	EUROPEAN COMMISSION RESEARCH AND INNOVATION DG	Final Report

Project No: 256823

Project Acronym: HyFacts

Project Full Name: Identification, Preparation and Dissemination of Hydrogen Safety Facts to Regulators and Public Safety Officials

Final Report

Period covered: from 01/02/2011 **to** 31/07/2013

Start date of project: 01/02/2011

Project coordinator name:
Mr. Christian Machens

Version: 2

Date of preparation: 17/09/2013

Date of submission (SESAM): 03/10/2013

Project coordinator organisation name:
TUV SUD Akademie GMBH

Final Report

PROJECT FINAL REPORT

Grant Agreement number:	256823
Project acronym:	HyFacts
Project title:	Identification, Preparation and Dissemination of Hydrogen Safety Facts to Regulators and Public Safety Officials
Funding Scheme:	FP7-JTI-CSA-FCH
Project starting date:	01/02/2011
Project end date:	31/07/2013
Name of the scientific representative of the project's coordinator and organisation:	Mr. Christian Machens TUV SUD Akademie GMBH
Tel:	+4915124155887
Fax:	+493411499192
E-mail:	coordinator@hyfacts.eu
Project website address:	www.hyfacts.eu

Final Report

Please note that the contents of the Final Report can be found in the attachment.

4.1 Final publishable summary report

Executive Summary

The HyFacts Project is a “Coordination and Support Action (CSA)” and aims to develop and initiate dissemination of training material for Regulators and Public Safety Officials, which are responsible persons and work for entities, having to position themselves in the increasing number of upcoming installation of hydrogen-related technologies in public areas, companies, universities, research centers, fairgrounds, harbour sites and other places where fuel cell and hydrogen (FCH) installations and mobile applications shall be installed and operated in the near future.

The HyFacts project has developed and will disseminate fully up-to-date contemporary material for customized training packages for regulators and public safety experts providing accurate information on the safe and environmentally friendly use of hydrogen as an energy carrier for stationary and transport applications under real conditions. The training material is focussing on the fundamental aspects of hydrogen safety and on the safety approaches and criteria developed in standards and according to which hydrogen systems are engineered for the safe use of hydrogen under all circumstances.

For a successful transfer of knowledge it was evident to have the audience involved at a very early stage in order to tailor the training packages to their specific needs. This has been achieved by issuing questionnaires and asking the potential audience identified earlier about their status of knowledge.

The first step for the development of the teaching material was to design and activate the project website (D5.1) and to identify the relevant contacts (D3.1) which made it possible to send out the questionnaire (D3.2) and make it available as online questionnaire in order to receive an indication on which content of the teaching material the relevant target group would be interested for their daily work. In D3.3, the results of this questionnaire are described. A total of 76 qualified answers were received from Germany, France, Great Britain and Italy and have been analysed as basis for the definition of the following parameters: Training content (focus on hydrogen safety, RCS and separation distances for HRS), training duration (1-2 days), frequency (yearly) and institution which is conducting the training (similar institution like TUV). This input has been reflected in the structuring and content of the teaching material (D2.1), which was the basis for the detailed collection of the content of the teaching material (D2.2), resulting in a document with a volume of 376 pages of technical content, consisting of 6 chapters with 156 figures and 52 tables. So D2.2 can be seen as the main working document of the HyFacts project and contains the raw information based on good engineering practice but also international standards and actual research results.

The basic document has been transferred into a useable format consisting of 215 slides and 379 pages of text in form of a “handout” for the participants. (D4.2), which all have been presented in the first Short Course in Munich at TÜV SÜD Akademie (Milestone 7) on 11/12 September 2012 with 11 participants from the primary target group, supporting the HyFacts project with their high-quality feed-back ad basis for the further improvement of the teaching material regarding content and duration of the course. In the second Short Course (Milestone 9), which has been conducted in Belfast at the University of Ulster on 24/25 January 2013 with 24 participants of the primary target group and additional participants from the industry, the material has further been improved and have finally been tested in the third Short course (Milestone 10) on 6/7 June in Rome (IT) before reaching its final status (D4.3) in PM30.

Summary description of project context and objectives

FCH technologies are relatively new to the public as well as to institutions which are dealing with issues like building regulations, local regulations, public safety and permission of technical

installations or even much earlier in the project development. Most of the staff of these institutions does not have the necessary knowledge to judge on safety aspects based on real facts but tend to take decisions on the basis of either obsolete or incomplete knowledge or refuse to take any decision at all. This situation leads to heavy delay of decisions or to technically unreasonable, costly and sometimes also very ineffective safety measures to obtain the approval for a hydrogen installation or the allowance to use hydrogen applications such as cars, busses or forklifts in public spaces.

In the past it could be observed that permission problems could have been avoided if the relevant involved persons would have had a higher level of knowledge regarding hydrogen and its related technologies based on already implemented technology, actual research results, realised projects and the regulations, codes and standards (RCS) currently in effect.

On the way to an increasing number of hydrogen related installations and vehicles throughout Europe, it can be expected that also more and more of these will be placed outside the major cities, where some projects might already have been implemented or where the liaison between the local industry which is active in this specific field and the relevant officials is already established. This will lead to the fact that more decentralised and smaller entities will get in touch with hydrogen related issues and will have to take profound decisions.
Significant efforts will be devoted to identifying and prioritizing the audiences that would need to be trained to facilitate the commercialization of hydrogen and its related technologies like decentralised hydrogen production, hydrogen storage and distribution systems, hydrogen refuelling stations, stationary fuel cells for combined production of heat and power (CHP) and other hydrogen consuming devices. A vision and road-map for the establishment of permanent training activities for the targeted audiences by recognized institutions, along with the proposal specific initiatives will be an important outcome of the project.
A large amount of knowledge on the behaviour of hydrogen that is very useful for developing safety approaches that are well adapted to the new use of hydrogen as an energy carrier has been developed during the last years (e.g. HySafe). These are now being applied for the engineering design of new products and applications. It is therefore very important that the persons in charge of ensuring public safety be trained on these new safety approaches.

Description of main S & T results/foregrounds

In HyFacts, no Technologies have been developed.

Potential impact and main dissemination activities and exploitation results

The HyFacts project is supporting the FCH JU aims in the following way:

Fuel Cell and Hydrogen Technologies shall be implemented in Europe in order to gain specific knowledge in applying these technologies and bringing them to a breakthrough by reaching the necessary “critical mass”. Only if the number of fuel cell cars, refuelling stations, small and large centralised and decentralised hydrogen systems in operation, the necessary impact on public acceptance and involvement can be achieved.
For reaching this aim, the regulators, which sometimes hold up approval of systems prior to their implementation, need to be trained in understanding and safe use of hydrogen and its related technologies much better and should even be brought to a supportive attitude.

Support of the RTD efforts in the member states can be strongly supported if the technologies developed can be used in the everyday life and large-scale implementation brings results from the use in the field. The regulators need to understand better the background of some very time-consuming developments and that their support is not only highly appreciated but inevitable for the success of the whole implementation of the hydrogen technologies.

Once the regulators across Europe have a better understanding of the matter, it will be a clear signal also for public and private RTD investment to increase their efforts and try to achieve realistic goals which before have been thought to be too unconventional.

Many efforts have already been undertaken to show regulators that hydrogen is not more dangerous than other energy-carriers such as liquid hydrocarbons, other gases like propane, natural gas or

electricity. Hydrogen just needs a specific understanding just like any other energy-carrier being used by the public in millions of technical appliances today. The benefit for Europe can be technology leadership in hydrogen related RTD and consequently products developed on the basis of experiences being made in Europe as well as security in energy supply.

Funds for implementing hydrogen technologies are used much more effectively if not only the technology developed can function in the right way but if they can be certified on the basis of true knowledge of the regulators.

The overall programme of the FCH JU is divided into four major horizontal application areas (AA): Transportation & Refuelling Infrastructure; Hydrogen Production, Storage & Distribution; Stationary Power Generation & CHP; and Early Markets. All of these areas are included in the teaching material and are explained on the basis of the latest research results, implemented technologies but also on accidents which occurred because some basic properties of hydrogen were not taken into account.

In order to achieve the aim of having 3.000 vehicles in the field by 2015, the HyFacts project will need to have a broad impact on different levels and comes just at the right time, when volumes are starting to climb, leading to a much higher involvement of public officials and their offices. Volume production and infrastructure availability need a good ground to be built on, namely knowledgeable regulators and certifiers.
But not only road vehicles shall be implemented over the next few years, also rail, marine and airborne applications will require the same amount of specific knowledge of the respective institutions.

Sustainable hydrogen production, storage and distribution processes are projected to meet 10% – 20% of the hydrogen demand for energy applications by 2015 and shall be ready for commercialisation by 2013. With the HyFacts project, which has now ended after 2,5 years, this requirement can be supported by the timely delivery of tailored knowledge in the form of training material, which can be understood as a supportive help for the work of the regulators.

All technologies of the different application areas can only be widely introduced across Europe if they are well understood by regulators and thus can be used in a way as other technologies today, without fear but with the necessary realistic evaluation.

Hydrogen and Fuel Cell technology implementation is not something what can be done locally or only in one or a few member states but need a common strategy and joint efforts on a high level of cooperation between all involved entities. Local particularities need to be taken into account and need to be reflected in the teaching materials but the common understanding of how hydrogen and its related technologies can be safely implemented needs to be focussed on and a clear way must be shown to how the safe implementation of them can be achieved. International cooperation in the field of product development also needs clear indications on what will be acceptable risks to the public and how regulators can be guided to a positive attitude rather than relying on their own intuition.

The DOE of the United States has issued a course named “Introduction to hydrogen for code officials”, but the content of this course is relatively limited in depth and does not take into account the different needs which arise from the large variety of activities, which regulators need to be involved in. For a broad use of hydrogen as a new energy carrier, many other hydrogen-related technologies like hydrogen production and storage, processing, transport, distribution and the final use of hydrogen in fuel cells but also in internal combustion engines and catalytic appliances need to be taken into account. This expanded scope and greater depth of explaining the different technologies is part of the teaching material which has been developed by the HyFacts project.

The successful achievement of the impact of the HyFacts teaching material will be determined by the quality of the teaching material defined by factors like:

- Technical completeness
- Up-to-date research results integrated
- Plausible links between different topics

• Appealing form of the teaching material
• Concise information with examples of well designed principles
• Suitable and modular courses for the particular audience adjusted to their status of knowledge

For a successful transfer of knowledge it is evident to have the audience involved at a very early stage in order to tailor the training packages to their specific needs. This has been achieved by issuing questionnaires and asking the potential audience identified earlier about their status of knowledge, their required knowledge for delivering professional results.

Address of project public website and relevant contact details

www.hyfacts.eu

4.2 Use and dissemination of foreground

Section A (public)

Publications

LIST OF SCIENTIFIC PUBLICATIONS, STARTING WITH THE MOST IMPORTANT ONES											
No.	Title / DOI	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date of publication	Relevant pages	Permanent identifiers (if applicable)	Is open access provided to this publication ?	Type

LIST OF DISSEMINATION ACTIVITIES								
No.	Type of activities	Main Leader	Title	Date	Place	Type of audience	Size of audience	Countries addressed

Section B (Confidential or public: confidential information marked clearly)

LIST OF APPLICATIONS FOR PATENTS, TRADEMARKS, REGISTERED DESIGNS,UTILITY MODELS, ETC.					
Type of IP Rights	Confidential	Foreseen embargo date dd/mm/yyyy	Application reference(s) (e.g. EP123456)	Subject or title of application	Applicant(s) (as on the application)

OVERVIEW TABLE WITH EXPLOITABLE FOREGROUND								
Type of Exploitable Foreground	Description of Exploitable Foreground	Confidential	Foreseen embargo date dd/mm/yyyy	Exploitable product(s) or measure(s)	Sector(s) of application	Timetable for commercial use or any other use	Patents or other IPR exploitation (licences)	Owner and Other Beneficiary(s) involved

ADDITIONAL TEMPLATE B2: OVERVIEW TABLE WITH EXPLOITABLE FOREGROUND	
Description of Exploitable Foreground	Explain of the Exploitable Foreground

4.3 Report on societal implications

B. Ethics

1. Did your project undergo an Ethics Review (and/or Screening)?	No
If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final reports?	

2. Please indicate whether your project involved any of the following issues :

RESEARCH ON HUMANS

Did the project involve children?	No
Did the project involve patients?	No
Did the project involve persons not able to consent?	No
Did the project involve adult healthy volunteers?	No
Did the project involve Human genetic material?	No
Did the project involve Human biological samples?	No
Did the project involve Human data collection?	No

RESEARCH ON HUMAN EMBRYO/FOETUS

Did the project involve Human Embryos?	No
Did the project involve Human Foetal Tissue / Cells?	No
Did the project involve Human Embryonic Stem Cells (hESCs)?	No
Did the project on human Embryonic Stem Cells involve cells in culture?	No
Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?	No

PRIVACY

Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	No
Did the project involve tracking the location or observation of people?	No

RESEARCH ON ANIMALS

Did the project involve research on animals?	No
Were those animals transgenic small laboratory animals?	No
Were those animals transgenic farm animals?	No
Were those animals cloned farm animals?	No
Were those animals non-human primates?	No

RESEARCH INVOLVING DEVELOPING COUNTRIES

Did the project involve the use of local resources (genetic, animal, plant etc)?	No
Was the project of benefit to local community (capacity building, access to healthcare, education etc)?	No

DUAL USE

Research having direct military use	No
Research having potential for terrorist abuse	No

C. Workforce Statistics

3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).

Type of Position	Number of Women	Number of Men
Scientific Coordinator	1	1
Work package leaders	1	3
Experienced researchers (i.e. PhD holders)	0	2
PhD student	0	0
Other	0	0

4. How many additional researchers (in companies and universities) were recruited specifically for this project?	0
Of which, indicate the number of men:	0

D. Gender Aspects

5. Did you carry out specific Gender Equality Actions under the project ?	No

6. Which of the following actions did you carry out and how effective were they?	
Design and implement an equal opportunity policy	Not Applicable
Set targets to achieve a gender balance in the workforce	Not Applicable
Organise conferences and workshops on gender	Not Applicable
Actions to improve work-life balance	Not Applicable
Other:	

7. Was there a gender dimension associated with the research content - i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?	No
If yes, please specify:	

E. Synergies with Science Education

8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?	No
If yes, please specify:	

9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?	Yes

F. Interdisciplinarity

10. Which disciplines (see list below) are involved in your project?	
Main discipline:	2.3 Other engineering sciences (such as chemical, aeronautical and space, mechanical, metallurgical and materials engineering, and their specialised subdivisions; forest products; applied sciences such as geodesy, industrial chemistry, etc.; the science and technology of food production; specialised technologies of interdisciplinary fields, e.g. systems analysis, metallurgy, mining, textile technology and other applied subjects)
Associated discipline:	1.3 Chemical sciences (chemistry, other allied subjects)

Associated discipline:	1.2 Physical sciences (astronomy and space sciences, physics and other allied subjects)

G. Engaging with Civil society and policy makers

11a. Did your project engage with societal actors beyond the research community? (if 'No', go to Question 14)	No
11b. If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?	
11c. In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?	
12. Did you engage with government / public bodies or policy makers (including international organisations)	
13a. Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?	

H. Use and dissemination

14. How many Articles were published/accepted for publication in peer-reviewed journals?	0
To how many of these is open access provided?	0
How many of these are published in open access journals?	0
How many of these are published in open repositories?	0
To how many of these is open access not provided?	0
Please check all applicable reasons for not providing open access:	
publisher's licensing agreement would not permit publishing in a repository	No
no suitable repository available	No
no suitable open access journal available	No
no funds available to publish in an open access journal	No
lack of time and resources	No
lack of information on open access	No
If other - please specify	

15. How many new patent applications ('priority filings') have been made? (''Technologically unique'': multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).	0

16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	
Trademark	0
Registered design	0
Other	0

17. How many spin-off companies were created / are planned as a direct result of the project?	0
Indicate the approximate number of additional jobs in these companies:	0

18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:	Difficult to estimate / not possible to quantify, In small and medium-sized enterprises

19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (FTE = one person working fulltime for a year) jobs:	1

I. Media and Communication to the general public

20. As part of the project, were any of the beneficiaries professionals in communication or media relations?	No

21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?	No

22. Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?	
Press Release	Yes
Media briefing	Yes
TV coverage / report	No
Radio coverage / report	No
Brochures /posters / flyers	Yes
DVD /Film /Multimedia	No
Coverage in specialist press	Yes

Coverage in general (non-specialist) press	Yes
Coverage in national press	No
Coverage in international press	No
Website for the general public / internet	Yes
Event targeting general public (festival, conference, exhibition, science café)	No

23. In which languages are the information products for the general public produced?	
Language of the coordinator	No
Other language(s)	No
English	Yes

Attachments	HyFacts Final Publishable Summary 02.pdf
Grant Agreement number:	256823
Project acronym:	HyFacts
Project title:	Identification, Preparation and Dissemination of Hydrogen Safety Facts to Regulators and Public Safety Officials
Funding Scheme:	FP7-JTI-CSA-FCH
Project starting date:	01/02/2011
Project end date:	31/07/2013
Name of the scientific representative of the project's coordinator and organisation:	Mr. Christian Machens TUV SUD Akademie GMBH
Name	
Date	03/10/2013
Signature	