CERTIFHY
Developing a European Framework for the generation of guarantees of origin for green hydrogen

Panel 6 — Cross-cutting

Acronym:	**CERTIFHY**
Project ID:	633107
Title:	Developing a European Framework for the generation of guarantees of origin for green hydrogen
Call Topic:	SP1-JTI-FCH.2013.5.5 (2)
Project total costs (€):	€ 551,6 million
FCH JU maximum contribution (€):	€ 432,5 million
Project start/end:	01 Nov 2014 - 31 Oct 2016
Coordinator:	Hinicio, Belgium
Beneficiaries:	Ludwig-Boelkow-Systemtechnik, Tuv Sud Industrie Service, Stichting Energieonderzoek Centrum Nederland
Website:	http://www.certifhy.eu/

Project and objectives

CertifHy aimed to:

1) Define a widely acceptable definition of green hydrogen
2) Determine how a robust GoO scheme for green hydrogen should be designed and implemented throughout the EU
3) Agree on a roadmap for implementation.

A core element of the project was a step-by-step consultation process with industry, policy makers, NGOs and other stakeholders to reach a wide consensus.

Major project achievements

- Achieved consensus of definition of green hydrogen, endorsed by a wide variety of stakeholders
- Industrial commitment ensured to produce green hydrogen GOs
- Common understanding and buy in on the roadmap for the implementation phase

Future steps

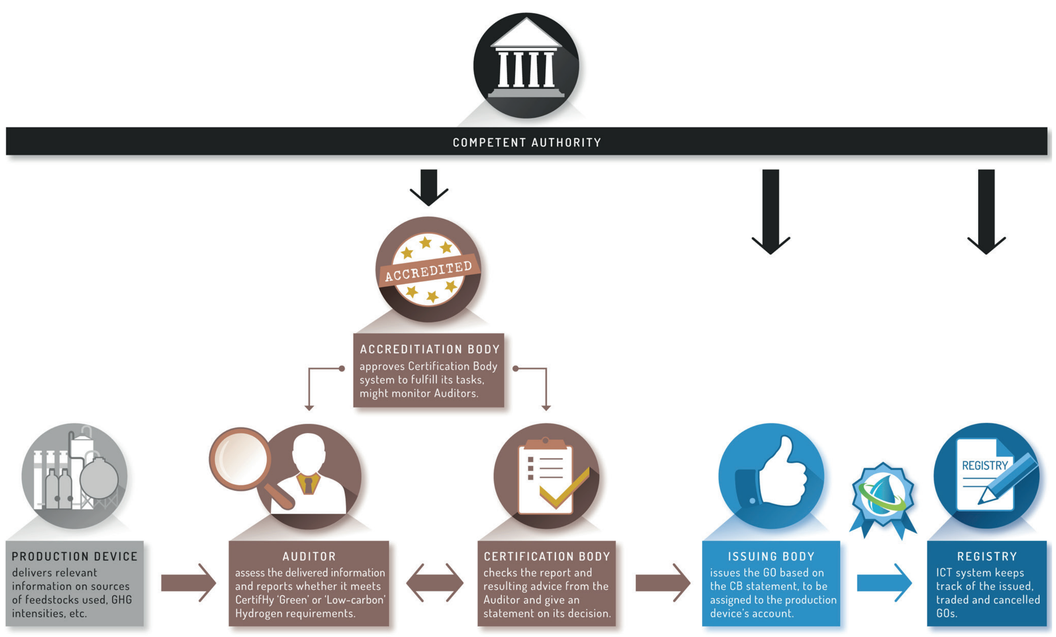
- Eleborate procedures for plant certification and batch auditing
- Development of GO registry
- Selection of pilot plants and testing of the procedures

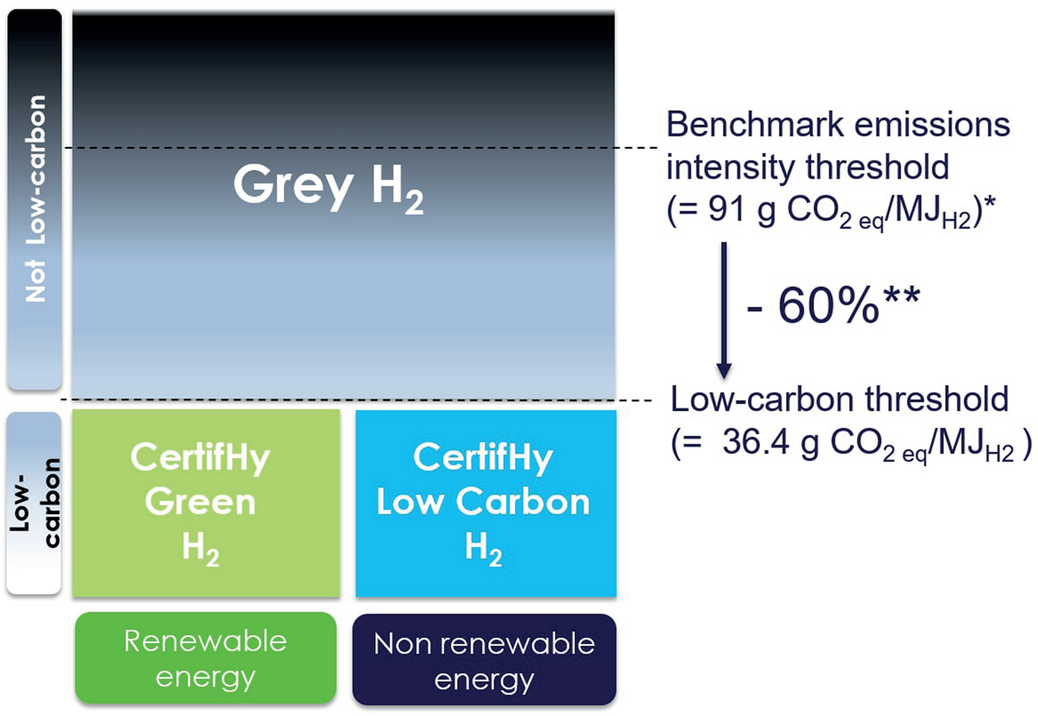
Non-quantitative objectives and status

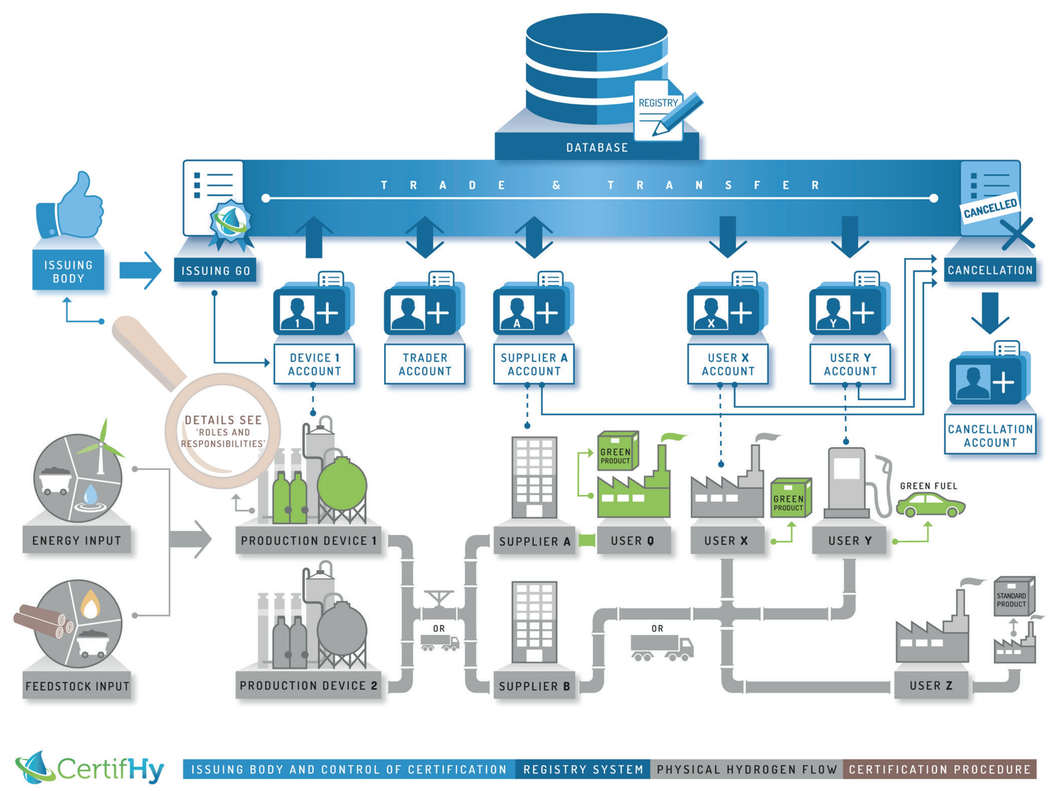
- Achieve consensus amongst stakeholders
  Endorsement from a wide variety of stakeholders have been achieved at the end of the project
- Roadmap for the implementation
  Stakeholders are prepared and engaged for a piloting phase

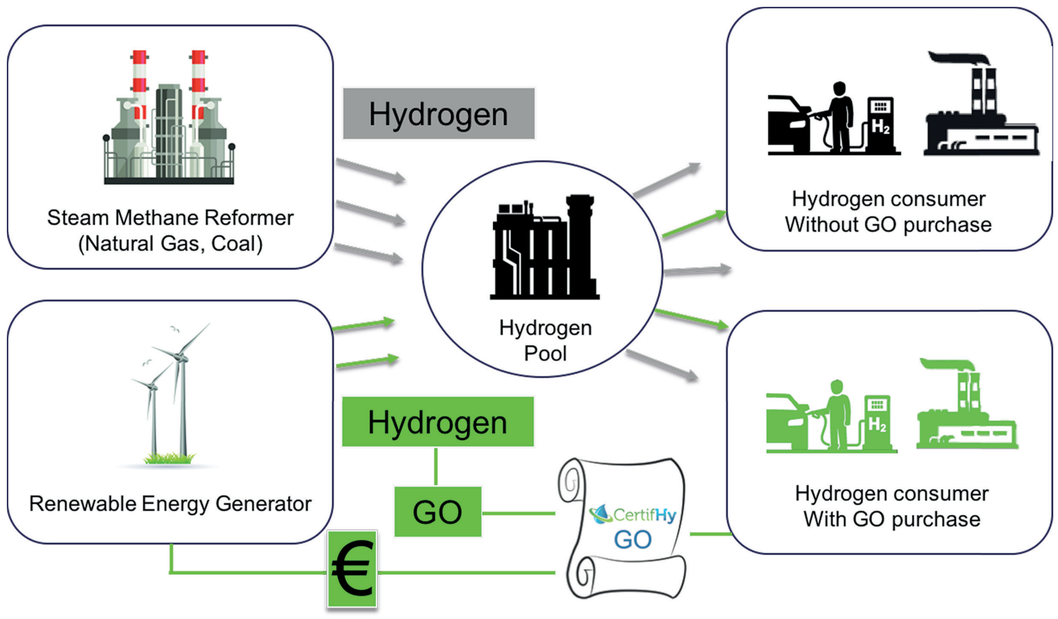
Relevant to FCH JU overarching objectives

- Demonstrate on a large scale the feasibility of using hydrogen to support integration of renewable energy sources into the energy systems, including through its use as a competitive energy storage medium for electricity produced from renewable energy sources









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PROGRAMME REVIEW DAYS 2017

FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

HYTECHCYCLING

New technologies and strategies for fuel cells and hydrogen technologies in the phase of recycling and dismantling

Panel 6 — Cross-cutting

Acronym:	**HYTECHCYCLING**
Project ID:	700190
Title:	New technologies and strategies for fuel cells and hydrogen technologies in the phase of recycling and dismantling
Call Topic:	FCH-04.1-2015
Project total costs (€):	€ 497,6 million
FCH JU maximum contribution (€):	€ 497,6 million
Project start/end:	01 May 2016 - 30 Apr 2019
Coordinator:	Fundacion para Desarrollo de las Nuevas Tecnologias del Hidrogeno en Aragon, Spain
Beneficiaries:	Parco Scientifico e Tecnol. Per l'Ambiente - Environment Park, Uni. V Ljubljani, Industrias Lopez Soriano, Fundacion Imdea Energia
Website:	www.hytechcycling.eu

Project and objectives

HYTECHCYCLING's main aim is to deliver reference documentation and studies about existing and new recycling and dismantling technologies and strategies applied to Fuel Cells and Hydrogen technologies, paving the way for future demonstration actions and advances in legislation. To date the project has studied the critical materials present in these technologies and the available recycling techniques and strategies. The regulatory framework has also been reviewed. A Life-cycle assessment (LCA), new recycling strategies and a business model are other project objectives.

Major project achievements

- Identification and classification of critical materials in fuel cells (PEMFC and SOFC) and water electrolysers (alkaline and PEM) linked to the existing recycling and dismantling technologies
- First approach of the LCA and the impact of the recycling and dismantling in FCH technologies
- Actual regulatory framework and barriers identified

Future steps

- Update the dissemination and awareness plan
- Initial workshop to have a first outlook of needs from FCH actors
- Final workshop for FCH actors to know and validate the final new strategies and technologies in the phase of recycling and dismantling
- LCA inventory of hazardous materials in FCH technologies and set-up of reference case studies with new strategies in dismantling and recycling stage
- New recycling and dismantling technologies and strategies for FCH technologies defined

Relevant to FCH JU overarching objectives

- Reduce the use of the EU defined 'Critical raw materials', for instance through low-platinum or platinum-free resources and through recycling or reducing or avoiding the use of rare earth elements

Non-quantitative objectives and status

- Identification of critical materials and roadmap for their reduction
  The identification has been done linked with strategies for recycling and dismantling. Next step: development of new strategies and roadmap.
- Reference LCA cases will be developed for implementation of recycling
  The first approach for LCA is finished. This will lead with the objective of "process data about recycling that can be used for life cycle analysis"
- Business model looking for wide implementation
  Not started yet
- Development of reference documentation, guidelines and recommendations
  Continuous progress

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PROGRAMME REVIEW DAYS 2017

FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

HYACINTH
Hydrogen acceptance in the transition phase

Panel 6 — Cross-cutting

Acronym:	**HYACINTH**
Project ID:	621228
Title:	Hydrogen acceptance in the transition phase
Call Topic:	SP1-JTI-FCH.2013.5.3
Project total costs (€):	€ 999,3 million
FCH JU maximum contribution (€):	€ 661,5 million
Project start/end:	01 Sep 2014 - 31 May 2017
Coordinator:	Centro Nacional de Experimentacion de Tecnologias de Hidrogeno y Pilasde Combustible Consorcio, Spain
Beneficiaries:	Aberdeen City Council*, I Plus F France, Norstat Deustchland, Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas-Ciemat, Uni. Leeds, Uni. Sunderland, Consultoria de Innovacion y Financiacion Sl, Fraunhofer Gesellschaft zur Foerderung der Angewandten Forschung, Fundacion Cidaut, Razvojni Center Za Vodikove Tehnologije
Website:	http://hyacinthproject.eu/
Twitter:	@HYACINTHPROJECT

Project and objectives

The objective of HYACINTH project is to achieve a greater understanding of the social acceptance of fuel cells and hydrogen (FCH) technologies and applications at European level through two studies: (1) Public awareness and acceptance and (2) Stakeholder acceptance of FCH technologies across Europe. In addition, with the obtained results, a tool to facilitate the product development and market introduction has been developed, being better aimed to the target audience, giving better response to the expectations and reducing the risks or barriers to FCH technologies' acceptance.

Major project achievements

- Report on results of the stakeholders survey
- Report on general finding on public acceptance
- Develop a Social Acceptance Management Toolbox (SAMT) to help promoters and decision makers integrate issues related to social acceptance

Future steps

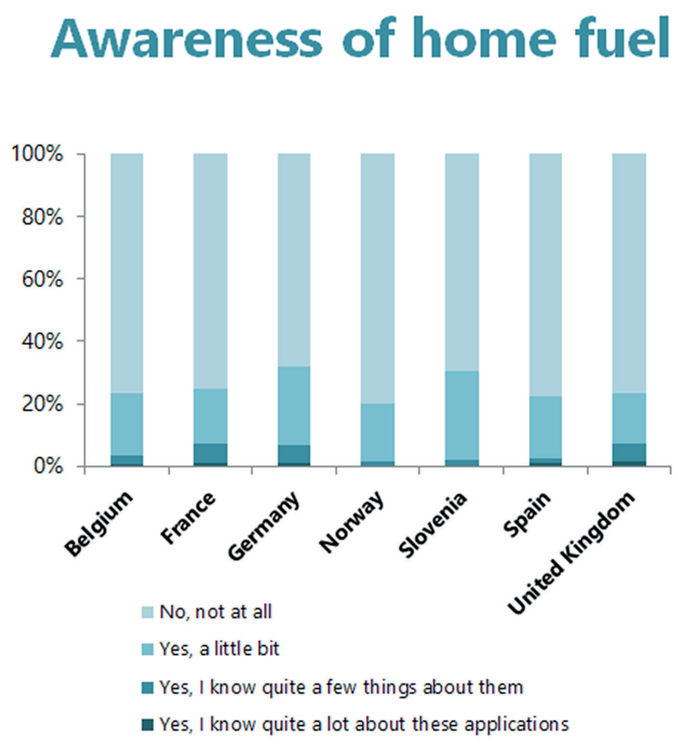
- Review the Report of the stakeholder survey and the Integrated report on general findings on public acceptance
- Write up the Periodic Report and Final Report for HYACINTH project
- To attend to conferences for a mayor dissemination of results

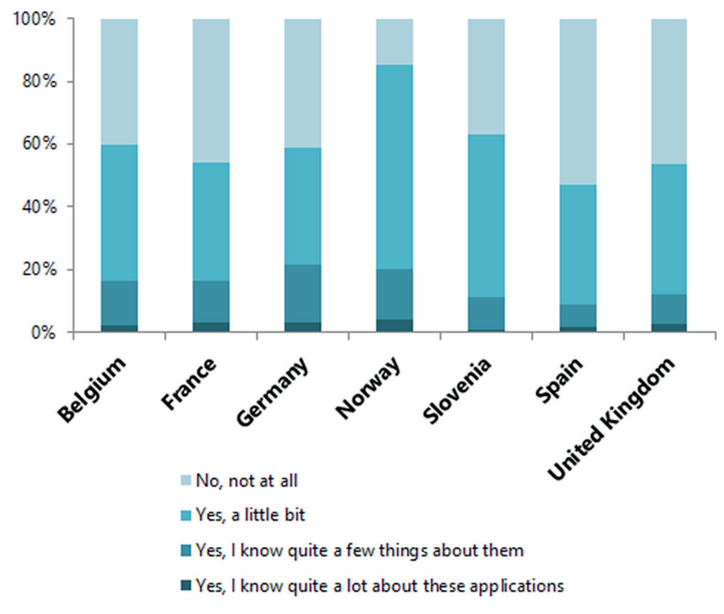
Relevant to FCH JU overarching objectives

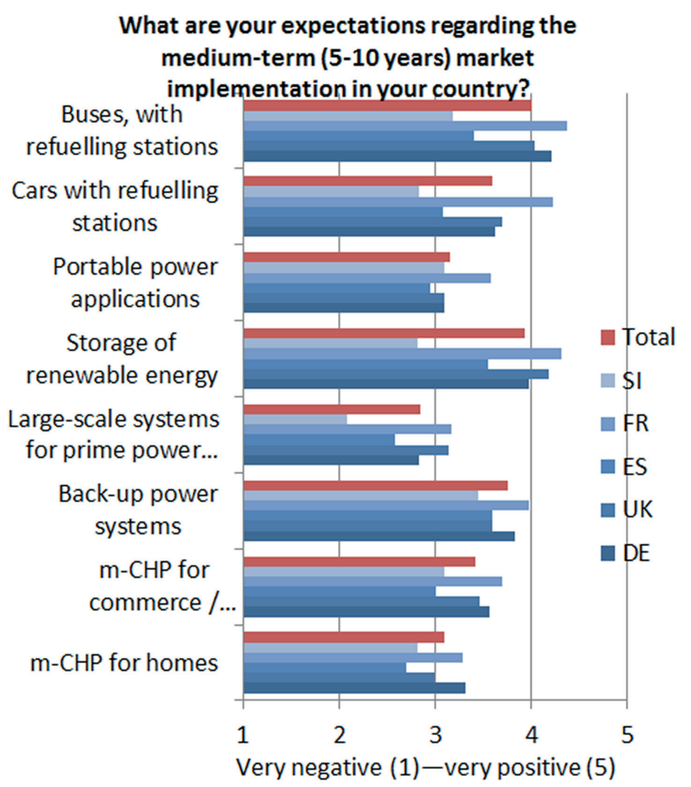
- Reduce the production cost of fuel cell systems to be used in transport applications, while increasing their lifetime to levels which can compete with conventional technologies
- Increase the electrical efficiency and the durability of the different fuel cells used for power production to levels which can compete with conventional technologies, while reducing costs
- Increase the energy efficiency of production of hydrogen mainly from water electrolysis and renewable sources while reducing operating and capital costs, so that the combined system of the hydrogen production and the conversion using the fuel cell system can compete with the alternatives for electricity production available on the market
- Demonstrate on a large scale the feasibility of using hydrogen to support integration of renewable energy sources into the energy systems, including through its use as a competitive energy storage medium for electricity produced from renewable energy sources

Non-quantitative objectives and status

- Public awareness (Achieved)
- European public acceptance: analysis (Achieved)
- Public familiarity with hydrogen technologies, namely in stationary and mobile applications (μ-CHP and vehicles, which are closer to the market. (Achieved)
- Identification of fears associated with FCH technologies - general public survey on costs and benefits of both applications and the evaluation of consequences (see next target) (Achieved)
- How is hydrogen safety perceived by the general public? The majority of issues raised by respondents are related to the price and safety (Achieved)
- Identify and understand acceptance of stakeholders - to examine public awareness, familiarity, perception of benefits and costs, global attitude and acceptance of FCH technologies (Recommendations) (Achieved)
- Social Acceptance research Management Toolbox (SAMT)
  The project has developed a Social Acceptance Information Tool Box (SAMT). Tool Box Handbook. https://hyacinth.sunderland.ac.uk/
- Impact of first use of hydrogen in the mobility sector in stakeholder
  HYACINTH project has asked attendees to the WHEC 2016 Conference who participated in a FC vehicle test drive about their opinion after the test drive.
- Stakeholders opinion on HYACINTH results
  The opinion of attendees to workshops is positive - results are very interesting for sector and the toolbox has a great utility







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PROGRAMME REVIEW DAYS 2017

FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

HYCORA
Hydrogen contaminant risk assessment

Panel 6 — Cross-cutting

Acronym:	**HYCORA**
Project ID:	621223
Title:	Hydrogen contaminant risk assessment
Call Topic:	SP1-JTI-FCH.2013.1.5
Project total costs (€):	€ 3,9 million
FCH JU maximum contribution (€):	€ 2,1 million
Project start/end:	01 Apr 2014 - 30 Jun 2017
Coordinator:	VTT, Finland
Beneficiaries:	Powercell Sweden, Commissariat à l'Energie Atomique et aux Energies Alternatives CEA, JRC -Joint Research Centre, European Commission, Protea Ltd, Stiftelsen Sintef
Website:	http://hycora.eu/

Project and objectives

The main objective of the HyCoRA project is to provide information to reduce the cost of hydrogen fuel quality assurance (QA). It will also provide recommendations for revision of the existing ISO 14687-2:2012 standard for hydrogen fuel in automotive applications.

For developing the strategy for hydrogen fuel QA cost reduction, a hydrogen quality risk assessment is used to define the needs for hydrogen impurity gas analysis, system level PEMFC contaminant research and purification in hydrogen production, especially by steam methane reforming (SMR) with pressure swing adsorption (PSA).

Major project achievements

- Cheaper and more reliable quality assurance procedures and instrumentation for HRSs
- The real susceptibility for various poisonous species (HCHO, HCOOH, CO, H2S) has been studied successfully
- Three sampling campaigns from the HRSs have been completed, technical data collected and results disseminated

Future steps

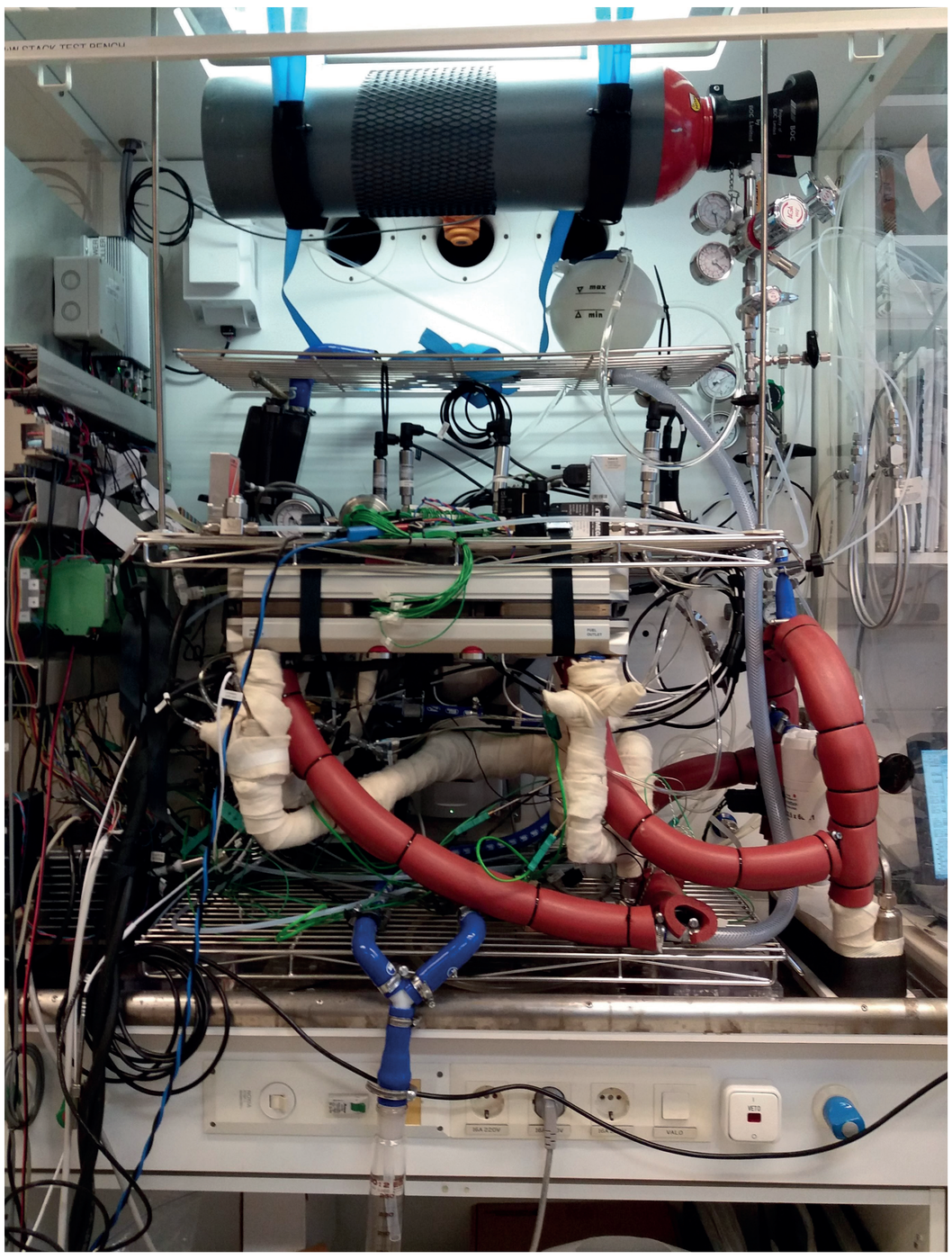
- Finalising some of the FC measurements
- Completing the remaining 10 technical deliverables
- Writing of publications

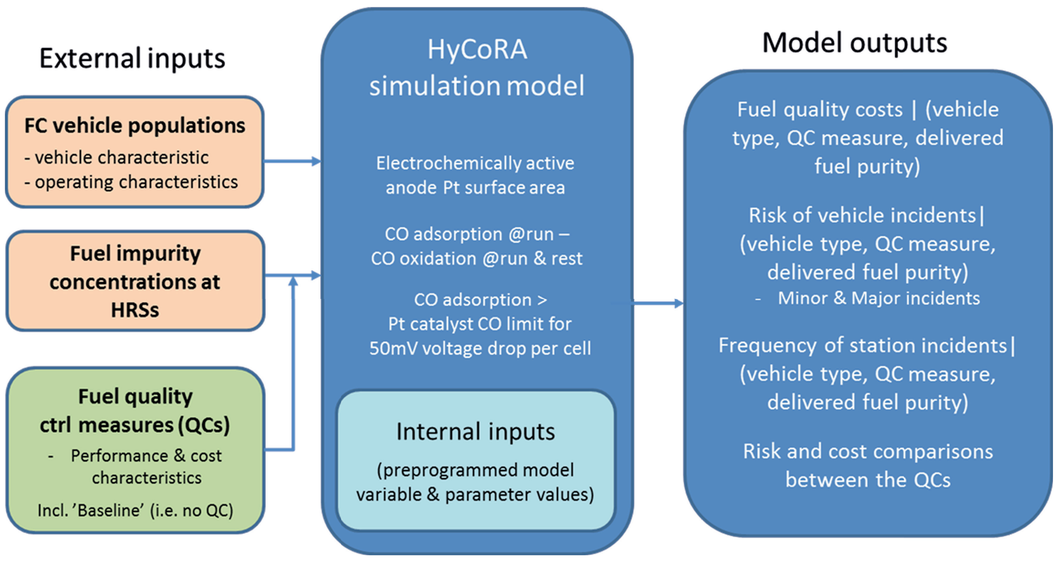
Relevant to FCH JU overarching objectives

- Demonstrate on a large scale the feasibility of using hydrogen to support integration of renewable energy sources into the energy systems, including through its use as a competitive energy storage medium for electricity produced from renewable energy sources

Non-quantitative objectives and status

- Identifying the impurity limits of PEMFCs under automotive operation
  A more complete overview of the real susceptibility of various contaminant in automotive operation achieved
- Technical data on fuel composition and impurity concentration at HRS
  Three sampling campaigns have been completed, fuel composition and impurity concentrations analysed. Particulate sampling conducted in 2nd and 3rd
- Simplified and diversified set of requirements for H_2 fuel quality
  Constructing a probabilistic risk assessment model for determining QA needs
- Design and verification of gas sampling instrumentation to HRS
  Verification of instrumentation for gas and particulate sampling is completed. Has been successfully utilised to complete 3 sampling campaigns





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PROGRAMME REVIEW DAYS 2017

FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

HYPACTOR
Pre-normative research on resistance to mechanical impact of composite overwrapped pressure vessels

Panel 6 — Cross-cutting

Acronym:	**HYPACTOR**
Project ID:	621194
Title:	Pre-normative research on resistance to mechanical impact of composite overwrapped pressure vessels
Call Topic:	SP1-JTI-FCH.2013.5.6
Project total costs (€):	€ 4,0 million
FCH JU maximum contribution (€):	€ 2,1 million
Project start/end:	01 Apr 2014 - 30 Jun 2017
Coordinator:	Commissariat à l'Energie Atomique et aux Energies Alternatives CEA, France
Beneficiaries:	Alma Consulting Group, Hexagon Raufoss, Institut de Soudure Association, Norges Tek-Naturvitenskapelige Uni., Politech. Wroclawska, L'Air Liquide
Website:	www.hypactor.eu

Project and objectives

The main objective of HYPACTOR is to provide recommendations for Regulations, Codes and Standards (RCS) regarding the qualification of new designs of Composite Overwrapped Pressure Vessels (COPV) and the procedures for periodic inspection in service of COPV subjected to mechanical impacts.

Relevant to FCH JU overarching objectives

- Demonstrate on a large scale the feasibility of using hydrogen to support integration of renewable energy sources into the energy systems, including through its use as a competitive energy storage medium for electricity produced from renewable energy sources

Major project achievements

- Recommendations for RCS regarding qualification of COPVs with respect to impact, inspection of impacted COPVs
- Understand & characterise the relationship between the impact, the damage and the loss of performance of COPV at short term
- Definition of a test configuration and inspection procedures for impacted COPVs

Future steps

- Final workshop and webinar to present pre-normative recommendations 19/06/17
- Final consortium meeting 20-21/06/17

Non-quantitative objectives and status

- Identify the different types of alterations that may be produced by mechanical impacts and develop an understanding of their consequences (not yet achieved - due later)
- Establish a relation between severity of impact, level of damage, and effect on structural integrity (achieved)
- Apply the results of the above to assess the reliability of composite pressure vessels in the foreseen applications and potential needs of protection (achieved)
- Evaluate non-destructive examination methods, such as analysis of acoustic emissions, and associated pass/fail criteria (achieved)
- Description and quantification of the effect of mechanical impacts on composite pressure vessel structure (achieved)
- Assessment of the structural reliability of composite pressure vessels in the foreseen service conditions and opportunities of improvement (achieved)
- Recommendations to industry and for international standards development (not yet achieved - due later)
- Improved methods and criteria for inspection of pressure vessels in service (not yet achieved - due later)
- Extensive experimental database database including impact & damage characteristics, NDT results & integrity (achieved)
- Numerical model for the prediction of residual bust pressure (achieved)
- Critical damage description (achieved)
- Testing configuration, NDT protocols, pass/fail criteria defined (achieved)

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PROGRAMME REVIEW DAYS 2017

FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

HYRESPONSE
European hydrogen emergency response training programme for first responders

Panel 6 — Cross-cutting

Acronym:	**HYRESPONSE**
Project ID:	325348
Title:	European hydrogen emergency response training programme for first responders
Call Topic:	SP1-JTI-FCH.2012.5.3
Project total costs (€):	€ 2,6 million
FCH JU maximum contribution (€):	€ 1,8 million
Project start/end:	01 Jun 2013 - 30 Sep 2016
Coordinator:	Ecole Nationale Superieure des Officiers de Sapeurs-Pompiers, France
Beneficiaries:	Areva Stockage D'Energie, Crisis Simulation Engineering, Fast - Federazione delle Associazioni Scientifiche e Tecniche, Uni. Ulster, Air Liquide Hydrogen Energy, The CCS Global Group Ltd
Website:	http://www.hyresponse.eu/

Project and objectives

The HyResponse project targets to create a European Hydrogen Safety Training Platform, which develops a toolbox for European First Responders to help them assessing status and decision making on the emergency response level in case of incident/accident on site. The training is threefold:

- Educational training including hydrogen hazard and risks from hydrogen applications
- Operational-level training on mock-up real scale transport and hydrogen stationary installations
- Innovative virtual training exercises reproducing entire accident scenarios

The project finished in September 2016.

Major project achievements

- Creation of the operational training platforms
- Realisation of the three experimental training sessions
- Edition of the European emergency response guide

Future steps

- Project finished

Relevant to FCH JU overarching objectives

- Demonstrate on a large scale the feasibility of using hydrogen to support integration of renewable energy sources into the energy systems, including through its use as a competitive energy storage medium for electricity produced from renewable energy sources

Non-quantitative objectives and status

- Developing training programmes at all levels: 3 training levels developed
- Dissemination of the programme results through public awareness events and initiatives
- Install a European Hydrogen Training Platform on which full scale exercises will be realised: Construction of a physical platform and also a virtual reality platform

PROGRAMME REVIEW DAYS 2017

FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

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HySEA
Improving Hydrogen Safety for Energy Applications (HySEA) through pre-normative research on vented deflagrations

Panel 6 — Cross-cutting

Acronym:	**HySEA**
Project ID:	671461
Title:	Improving Hydrogen Safety for Energy Applications (HySEA) through pre-normative research on vented deflagrations
Call Topic:	FCH-04.3-2014
Project total costs (€):	€ 1,5 million
FCH JU maximum contribution (€):	€ 1,5 million
Project start/end:	01 Sep 2015 - 31 Aug 2018
Coordinator:	Gexcon, Norway
Beneficiaries:	Hefei Uni. Tech., Impetus Advanced Finite Element Analyses, Uni. Science & Tech. China, Uni. Di Pisa, Uni. Warwick, Fike Europeba
Website:	www.hysea.eu

Project and objectives

The overall goal of the HySEA project is to conduct pre-normative research on vented hydrogen deflagrations with an aim to provide recommendations for European and international standards on hydrogen explosion venting mitigation systems, and to develop and validate engineering models (EMs), computational fluid dynamics (CFD) and finite element (FE) methods that can be verified and validated against data from experiments performed in containers and smaller enclosures with industry-representative obstacles.

Major project achievements

- Completed two experimental campaigns with vented hydrogen deflagrations for homogeneous mixtures
- Completed blind-prediction study for vented hydrogen deflagrations in 20-foot ISO container
- Improved computational fluid dynamics (CFD) models for vented hydrogen deflagration

Future steps

- Organize second HySEA blind-prediction study with vented hydrogen deflagrations in 20-foot ISO containers with obstacles and inhomogeneous mixtures
- Complete second experimental campaign with vented hydrogen deflagrations in 20-foot ISO containers with obstacles and inhomogeneous mixtures
- Complete second experimental campaign with vented hydrogen deflagrations in small-scale enclosure with obstacles and inhomogeneous mixtures
- Release improved computational fluid dynamics (CFD) tools for vented hydrogen deflagrations
- Evaluate and possibly improve engineering models for vented hydrogen deflagrations and present these to members of relevant standardizing committees

Relevant to FCH JU overarching objectives

- Demonstrate on a large scale the feasibility of using hydrogen to support integration of renewable energy sources into the energy systems, including through its use as a competitive energy storage medium for electricity produced from renewable energy sources

Non-quantitative objectives and status

- To perform experiments in real-life enclosures with obstacles
  This work progresses according to schedule, but with some delays in reporting due to more demanding analysis of data than expected.
- To organize blind-prediction validation studies
  On schedule (one completed, one scheduled for autumn 2017).
- To develop, verify and validate EMs and CFD-based tools
  On schedule
- To formulate recommendations to the standardizing committees
  Somewhat behind schedule due to delayed recruitment of personnel

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IRMFC
Development of a portable internal reforming methanol High Temperature PEM fuel cell system

Panel 6 — Cross-cutting

Acronym:	**IRMFC**
Project ID:	325358
Title:	Development of a portable internal reforming methanol High Temperature PEM fuel cell system
Call Topic:	SP1-JTI-FCH.2012.4.2 SP1-JTI-FCH.2012.4.4
Project total costs (€):	€ 3,4 million
FCH JU maximum contribution (€):	€ 1,5 million
Project start/end:	01 May 2013 - 31 Oct 2016
Coordinator:	Foundation for Research and Technol. Hellas, Greece
Beneficiaries:	Advanced Energy Technol. Ae Ereunas & Anaptyxis Ylikon & Proiontonananeosimon Pigon Energeias & Synafon Symvouleftikon Y Piresion*AdvenT, Arpedon Metritikes Diataxeis Kai Organa Michanimata Ypresies EPE, Enerfuel Inc., Institut Fuer Mikrotechnik Mainz, Uni. Patras, Fraunhofer Gesellschaft zur Foerderung der Angewandten Forschung, Zentrum Fur Brennstoffzellen-Technik, JRC -Joint Research Centre, European Commission, Uniwersytet Marii Curie-Sklodowskiej
Website:	http://irmfc.iceht.forth.gr/

Project and objectives

Taking advantage of the innovative outcomes of previous FCH JU project IRAFC, the functionality of internal reforming methanol fuel cell (IRMFC) modules of 100 W was demonstrated. The IRMFC partnership brought together specialists in catalysis, high-temperature polymer electrolytes, high-temperature PEMFC stacks and RSC for portable applications. The observed stability of the IRMFC module and key components was satisfactory in the timeframe of the performed tests. Specific targets for efficiency improvement were identified, including the reformer activity and thermal stability of the membrane under on/off cycles.

Major project achievements

- New-type methanol reformer (ultrathin and lightweight) and bipolar plates (operation at 200-230°C) delivered and tested for >1000 h
- IRMFC stacks (up to 100 W) and BoP components tested and delivered
- Poor cycling stability of the membrane-electrode assembly (MEA) limited operation for long periods; currently confronted with new generation of polymer electrolytes under development

Future steps

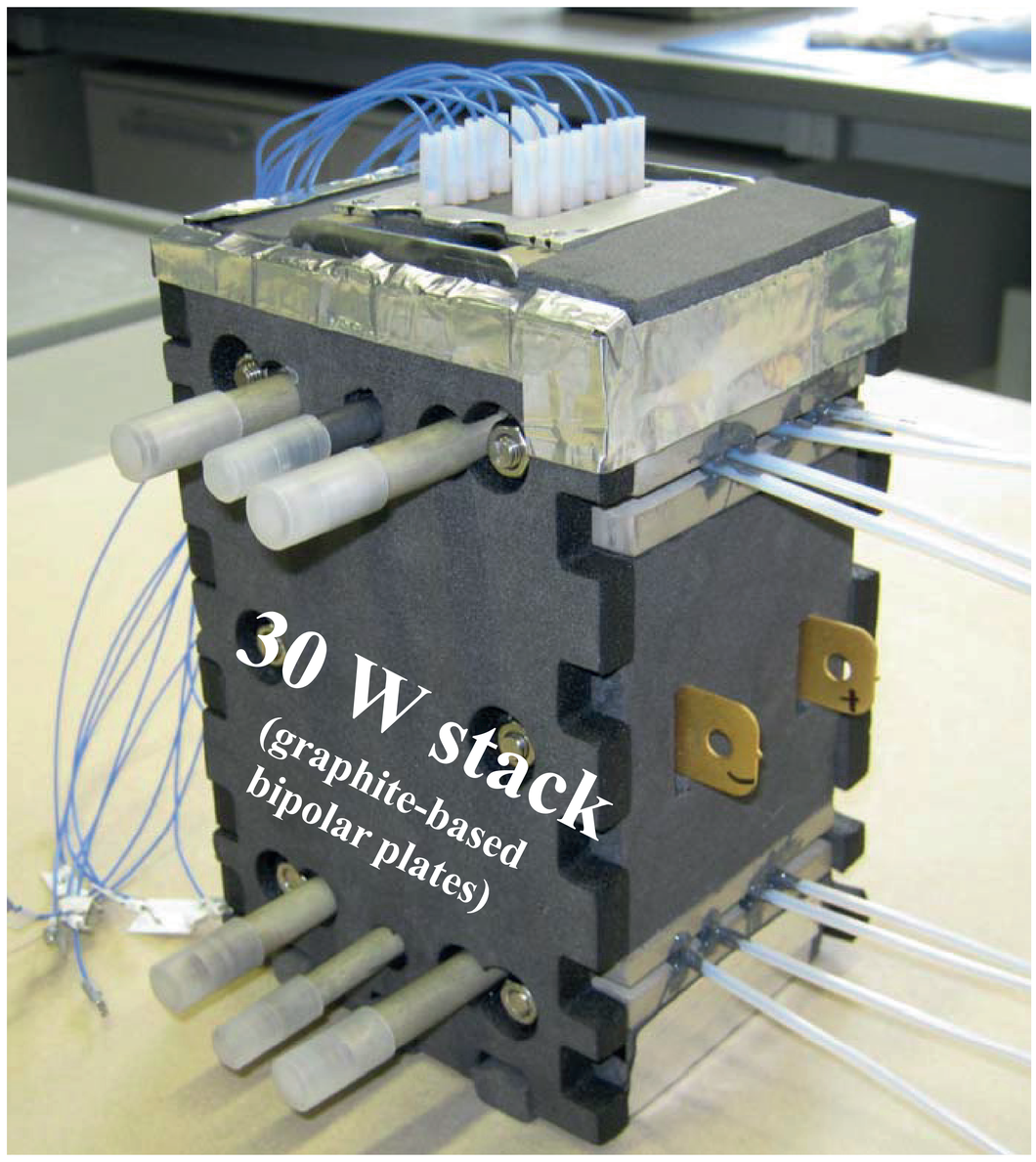
- Project finished

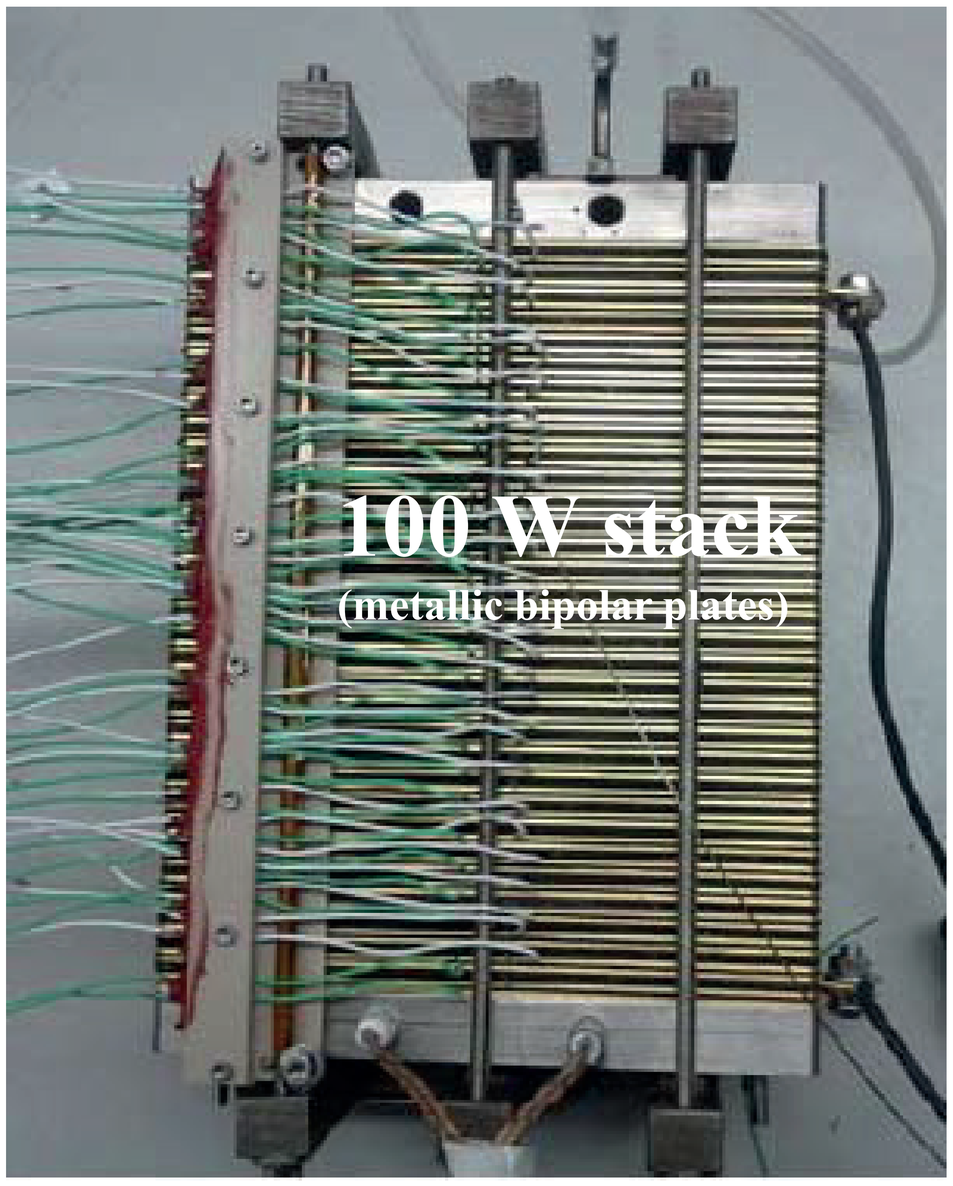
Relevant to FCH JU overarching objectives

- Increase the electrical efficiency and the durability of the different fuel cells used for power production to levels which can compete with conventional technologies, while reducing costs

Non-quantitative objectives and status

- Operation of 100 W Internal Reforming Methanol Fuel Cell
  Two 100 W modules were tested and delivered. Low stability of membrane against on/off cycling conditions limited operation for long periods
- Cost reduction to < 5000€/kW
  The final cost is much higher because of the delivery of a single integrated system. A rough estimation for the equivalent at mass production is below this target
- Electrical efficiency > 30% at 210-220°C (methanol/water fuel)
  Not measured for the final system. Balance-of-plant (BoP) completed but not integrated with the stack





FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

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KNOWHY
Improving the knowledge in hydrogen and fuel cell technology for technicians and workers

Panel 6 — Cross-cutting

Acronym:	**KNOWHY**
Project ID:	621222
Title:	Improving the knowledge in hydrogen and fuel cell technology for technicians and workers
Call Topic:	SP1-JTI-FCH.2013.5.2
Project total costs (€):	€ 1,4 million
FCH JU maximum contribution (€):	€ 1,0 million
Project start/end:	01 Sep 2014 - 31 Aug 2017
Coordinator:	Tech. Uni. Delft, The Netherlands
Beneficiaries:	Campus Automobile Spa-Francorchamps, Fast - Federazione delle Associazioni Scientifiche e Tecniche, Fundacion San Valero, Kiwa Training, Mcphy Energy, Parco Scientifico e Tecnol. Per l'Ambiente - Environment Park, PNO Consultants, Tech. Uni. Muenchen, Uni. Birmingham, Vertigo Games, Fundacion para Desarrollo de las Nuevas Tecnologias del Hidrogeno en Aragon, Inst. Superior Tecnico
Website:	http://knowhy.eu/
Linkedin:	KnowHy

Project and objectives

KnowHy aims to provide the fuel cells and hydrogen (FC & H2) sector with a training offer for technicians and workers featuring quality in contents, accessibility in format and language, practicality for the targeted audience, ease of scalability and update, and at competitive costs to make the training offer economically sustainable after project completion.

The main project actions are:

- Developing an online tool for accessing to the training contents via the web
- Developing specific courses adapted to the different applications
- Carrying out practical seminars in existing facilities

Major project achievements

- Development of a core module with 5 specialisation modules including serious games and practical sessions - all have been translated into 6 European languages
- So far 668 trainees have been registered on the KnowHy platform of which 21% have finished e-learning and practical session
- Results of satisfaction survey:
  - Overall satisfaction: 9/10
  - Companies satisfaction: 8.5/10
  - Practical session: 9/10
  - Serious Games: 8.6/10

Future steps

- Improve the quality of course contents
- Finalise the structure of the KnowHy a Special Purpose Vehicle
- Attempt a new round of training during September and October 2017 in some partner countries
- Contact the trainees who did not finish the courses and encourage them to complete them
- Offer courses in other countries such as US, Norway and Slovenia

Non-quantitative objectives and status

- Develop 6 modules including serious games and practical sessions
  Achieved, translated into 6 European languages
- Teach 1000 trainees
  668 trainees registered on the KnowHy platform by May 1st, 2017
- Identification of target group, topics and modules definition
  Done, providing the technicians with the required training in the field of FC & H2 with foremost importance on the safety & maintenance aspects
- Effective teaching methodology defined & the course platform set
  Done, developing an effective teaching methodology based on e-learning (including video lectures), serious game, practical session
- Establish a self-financing KnowHy legal entity
  Will be completed - need to set up a Special Purpose Vehicle (SPV) plan and discussions are ongoing
- Dissemination of results to industry, stakeholders, etc
  Will be completed - collect the feedback from students, analyse and identify improvement potential based on lessons learned

FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

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SOCTESQA
Solid oxide cell and stack testing, safety and quality assurance

Panel 6 — Cross-cutting

Acronym:	**SOCTESQA**
Project ID:	621245
Title:	Solid oxide cell and stack testing, safety and quality assurance
Call Topic:	SP1-JTI-FCH.2013.5.4
Project total costs (€):	€ 3,2 million
FCH JU maximum contribution (€):	€ 1,6 million
Project start/end:	01 May 2014 - 30 Apr 2017
Coordinator:	DLR, Deutsches Zentrum fuer Luft und Raumfahrt, Germany
Beneficiaries:	ENEA, Agenzia Nazionale per le Nuove Tecnologie, l'Energia e lo Sviluppo Economico Sostenibile, Danmarks Tek. Uni., Commissariat à l'Energie Atomique et aux Energies Alternatives CEA, Eifer Europaisches Inst. fur Energieforschung, JRC -Joint Research Centre, European Commission
Website:	http://www.soctesqa.eu/

Project and objectives

The aim of the project is to develop uniform and industry-wide test modules and programs for solid oxide cell and stack (SOC) assembly units. New application fields are addressed, based on the operation of the SOC cell/stack assembly in the fuel cell (SOFC), in the electrolysis (SOEC) and in the combined SOFC/SOEC mode. This covers the wide field of power generation systems, e.g. stationary SOFC, µ-CHP, mobile SOFC APU, SOEC power-to-gas and combined SOFC/SOEC power-to-gas-to-power systems. The results of the project are being successfully implemented into international standards.

Major project achievements

- Altogether 11 generic test modules for SOFC, SOEC and combined SOFC/SOEC have been developed which cover stationary and mobile applications
- The test procedures contain all important guideline information in order to achieve high quality, reproducible and repeatable test results
- The project outcome is already being transferred to standards developing organisations (e.g. IEC, CEN/CENELEC, ISO, VDMA)

Future steps

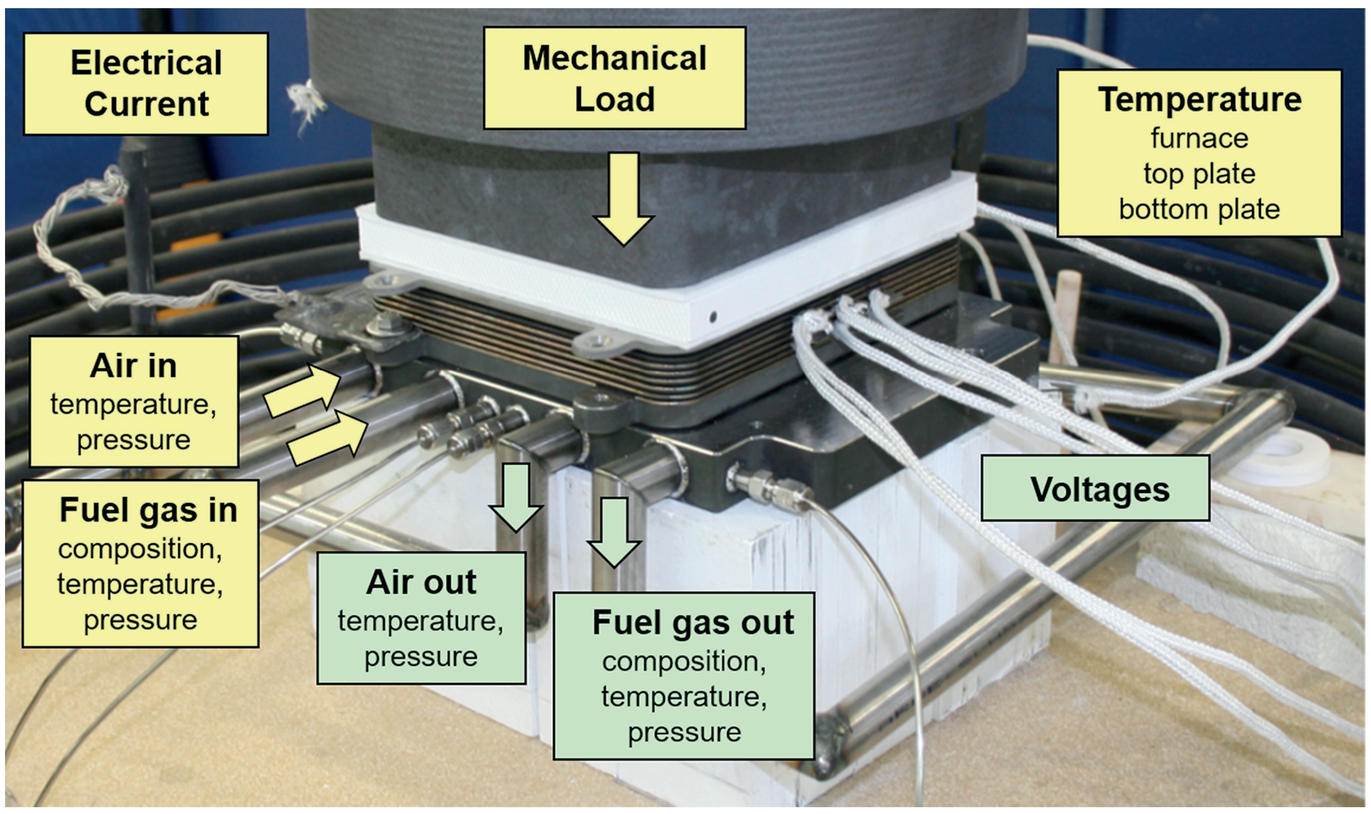
- Project finished

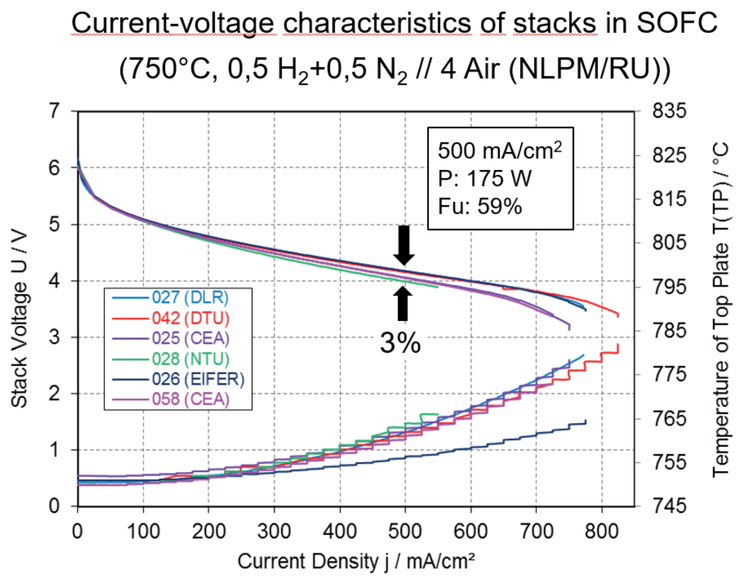
Relevant to FCH JU overarching objectives

- Reduce the production cost of fuel cell systems to be used in transport applications, while increasing their lifetime to levels which can compete with conventional technologies
- Increase the electrical efficiency and the durability of the different fuel cells used for power production to levels which can compete with conventional technologies, while reducing costs
- Increase the energy efficiency of production of hydrogen mainly from water electrolysis and renewable sources while reducing operating and capital costs, so that the combined system of the hydrogen production and the conversion using the fuel cell system can compete with the alternatives for electricity production available on the market

Non-quantitative objectives and status

- Development and validation of testing procedures for SOFC/SOEC
  Altogether 11 generic test modules for SOFC/SOEC applications have been developed, validated and optimised within 4 different testing campaigns
- Identification of testing procedures for solid oxide technology
  All specifications, nomenclature, test modules and test programmes were identified and defined
- Establishment of methodologies for testing data
  A general test module (TM00) was developed, which describes methodologies, collection, formulary, analysis and presentation of test data
- Interaction with standards developing organisations (SDOs)
  Results are being transferred to main bodies currently working on regulations for hydrogen and fuel cell technology (e.g. IEC, CEN/CENELEC, ISO, VDMA)





EG-04-17-700-EN-P

SUSANA
Support to safety analysis of hydrogen and fuel cell technologies

Panel 6 — Cross-cutting

Acronym:	**SUSANA**
Project ID:	325386
Title:	Support to safety analysis of hydrogen and fuel cell technologies
Call Topic:	SP1-JTI-FCH.2012.5.2
Project total costs (€):	€ 2,1 million
FCH JU maximum contribution (€):	€ 1,1 million
Project start/end:	01 Sep 2013 - 31 Aug 2016
Coordinator:	Karlsruher Inst. Technol., Germany
Beneficiaries: Areva Stockage d'Energie, Health and Safety Executive, Element Energy, JRC -Joint Research Centre, European Commission, Uni. Ulster, National Center For Scientific Research "Demokritos"	
Website:	http://www.support-cfd.eu

Project and objectives

SUSANA critically reviewed the state-of-the-art in physical and mathematical modelling of phenomena and scenarios relevant to hydrogen safety, i.e. releases and dispersion, ignitions and fires, deflagrations and detonations, etc. A major objective was to develop and compile a guide of best practices in use of Computational Fluid Dynamics (CFD) for safety analysis of FCH systems and infrastructures, to update verification and validation procedures and to generate a database of verification problems and model validation. Dissemination activities, workshops and seminars executed concluded the work at end of project.

Major project achievements

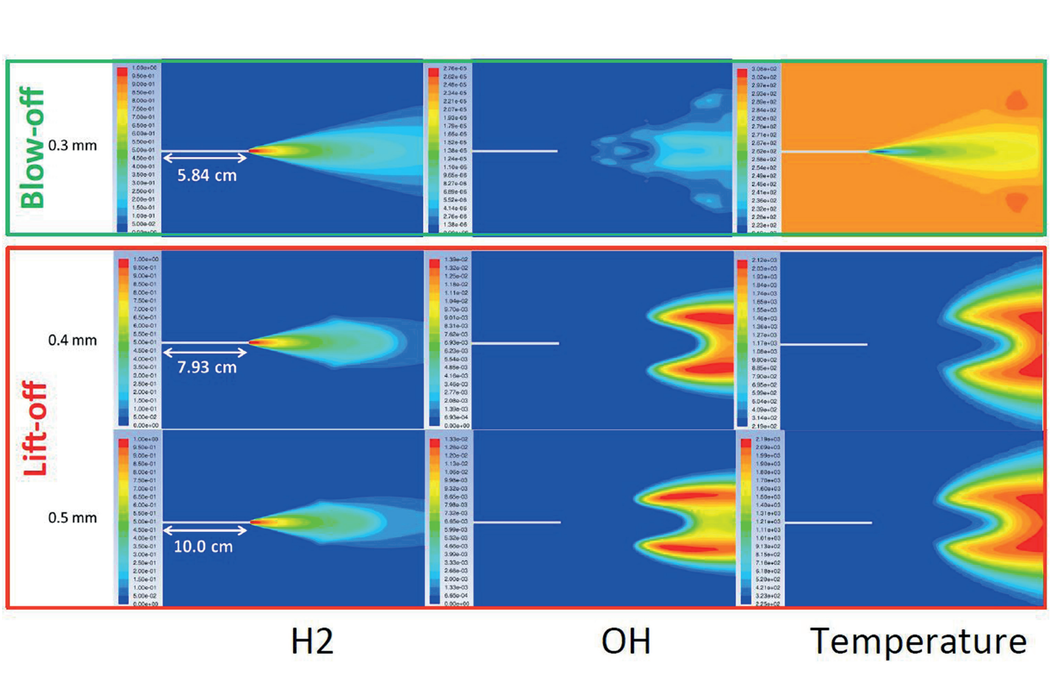
- Support of the Computational fluid Dynamics (CFD) user community through the creation of a database of the simulations performed identifying the reliability of the applied analysis
- Development of a verification and validation database to support the CFD community
- Model evaluation protocol and guidelines to best practice in safety-related numerical simulations

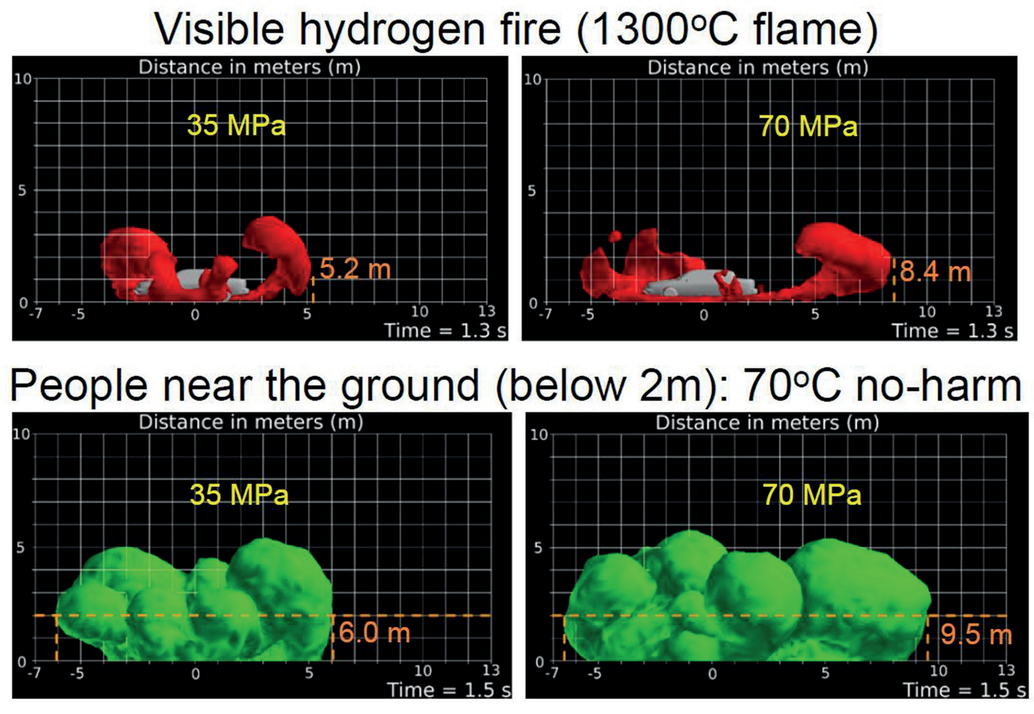
Future steps

- Project finished

Non-quantitative objectives and status

- Database for verification and validation problems in CFD analysis (Achieved)
  A database was developed to incorporate related experimental data concerning modelling and simulation of safety analysis by CFD (database available)
- Model evaluation protocol (Achieved)
  A model evaluation protocol was developed to guide CFD users to achieve best results in safety related simulations
- Critical analysis and requirements to physical and mathematical models (Achieved)
  Critical analysis was executed by reviewing the state-of-the-art of safety-related documents and publications at international level
- Best practices in numerical simulations (Achieved)
  Guidelines were developed in relation to best practice in numerical simulation





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PROGRAMME REVIEW DAYS 2017

FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING