

HYPROFESSIONALS



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1 Objectives of the report

The objective of this Task is to develop specific proposals/initiatives to deal with and cover the educational needs at different levels identified previously to develop the necessary human resource base.

In the task 2.1 was defined a European strategic working plan to launch initiatives and proposals which help to solve the situation in a right way.

The initiatives and experiences carried out or on-going, the standards of the different educational systems at different levels and the industry and market expectations/needs were be taken into consideration.

In the previous reports a relevant number of stakeholders were collected in 13 countries: 57 Educational / Training centres and 72 Companies.

In total 129 contacts and profiles were collected.

From the sector of interest data collection a wide spread of interest in the different topics/aspects of the hydrogen and fuel cell chain has been found. From data industrial sector however there are 3 primary topics of interest for the training actions:

- Hydrogen production
- Hydrogen storage
- Fuel Cells Applications

The sector “Fuel Cell Applications” refers to all the applications out of the vehicle sector which is pretty much different from the rest, especially in the number of players involved and in the communication with the outside. This sector collects several applications, including Early Markets such as forklift and UPS as first movers. Automotive field anyhow is characterized by a lower number of big size players if compared to other sectors, thus meaning a specific need of training will grow independently.

Regarding the identification of the industrial stakeholder along the H2/FC chain most of them are key components suppliers or core technologies manufacturer: only a small minority of balance of plant suppliers were involved as stakeholders. This is mainly related to the present low volume of production of fuel cell systems,



and it is expected to grow with the market. A specific need of training will follow for this sector.

On the other side Hydrogen Production and Storage are somehow related to the renewable energy market which is growing significantly: this overlap is by sure a strong driving force for the development of the sector.

Training actions should take into account this relationship between fuel cells and renewable energy.

Most of the companies and educational bodies are already cooperating at European level thus showing as this sector is developing at international level. Data collection shows a homogeneous involvement in Regional, National and European level.

Starting from these assumptions, proposals of educational and training actions from the partners were collected using a web-form data collector, by the task leader.

2 Methodology

Proposals from the partners were first collected using an on-line questionnaire, shared by the partners. The questionnaire was designed by ENV with a strong contribution from FHa, as project coordinator.

All the partners were asked to describe some specific initiatives and then the collected material was processed and merged in this document.

In particular the proposals collected from all partners are based upon a previous questionnaire prepared for the task 2.2 and also utilized for the deliverable 8. In the questionnaire addressed to Industrial Stakeholders and Educational/Training bodies two questions were reported “what are the educational gaps and needs of the hydrogen sector and what initiative could be develop to fill in the gaps?”.

The questionnaires and interviews showed that at short term, young people information is needed in order to increase awareness. In addition, hydrogen topic can be added in existing trainings (course of several hours) at technician and engineer levels.

At middle term, the needs will concern:

- Short trainings adapted to engineers but more particularly to technicians: internal and/or external trainings
- All the industrial sectors concerning technical and regulatory aspects. And the industrial sectors concerned by hydrogen topic are numerous!

Cooperation between institutes and industries must be improved in order to develop hydrogen trainings.

Now, however, fuel cells that use direct hydrogen are opening up new markets for hydrogen suppliers. Those key applications include light duty vehicles, forklifts, buses, stationary power (CHP, UPS..), and scooters. It is therefore necessary to increase training for these new market.



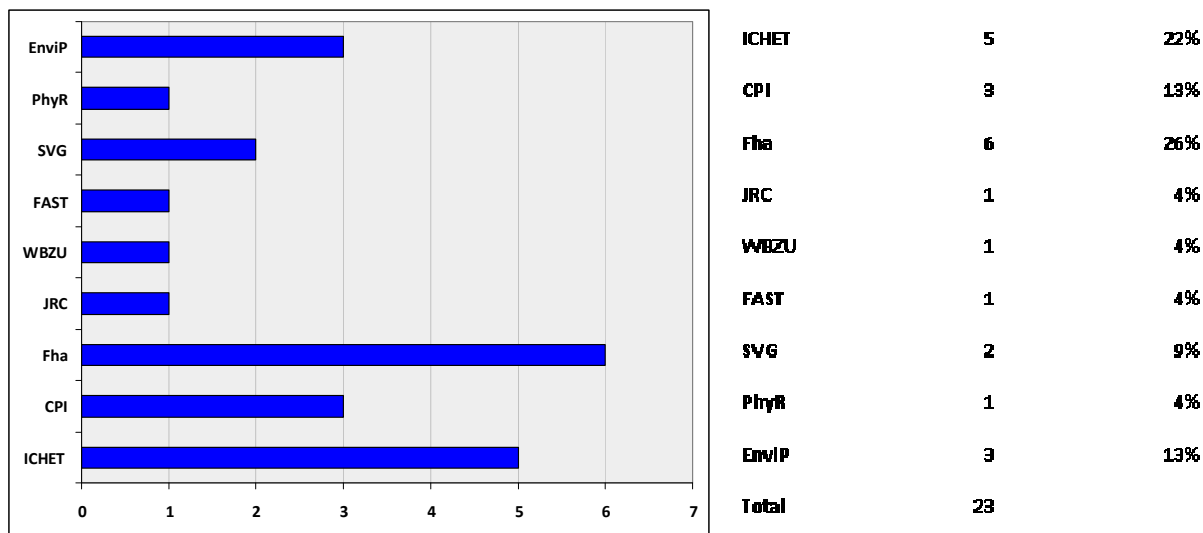
The "Gap and Need Analysis" for automotive market has highlighted the need of workforce trained in hydrogen and fuel cells technologies between 5 and 10 years for the sector (hydrogen mobility). For this application the hydrogen demand by 2015 will only be very small (a few thousand vehicles per year). So technician training could be done incrementally, that is to say first in-house training (short course) and then from 2020 (when demand is greatest) integrate training in technicians initial training (vocational training).

The questionnaire submitted to all partners was structured as follows:

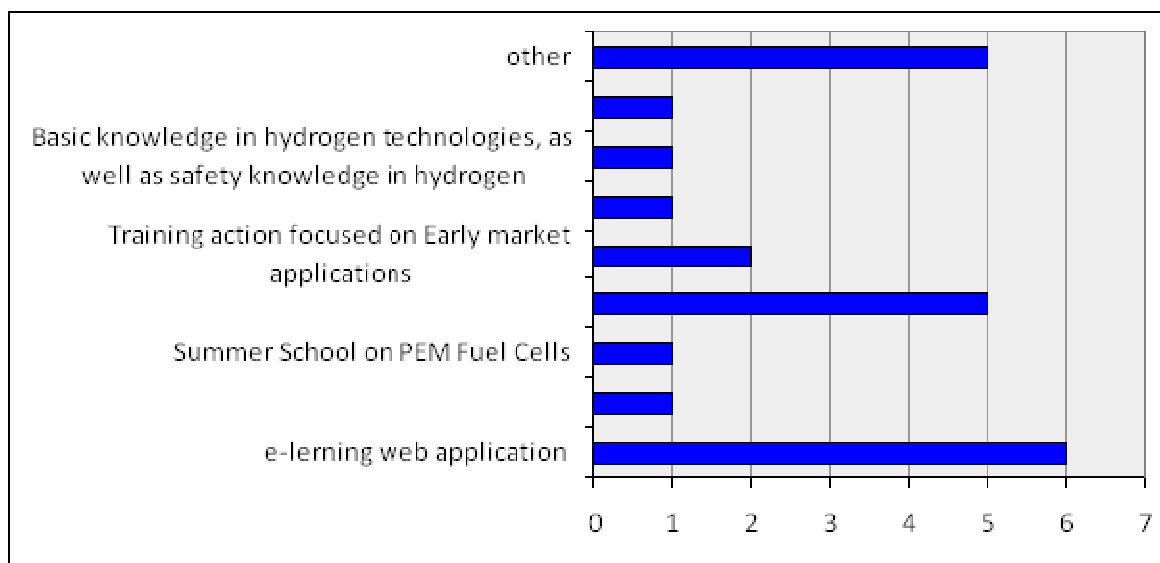
- ✓ Proposal description
- ✓ Target of the proposal
- ✓ Target of stakeholder
- ✓ Possible funds
- ✓ When the training will start or should start
- ✓ Duration of the training action
- ✓ Place of the training action
- ✓ Training action content description and required materials
- ✓ Language of the training action

3 Proposals overview and analysis

21 proposals from the partners were collected and analyzed.



Proposals distribution



e-learning web application	6	26%
Developing Hydrogen & Fuel Cell Education Syllabus and Curriculum	1	4%
Summer School on PEM Fuel Cells	1	4%
Training action focused to introduce fuel cell technology applied on cars	5	22%
Training action focused on Early market applications	2	9%
In lab training and demo	1	4%
Basic knowledge in hydrogen technologies, as well as safety knowledge in hydrogen manipulation	1	4%
Train the renewable energy technicians	1	4%
other	5	22%
Total	23	

Collected proposals: main topics

3.1 Duration of training actions

The target of stakeholders are people with technical university background (engineering, chemistry, physics...) working for Companies involved in Hydrogen Chain, so the duration of most part of training actions could be 1 month or less.



3.2 Place of the actions



The proposals show the need to carry out training actions directly in the stakeholder facilities, in order to focus the possibility of assemble and disassemble the main parts of a electric fuel cell vehicle, CHP and UPS system. The implementation of the courses directly in the stakeholders facilities allows to analyze the most crucial issues of hydrogen systems (security, hydrogen manipulation,).

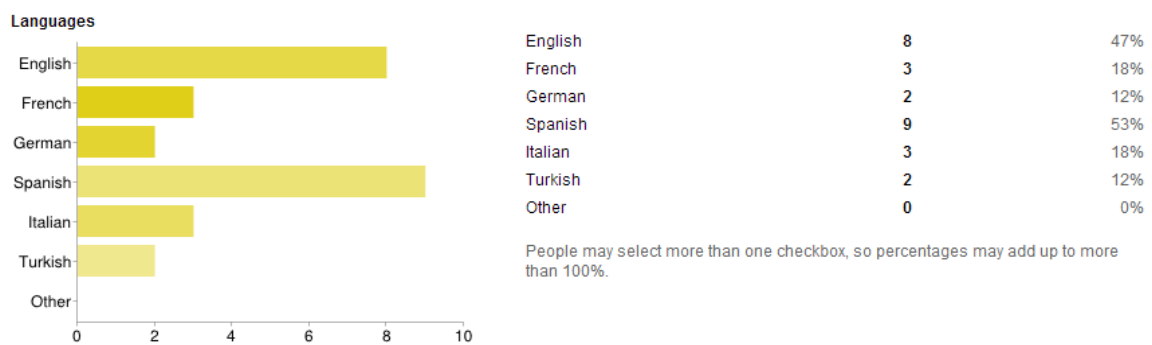
The proposals highlight also the need to develop and implement an e-learning platform freely accessible to provide training materials as modules (pdf files, videos...).



The training activity will be focused in particular on: FC & H2 technologies; components & system integration; market requirements & potentials current market applications.

A close cooperation between Institutes and Industries, in particular in drawing up its proposals, must be improved in order to develop hydrogen trainings.

3.3 Language



3.4 Proposals descriptions and target stakeholders

3.4.1 E-learning material on basic fuel cell and hydrogen technologies

Proposal description

A website dedicated to provide open access lectures, e-learning, animations and training materials useful to guide interested stakeholders on the subject of fuel cells & hydrogen technologies.

In particular e-learning materials based on the basics of fuel cells and hydrogen: what is a fuel cell, fuel cell versus battery, different types of fuel cells and their applications, applications for fuel cells in different markets, opportunities for fuel cells and market potentials, Hydrogen safety and legislation.

The Internet platform may contain, in addition to learning materials also practical applications, for example a software(webapp) bench-test for fuel cell and fuel cells systems, a software based on real fuel cell polarization curve with a simplified model.

The website creation could be followed by workshops to disseminate the information about existing of the e-learning system and how it works. Each partner should carrying out a workshop in his country to provide the information in the right channels.

Steps to establish the proposal

Preliminary steps:

1. Fine-tuning the idea
2. Form consortium to write the proposal
3. Identify funding opportunities
4. Submit to funding agency

The early stage is important because it identifies possible funds available for the proposal: EU Regional & Structural funds, National Programme, ESF (European Social Found), Marie Curie Initial Training Networks (ITN), EIT.

Implementation phase:

1. Setup of the e-learning platform structure
2. Produce e-learning material on fuel cells and hydrogen
3. Define assessment levels
4. Perform e-trials by inviting a selected number of potential addresses
5. Try and establish contact with vocational training centre who would be interested
6. Work with the vocational training centre

Target of the stakeholders

The e- learning courses are addressed to:

1. Young professionals & technical students (technician & bachelor levels) desiring an understanding of FC Technology;
2. Scientists and engineers working in or entering the fuel cell industry;
3. Employees of industries that have recently invested or plan to invest in fuel cell technology;
4. System developers & integrators;
5. End users and system operators.



3.4.2 Developing Hydrogen & Fuel Cell Education Syllabus and Curriculum

Proposal will develop 120 hrs of training materials for hydrogen & fuel cell technicians to get theoretical and hands-on knowledge. There will be bench-top training modules including hydrogen production modules, hydrogen storage modules, fuel cell modules.

Specific outputs are: Syllabus; Content of the lectures; Animations; Bench-top experimental modules developed for hands-on training.

Proposal can be specific to educate technicians or newly graduate engineers. Instead of one location to train everybody, every location can be training center by obtaining content and supporting modules.

Steps to establish the proposal

1. Fine-tuning the idea
2. Forming consortia to write the proposal
3. Identifying funding opportunities
4. Submitting to funding agency

Possible funds available for the proposal are: FCH JU, Marie Curie Initial Training Networks (ITN).

3.4.3 Training action focused to introduce safety knowledge and hydrogen manipulation

This training action is addressed to technician in active employment and its aim is to avoid rejection of maintenance of installations based on Hydrogen Technologies.

The main topics could be:

1. General concepts
2. Applications
3. Safety
4. Theoretical lectures and also practical

Steps to establish the proposal

1. Proposal description
2. Funding program or client definition (JTI National Ministries, Private Companies)
3. Development and planning

3.4.4 Training action focused to maintain the demonstrative projects from JTI

The purpose of this training action is to train the technicians who are going to maintain the demonstrative projects from JTI, in order to guarantee the right development and future of the demonstrative projects.

The demonstrative projects from JTI evolve around different kind of applications so this proposal will be adapted on that. The 5 different proposals will be: Hydrogen production, Hydrogen distribution, Refueling infrastructure, Automotive, End user.

The contents will change depending on the demonstrative project, but the main points are:

1. General concepts
2. Hydrogen technology basis
3. Hydrogen production
4. Hydrogen storage
5. Hydrogen distribution

6. Hydrogen fuel stations
7. Hydrogen applications – Fuel cells
8. Maintenance
9. Safety
10. Theoretical lectures and also practical

3.4.5 Training action focused to introduce fuel cell technology applied on cars

Proposals description

Studying the market and taking into account the gap analysis, it is noticed that automotive field is ready to the commercialization phase but the infrastructures and the people are not ready yet.

In the gap analysis is underlined that:

By 2015, only some specialization courses will be enough to satisfy the demand.

By 2020, half of the Automotive vocational training students will need to have fuel cell knowledge. In particular Automotive vocational training has to be updated and adapted to the FC technologies, at least in some centers.

By 2030, more than 3,5 times the Automotive vocational training students will need to have fuel cell knowledge. All centers will need to train FC technologies.

Target of the stakeholders

1. Owners of cars workshops
2. Car dealer and manufacturer companies
3. Local association of car workshops
4. Taxi drivers

Training action content description and required materials

The close link that exists between Research Institutes, Universities, Polytechnic and car-Companies has resulted to focus training events for technical people involved in car workshops.

These training actions could be actuated through the use of an handbook.

The main topics could be:

1. Introduction, general knowledge
2. Components of the vehicle
3. Actuations of workshops about repairing the electric and fuel cell vehicle.
The focus is in the possibility of assemble and disassemble the main parts of a electric fuel cell vehicle
4. Prospective about electric and fuel cell vehicle
5. Advantages and calculations of costs related to maintenance of the vehicle.

The way to make the training action will based on classes with a teacher who explain the possibilities of fuel cell applications on cars.

Training materials utilized: Documentation in paper and CD

Steps to establish the proposal

Preliminary steps:

1. Screening of the industrial associations and enterprises potentially interested in the project
2. Selection of the most competent trainers, both from the academy and from industry;
3. Selection of motivated participants, with solid background and able to provide a prompt spin-off of their participation in the training;
4. Involvement of institutions in order to unblock the available funds.
5. Take a vehicle which let a simple dissassamble and assamble of the main parts of it related to electric components and fuel cell

The early stage is important because it identifies possible funds available for the proposal: Local o Regional, founds from Commerce Chamber.

Inter-professional funds for training, which aim is aims are to promote and support the financing of the agreed training plans, for the continuing training of the employees and managers.



The Funds are financed through a compulsory contribution by the enterprises that decide to participate.

The Funds allow the enterprises to use 0,30% of the compulsory contribution for involuntary unemployment sent to INPS (National Institute for Social Security).

Implementation phase:

1. Make the worksohp documentation
2. Introduce and show the proposal in engineering schools
3. Make the documentation related to teaching material
4. Training actions, for example at nationals centres, local bussines associations, local taxi associations
5. Take contact with local taxi associations to make though them the proposals.

3.4.6 Training action focused to introduce fuel cell technology applied on Early Market installations: UPS (Uninterruptible Power Supply) and relative devices, Forklift and CHP

Proposals description

Nowadays, fuel cell-powered UPS have emerged as potential alternatives to battery and ICE-powered systems as for the forklift market. Fuel cell systems can fit some specific telecom companies requirements where uninterruptible power is a mandatory requirement.

As shown in D8, actually vocational training is mainly required for Installers and After sale operations.

Manufacturers are actually training their installers internally because the product line is still evolving quite rapidly, as well as certification requirements for the installations, different from country to country.

Develop training courses for technicians involved in early market installations to facilitate hydrogen infrastructure installation and spread. This activity could involve early market application manufacturers such as UPS, Forklift and portable application. Also microCHP manufacturers should be included.

UPS systems

The target of the proposal could be Companies which integrate systems solutions related to data bases and company data.

The elaborated documentation, related to direct applications of fuel cells on UPS, must be descriptive and technical one. The target people can take a complete knowledge about these applications.

In particular the training must give much comparative information related to maintenance of devices and lifelong duration.

The way to make the training action will be based on classes with a teacher who explains the possibilities of fuel cell applications on cars.

Training materials will consist of documentation in paper and CD UPS fuel cell based.



The stakeholders target are people who manage companies dedicated to data protection and data managing (UPS systems).

Steps to establish the proposal

1. Make the documentation related to teaching material
2. Take contact to possible collaborators or centres to get places where make the training actions, for example national centres, local business associations

4 Conclusions

Several different proposals were collected and discussed among the partners in order to define a common program. First step is the definition of a fuel cell education syllabus and curriculum, updated to the market development and perspectives.

E-learning platform seems to be the best way to disseminate the contents for this kind of purpose, at least in a first stage. Practical courses are also recommended for specific topics in the early market maintenance for instance.

The content of the courses should have a general common core with additional modules addressing specific topic and needs as shown below:



Different targets for the training actions were highlighted:

1. Young professionals & technical students (technician & bachelor levels) desiring an understanding of FC Technology;
2. Scientists and engineers working in or entering the fuel cell industry;
3. Employees of industries that have recently invested or plan to invest in fuel cell technology;



4. System developers & integrators;
5. End users and system operators.

In any case **two primary targets were defined**: Teaching the teachers of vocational training centres, and create specific courses for early market applications installers (UPS, mCHP, forklift).