEN ▪ McPhy Energy SA ▪ AIR LIQUIDE ADVANCED BUSINESS ▪ H2 Logic A/S ▪ AIR LIQUIDE ADVANCED TECHNOLOGIES SA ▪ SYMBIOFCELL SA ▪ H2 MOBILITY DEUTSCHLAND GMBH & CO KG	▪ DANISH HYDROGEN FUEL AS ▪ RENAULT SAS ▪ AGA AB ▪ HONDA R&D EUROPE (DEUTSCHLAND) GMBH ▪ CENEX - CENTRE OF EXCELLENCE FOR LOW CARBON AND FUEL CELL TECHNOLOGIES ▪ DAIMLER AG ▪ COMMUNAUTE D'AGGLOMERATION SARREGUEMINES CONFLUENCES ▪ EIFER EUROPAISCHES INSTITUT FUR ENERGIEFORSCHUNG EDF-KIT EWIV ▪ HYOP AS ▪ LINDE AG ▪ ITM POWER (TRADING) LIMITED ▪ ICELANDIC NEW ENERGY LTD
Countries: SE;DE;UK;FR;AT;IS;DK;BE;NO	

Objectives:

Hydrogen Mobility Europe (H2ME) brings together Europe's 4 most ambitious national initiatives on hydrogen mobility (Germany, Scandinavia, France and the UK). The project will expand their developing networks of HRS and the fleets of fuel cell vehicles (FCEVs) operating on Europe's roads, to significantly expand the activities in each country and start the creation of a pan-European hydrogen fuelling station network. In creating a project of this scale, the FCH JU will create not only a physical but also a strategic link between the regions that are leading in the deployment of hydrogen. The project will also include 'observer countries' (Austria, Belgium and the Netherlands), who will use the learnings from this project to develop their own hydrogen mobility strategies.

The project is the most ambitious coordinated hydrogen deployment project attempted in Europe. The scale of this deployment will allow the consortium to:

• Trial a large fleet of FCEVs in diverse applications across Europe - 200 OEM FCEVs (Daimler and Hyundai) and 125 fuel cell range-extended vans (Symbio FCell collaborating with Renault) will be deployed

• Deploy 29 state of the art refuelling stations, using technology from the full breadth of Europe's hydrogen refuelling station providers. The scale will ensure that stations will be lower cost than in previous projects and the breadth will ensure that Europe's hydrogen station developers advance together

• Conduct a real world test of 4 national hydrogen mobility strategies and share learnings to support other countries' strategy development

• Analyse the customer attitude to the FCEV proposition, with a focus on attitudes to the fuelling station networks as they evolve in each country

• Assess the performance of the refuelling stations and vehicles in order to provide data of a sufficient resolution to allow policy-makers, early adopters and the hydrogen mobility industry to validate the readiness of the technology for full commercial roll-out.

Topic FCH-02.10– Projects

Topic: FCH-02.10-2014 (Energy)	**Acronym:** HyBalance
Call: H2020-JTI-FCH-2014-1	**Type of Action:** FCH2-IA
Title: HyBalance	
Starting date: 01.10.2015	**End date:** 30.09.2020
Total Cost: 15,184,265.78 €	**EU max. contribution:** 7,999,370.80 €
Coordinator: AIR LIQUIDE ADVANCED BUSINESS	
Participants: ▪ AIR LIQUIDE GLOBAL E&C SOLUTIONS FRANCE ▪ CEMTEC FONDEN ▪ Ludwig-Boelkow-Systemtechnik GmbH ▪ HYDROGENICS EUROPE NV ▪ COPENHAGEN HYDROGEN NETWORK AS ▪ NEAS ENERGY AS	
Countries: BE;DK;DE;FR	

Objectives:

Power-to-Gas (PtG) is an innovative energy concept which will help to incorporate flexibility into future energy systems, increasingly characterised by the use of fluctuating renewable electricity. One PtG option, dubbed Power-to Hydrogen (PtH2) is to produce hydrogen from water electrolysis applying cheap renewable electricity in times of surplus and providing it for re-electrification in times of electricity shortages or to other hydrogen end-users, whatever promises the best business opportunities. It has been shown by recent studies that these can be best exploited, if PtH2 simultaneously supplies hydrogen to more than one end-use sector. The combination of electricity and mobility sectors has been earmarked as being specifically relevant, promising high utilization of the electrolysers and hence possible revenues.

It is the purpose of the HyBalance project to demonstrate the concept of multi-sectoral hydrogen end-use in the renewable energy friendly environment of wind-rich Denmark at Megawatt scale with a PtH2 plant. A group of partners representing all steps along the renewable electricity to hydrogen to end-use value chain have convened to develop a PtH2 demonstration plant. This plant will be designed for combined operation providing both grid balancing services and hydrogen for industry and as a fuel for transport in the community of Hobro in the Danish province of Nordjylland. The plant will be used to demonstrate its feasibility to identifying potential revenue streams from PtH2 under today's and future constraints (regulatory environment, state-of-art of key technologies), simultaneously applying most recent developments for hydrogen distribution and storage.

Relevant applications in the hydrogen production site's proximity are: hydrogen refuelling stations for fuel cell cars and buses in Hobro, local industry and, as perspective, hydrogen storage in salt caverns located in Hvornum and Lille Torup.

Topic FCH-02.11– Projects

Topic: FCH-02.11-2014 (Energy)	**Acronym:** DEMOSOFC
Call: H2020-JTI-FCH-2014-1	**Type of Action:** FCH2-IA
Title: DEMOnstration of large SOFC system fed with biogas from WWTP	
Starting date: 01.09.2015	**End date:** 01.09.2020
Total Cost: 5,905,336.25€	**EU max. contribution:** 4,492,561.00 €
Coordinator: POLITECNICO DI TORINO	
Participants: ▪ Teknologian tutkimuskeskus VTT Oy ▪ CONVION OY ▪ IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE ▪ Società Metropolitana Acque Torino S.p.A.	
Countries: UK;IT;FI	

Objectives:

Energy Context and EU position

The “Europe 2020” strategy promotes the shift towards a resource-efficient, low-carbon economy to achieve sustainable growth. The European policies on energy and sustainability are thus contributing to the diversification of the primary energy mix and to the introduction of distributed power technologies with high efficiency and low carbon emissions. ,

From the point of view of energy policy, the European Strategic Energy Technology (SET) Plan for 2020 identifies Strategic Technologies Focus on the following priorities:

• Energy Efficiency: high efficiency conversion devices represent elements of a higher efficiency portfolio

• Renewable Energy: traditional RES (solar, wind, hydro) but also biogenous fuels (biogas, bio-syngas, bio-fuels) and new synthetic vectors (H2, synthetic NG,….)

• Carbon capture and storage: mitigation of CO2 emissions (related to efficient energy conversion devices, and improved adoption of RES fuels) and CO2 recovery

• Smart Grid: large topic, in which several technologies are included (energy storage, ICT intelligence of the grid, prosumer….), among which the concept of distributed CHP plant gets an important role

DEMOSOFC objectives

1. DEMO and deep analysis of an innovative solution of distributed CHP system based on SOFC, with high interest in the industrial/commercial application representing the best solution in the sub-MW distributed CHP in terms of efficiency and emissions

2. DEMO of a distributed CHP system fed by a biogenous CO2 neutral fuel: biogas from anaerobic digestion

3. DEMO in a real industrial installation

4. DEMO of the high achievements of such systems: electrical efficiency, thermal recovery, low emissions, plant integration, economic interest for best use of renewable fuels in a future of decreasing incentives

5. EXPLOITATION and BUSINESS analysis of replication of this type of innovative energy systems

6. DISSEMINATION of the high interest (energy and economic) of such systems

Topic FCH-02.1– Projects

Topic: FCH-02.1-2014 (Energy)	**Acronym:** SElySOs
Call: H2020-JTI-FCH-2014-1	**Type of Action:** FCH2-RIA
Title: Development of new electrode materials and understanding of degradation mechanisms on Solid Oxide High Temperature Electrolysis Cells.	
Starting date: 02.11.2015	**End date:** 02.11.2019
Total Cost: 2,939,655.00€	**EU max. contribution:** 2,939,655.00 €
Coordinator: FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	
Participants: ▪ Prototech AS ▪ VYSOKA SKOLA CHEMICKO-TECHNOLOGICKA V PRAZE ▪ ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS ▪ PYROGENESIS SA ▪ CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS ▪ FORSCHUNGSZENTRUM JUELICH GMBH	
Countries: EL;CZ;NO;DE;FR	

Objectives:

The high temperature Solid Oxide Electrolysis (SOEC) technology has a huge potential for future mass production of hydrogen and shows great dynamics to become commercially competitive against other electrolysis technologies (AEL, PEMEL), which are better established but more expensive and less efficient. On the downside, up to now SOECs are less mature and performance plus durability are currently the most important issues that need to be tackled, while the technological progress is still below the typically accepted standard requirements. Indicatively, the latest studies on State-of-the-Art (SoA) cells with Ni/YSZ and LSM as cathode and anode electrodes, respectively, show that the performance decreases about 2-5% after 1000h of operation for the H2O electrolysis reaction, whereas for the co-electrolysis process the situation is even worse and the technology level is much more behind the commercialization thresholds. In this respect, SElySOs is taking advantage of the opportunity for a 4-years duration project and focuses on understanding of the degradation and lifetime fundamentals on both of the SOEC electrodes, for minimization of their degradation and improvement of their performance and stability mainly under H2O electrolysis and in a certain extent under H2O/CO2 co-electrolysis conditions. Specifically, the main efforts will be addressed on the study of both water and O2 electrodes, where there will be investigation on: (i) Modified SoA Ni-based cermets, (ii) Alternative perovskite-type materials, (iii) Thorough investigation on the O2 electrode, where new more efficient O2 evolving electrodes are going to be examined and proposed. An additional strong point of the proposed project is the development of a theoretical model for description of the performance and degradation of the SOEC fuel electrode. Overall, SElySOs adopts a holistic approach for coping with SOECs degradation and performance, having a strong orientation on the market requirements.

Topic FCH-02.2– Projects

Topic: FCH-02.2-2014 (Energy)	**Acronym:** BIONICO
Call: H2020-JTI-FCH-2014-1	**Type of Action:** FCH2-RIA
Title: BIOgas membrane reformer for deceNtralIzed hydrogen produCtiOn	
Starting date: 01.09.2015	**End date:** 01.09.2018
Total Cost: 3,396,640.00€	**EU max. contribution:** 3,147,640.00 €
Coordinator: POLITECNICO DI MILANO	
Participants: ▪ RAUSCHERT KLOSTER VEILSDORF GMBH ▪ ABENGOA HIDROGENO SA ▪ FUNDACION TECNALIA RESEARCH & INNOVATION ▪ ENC POWER LDA ▪ QUANTIS SARL ▪ JOHNSON MATTHEY PLC ▪ TECHNISCHE UNIVERSITEIT EINDHOVEN	
Countries: UK;DE;NL;ES;CH;PT	

Objectives:

BIONICO will develop, build and demonstrate at a real biogas plant (TRL6) a novel reactor concept integrating H2 production and separation in a single vessel. The hydrogen production capacity will be of 100 kg/day.

By using the novel intensified reactor, direct conversion of biogas to pure hydrogen is achieved in a single step, which results in an increase of the overall efficiency and strong decrease of volumes and auxiliary heat management units. The BIONICO process will demonstrate to achieve an overall efficiency up to 72% thanks to the process intensification.

In particular, by integrating the separation of hydrogen in situ during the reforming reaction, the methane in the biogas will be converted to hydrogen at a much lower temperature compared with a conventional system, due to the shifting effect on the equilibrium conversion.

The fluidization of the catalyst makes also possible to (i) overcome problems with temperature control (formation of hotspots or too low temperature), (ii) to operate with smaller particles while still maintaining very low pressure drops and (iii) to overcome any concentration polarization issue associated with more conventional fixed bed membrane reactors. Dedicated tests with different biogas composition will be carried out to show the flexibility of the process with respect to the feedstock type.

Compared with any other membrane reactor project in the past, BIONICO will demonstrate the membrane reactor at a much larger scale, so that more than 100 membranes will be implemented in a single fluidized bed membrane reactor, making BIONICO’s

In this way a more easy operation can be carried out so that a stable pure hydrogen production can be achieved. BIONICO project is based upon knowledge and experience directly gained in three granted projects: ReforCELL, FERRET and FluidCELL.

Topic FCH-02.3– Projects

Topic: FCH-02.3-2014 (Energy)	**Acronym:** HEALTH-CODE
Call: H2020-JTI-FCH-2014-1	**Type of Action:** FCH2-RIA
Title: Real operation pem fuel cells HEALTH-state monitoring and diagnosis based on dc-dc COnverter embeddeD Eis	
Starting date: 01.09.2015	**End date:** 01.09.2018
Total Cost: 2,358,736.25 €	**EU max. contribution:** 2,358,736.25 €
Coordinator: UNIVERSITA DEGLI STUDI DI SALERNO	
Participants: ▪ UNIVERSITE DE FRANCHE-COMTE ▪ EIFER EUROPAISCHES INSTITUT FUR ENERGIEFORSCHUNG EDF-KIT EWIV ▪ AALBORG UNIVERSITET ▪ ABSISKEY CP ▪ TORINO E-DISTRICT CONSORZIO ▪ ELECTRO POWER SYSTEMS MANUFACTURINGSRL ▪ DANTHERM POWER A/S	
Countries: FR;IT;DK;DE	

Objectives:

HEALTH-CODE aims at implementing an advanced monitoring and diagnostic tool for µ-CHP and backup PEM fuel cell systems equipped with different stacks. Such a tool is able to determine the FC current status (condition monitoring) to support stack failures detection and to infer on the residual useful lifetime. Five failure modes will be detected: i) change in fuel composition; ii) air starvation; iii) fuel starvation; iv) sulphur poisoning; v) flooding and de-hydration.

The main project objectives are: i) the enhancement of electrochemical impedance spectroscopy (EIS) based diagnosis; ii) the development of a monitoring and diagnostic tool for state-of-health assessment, fault detection and isolation as well as degradation level analysis for lifetime extrapolation; iii) the reduction of experimental campaign time and costs. Moreover, the improvement of power electronics for FC is also considered. These targets will be achieved through the implementation of several methodologies and techniques, well suited for industrial application.

Several algorithms will be developed relying on on-board EIS measurements of the fuel cell system impedance. Moreover, low-cost diagnostic concepts are also proposed for a straightforward implementation on FCS controllers.

The project exploits the outcomes of the previous FCH 1 JU funded project D-CODE, during which a proof of-concept validated in laboratory (TRL3-4) was developed. HEALTH-CODE will increase the TRL up to level 5.

The exploitation of the project outcomes will lead to low-cost and reliable monitoring and diagnostic approaches and related applications (e.g. power electronics). These results will have an impact on stationary FCS with a direct increase in electrical efficiency, availability and durability, leading to a reduction in maintenance and warranty costs, thus increasing the customers' satisfaction. Therefore, HEALTH-CODE contributes to the enhancement of FC competitiveness towards a wider market deployment.

Topic FCH-02.5– Projects

Topic: FCH-02.5-2014 (Energy)	**Acronym:** AutoRE
Call: H2020-JTI-FCH-2014-1	**Type of Action:** FCH2-RIA
Title: AUTomotive deRivative Energy system	
Starting date: 01.08.2015	**End date:** 01.08.2018
Total Cost: 4,464,447.25 €	**EU max. contribution:** 3,496,947.00 €
Coordinator: ALSTOM POWER LTD	

Participants:

- STIFTELSEN SINTEF
- ELVIO ANONYMI ETAIREIA SYSTIMATON PARAGOGIS YDROGONOU KAI ENERGEIAS
- GENERAL ELECTRIC (SWITZERLAND) GMBH
- UNIVERSITA DEGLI STUDI DELLA TUSCIA
- SVEUCILISTE U SPLITU, FAKULTET ELEKTROTEHNIKE, STROJARSTVA I BRODOGRADNJE
- DAIMLER AG

Countries: HR;IT;DE;EL;NO;CH

Objectives:

"The overall aim is to create the foundations for commercializing an automotive derivative fuel cell system in the 50 to 100 kW range, for combined heat and power (CHP) applications in commercial and industrial buildings. More specifically, the project has the following objectives:

• develop system components allowing reduced costs, increased durability and efficiency

• build and validate a first 50 kW PEM prototype CHP system

• create the required value chain from automotive manufacturers to stationary energy end-users

Mass-market production of fuel cells will be a strong factor in reducing first costs. In this respect, joining the forces of two non-competing sectors (automotive and stationary) will bring benefits to both, to increase production volume and ultimately reduce costs to make fuel cells competitive. As a consequence, the project partners have identified a PEM fuel cell based CHP concept to address the stationary power market, primarily for commercial and industrial buildings requiring an installed capacity from about 50 kWe to some hundreds of kWe. The main components of the system have been validated to at least laboratory scale (TRL>4). As a part of the present AutoRE proposal, the overall system will be demonstrated and further validated to increase the technology readiness level to TRL5. In addition, innovative solutions will be demonstrated to continuously improve performance and reduce costs and complexity. The project consortium reflects the full value chain of the fuel cell CHP system which will enhance significantly the route to market for the system/technology.

The proposal relates to FCH-02.5-2014: Innovative fuel cell systems at intermediate power range for distributed combined heat and power generation, and it addresses the main specific challenges and scope laid down in the FCH JU AWP2014 to “develop, manufacturing and validation of a new generation of fuel cell systems with properties that significantly improve competitiveness""."

Topic: FCH-02.5-2014 (Energy)	**Acronym:** INNO-SOFC
Call: H2020-JTI-FCH-2014-1	**Type of Action:** FCH2-RIA
Title: Development of innovative 50 kW SOFC system and related value chain	
Starting date: 01.09.2015	**End date:** 01.03.2018
Total Cost: 3,998,081.25 €	**EU max. contribution:** 3,998,081.25 €
Coordinator: Teknologian tutkimuskeskus VTT Oy	

Participants:

- AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE,L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE
- ELRINGKLINGER AG
- ELCOGEN OY
- ENERGY MATTERS BV
- FORSCHUNGSZENTRUM JUELICH GMBH
- CONVION OY

Countries: NL;DE;FI;IT

Objectives:

INNO-SOFC project combines leading European SOFC technology companies and research centres to collaborate and form required phases in the SOFC value chain. Within this project a next generation 50 kW SOFC system together with its key components will be developed, manufactured, and validated. This system includes many significant improvements compared to current State of the Art, leading to 30000 hours operating time, 4000 €/kW system costs, 60% electrical efficiency, and 85% total efficiency, which are required for large-scale commercialization of stationary fuel cells. Efficiency, performance, and life-time of the system and its key components will be validated according to IEC standards in conditions that are relevant for end-users. Proof of reliability and durability of the system will be achieved in 3000 hours demonstration together with 10000 hours stack validation runs.

The project is based on the products of industrial partners (Convion, EnergyMatters, Elcogen, and ElringKlinger) and motivated by their interest to further improve their products and consolidate an efficient value chain by collaboration. Industrial partners are operating at different phases of the value chain and are not therefore competing against each other, which enables an efficient collaboration and knowledge sharing within the project. Within this approach, whole system and its components will be optimized comprehensively to fulfil and exceed end-users' requirements. Research centres (VTT, Jülich, and ENEA) support these companies to develop, experimentally validate and demonstrate their products.

Effective exploitation and dissemination of resulting improved products, services, and know-how is a natural purpose of each partner and these actions are boosted by this project. This makes project results available also for other parties and increases competitiveness of European fuel cell industry.

Topic FCH-02.8– Projects

Topic: FCH-02.8-2014 (Energy)	**Acronym:** ELYntegration
Call: H2020-JTI-FCH-2014-1	**Type of Action:** FCH2-RIA
Title: Grid Integrated Multi Megawatt High Pressure Alkaline Electrolysers for Energy Applications	
Starting date: 01.09.2015	**End date:** 01.09.2018
Total Cost: 3,301,391.25€	**EU max. contribution:** 1,861,309.00 €
Coordinator: FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON	

Participants:

- FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.
- INDUSTRIE HAUTE TECHNOLOGIE SA
- RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN
- INSTRUMENTACION Y COMPONENTES SA
- VLAAMSE INSTELLING VOOR TECHNOLOGISCH ONDERZOEK N.V.

Countries: BE;ES;DE;CH

Objectives:

The strategic goal of the ELYntegration Project is the design and engineering of a robust, flexible, efficient and cost-competitive single stack Multimegawatt High Pressure Alkaline Water Electrolysis of 4,5 T H2/day capable to provide cutting-edge operational capabilities under highly dynamic power supplies expected in the frame of generation/ transmission/ distribution scenarios integrating high renewable energies (RE) shares.

The final design of the MW HP AWE will be achieved on the basis of the development, validation and demonstration of a HP AWE industrial prototype of 250 kW (250 HP AWE) (TRL 7) comprising:

- cylindrical stack consisting of industrial size elementary cells (1,600 mm cell diameter)
- balance of plant (BOP)
- power electronics
- advanced communication & control system

In the early phase of the development process, great attention will be brought to the identification of end-user's needs and relevant/critical operational requirements.

The target behaviour of the industrial prototype will be thoroughly demonstrated in an operational environment reflecting different on-grid integration schemes using power facilities already available to the Consortium (notably, 635 kW wind and 100 kW photovoltaic power plants).

As previously mentioned, the successful demonstration of the industrial prototype will be paving the way towards the implementation and the commercial deployment of the 4.5 T H2/day HP AWE technology in the frame of large scale demonstration projects which shall be the next step after the conclusion of ELYntegration.

Topic FCH-02.9– Projects

Topic: FCH-02.9-2014 (Energy)	**Acronym:** D2Service
Call: H2020-JTI-FCH-2014-1	**Type of Action:** FCH2-IA
Title: Design of 2 Technologies and Applications to Service	
Starting date: 01.09.2015	**End date:** 01.09.2018
Total Cost: 3,636,797.50 €	**EU max. contribution:** 2,953,790.75 €
Coordinator: EWE-Forschungszentrum für Energietechnologie e. V.	
Participants: ▪ ENERGY PARTNERS SRL ▪ ZENTRUM FUR BRENNSTOFFZELLEN-TECHNIK GMBH ▪ SOLIDPOWER SPA ▪ BRITISH GAS TRADING LIMITED ▪ BOSAL EMISSION CONTROL SYSTEMS NV ▪ DANTHERM POWER A/S	
Countries: IT;DK;DE;UK;BE	

Objectives:

The current “Design to service” project aims at simplifying both, residential and commercial fuel cell systems for easy, fast and save system service and maintenance. In order to make best use of lessons learned and available resources, this project jointly works on two distinguished technologies (PEFC&SOFC) in two different markets (residential & extended UPS). Both SME manufacturers are committed to establish lean after-sales structures, a significant step towards mass manufacturing and deployment. Maintenance is one significant part of Total Cost of Ownership of FC systems.

Pooling the operational experience of field test programs, such as ene.field and Callux, critical analysis will lead to a priority list of required technical changes. For cold Balance of Plant Components, joint efforts will focus on the desulphuriser and the water treatment system. Actions are taken for both, simplified maintenance and extended durability for prolonged service intervals. Logistics for replacement component supply will be considered. For the hot component parts, the manufacturers work on their individual hot topics to adapt and simplify the design of the current units, e.g. to allow replacement of individual components instead of sub-units. A large decrease of costs impact is expected once individual stacks can be changed in a simple maintenance operation instead of complete sub-units. It is important that such operations can be performed by a significant pool of qualified installers. This is addressed by the elaboration of simple technical manuals that will be exposed to real-life practical technicians in training programs. These actions aim at decreasing the technical barrier to service systems.

Finally, the improved BoP units will be validated by testing single and multiple units. Beyond the classical features of high efficiency and silent operation, this will also add values like flexibility and modularity of FC technologies with respect to individual customer requests.

Topic FCH-04.2– Projects

Topic: FCH-04.2-2014 (Crosscutting)	**Acronym:** HY4ALL
Call: H2020-JTI-FCH-2014-1	**Type of Action:** FCH2-CSA
Title: Hydrogen For All of Europe (HY4ALL)	
Starting date: 01.09.2015	**End date:** 01.09.2018
Total Cost: 1,998,339.55 €	**EU max. contribution:** 1,998,339.30 €
Coordinator: AIR LIQUIDE ADVANCED TECHNOLOGIES SA	

Participants:

- COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES
- FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON
- CAMBRIDGE ECONOMETRICS LIMITED
- SIEMENS AKTIENGESELLSCHAFT
- DAIMLER AG
- ELEMENT ENERGY LIMITED
- PRAGMA INDUSTRIES
- INTELLIGENT ENERGY LIMITED
- ISTITUTO PER INNOVAZIONI TECNOLOGICHE BOLZANO SCARL
- IMAGINATION FACTORY
- FUELCELL ENERGY SOLUTIONS GMBH

Countries: DE;FR;UK;IT;ES

Objectives:

"Despite major technological development and the start of commercial deployments of the fuel cells and hydrogen technology, the public awareness of FCH technologies has lagged behind this technical progress so far, restricting the appetite of potential customers and risking a lack of support from policymakers.

To address this challenge, a consortium of leading experts has come together, combining communication experts, PR of established manufacturers and technology suppliers and world-class experts on the societal benefits of low carbon technologies. Together, the they will deliver HY4ALL, an ambitious programme to drive a step-change in awareness and excitement around fuel cells and hydrogen and deliver clear and consistent messages that resonate with all audiences, from policymakers to the general public. The project will be active in minimum 11 member states, and will be closely linked to the large numbers of existing hydrogen initiatives and demonstrations, maximising its impact and allowing the communication strategy to influence dissemination work beyond the project for lasting effects.

The project aims will be delivered through the following activities:

• Development of an overarching communication strategy, that will form the basis for all subsequent project activities and will allow the FCH community to speak with ‘one voice’

• Creation of an interactive web portal for FCH technologies, providing a ‘one stop shop’ for visitors seeking information and acting as a single brand and hub for all other dissemination activities

• A cross-European "hydrogen for society" roadshow with fuel cell vehicles travelling between cities across the EU. The roadshow will form the focal point for a variety of innovative dissemination activities, public debates, co-hosting of national vehicle and infrastructure launches

• A robust assessment of of the macro-economic and societal benefits of FCH technologies, providing fact-based analysis used to convey clear messages."

Topic FCH-04.3– Projects

Topic: FCH-04.3-2014 (Crosscutting)	**Acronym:** HySEA
Call: H2020-JTI-FCH-2014-1	**Type of Action:** FCH2-RIA
Title: Improving Hydrogen Safety for Energy Applications (HySEA) through pre-normative research on vented deflagrations	
Starting date: 01.09.2015	**End date:** 01.09.2018
Total Cost: 1,511,780.00 €	**EU max. contribution:** 1,494,780.00 €
Coordinator: GEXCON AS	
Participants: ▪ University of Science and Technology of China ▪ FIKE EUROPE BVBA ▪ THE UNIVERSITY OF WARWICK ▪ IMPETUS ADVANCED FINITE ELEMENT ANALYSES AS ▪ UNIVERSITA DI PISA	
Countries: NO;UK;IT;BE;CN	

Objectives:

The aim of the HySEA project is to conduct pre-normative research on vented deflagrations in enclosures and containers for hydrogen energy applications. The ambition is to facilitate the safe and successful introduction of hydrogen energy systems by introducing harmonized standard vent sizing requirements. The partners in the HySEA consortium have extensive experience from experimental and numerical investigations of hydrogen explosions. The experimental program features full-scale vented deflagration experiments in standard ISO containers, and includes the effect of obstacles simulating levels of congestion representative of industrial systems. The project also entails the development of a hierarchy of predictive models, ranging from empirical engineering models to sophisticated computational fluid dynamics (CFD) and finite element (FE) tools. The specific objectives of HySEA are:

- To generate experimental data of high quality for vented deflagrations in real-life enclosures and containers with congestion levels representative of industrial practice;

- To characterize different strategies for explosion venting, including hinged doors, natural vent openings, and commercial vent panels;

- To invite the larger scientific and industrial safety community to submit blind-predictions for the reduced explosion pressure in selected well-defined explosion scenarios;

- To develop, verify and validate engineering models and CFD-based tools for reliable predictions of pressure loads in vented explosions;

- To develop and validate predictive tools for overpressure (P) and impulse (I), and produce P-I diagrams for typical structures with relevance for hydrogen energy applications;

- To use validated CFD codes to explore explosion hazards and mitigating measures in larger enclosures, such as warehouses; and

- To formulate recommendations for improvements to European (EN-14994), American (NFPA 68), and other relevant standards for vented explosions.

List of Calls Fuel Cells and Hydrogen

CALL: H2020-JTI-FCH-2014-1 Deadline: 06.11.2014			
Topic	**Title**	**Number of funded projects**	**Total EU-contribution [€]**
FCH-01.2	Cell and stack components, stack and system manufacturing technologies and quality assurance	1	4,961,950.00
FCH-01.5	Development of cost effective and reliable hydrogen refuelling station components and systems for fuel cell vehicles	1	5,968,554.00
FCH-01.6	Engineering studies for large scale bus refuelling	1	2,438,919.27
FCH-01.7	Large scale demonstration of refuelling infrastructure for road vehicles	1	32,000,000.00
FCH-02.10	Demonstrating the feasibility of central large scale electrolysers in providing grid services and hydrogen distribution and supply to multiple high value markets	1	7,999,370.80
FCH-02.11	Large scale fuel cell power plant demonstration in industrial/commercial market segments	1	4,492,561.00
FCH-02.1	Research in electrolysis for cost effective hydrogen production	1	2,939,655.00
FCH-02.2	Decentralized hydrogen production from clean CO2-containing biogas	1	3,147,640.00
FCH-02.3	Stationary fuel cell system diagnostics: development of online monitoring and diagnostics systems for reliable and durable fuel cell system operation	1	2,358,736.25
FCH-02.5	Innovative fuel cell systems at intermediate power range for distributed combined heat and power generation	2	7,495,028.25
FCH-02.8	Improvement of electrolyser design for grid integration	1	1,861,309.00
FCH-02.9	Significant improvement of installation and service for fuel cell systems by Design-to-Service	1	2,953,790.75
FCH-04.2	Develop strategies to raise public awareness of fuel cell and hydrogen technologies	1	1,998,339.30
FCH-04.3	Pre-normative research on vented deflagrations in containers and enclosures for hydrogen energy applications	1	1,494,780.00
Total		**15**	**82,110,633.62**

List of Abbreviations

Type of Actions

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

Topics

EE	Efficient Energy
LCE	Low Carbon Energy
SCC	Smart Cities and Communities
FCH	Fuel Cells and Hydrogen

Others

H2020	Horizon 2020
NCP	National Contact Point
PPP	Public Private Partnership
PDA	Project Development Assistance