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| Project ID: | 621228 |
| Call topic: | SP1-JTI-FCH.2013.5.3 - Social acceptance of FCH technologies throughout Europe |
| Project total costs: | € 999,383 |
| FCH JU max. Contribution: | € 661,584 |
| Project start - end: | 01/09/2014 - 31/05/2017 |
| Coordinator: | CENTRO NACIONAL DE EXPERIMENTACION DE TECNOLOGIAS DE HIDROGENO Y PILASDE COMBUSTIBLE CONSORCIO, ES |
| Website: | www.hyacinthproject.eu |



BENEFICIARIES: ABERDEEN CITY COUNCIL*, CENTRO DE INVESTIGACIONES ENERGETICAS, MEDIOAMBIENTALES Y TECNOLOGICAS-CIEMAT, CONSULTORIA DE INNOVACION Y FINANCIACION SL, FRAUNHOFER GESELLSCHAFT ZUR FORDERUNG DER ANGEWANDTEN FORSCHUNG EV, FUNDACION CIDAUT, I PLUS F FRANCE SARL, NORSTAT DEUTSCHLAND GmbH, RAZVOJNI CENTER ZA VODIKOVE TEHNOLOGIJE, UNIVERSITY OF LEEDS, UNIVERSITY OF SUNDERLAND

PROJECT AND OBJECTIVES

The project objectives are firstly to gain a deeper understanding of European-level social awareness and acceptance of Fuel Cell and Hydrogen (FCH) technologies. To achieve these objectives, two studies were undertaken related to awareness and acceptance of hydrogen technologies – one of the general public and one of selected stakeholders - in several EU countries. Finally, the data collected in both studies have informed the SAMT, a Social Acceptance Management toolbox. This provides an

accessible interface to the study results and is intended to support queries relevant to developers.

NON QUANTITATIVE OBJECTIVES

- Projects own. Social Acceptance research Management Toolbox (SAMT)
- Impact of first use of hydrogen in the mobility sector in stakeholder
- Stakeholder's opinion on HYACINTH results. D 6.3. Optimized and tested

PROGRESS & MAIN ACHIEVEMENTS

- Study and Report on general public acceptance on hydrogen and fuel cell technologies
- Study and Report on Stakeholder's views on the acceptance of hydrogen fuel cell technologies
- Development a Social Acceptance Management toolbox (SAMT)

FUTURE STEPS & PLANS

Project is finished.

| | Key Strengths | Perceived weaknesses | Key expectations | Recommendations |
|-------------------------|---|---|---|---|
| Hydrogen supply and use | 1. Environmental performance 2. Versatility | 1. Cost 2. Inadequate/excessive regulation | 1. Positive 2. Market development (near term) 3. Uncertainty by govt support | 1. More govt and political support 2. Inform & engage stakeholders 3. R&D |
| Stationary applications | 1. Utility of portable /UPS 2. Environmental advantages | 1. Cost 2. Complexity of systems 3. Limited support by regulators | 1. Mixed 2. Related to nat policies 3. Different between countries | 1. More sustained govt support 2. Regulatory & public support |
| Mobile applications | 1. Technical performance 2. Lack of local emissions 3. Good vs other alternatives | 1. Financial cost 2. Limited awareness of regulators 3. Rivalry vs other technologies | 1. Divided: many positive and many pessimistic in short term. 2. Differences between countries | 1. Govt, political and regulatory support. 2. Investment in infrastructure |

QUANTITATIVE TARGETS AND STATUS

FCH JU Programme Targets*

| PARAMETER | UNIT | TARGET | DESCRIPTION |
|---|------|--|--|
| Public awareness and acceptance | % | The current state of public awareness of FCH technologies in Europe | D5.2. General Finding on Public acceptance.3.1.2,3.2.1, 3.4.1. 3.2.7, 3.3. and 3.4.8 |
| Familiarity with hydrogen technology | % | Familiarity with hydrogen technology in stationary and mobile applications (micro-CHP and FCEV). These are closer to the market. | D5.2. General Finding on Public acceptance.3.2.3 and 3.4.4 pages 32, 44 and 73 |
| Fears associated with FCH technology | % | In general public survey was asked about costs and benefits of both applications and the evaluation of consequences (see next target) | D5.2. General Finding on Public acceptance.3.2.4. and 3.4.5 pages 50 and 79 |
| How is hydrogen safety perceived by the general public? | % | The majority of issues raised by respondents are related to the price and safety | D5.2. General Finding on Public acceptance.3.2.4. and 3.4.5 pages 50 and 79 |
| Identify and understand acceptance of stakeholders | % | To examine public awareness, familiarity, perception of benefits and costs, global attitude and acceptance of FCH technologies (Recommendations) | D5.1. Report on the results of the Stakeholders survey |

*As identified in AIP 2013 and project's own objectives, Target year 2017

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| Project ID: | 621223 |
| Call topic: | SP1-JTI-FCH.2013.1.5 - Fuel Quality Assurance for Hydrogen Refuelling Stations |
| Project total costs: | € 3,842,049 |
| FCH JU max. Contribution: | € 2,159,024 |
| Project start - end: | 01/04/2014 - 30/06/2017 |
| Coordinator: | Teknologian tutkimuskeskus VTT Oy, FI |
| Website: | www.hycora.eu |

BENEFICIARIES: COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES, JRC -JOINT RESEARCH CENTRE- EUROPEAN COMMISSION, Powercell Sweden AB, PROTEA LIMITED, STIFTELSEN SINTEF, TEKNOLOGIAN TUTKIMUSKESKUS VTT project results have been essential for the introduction of a total budget for these and CO into the standard.



PROJECT AND OBJECTIVES

The main objective of HyCoRA project was to provide information to reduce cost of hydrogen fuel quality assurance (QA). A probabilistic simulation model was developed to quantify the risk induced by fuel contaminants on FCEVs' performance and to assess the overall cost impact of quality control measure options. The HRS sampling strategy has been widely accepted and successful sampling campaigns culminated in its standardization in Annex I to 19880-1. HCHO and HCOOH project results have been essential for the introduction of a total budget for these and CO into the standard.

NON QUANTITATIVE OBJECTIVES

- Identifying the impurity limits of PEMFCs under automotive operation
- Technical data on fuel composition and impurity concentration at HRS
- Simplified and diversified set of requirements for H2 fuel quality
- Design and verification of gas sampling instrumentation to HRS

PROGRESS & MAIN ACHIEVEMENTS

- FC impurity measurements with HCHO and HCOOH have been essential for the introduction of a total budget for these and CO into the standard
- Three HRS sampling campaigns, fuel composition and impurity concentrations analysed. Standardization of the sampling by adding Annex I to 19880-1
- A probabilistic simulation model to quantify the risk induced by fuel contaminants on FCEVs' performance

FUTURE STEPS & PLANS

Project is finished.

RELEVANCE 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

Data and support for correct limits and guidelines for standardization H2 fuel and H2 fuel QA assist promoting feasibility of using H2 in energy systems.



QUANTITATIVE TARGETS AND STATUS

State of the Art (SoA)*

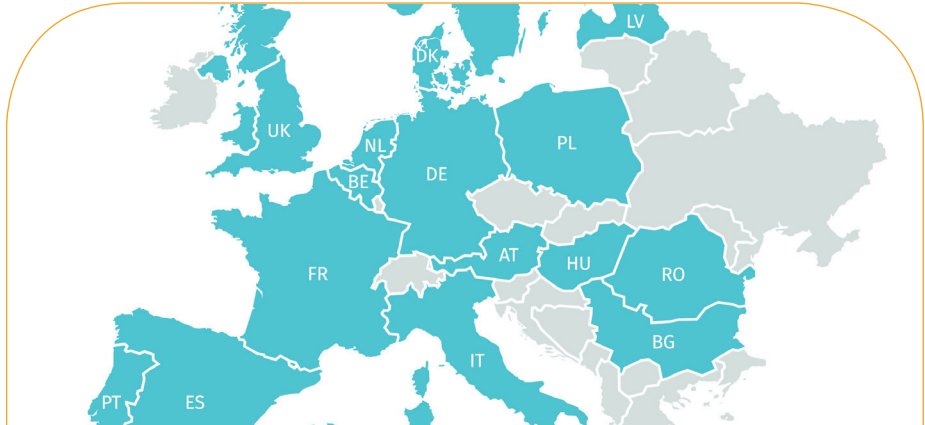
| PARAMETER | RESULT ACHIEVED TO DATE | SoA Source |
|--|---|--|
| Identifying the impurity limits of PEMFCs under automotive operation | FC measurement test system is SoA, and has been introduced to other institutes. E.g. LANL is replicating and improving the recirculation system developed by VTT with the help of VTT | E.g. https://energy.gov/eere/fuelcells/downloads/hydrogen-fuel-quality-specifications-polymer-electrolyte-fuel-cells-road |
| Technical data on fuel composition and impurity concentration at HRS | Very unique sampling data sets: data is public and analysis has been performed in compliance with ISO 14687/SAE J2719 | N/A |
| Probabilistic risk assessment model to quantify the risk from H2 fuel contaminant(s) | No other similar approach available (public) | N/A |
| Design and verification of gas sampling instrumentation to HRS | Commercial equipment utilized (as available), but the selection of equipment and the chosen strategy led successful sampling campaigns, and culminated in Annex I to 19880-1 | N/A |

* Data available as provided by the project



HyLAW

IDENTIFICATION OF LEGAL RULES AND ADMINISTRATIVE PROCESSES APPLICABLE TO FUEL CELL AND HYDROGEN TECHNOLOGIES' DEPLOYMENT, IDENTIFICATION OF LEGAL BARRIERS AND ADVOCACY TOWARDS THEIR REMOVAL



| | |
|----------------------------------|---|
| Project ID: | 735977 |
| Call topic: | FCH-04-2-2016 - Identification and reduction of legal-administrative barriers for the installation and operation of key FCH technologies |
| Project total costs: | € 1,143,000 |
| FCH JU max. Contribution: | € 1,143,000 |
| Project start - end: | 01/01/2017 - 31/12/2018 |
| Coordinator: | HYDROGEN EUROPE, BE |
| Website: | www.hylaw.eu |

BENEFICIARIES: AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE, ASSOCIATION FRANCAISE POUR L'HYDROGENE ET LES PILES A COMBUSTIBLE, BRINTBRANCHEN, BULGARIAN ACADEMY OF SCIENCES, COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES, DANSK GASTEKNISK CENTER AS, DEUTSCHER WASSERSTOFF- UND BRENNSTOFFZELLENERBAND EV, FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON, GREATER LONDON AUTHORITY, INSTYTUT ENERGETYKI, LATVIJAS UDENRAZA ASOCIACIJA, MAGYAR TUDOMANYOS AKADEMIA TERMESZETTUDOMANYI KUTATOKOZPONT, NATIONAL RESEARCH AND DEVELOPMENT INSTITUTE FOR CRYOGENICS AND ISOTOPIC TECHNOLOGIES ICSI RM VALCEA, OSTERREICHISCHE ENERGIEAGENTUR AUSTRIAN ENERGY AGENCY, STI - SISTEMAS E TECNICAS INDUSTRIAIS LDA, STICHTING NEDERLANDS NORMALISATIE – INSTITUUT, STIFTELSEN SINTEF, Teknologian tutkimuskeskus VTT Oy, THE SCOTTISH HYDROGEN AND FUEL CELL ASSOCIATION LTD, UK HYDROGEN AND FUEL CELL ASSOCIATION, VATGAS SVERIGE IDEELL FORENING, WaterstofNet vzw

PROJECT AND OBJECTIVES

HyLAW aims to deliver the most detailed and robust assessment to date of Legal and Administrative Processes and their impacts on FCH technologies across the EU. This will provide the facts and underlying evidence essential for discussions with regulatory agencies, policymakers and other stakeholders. The objective of the project is to identify regulatory barriers (due to in adapted or missing regulation) and to provide recommendations on how those can be improved. It was not in the scope of the project to ensure the regulatory / standard change within its timeline.

NON QUANTITATIVE OBJECTIVES

- **CREATE:** a coherent database covering 17 MSs and 1 associated State
- Identify significant variations and 'best practice' approaches implemented locally, regionally or/and nationally
- **INFORM:** provide accessibility via a single portal to information about FCH technologies

- **COMMUNICATE AND DISSEMINATE:** provide a coherent communication strategy and meet the dissemination needs of different FCH sectors and different member states

PROGRESS & MAIN ACHIEVEMENTS

- A list of 64 legal and administrative process relevant to hydrogen technology deployment, spanning 18 different hydrogen applications in 9 Categories
- Identification of the most severe legal and administrative barriers associated with deployment of hydrogen technologies
- An online database containing descriptions of relevant legal and administrative processes in 18 countries

FUTURE STEPS & PLANS

- The bulk of the analytical work (assessment of severity of barriers, identification of barriers takes place in Q2 2018
- Results of cross-country analysis and severity of barriers will be made public in August 2018 and will

take the form of technical reports

- Information and descriptions of legal and administrative processes relevant to hydrogen technology deployment in 18 countries online July 2018
- 18 National Policy papers will be drafted with recommendations on how to address the major barriers identified (Q3 2018)
- 18 National Workshops and 1 EU Workshop will invite policy makers, administrations, industry and will be used as dissemination of results (Q4 2018)

RELEVANCE TO FCH JU OVERARCHING OBJECTIVES

Reduce the use of the EU defined 'Critical raw materials'

The project focused on legal and administrative barriers and providing information to project developers on how to overcome them. This may speed-up the deployment and commercial uptake of hydrogen based technologies and provide significant benefits towards the EU's climate, energy and environmental goals.

QUANTITATIVE TARGETS AND STATUS

FCH JU Project Targets*

| PARAMETER | UNIT | RESULT ACHIEVED |
|--|------|-----------------|
| Progress vs knowledge gap | % | 65 |
| Regulatory bodies contacted to date | N/A | 19 |
| Number of meetings with regulatory organisations | | 19 |
| Number of peer reviewed publications | | 1 |
| Number of oral presentations @ scientific seminars/conferences | | 19 |
| Number of posters at scientific seminars/conferences | | 1 |

* Project's own targets



| | |
|----------------------------------|---|
| Project ID: | 621194 |
| Call topic: | SP1-JTI-FCH.2013.5.6 - Pre-normative research on resistance to mechanical impact of pressure vessels in composite materials |
| Project total costs: | € 4,049,293.42 |
| FCH JU max. Contribution: | € 2,143,665 |
| Project start - end: | 01/04/2014 - 30/06/2017 |
| Coordinator: | COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES, FR |
| Website: | www.hypactor.eu |



BENEFICIARIES: ABERDEEN CITY COUNCIL*, CENTRO DE INVESTIGACIONES ENERGETICAS, MEDIOAMBIENTALES Y TECNOLOGICAS-CIEMAT, CONSULTORIA DE INNOVACION Y FINANCIACION SL, FRAUNHOFER GESELLSCHAFT ZUR FORDERUNG DER ANGEWANDTEN FORSCHUNG EV, FUNDACION CIDAUT, I PLUS F FRANCE SARL, NORSTAT DEUTSCHLAND GmbH, RAZVOJNI CENTER ZA VODIKOVE TEHNOLOGIJE, UNIVERSITY OF LEEDS, UNIVERSITY OF SUNDERLAND

PROJECT AND OBJECTIVES

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

PROGRESS & MAIN ACHIEVEMENTS

- Recommendations for RCS regarding qualification of COPVs with respect to impact, inspection of impacted COPVs
- Understand & characterize 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 & PLANS

Project is finished

RELEVANCE 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

Improvement of COPVs

QUANTITATIVE TARGETS AND STATUS

FCH JU Project Targets

| PARAMETER | UNIT | RESULT ACHIEVED TO DATE |
|---|------|-------------------------|
| Identify the different types of alterations that may be produced by mechanical impacts and develop an understanding of their consequences | | |
| Establish a relation between severity of impact, level of damage, and effect on structural integrity | | |
| Apply the results of the above to assess the reliability of composite pressure vessels in the foreseen applications and potential needs of protection | | |
| Evaluate non-destructive examination methods, such as analysis of acoustic emissions, and associated pass/fail criteria for controlling pressure vessel structure | % | 100 |
| Description and quantification of the effect of mechanical impacts on composite pressure vessel structure | | |
| Assessment of the structural reliability of composite pressure vessels in the foreseen service conditions and opportunities of improvement and optimise | | |
| Recommendations to industry and for international standards development | | |
| Improved methods and criteria for inspection of pressure vessels in service | | |

* Project's own targets

Project ID: 700190

Call topic: FCH-04.1-2015 - Recycling and Dismantling Strategies for FCH Technologies

Project total costs: € 497,666.25

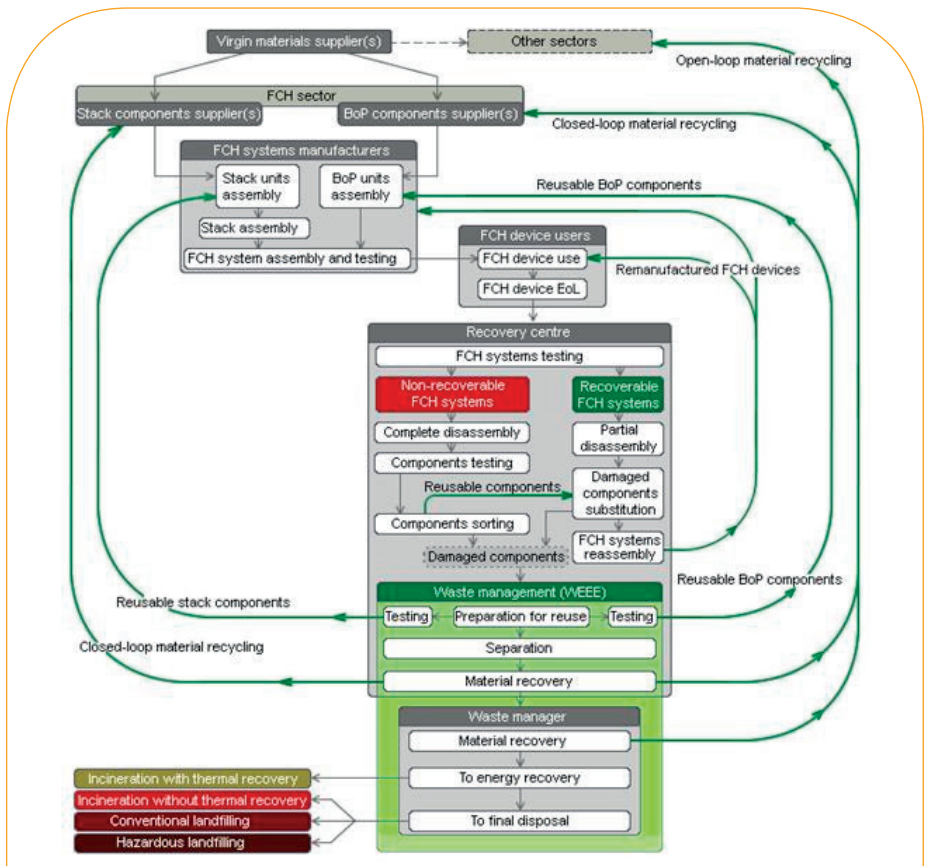
FCH JU max. Contribution: € 497,666.25

Project start - end: 01/05/2016 - 30/04/2019

Coordinator: FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON, ES

Website: www.hytechcycling.eu

BENEFICIARIES: Fundacion IMDEA Energia, INDUSTRIAS LOPEZ SORIANO SA, PARCO SCIENTIFICO TECNOLOGICO PER LAMBIENTE ENVIRONMENT PARK TORINO SPA, UNIVERZA V LJUBLJANI



PROJECT AND OBJECTIVES

HyTechCycling has as objective precede the implementation of the technologies, facilitating the development of future actions and avoiding problems related to the implementation and regulatory framework in the recycling and dismantling of the FCH technologies in their different applications. HyTechCycling has classified the materials that appear in the FCH, identified barriers and needs from different points of view and worked in a LCA, considering the whole EoL and the new technologies and strategies studied. A business model will be developed with all the developments of the project.

NON QUANTITATIVE OBJECTIVES

- Research in regulation from the EU and how affects FCH during the EoL
- Classification of the FCH technologies according different criteria
- Research for new technologies and strategies in the recycling phase
- Identification of the needs and challenges for all actors through surveys
- Performing of a complete LCA of the whole life of the technologies. Work in Progress. LCA for the equipment partially done. Waiting for specific data for validate and for the results and validation

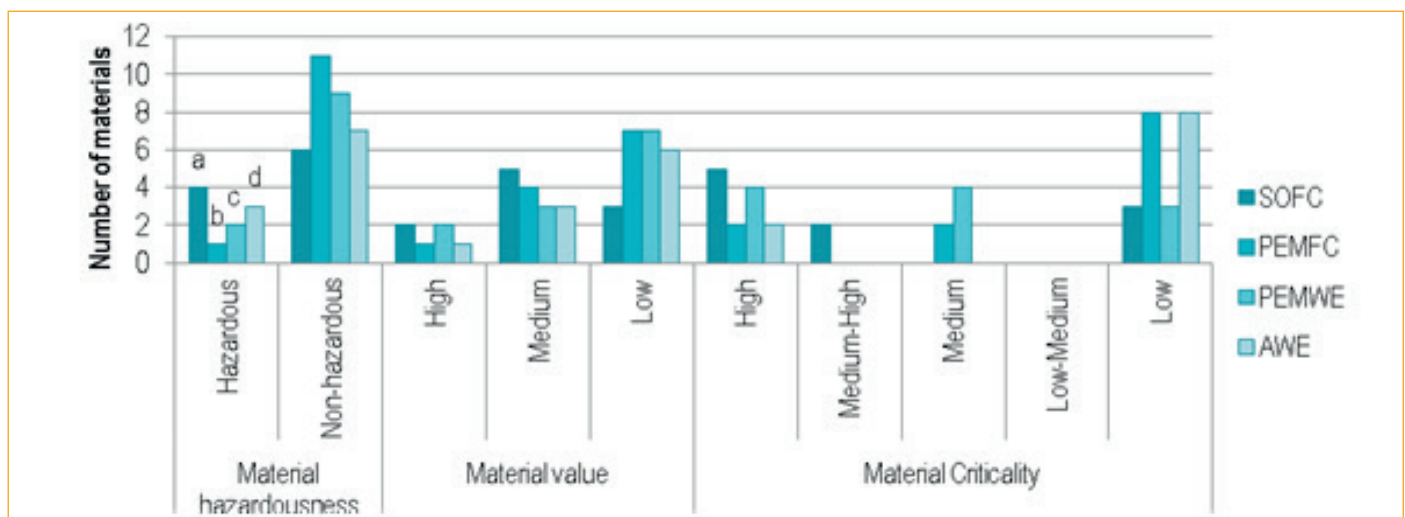
PROGRESS & MAIN ACHIEVEMENTS

- Identification of the critical materials that exists in the FCH technologies
- Create interest among the different actors of the FCH life about the project evolution.
- Selection of the new strategies and technologies in the recycling phase for critical materials

RELEVANCE TO FCH JU OVERARCHING OBJECTIVES

Reduce the use of the EU defined 'Critical raw materials'

The project is mainly focused on the analysis of these materials and its impact in order to reduce their use.





HySEA

IMPROVING HYDROGEN SAFETY FOR ENERGY APPLICATIONS (HYSEA)
THROUGH PRE-NORMATIVE RESEARCH ON VENTED DEFLAGRATIONS

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|----------------------------------|--|
| Project ID: | 671461 |
| Call topic: | FCH-04.3-2014 - Pre-normative research on vented deflagrations in containers and enclosures for hydrogen energy applications |
| Project total costs: | € 1,511,780 |
| FCH JU max. Contribution: | € 1,494,780 |
| Project start - end: | 01/09/2015 - 30/11/2018 |
| Coordinator: | GEXCON AS, NO |
| Website: | www.hysea.eu |



BENEFICIARIES: FIKE EUROPE BVBA, HEFEI UNIVERSITY OF TECHNOLOGY, IMPETUS ADVANCED FINITE ELEMENT ANALYSES AS, THE UNIVERSITY OF WARWICK, UNIVERSITA DI PISA, University of Science and Technology of China

PROJECT AND OBJECTIVES

The main objective of the project Improving Hydrogen Safety for Energy Applications through pre-normative research on vented deflagrations (HySEA) 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.

NON QUANTITATIVE OBJECTIVES

Increased awareness of inherent limitations in current standards for vented hydrogen deflagrations.

PROGRESS & MAIN ACHIEVEMENTS

- Completed two experimental campaigns with vented hydrogen deflagrations in a small-scale enclosure
- Completed two experimental campaigns with vented hydrogen deflagrations in 20-foot ISO containers
- Completed two blind-prediction studies with vented hydrogen deflagrations in 20-foot ISO containers

FUTURE STEPS & PLANS

- Finalise reports from experiments in 20-foot containers
- Request extension of project period
- Submit outstanding publications

- Organize final dissemination event
- Organize final meeting/workshop with standardizing committee (CEN TC 305)

RELEVANCE 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

Safe storage and handling of hydrogen will in many situations require proper design of explosion venting devices.

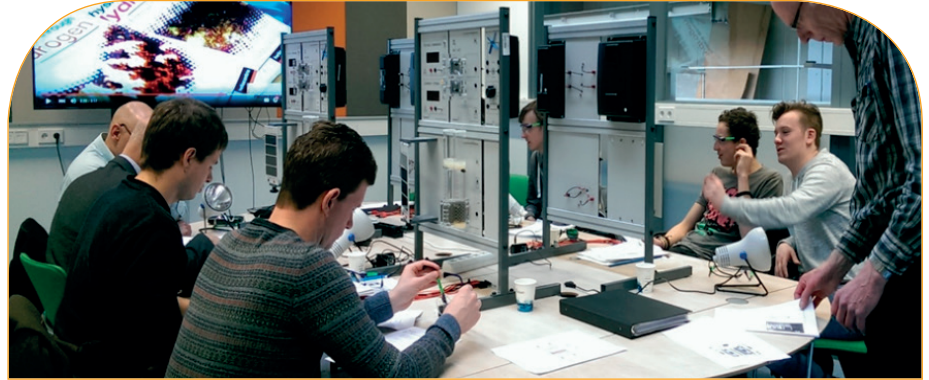




KnowHy

IMPROVING THE KNOWLEDGE IN HYDROGEN AND FUEL CELL TECHNOLOGY FOR TECHNICIANS AND WORKERS

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|----------------------------------|---|
| Project ID: | 621222 |
| Call topic: | SP1-JTI-FCH.2013.5.2 - Training on H2&FC technologies for Operation & Maintenance |
| Project total costs: | € 1,437,062.4 |
| FCH JU max. Contribution: | € 1,000,000 |
| Project start - end: | 01/09/2014 - 28/02/2018 |
| Coordinator: | TECHNISCHE UNIVERSITEIT DELFT, NL |
| Website: | www.knowhy.eu |



BENEFICIARIES: CAMPUS AUTOMOBILE SPA-FRANCORCHAMPSASBL, FAST - FEDERAZIONE DELLE ASSOCIAZIONI SCIENTIFICHE E TECNICHE, FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON, FUNDACION SAN VALERO, INSTITUTO SUPERIOR TECNICO, KIWA TRAINING BV, McPhy Energy SA, PARCO SCIENTIFICO E TECNOLOGICO PER L'AMBIENTE - ENVIRONMENT PARK SPA, PNO CONSULTANTS BV, TECHNISCHE UNIVERSITEIT MUENCHEN, THE UNIVERSITY OF BIRMINGHAM

PROJECT AND OBJECTIVES

KnowHy aims to provide the 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 which make the training offer economically sustainable after project completion. An online tool for accessing to the training contents via web has been developed for all modules. Moreover, practical sessions have been designed in existing facilities, such as demo projects, or labs adapted to the training.

NON QUANTITATIVE OBJECTIVES

- Identification of target group, topics and modules definition
- Effective teaching methodology defined & the course platform set
- Establish a self-financing KnowHy legal entity
- Dissemination of results to industry, stakeholders and etc.

PROGRESS & MAIN ACHIEVEMENTS

- The number of trainees: 862 students have been

undergone training for the core module and all 5 specialization modules.

- According to Second analysis of the feedback, from more than 400 surveys, the global satisfaction of the students is very high (3,7 over 4)
- Feedbacks from companies that sent students shows

a positive evaluation rating with 8.5/10. They are willing to introduce KnowHy to other companies

FUTURE STEPS & PLANS

Project is finished



QUANTITATIVE TARGETS AND STATUS

FCH JU Project Targets*

| PARAMETER | RESULTS ACHIEVED TODAY | DESCRIPTION |
|---|------------------------|------------------------|
| Total number of people trained in project | 42 | APU AND BACKUP POWER |
| Number of diplomas/certificates issued in the project | 27 | APU AND BACKUP POWER |
| Total number of people trained in project | 680 | CORE TRAINING |
| Number of diplomas/certificates issued in the project | 259 | CORE TRAINING |
| Total number of people trained in project | 197 | H2 production-handling |
| Number of diplomas/certificates issued in the project | 56 | H2 production-handling |
| Total number of people trained in project | 208 | HFC for transport |
| Number of diplomas/certificates issued in the project | 62 | HFC for transport |
| Total number of people trained in project | 3 | MICRO FUEL CELLS |
| Total number of people trained in project | 60 | CHP |
| Number of diplomas/certificates issued in the project | 34 | CHP |

* Project's own targets



NET-Tools

NOVEL EDUCATION AND TRAINING TOOLS BASED ON DIGITAL APPLICATIONS RELATED TO HYDROGEN AND FUEL CELL



Project ID: 736648

Call topic: FCH-04-1-2016 - Novel Education and Training Tools

Project total costs: € 1,596,007.5

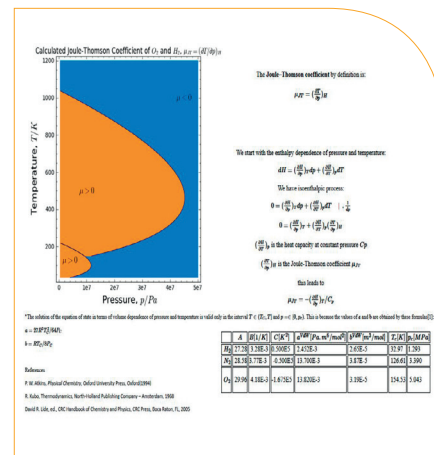
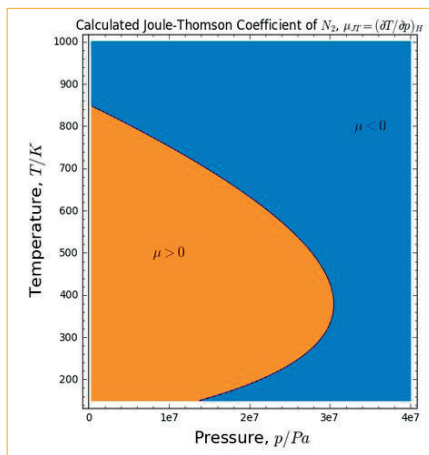
FCH JU max. Contribution: € 1,596,007.5

Project start - end: 01/03/2017 - 29/02/2020

Coordinator: Karlsruhe Institut fuer Technologie, DE

Website: www.h2fc-net.eu

BENEFICIARIES: DANMARKS TEKNISKE UNIVERSITET, ELEMENT ENERGY LIMITED, INSTITUTE OF ELECTROCHEMISTRY AND ENERGY SYSTEMS, NATIONAL CENTER FOR SCIENTIFIC RESEARCH "DEMOKRITOS", PERSEE, UNIVERSITA DEGLI STUDI DI PERUGIA, UNIVERSITY OF ULSTER



PROJECT AND OBJECTIVES

Main objective of the project is to develop a unique European e-platform to support education in FCH technologies by providing e-content (teaching and training materials) via an LMS running under open access to a broad spectrum of stakeholders. In this relation NET-Tools starts to generate, construct and develop technically the e-platform. In parallel the development of specific e-tools was started and reviews of existing LMS content executed. The e-tools shall get implemented further in e-Lectures as demonstration on "how to incorporate practically e-tools in modern e-Learning".

NON QUANTITATIVE OBJECTIVES

- Expert Workshop on the demands
- Webinars on status on the developed e-tools (outcome,

usability and handling)

- Technical School (test lessons and lectures for feedback related to experts but also other stakeholders for demonstration)
- Demo courses (lectures) to be provided via LMS
- Technical School (test lessons and lectures for students and stakeholders)

PROGRESS & MAIN ACHIEVEMENTS

- Realisation and development of an open source based e-infrastructure dedicated to LMS and existing FCH knowledge and science
- Development of specific e-tools to be incorporated in LMS as approach for practical support on more theoretical oriented e-Learning materials
- Reviews of existing e-Learning materials and LMS

systems as well as expert workshop to learn about different demands arising from industry/academia

FUTURE STEPS & PLANS

- Development of unique e-infrastructure under modified aspects and approach (webpage shall be used as an entry point providing linkage instead server)
- Guidelines and advise on "how to prepare e-lectures and content" via used external LMS
- Review of existing e-Learning content and materials (external and internal) must get reworked
- Data management (also handling of personal data) must get reworked according the new regulatory
- Guidelines about responsibilities, liabilities and ownership (IPR) must get reworked according to the new structure of providing open access LMS

QUANTITATIVE TARGETS AND STATUS

FCH JU Project Targets*

| PARAMETER | RESULTS ACHIEVED TODAY |
|---|------------------------|
| Total number of people trained in project | 30 |

* Project's own targets





SOCTESQA

SOLID OXIDE CELL AND STACK TESTING, SAFETY AND QUALITY ASSURANCE

Project ID: 621245

Call topic: SP1-JTI-FCH.2013.5.4 - Development of industry wide uniform performance test schemes for SOFC/SOEC cells & stacks

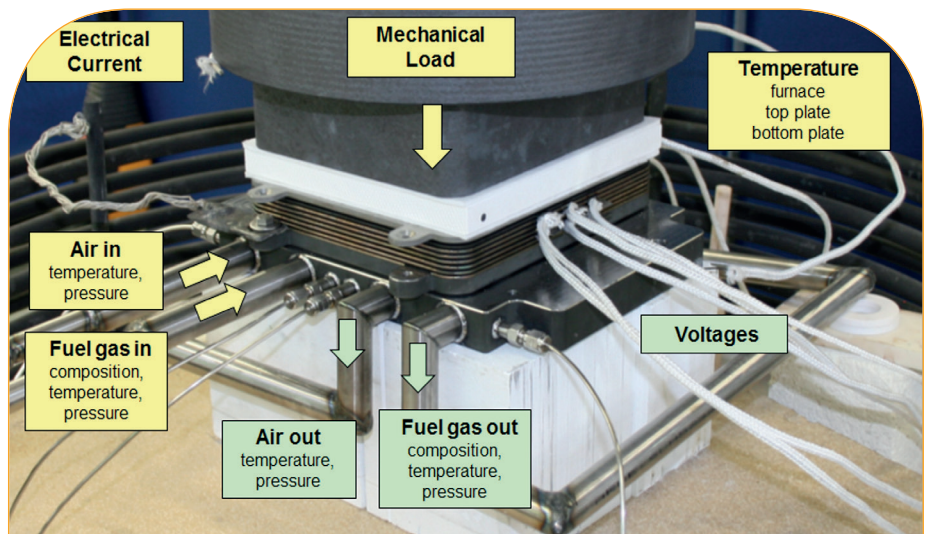
Project total costs: € 3,212,186.2

FCH JU max. Contribution: € 1,626,373.2

Project start - end: 01/05/2014 - 30/04/2017

Coordinator: DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV, DE

Website: www.soctesqa.eu



BENEFICIARIES: AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE, COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES, DANMARKS TEKNISKE UNIVERSITET, EIFER EUROPAISCHES INSTITUT FUR ENERGIEFORSCHUNG EDF-KIT EWIV, JRC - JOINT RESEARCH CENTRE- EUROPEAN COMMISSION

PROJECT AND OBJECTIVES

The aim of the project is to develop pre-normative and industry wide test modules and programs for solid oxide cell and stack (SOC) assembly units. The test procedures cover the solid oxide fuel cell (SOFC), the solid oxide electrolysis cell (SOEC) and the combined SOFC/SOEC operation mode. A close interaction with an industrial advisory board ensures to achieve industrial relevant outcome of the project. Additionally, a continuous liaison with standards developing organizations is aspired in order to implement the outcome of the project successfully into international standards.

NON QUANTITATIVE OBJECTIVES

- Training
- Safety

PROGRESS & MAIN ACHIEVEMENTS

- Altogether 11 pre-normative test modules for SOFC, SOEC and combined SOFC/SOEC have been developed which cover

- stationary and mobile applications
- The test procedures contain all important guidelines information in order to achieve high quality, reproducible and repeatable test results
- The project outcome is being transferred to standards developing organisations (e.g. IEC, CEN/CENELEC, ISO, VDMA)

FUTURE STEPS & PLANS

Project is finished.

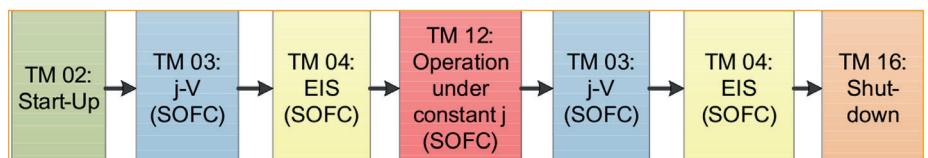
RELEVANCE TO FCH JU OVERARCHING OBJECTIVES

Increase the electrical efficiency and the durability of the different fuel cells

By applying the test modules, which address efficiency and durability, the quality and reproducibility of the stack results increases. Thus the efficiency and durability requirements of the stacks can be reached faster.

Increase the energy efficiency of production of hydrogen mainly from water electrolysis and renewable sources while reducing operating and capital costs

By applying the test modules, which address the combined SOFC/SOEC application, the Quality and reproducibility of the stack results increases. Thus the operating and capital costs can be reduced.



QUANTITATIVE TARGETS AND STATUS

State of Art (SoA)*

| PARAMETER | UNIT | RESULTS ACHIEVED TO DATE | SOA RESULT ACHIEVED TO DATE BY OTHER GROUP/PROJECT | SOA YEAR | SoA Source |
|-------------------------|---|---|--|----------|--|
| Quality of test results | Number of test procedures for SOFC stacks | Altogether 11 test modules for SOFC stacks for stationary and mobile applications have been developed | In the previous project FCTESQA only two test modules for SOFC stacks were developed | 2010 | FCTESQA project (website closed) |
| Quality of test results | Number of test procedures for SOFC cells | Altogether 11 test modules for SOFC cells for stationary and mobile applications have been developed | Only one Standardisation document for SOFC cells was developed by IEC TC 105 | 2014 | IEC 62282-7-2: Single cell and stack test methods - Single cell and stack performance tests for solid oxide fuel cells (SOFC), https://webstore.iec.ch/publication/6766 |

* Data available as provided by the project