AD ASTRA

HARNESSING DEGRADATION MECHANISMS TO PRESCRIBE ACCELERATED STRESS TESTS FOR THE REALIZATION OF SOC LIFETIME PREDICTION ALGORITHMS

Project ID:	**825027**
Call topic:	**FCH-04-3-2018:** Accelerated Stress Testing (AST) protocols for Solid Oxide Fuel Cells (SOFC)
Project total costs:	**€3 008 426**
FCH JU max. Contribution:	**€3 008 426**
Project start - end:	01/01/2019 - 31/12/2021
Coordinator:	**AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE, IT**
Website:	**www.ad-astra.eu**

BENEFICIARIES: SUNFIRE GMBH, SOLIDPOWER SPA, EIFER EUROPAISCHES INSTITUT FUR ENERGIEFORSCHUNG EDF KIT EWIV, INSTITUTE OF ELECTROCHEMISTRY AND ENERGY SYSTEMS, UNIVERSITA DEGLI STUDI DI SALERNO, ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE, UNIVERSITA DEGLI STUDI DI GENOVA, DANMARKS TEKNISKE UNIVERSITET, COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES

PROJECT AND OBJECTIVES

Accelerated stress tests deliberately stress a test material, component or product for a short period of time to assess the stability of new materials without having to use them in an operational system over a long-term period. The AD ASTRA project aims to define accelerated stress testing protocols deduced from a systematic understanding of degradation mechanisms in aged components of solid oxide cell stacks operating in both fuel cell and electrolysis modes. Benchmarking and the first two campaigns of possible accelerated tests have been completed: their validation is next.

NON-QUANTITATIVE OBJECTIVES

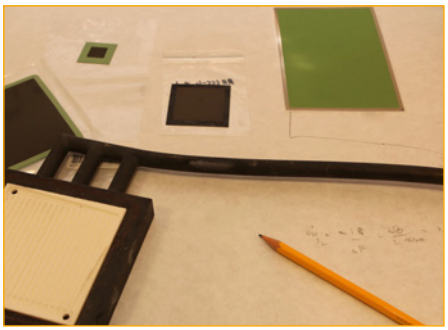
A Comprehensive Review article has been submitted to the *Journal of Electrochemical Science Advances* as open access. The submission is under peer evaluation.

PROGRESS AND MAIN ACHIEVEMENTS

- 160 samples from in-field and laboratory tests have been delivered and analysed
- Online database set up for the collection of all data (sample identity details, test conditions, measurement results) in an indexed archive
- First model for transfer functions developed from AST conditions to real-life operation.

FUTURE STEPS AND PLANS

- Finalisation of a second round of experiments and evaluation of results. Deliverable 3.2 will reflect this and is being assembled
- Definition of experimental campaign for validation of selected AST procedures. Deliverable 2.2 will incorporate results from D3.2 and present this
- Inclusion of experimental data in the tailored degradation models. Deliverable 5.2 will present this phase.

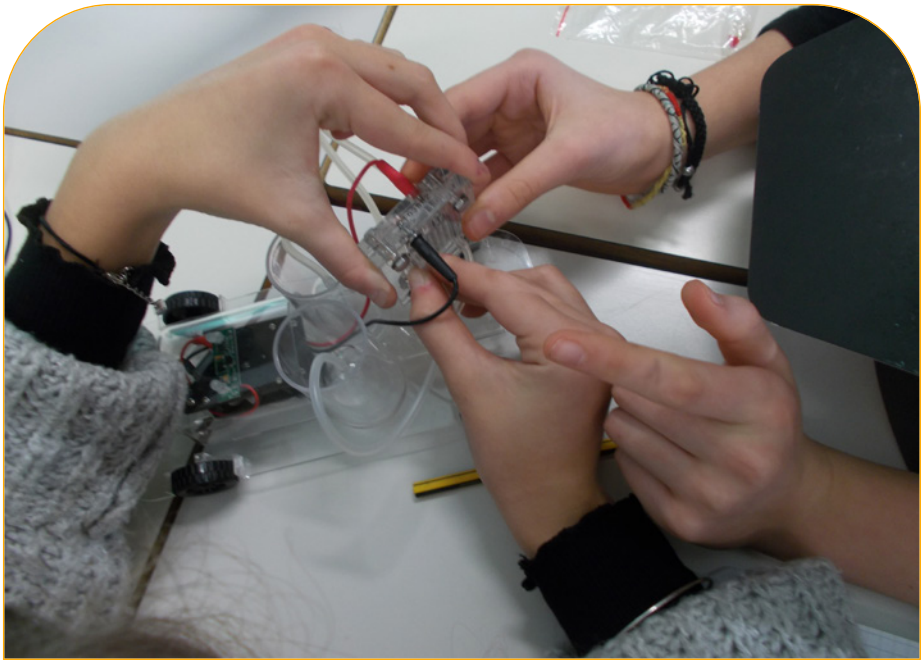


QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?
Project's own objectives	Degradation acceleration	10x	4x	✓
	Published articles	2 for each WP 2, 3 and 4	2 for WP3, 1 for WP4, 3 for WP5	
AWP 2018	Submission of NWIP to IEC for standardisation	1	Contributions from project to Ad Hoc Group received	

FCHgo

FUEL CELLS HYDROGEN EDUCATIONAL MODEL FOR SCHOOLS



Project ID:	**826246**
Call topic:	**FCH-04-4-2018:** Strengthening public acceptance and awareness of FCH technologies by educating pupils at schools
Project total costs:	**€502 499**
FCH JU max. Contribution:	**€502 499**
Project start - end:	01/01/2019 - 30/06/2021
Coordinator:	**UNIVERSITA DEGLI STUDI DI MODENA E REGGIO EMILIA, IT**
Website:	**fchgo.eu**

BENEFICIARIES: STEINBEIS 2I GMBH, INEUROPA SRL, ZURCHER HOCHSCHULE FUR ANGEWANDTE WISSENSCHAFTEN, UNIWERSYTET MIKOLAJA KOPERNIKA W TORUNIU, LIBERA UNIVERSITA DI BOLZANO, DANMARKS TEKNISKE UNIVERSITET

PROJECT AND OBJECTIVES

FCHgo aims to explain the functioning and application of FCH technologies to young people by providing an educational toolkit with a narrative approach and a website as a connection point for all users. A set of classrooms lessons from six countries will be available, designed for pupils from 8 to 18. FCHgo has also launched the first edition of a new annual award for the best idea/solution for using FCH. The final version of the FCHgo toolkit is now available, having been tested in classrooms and validated.

NON-QUANTITATIVE OBJECTIVES

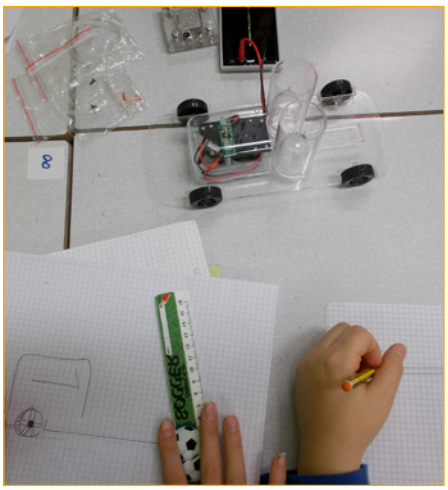
- Educational Programme Delivery Model (EPDM). The final version of the EPDM consists of an educational toolkit comprising a set of guidelines, lessons, toys, plays and videos to support educational activities in European schools. The EPDM is currently available in five languages
- Launch of the FCHgo award, offering all European students the opportunity to propose their best ideas for future FCH applications. The award is up and running.

PROGRESS AND MAIN ACHIEVEMENTS

- Final version of the FCHgo EPDM available
- Testing of the EPDM has been completed in all partners countries
- FCHgo award activities are under way.

FUTURE STEPS AND PLANS

First edition of the FCHgo award. Award submissions closed on 31 March 2021 and the prizes were awarded in June 2021. More editions of this annual award have been scheduled.



QUANTITATIVE TARGETS AND STATUS

PARAMETER	UNIT	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?
Participation in educational activities	Pupils	800	1 842	✓
Website visitors	Number of visitors	3 000	5 966	✓
Number of likes/followers in social networks	Number of likes/followers	1 000	1 142	✓
Participation in external events	Events	10	12	✓

HYDRAITE

HYDROGEN DELIVERY RISK ASSESSMENT AND IMPURITY TOLERANCE EVALUATION

Project ID:	**779475**
Call topic:	**FCH-04-1-2017:** Limiting the impact of contaminants originating from the hydrogen supply chain
Project total costs:	**€3 499 867.50**
FCH JU max. Contribution:	**€3 499 867.50**
Project start - end:	01/01/2018 - 31/12/2020
Coordinator:	**TEKNOLOGIAN TUTKIMUSKESKUS VTT OY, FI**
Website:	**hydraite.eu**

BENEFICIARIES: COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES, STIFTELSEN SINTEF, NPL MANAGEMENT LIMITED, ZENTRUM FUR SONNENENERGIE- UND WASSERSTOFF-FORSCHUNG BADEN-WURTTEMBERG, POWERCELL SWEDEN AB, ZENTRUM FUR BRENNSTOFFZELLEN-TECHNIK GMBH, SINTEF AS

PROJECT AND OBJECTIVES

The HYDRAITE project aims to solve the issue of hydrogen quality for transportation applications. It involves studying the effects of contaminants that originate from the hydrogen supply chain, on fuel cell systems in automotive applications. An HRS sampling campaign has been conducted. The project has developed in-line monitoring of hydrogen quality at the HRS as well as a sampling strategy and methodology for new impurities, gas, particles and liquids. Three European H2 laboratories have been established, capable of measuring all contaminants according to ISO 14687 standards.

NON-QUANTITATIVE OBJECTIVES

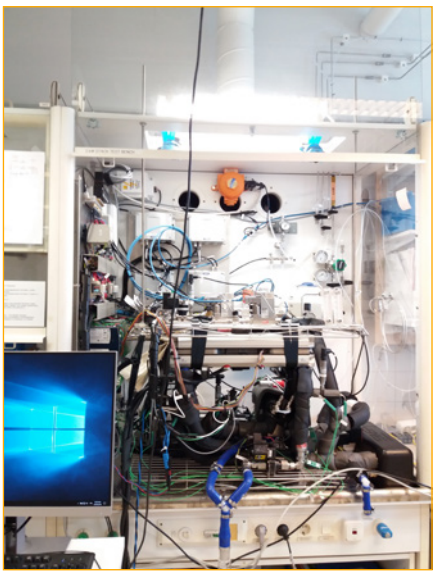
- Recommendations for revision of ISO standard 14687. Similar measurement set-ups of six partners are ready, methodology has been validated, FC measurements have started with CO, CO2, sulphur, ionic liquids, freon and toluene
- Recommendations for FC stack contaminant measurements in automotive-type operation. Recommendations will derive from the successful measurement campaigns
- Technical data on fuel composition from HRS. The first HRS measurement campaign has been completed, external analysis completed, internal analysis and inter-laboratory comparison are ongoing. The second SC was realised in spring 2021
- In-line monitoring of hydrogen fuel quality. The concept of a PEM-based sensor and HRS in-line quality monitoring has been established.
- Three European laboratories to measure the ISO contaminants. Three laboratories with analytical methods compliant with ISO 14687 have been set up.

PROGRESS AND MAIN ACHIEVEMENTS

- Three European hydrogen quality laboratories have been established, capable of full analysis according to EN 17124
- The first HRS sampling campaign was conducted, with 10 gas and particle samples collected from 8 different stations in Germany, Sweden and Norway
- Validating the methodology for studying the effect of impurities on FC stacks.

FUTURE STEPS AND PLANS

- FC measurements will be made as planned in the DoA by 6 project partners and the results reported
- Recommendations will be formulated based on the experience and results from FC measurement campaigns
- The second HRS measurement campaign will be conducted.
- Reporting of the analytical solutions and development of an in-line sensor for hydrogen fuel monitoring
- Three European H2 quality laboratories will have their third and final inter-comparison.



3 analytical laboratories ready for Hydrogen quality ISO 14687

PRD 2021 PANEL
SUPPORT FOR MARKET UPTAKE

HyResponder

EUROPEAN HYDROGEN TRAIN THE TRAINER PROGRAMME FOR RESPONDERS

Project ID:	875089
Call topic:	FCH-04-1-2019: Training of Responders
Project total costs:	€1 000 000
FCH JU max. Contribution:	€1 000 000
Project start - end:	01/01/2020 - 31/12/2022
Coordinator:	UNIVERSITY OF ULSTER, UK
Website:	hyresponder.eu/

BENEFICIARIES: FIRE SERVICE COLLEGE LIMITED, INTERNATIONAL FIRE ACADEMY, MINISTRY OF THE INTERIOR OF THE CZECH REPUBLIC, UNIVERSITETET I SOROST-NORGE, LANDES-FEUERWEHRVERBAND TIROL, PERSEE, CRISIS SIMULATION ENGINEERING SARL, ECOLE NATIONALE SUPERIEURE DES OFFICIERS DE SAPEURS-POMPIERS (ENSOSP), SERVICE PUBLIC FEDERAL INTERIEUR, AYUNTAMIENTO DE ZARAGOZA, ASSOCIATION COMITE NATIONAL FRANCAIS DU CTIF (COMITE TECHNIQUE INTERNATIONAL DE PREVENTION ET D EXTINCTION DU FEU), DLR-INSTITUT FUR VERNETZTE ENERGIESYSTEME EV, AIR LIQUIDE SA, DEUTSCHES ZENTRUM FUR LUFT- UND RAUMFAHRT EV, UNIVERSITA DEGLI STUDI DI ROMA LA SAPIENZA, COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES

PROJECT AND OBJECTIVES

The aim of HyResponder is to develop and implement a sustainable train the trainer programme in hydrogen safety for responders throughout Europe. Updated operational, virtual reality and educational training will reflect the state of the art in hydrogen safety. The European Emergency Response Guide will be revised. The materials for responders will be translated and available in 8 languages via a purpose-built e-platform. The translated materials will be utilised by trainers to deliver workshops in 10 countries across Europe, enhancing the reach and impact of the programme.

NON-QUANTITATIVE OBJECTIVES

- Expansion of national networks beyond those specified in the project. This is ongoing through the SAB
- Development of training packages at different levels. A plan is in place and an example has been completed for feedback.

PROGRESS AND MAIN ACHIEVEMENTS

- Identified new safety aspects and scenarios of technologies, systems and infrastructures pertinent to responders, specifically LH2 (D1.1, 1.3)
- Revised the international curriculum in hydrogen safety for responders and produced a draft of updated training materials (WP2 outputs)
- Identified a stratification approach for the training materials to reflect four learning levels and requirements with partner and SAB input.

FUTURE STEPS AND PLANS

- Delivery of the train the trainer event. Plans in place to deliver this virtually, with the preliminary list of trainers identified
- Delivery of 10 regional workshops. Draft schedule prepared for 2022, to be submitted as a milestone in April 2021
- Training package with three sets of training materials (lectures, operational, VR). Plans are in place, the first draft of lectures is complete, materials to be available in June 2021 and revised based on feedback. They will be publicly available in 2022
- Translation of training package to be completed from June 2021 to December 2022
- Development of e-platform incorporating training materials and online tools. The draft structure is under preparation and the platform basis will be in place by the end of 2021. It will be publicly available at the end of 2022
- Recognition of the training package across Europe. Training materials are being reviewed with this in mind.

QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	TARGET	TARGET ACHIEVED?
Project's own objectives	Training events (1 train the trainer, 10 national)	11	
	Three sets of training materials (lectures, operational, VR)	3	
	Revised EERG	1	
	E-platform for responders	1	

PRD 2021 PANEL
SUPPORT FOR MARKET UPTAKE

HyTunnel-CS

PNR FOR SAFETY OF HYDROGEN DRIVEN VEHICLES AND TRANSPORT THROUGH TUNNELS AND SIMILAR CONFINED SPACES

Project ID:	**826193**
Call topic:	**FCH-04-1-2018:** PNR for safety of hydrogen driven vehicles and transport through tunnels and similar confined spaces
Project total costs:	**€2 500 000**
FCH JU max. Contribution:	**€2 500 000**
Project start - end:	01/03/2019 - 28/02/2022
Coordinator:	**UNIVERSITY OF ULSTER, UK**
Website:	**hytunnel.net**

BENEFICIARIES: INTERNATIONAL FIRE ACADEMY, UNIVERSITETET I SOROST-NORGE, SERVICE PUBLIC FEDERAL INTERIEUR, PRO-SCIENCE - GESELLSCHAFT FUR WISSENSCHAFTLICHE UND TECHNISCHE DIENSTLEISTUNGEN MBH, KARLSRUHER INSTITUT FUER TECHNOLOGIE, FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON, HEALTH AND SAFETY EXECUTIVE, STICHTING KONINKLIJK NEDERLANDS NORMALISATIE INSTITUUT, NATIONAL CENTER FOR SCIENTIFIC RESEARCH 'DEMOKRITOS', UNIVERSITA DEGLI STUDI DI ROMA LA SAPIENZA, DANMARKS TEKNISKE UNIVERSITET, COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES

PROJECT AND OBJECTIVES

This pre-normative research project focuses on the safety of hydrogen-driven vehicles in underground infrastructure. The project will synthesise analytical, numerical and experimental research to produce recommendations for: (i) intervention strategies and tactics for first responders; (ii) the safer use of hydrogen vehicles in underground transportation systems; and (iii) RCS. HyTunnel-CS will reduce over-conservatism in infrastructure safety design for hydrogen accidents and save costs on underground systems. The outcomes could be directly implemented in relevant RCS.

NON-QUANTITATIVE OBJECTIVES

The risk to FCEVs entering tunnels to be equal or below that of fossil fuel vehicles. Approach the issue by considering the tunnel-vehicle as a system in experimental, theoretical and numerical studies.

PROGRESS AND MAIN ACHIEVEMENTS

- Analytical, numerical, small- and medium-scale experimental research programmes are being fulfilled as planned
- Large-scale experimental programme on hydrogen release, fires and explosions, including in a real tunnel (CEA), has commenced
- Progress communicated at the Stakeholders Workshop (220+ participants), Emergency Services Workshop (158 participants) and a meeting with car OEMs (28 participants).
- Recommendations for inherently safer use of hydrogen vehicles (M34), for RCS (M35), response to hydrogen accidents (M36). Development of all recommendations is on track.

FUTURE STEPS AND PLANS

- Analytical and numerical campaign: finalisation of the remaining analytical studies, validation of CFD simulations against large-scale experimental programme results. The work is expected to finish after completion of large-scale experimental campaigns in September 2021
- Experimental campaign: fulfilling experimental programme on hydrogen releases, fires and deflagrations. Mitigating delays in the large-scale experimental programme: expected to be completed in/by September 2021
- Communication campaign with results communicated via a dissemination conference scheduled for M36 (February 2022)

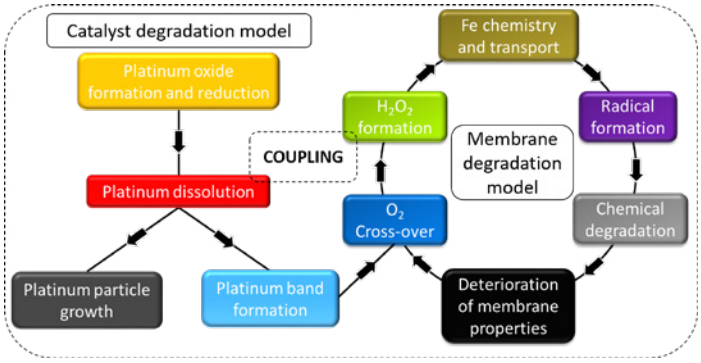
QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?
Project's own objectives	Modelling and simulation campaigns	43	21	
	Two seminars (M6, M30), two workshops (both M15), dissemination conference (M36)	5	3	
AWP 2018	Experimental campaigns	20	13	✗
	Recommendations for inherently safer use of hydrogen vehicles in underground traffic systems	1	0	
	Recommendations for RCS	1	0	
	Harmonised recommendations on response to hydrogen accidents	1	0	

ID-FAST

INVESTIGATIONS ON DEGRADATION MECHANISMS AND DEFINITION OF PROTOCOLS FOR PEM FUEL CELLS ACCELERATED STRESS TESTING

Project ID:	**779565**
Call topic:	**FCH-04-5-2017** - Definition of Accelerated Stress Testing (AST) protocols deduced from understanding of degradation mechanisms of aged stack components in Fuel Cell systems
Project total costs:	**€2 748 195**
FCH JU max. Contribution:	**€2 748 195**
Project start - end:	01/01/2018 - 31/12/2021
Coordinator:	**COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES, FR**
Website:	**id-fast.eu**



BENEFICIARIES: SYMBIO, FREUDENBERG PERFORMANCE MATERIALS SE & CO KG, FREUDENBERG TECHNOLOGY INNOVATION SE & CO. KG, BAYERISCHE MOTOREN WERKE AKTIENGESELLSCHAFT, ZENTRUM FUR SONNENENERGIE- UND WASSERSTOFF-FORSCHUNG BADEN-WURTTEMBERG, POLITECNICO DI MILANO, DEUTSCHES ZENTRUM FUER LUFT- UND RAUMFAHRT EV, FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG EV

PROJECT AND OBJECTIVES

ID-FAST aims to support the deployment of PEMFC by developing specific accelerated stress tests that can be linked to real-world durability. The core focus is on understanding degradation and validation of new ASTs relating in-/ex-situ and modelling data. Post-mortem analyses after ageing and models give insights into the mechanisms involved. Experiments and simulations using single or coupled mechanisms and various stressors have led to proposals for accelerating protocols applied in single cells. Validation with different MEAs, stress tests on stacks and the proposal of transfer functions linking AST to real-life conditions will conclude the project.

NON-QUANTITATIVE OBJECTIVES

- Identification of real ageing mechanisms and impact of conditions. Mechanisms identified, including local issues from post-mortem analyses of stack components aged following real ageing profiles.
- Development of models and coupling of mechanisms for simulation of ASTs. Coupling of the mechanisms involved within the cathode catalyst layers achieved. The simulation was conducted with a model coupling membrane degradation and bipolar plate corrosion
- Development and validation of specific and combined AST protocols. Operando ASTs for single components tested with multiple stressors as well as specific ASTs based on the project reference drive cycles
- Proposal of transfer functions relating accelerated to real degradation. Comparison between real ageing conditions and accelerated conditions has started for some mechanisms and further analyses of combined protocols are needed
- Support standardisation efforts on fuel cell testing related to ASTs. Contribution to working group AHG11 of IEC TC105 started in 2019, dedicated to AST for fuel cells, in collaboration with the SOFC project AD ASTRA.

PROGRESS AND MAIN ACHIEVEMENTS

- Identification of main stressors and acceleration mechanisms for MEA components with specific ageing tests in cells or stacks and post-mortem analyses
- Simulation including multi-mechanism degradation modes based on models coupling cathode catalyst layer phenomena or membrane and metallic ions
- Definition of operando single component AST and AST with multiple stressors based on ID-FAST drive cycles towards further combined AST and validation.

FUTURE STEPS AND PLANS

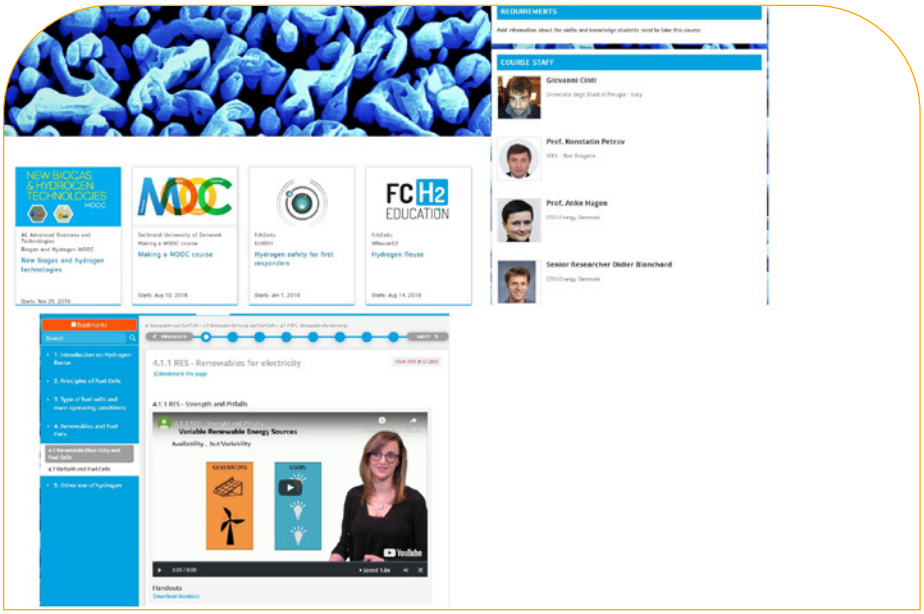
- Complete the testing plan, including ageing tests in single cells and stacks to finalise AST development and then the validation process with different core components. Tests in progress at several partners. The focus and selection of the most relevant ageing tests will be considered throughout 2021 to achieve major outcomes
- Finalise the definition of combined ASTs based on experiments/models and the related transfer functions to link accelerated and real ageing. This is in progress and be done by coupling experimental and simulation results of performance losses and the impact of stressors during ageing following drive cycle profiles.

QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	TARGET ACHIEVED?	SOA RESULT ACHIEVED TO DATE (BY OTHERS)	YEAR FOR SOA TARGET
Project's own objectives	Accelerated degradation rate	µV/h	>100 µV/h	✗	Limited SoA on combined AST representative of the real world	N/A
	Acceleration factor	-	2 to 10 involving multiple stressors	✓ (involving multiple stressors)	Limited SoA on combined AST representative of the real world	N/A
	ASTs		New (different component or combined protocols)	✓	Single mechanism AST available for CCM components	<2018
	Ageing protocols		New (more representative of real ageing)	✓	e.g. FC-DLC	<2018
	Reducing gaps in the understanding of degradation		Improvement	✓ (progress on mechanisms and coupling)	Analyses of MEA degradation mechanisms (exp. and model)	<2020
	Transfer function linking real ageing and accelerated ageing		Relation defining the relative impact of real and accelerated ageing on the degradation rates	✗	Limited SoA on combined AST representative of the real world	N/A

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 - 30/11/2020
Coordinator:	**KARLSRUHER INSTITUT FUER TECHNOLOGIE, DE**
Website:	**www.h2fc-net.eu**

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

PROJECT AND OBJECTIVES

NET-Tools aimed to develop a functional e-platform which operates as a gateway for the FCH community. The e-platform provides FCH relevant e-learning content compiled and provided under different categories. These categories are e-laboratory, e-learning and e-repository. While e-laboratory and e-learning are dedicated to FCH-related education, the e-repository offers additional opportunities to publish FCH-related information or research results. The e-platform is in operation and the e-laboratory provides e-tools. The e-platform is in operation and the e-laboratory provides all the e-tools and e-learning examples. The project has finished.

NON-QUANTITATIVE OBJECTIVES

- Deliver courses based on NET-Tools e-learning. The first course in the Bulgarian Institute of Science (BAS), Sofia, had 12 candidates and 10 certificates were awarded. The second course was in Buenos Aires, Argentina
- Collection of e-tools. Compilation of calculation tools based on peer-reviewed publications
- Flying teachers. Two webinars presented instead of physical meetings
- Educational Schools. Specific project events to introduce the NET-Tools e-platform: the 1st Educational School was held in Bulgaria and the 2nd Educational School in Denmark
- Development of MOOCs.

PROGRESS AND MAIN ACHIEVEMENTS

- Technical realisation and structuring of the e-platform and its categories e-laboratory, e-learning and e-repository
- The programming of a set of e-tools that are included in the e-laboratory. The e-tools can be used for educational purposes and simple calculations
- The development of e-learning materials available under the e-learning category.

FUTURE STEPS AND PLANS

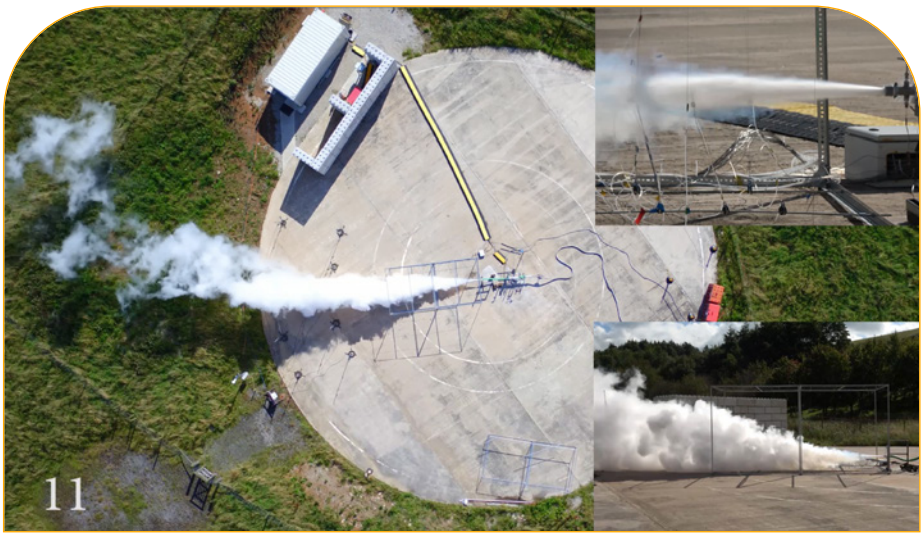
- Course content may be added to the e-learning category on the e-platform on a free basis, depending on the willingness of external contributors
- Additional e-tools for calculation and educational use may be added to the e-laboratory on a free basis, depending on the willingness of external contributors.

QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?
Project's own objective	E-tools	35	35	✓
	E-courses	3	3	
	Public project events	5	5	
	E-newsletter	6	6	
	Persons in collaboration	100	50	✗

PRESLHY

PRE-NORMATIVE RESEARCH FOR SAFE USE OF LIQUIDE HYDROGEN



Project ID:	**779613**
Call topic:	**FCH-04-4-2017:** PNR for a safe use of liquid hydrogen
Project total costs:	**€1 905 862.50**
FCH JU max. Contribution:	**€1 724 277**
Project start - end:	01/01/2018 - 31/05/2021
Coordinator:	**KARLSRUHER INSTITUT FUER TECHNOLOGIE, DE**
Website:	**www.preslhy.eu**

BENEFICIARIES: INTERNATIONAL ASSOCIATION FOR HYDROGEN SAFETY, PRO-SCIENCE - GESELLSCHAFT FUR WISSENSCHAFTLICHE UND TECHNISCHE DIENSTLEISTUNGEN MBH, HEALTH AND SAFETY EXECUTIVE, UNIVERSITY OF ULSTER, INSTITUT NATIONAL DE L'ENVIRONNEMENT ET DES RISQUES INERIS, AIR LIQUIDE SA, THE UNIVERSITY OF WARWICK, NATIONAL CENTER FOR SCIENTIFIC RESEARCH 'DEMOKRITOS'

PROJECT AND OBJECTIVES

PRESLHY conducts pre-normative research for the safe use of cryogenic LH2 in non-industrial settings. In a preparatory phase, the state of the art was summarised and the experimental programme was adjusted to the outcome of a research priorities workshop. The central part of the project consists of three phenomena-oriented work packages addressing release, ignition and combustion with analytical approaches, experiments and simulations. The results will improve the general understanding and provide recommendations for SDOs.

PROGRESS AND MAIN ACHIEVEMENTS

- Organised 3 measurement data workshops and the LH2 session at the Research Priorities Workshop in 2020
- Experimental programme was accomplished, white paper and chapter on LH2 safety published
- Initiation of TF2 in the ISO TC 197 WG 29 for revising ISO TR 15916:2015 with respect to LH2 safety.

FUTURE STEPS AND PLANS

Integration of the project results into the revision of ISO TR 15916:2015 via the ISO TC 197 WG29 TF2 coordinated by the project coordinator. Revision has been formally initiated and it is planned to conclude in 2022.

QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?
Support for RCS development	Number of reports sent to SDOs	1	3	✓
	Number of workshops with SDOs invited	1	4	
	Consortium partners involved in SDOs	1	5	
	Review of standard initiated	1	1	
Dissemination	Peer reviewed journal publications	1	3	

PRHYDE

PROTOCOL FOR HEAVY DUTY HYDROGEN REFUELLING

Project ID:	**874997**
Call topic:	**FCH-04-2-2019:** Refuelling Protocols for Medium and Heavy-Duty Vehicles
Project total costs:	**€3 167 077.50**
FCH JU max. Contribution:	**€1 494 417.00**
Project start - end:	01/01/2020 - 31/12/2021
Coordinator:	**LUDWIG-BOELKOW-SYSTEMTECHNIK GMBH, DE**
Website:	**prhyde.eu/**

BENEFICIARIES: TOYOTA MOTOR NORTH AMERICA, NIKOLA CORPORATION, SHELL DEUTSCHLAND OIL GMBH, ITM POWER (TRADING) LIMITED, ZENTRUM FUR BRENNSTOFFZELLEN-TECHNIK GMBH, NEL HYDROGEN AS, TOYOTA MOTOR EUROPE NV, ENGIE, AIR LIQUIDE SA, COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES

PROJECT AND OBJECTIVES

The project aims to investigate the refuelling protocol requirements and provide data for compressed (gaseous) hydrogen refuelling protocols developed for 35, 50 and 70 MPa nominal working pressures. This will help facilitate the future standardisation of fuelling protocols for medium- and heavy-duty vehicles.

PROGRESS AND MAIN ACHIEVEMENTS

- Webinars in first year
- Publication of deliverables to date
- Survey of interested stakeholders outside of consortium.

QUANTITATIVE TARGETS AND STATUS

PARAMETER	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?
Meetings with standards organisation groupings	4	2	
Number of reports sent to standards developing organisations	15	9	✗
Publicly accessible workshops/webinars	5	3	

TeacHy

TEACHING FUEL CELL AND HYDROGEN SCIENCE AND ENGINEERING ACROSS EUROPE WITHIN HORIZON 2020

Project ID:	**779730**
Call topic:	**FCH-04-3-2017:** European Higher Training Network in Fuel Cells and Hydrogen
Project total costs:	**€1 248 528.75**
FCH JU max. Contribution:	**€1 248 528.75**
Project start - end:	01/11/2017 - 31/10/2020
Coordinator:	**THE UNIVERSITY OF BIRMINGHAM, UK**
Website:	**www.teachy.eu**

BENEFICIARIES: KARLSRUHER INSTITUT FUER TECHNOLOGIE, NATIONAL TECHNICAL UNIVERSITY OF UKRAINE IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE, UNIVERSITATEA POLITEHNICA DIN BUCURESTI, VYSOKA SKOLA CHEMICKO-TECHNOLOGICKA V PRAZE, INSTITUT POLYTECHNIQUE DE GRENOBLE, UNIVERSITY OF ULSTER, ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE, TECHNISCHE UNIVERSITEIT DELFT, POLITECNICO DI TORINO, UNIVERSITE LIBRE DE BRUXELLES, DANMARKS TEKNISKE UNIVERSITET

PROJECT AND OBJECTIVES

As the FCHT industry gradually emerges into the markets, the need for trained staff becomes more pressing. TeacHy2020, or TeacHy for short, specifically addresses the supply of undergraduate and graduate education (BEng/BSc, MEng/MSc, PhD, etc.) in fuel cell and hydrogen technologies (FCHT) across Europe. TeacHy2020 will take a lead in building a repository of university grade educational material, and design and run an MSc course in FCHT that is accessible to students from all parts of Europe.

PROGRESS AND MAIN ACHIEVEMENTS

- MSc blended learning programme content established
- First MSc programme to start in October 2021
- CPD modules established and trialled at several universities.

FUTURE STEPS AND PLANS

Forming a business entity to further support and manage the MSc programme material post-project. This is in progress.

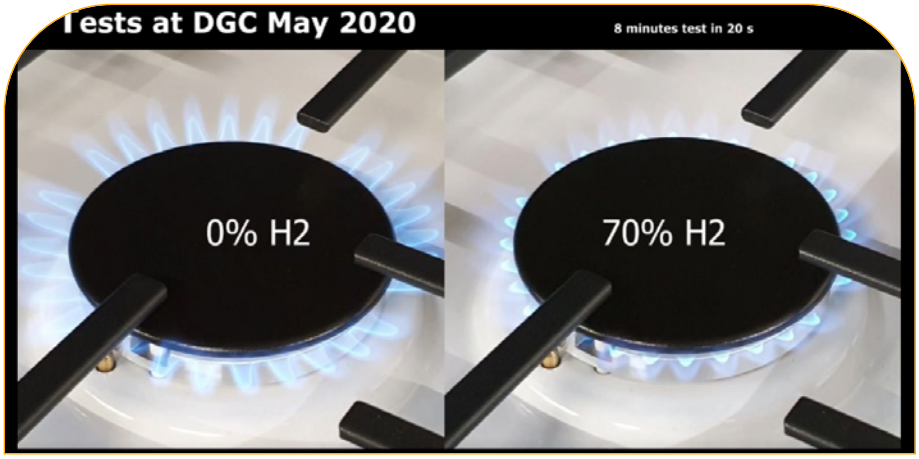
QUANTITATIVE TARGETS AND STATUS

PARAMETER	UNIT	TARGET	TARGET ACHIEVED?
Start of MSc course	Date	October 2019	✗
Modules translated into different languages	Number of modules	12	
Minimum of 12 modules established on LMS	Number of modules	12	✓
Used MSc modules for CPD delivery	Modules run	-	

PRD 2021 PANEL
SUPPORT FOR MARKET UPTAKE

THyGA

TESTING HYDROGEN ADMIXTURE FOR GAS APPLICATIONS



Project ID:	**874983**
Call topic:	**FCH-04-3-2019:** Hydrogen admixtures in natural gas domestic and commercial end uses
Project total costs:	**€2 468 826.25**
FCH JU max. Contribution:	**€2 468 826.25**
Project start - end:	01/01/2020 - 31/12/2022
Coordinator:	**ENGIE, GR**
Website:	**thyga-project.eu/**

BENEFICIARIES: DANSK GASTEKNISK CENTER AS, BDR THERMEA GROUP BV, GERG LE GROUPE EUROPEEN DE RECHERCHES GAZIERES, GAS.BE, GASWARME-INSTITUT ESSEN EV, DVGW DEUTSCHER VEREIN DES GAS- UND WASSERFACHES - TECHNISCH-WISSENSCHAFTLICHER VEREIN EV, ELECTROLUX ITALIA SPA, COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES

PROJECT AND OBJECTIVES

The THyGA project is investigating the amounts of hydrogen that can be injected without compromising the safety, emissions and efficiency of existing and new applications. It focuses on the end-user perspective: domestic and commercial gas appliances (space heating, hot water, cooking and catering), which account for more than 40 % of the EU's gas consumption.

NON-QUANTITATIVE OBJECTIVES

Participation of external partners in the project. Some laboratories and manufacturers expressed a wish to use the THyGA protocol to do their own tests and contribute to the project's analysis.

PROGRESS AND MAIN ACHIEVEMENTS

- WP2 made an extensive assessment of the theoretical impact of H2NG blends on natural gas appliances (combustion and non-combustion impacts)
- Development of a generic protocol to assess the impact of H2NG blends on all appliances that will be tested during the project
- Test of around 15 appliances by end of March 2021 (the target is 100 appliances by 2022).

FUTURE STEPS AND PLANS

- Completion of the test campaign. So far, around 10 % of the test objectives have been attained and the goal is to achieve the 100 tests within the project timeline (by end of 2022)
- Support of the stakeholders on standardisation. THyGA has already begun exchanging information with technical committees and plans to develop a common work programme to support standardisation and certification with respect to H2NG for appliances
- Mitigation approaches. The objective is to identify the technical possibilities of mitigation to improve the acceptable rate of H2 that appliances can deal with (in terms of safety, efficiency, power, etc.).

QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	TARGET	ACHIEVED TO DATE BY THE PROJECT	SOA RESULT ACHIEVED TO DATE (BY OTHERS)	YEAR FOR SOA TARGET
Project's own objectives	Understanding the actual theoretical and experimental knowledge on the impact of H2NG blends on combustion	2 deliverables published on theoretical calculation and bibliography study	Several studies and test reports	2020
	Understanding the actual theoretical and experimental knowledge on the impact of H2NG blends on materials	Bibliography review and preparation of test rig	Several studies and test reports	
	Segmentation of the types of appliances	Segmentation validated with stakeholders	Similar approaches on segmentation	
	Test of up to 100 appliances	N/A	N/A	N/A