THEME [SP1-JTI-FCH.2011.3.7]
[Field demonstration of small stationary fuel cell systems for residential and commercial applications]

Deliverable 3.1 Field support reports
Report submission date:25/02/2013
Work task leader: Envipark
Status: FD

(D-Draft, FD-Final Draft, F-Final)

Dissemination level: PU

(PU – Public, PP – Restricted to other programme participants, RE –

Restricted to a group specified by the consortium, CO – Confidential)

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0. Introduction

The ene.field demonstration action will be the first real European wide opportunity to gain knowledge on the needs for technical personnel training involved in these activities.

We will start the project, with an evaluation on the current state of the art with regards to field support arrangements, training and certification. This document will ensure that all partners are aware of lessons learnt during previous projects (including the Callux project and other national field trials) and that ene.field builds upon this experience. Work will be carried out in synergy with the JTI-FCH Project Hyprofessionals focused on the vocational training actions (of which Envipark, the task leader is a partner). In the past Envipark has participated to two European projects (Leonardo Program) for the development of training courses (H2-Training and H2-Employment) in which pilot training courses were developed and tested. Outcomes of these projects will also be considered when drawing up the current best practice document.

A final review of the lessons learned on training and qualification during ene.field will be developed which will summarise best practices across the EU Member States for the future including:

• Training and certification for installers and maintenance personnel

• Structure and management of maintenance support

• How the field support supply chain has been expanded/improved as a result of the project

The final document will include sections specific to each of the 12 EU Member States.

The deliverable reports an overview of training courses and in particular the interest in the different topics/aspects of hydrogen and fuel cell chain.

A collection of pilot training actions is reported and allows to underline the real interest on hydrogen technologies.

The objective of this report is to review the pilot actions which were carried out by Hyprofessional Project Partners.

The report highlights the success of these pilot actions which in total were attended (both physically and virtually) by over 350 students.

Moreover it has also emerged the need of a 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: safety, RCS, UPS operation and maintenance, forklift operation and maintenance, microCHP operation and maintenance.

What we wish to achieve on this topic in the context of ene.field is to raise awareness among utilities and users on the use of microCHP .

A lack of specific courses on CHP technologies has highlighted during the course on fuel cell.

In particular it is necessary:

- *A real world learning, demonstration of market potential, segmentation, cost and environmental benefits of micro FC-CHP ;*
- *Developed market focused-product , specifications and harmonized codes and standards*
- *A more mature supply chain, readied for deployment of micro FC-CHP in 12 member states.*
- *An evidence base on cost and environmental performance, that can be used to accelerate policy support from governments, and adoption by channels to market.*

A specific objective of the Project is to support the relationship between end users (utilities) and manufacturers, working in relation with the utilities that is of great importance at this early stage of the project.

1. Report on target groups identified during Hyprofessionals project (with statistical analysis, numbers of stakeholders, general needs)

The objective is the identification of European target groups and stakeholders in the hydrogen and fuel cells sector. Final aim of the investigation is focused on the identification of training needs from the industrial sector in order to facilitate the widespread of these technologies.

Two different web-questionnaires were created to address specific questions: the first for the industrial stakeholders and the second for educational/training bodies.

From the data collection **129 stakeholders were collected from 13 countries**.

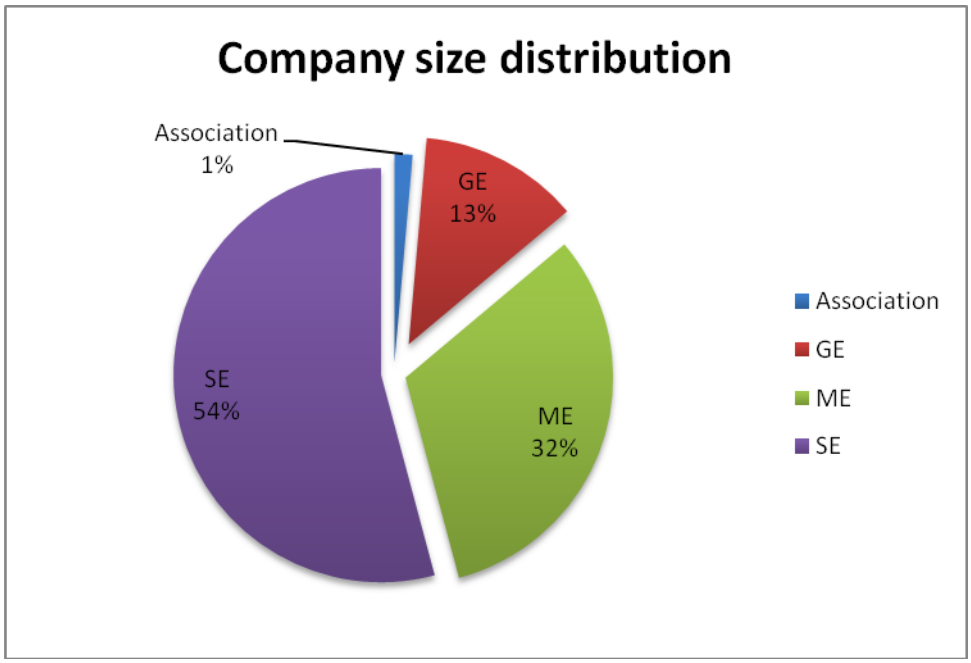
1.1 Industrial stakeholders

1.1.1 IND - Geographical and size distribution

From the industrial sector 72 stakeholders were collected from 9 countries

Country	Total
Austria	1
Denmark	1
France	9
Germany	18
Italy	15
Nederland	2
Spain	15
Turkey	3
Total	**72**

More than 50% of the stakeholders are SMEs, as show in the company size distribution diagram, while 32% are medium and 13% big enterprises.

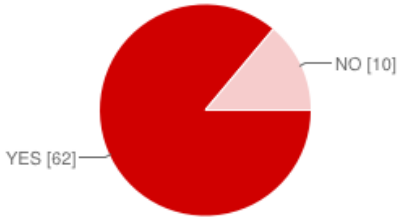


Company Size distribution		
	Already in H2 Business	Total
Association	NO	1
		1
GE	NO	5
	YES	4
GE Total		**9**
ME	NO	10
	YES	13
ME Total		**23**
SE	NO	19
	YES	20
SE Total		**39**
Total		**72**

As show in the table in all the three size classes the percentage of stakeholder already in the H2/FC business in close to 50%.

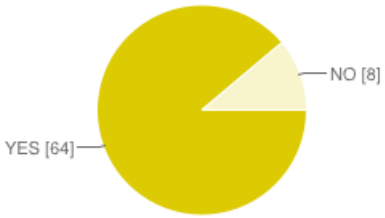
1.1.2 IND - Assessment of the level of perception on Hydrogen and Fuel cells

Does your company have or had in the past hydrogen / fuel cell related activities?



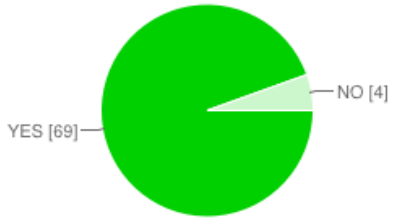
YES	**62**	85%
NO	**10**	14%

Does your company have ongoing projects in this topic?



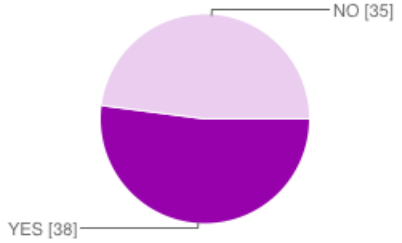
YES	**64**	88%
NO	**8**	11%

Do your company trust hydrogen and fuel cell will be a market opportunity in the future?



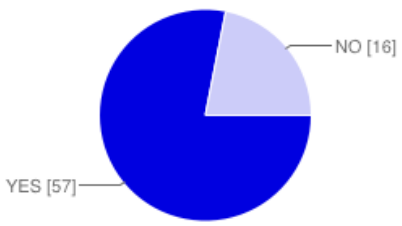
YES	**69**	95%
NO	**4**	5%

Does your company already sell some products in the H-FC field?

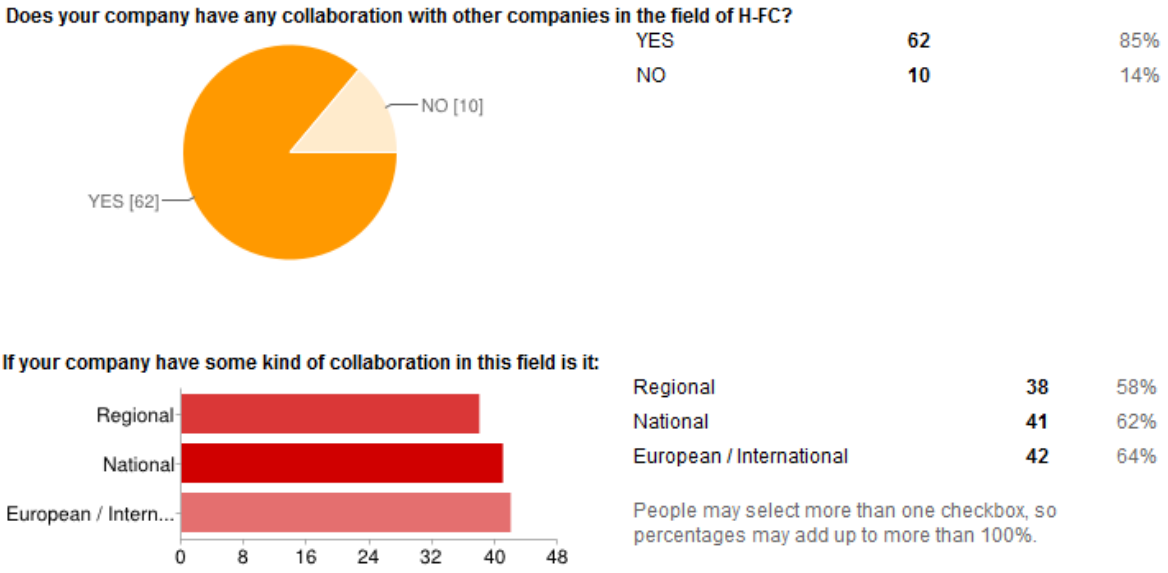


YES	**38**	52%
NO	**35**	48%

Does your company have any collaboration with University or Research Centers in the field of H-FC?

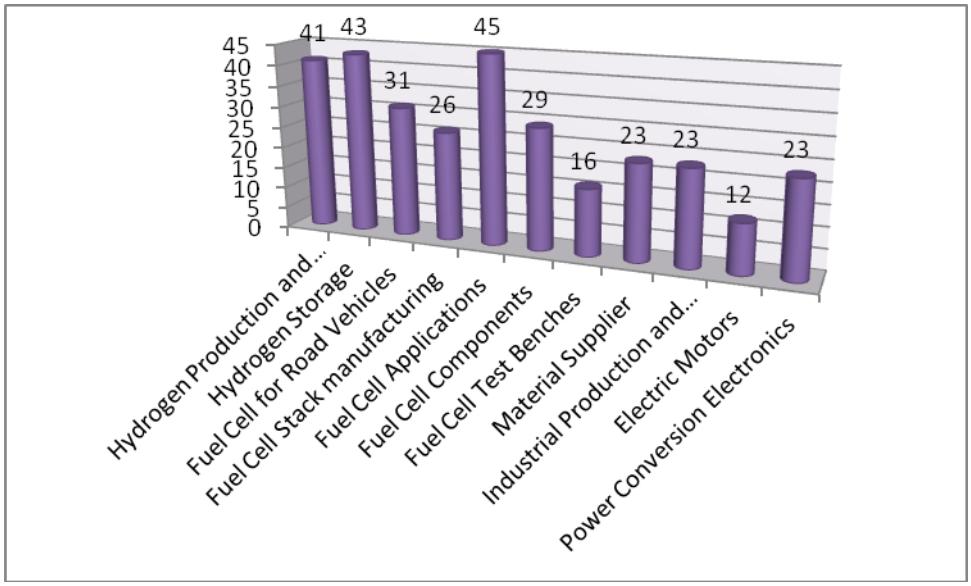


YES	**57**	78%
NO	**16**	22%



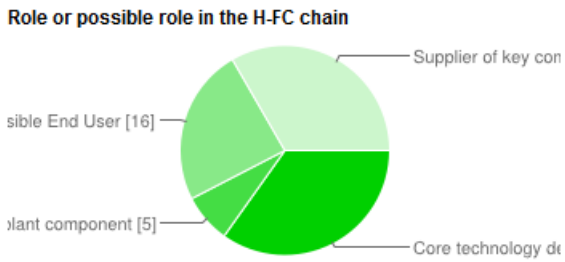
1.1.3 IND - Hydrogen and Fuel Cell sector of interest

Stakeholders were asked to specify their sector of interest in the hydrogen and fuel cell sector and their possible role in the chain. The choice of the sectors was thought to be enough detailed to better understand the training needs and the moving actors of the scene.



Hydrogen Production and distribution	**41**	56%
Hydrogen Storage	**43**	59%
Fuel Cell for Road Vehicles	**31**	42%
Fuel Cell Stack manufacturing	**26**	36%
Fuel Cell Applications	**45**	62%
Fuel Cell Components	**29**	40%
Fuel Cell Test Benches	**16**	22%
Material Supplier	**23**	32%
Industrial Production and Automation technologies	**23**	32%
Electric Motors	**12**	16%
Power Conversion Electronics	**23**	32%

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.

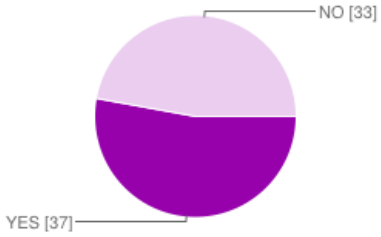


Core technology developer	**23**	32%
Supplier of balance of plant component	**5**	7%
End User / Possible End User	**16**	22%
Supplier of key component	**22**	30%

As far as the supplier sector is concerned a lower number of stakeholders was reached. The main reason is related to the low volume of production of fuel cell systems at present. This sector however is expected to grow in the next future, following first the early markets and subsequently the transport sector.

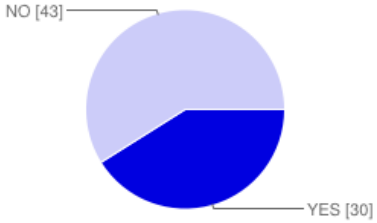
1.1.4 IND – Specific need of training actions

Does the company have any cooperation with educational / training centres?



YES	**37**	51%
NO	**33**	45%

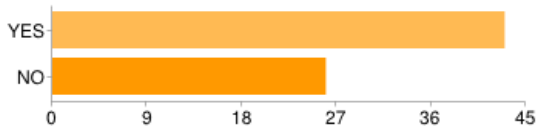
Is it easy to find qualified workers ?



YES	**30**	41%
NO	**43**	59%

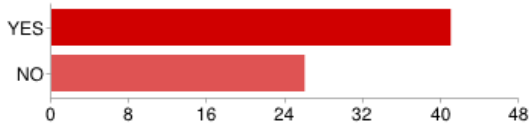
Does the company need to train technicians for H-FC related activities?

Does the company need to train technicians for H-FC related activities? - Internal Training



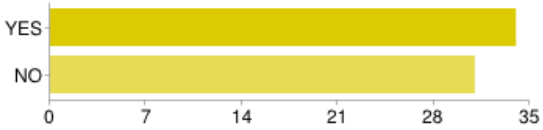
YES	**43**	59%
NO	**26**	36%

Does the company need to train technicians for H-FC related activities? - Short Professional Training



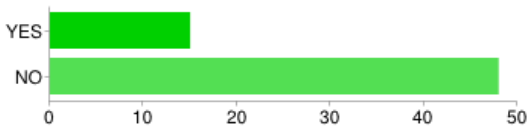
YES	**41**	56%
NO	**26**	36%

Does the company need to train technicians for H-FC related activities? - Short Theorical courses



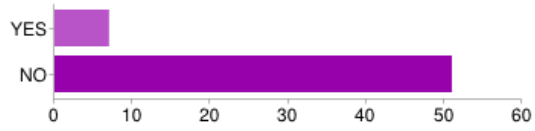
YES	**34**	47%
NO	**31**	42%

Does the company need to train technicians for H-FC related activities? - Long formation at University



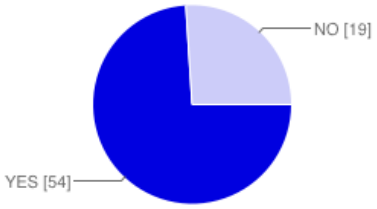
YES	**15**	21%
NO	**48**	66%

Does the company need to train technicians for H-FC related activities? - Long formation at training centers



YES	**7**	10%
NO	**51**	70%

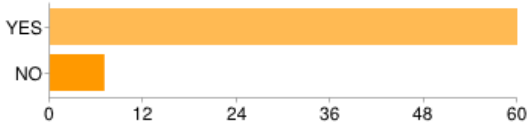
Does the company need to train workers for H2-FC related activities?



YES	**54**	74%
NO	**19**	26%

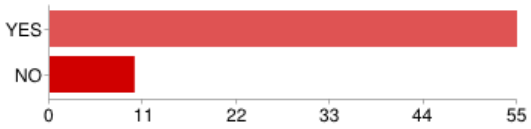
Training aspect of interest:

Training aspect of interest - Technical aspects



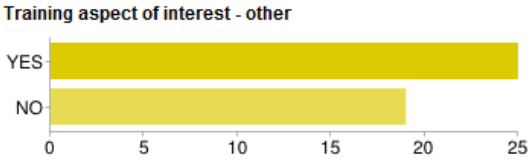
YES	**60**	82%
NO	**7**	10%

Training aspect of interest - Regulatory/security aspects



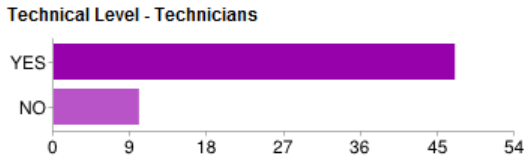
YES	**55**	75%
NO	**10**	14%

Training aspect of interest - other

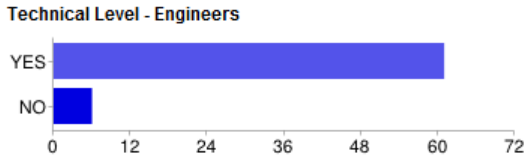


YES	**25**	34%
NO	**19**	26%

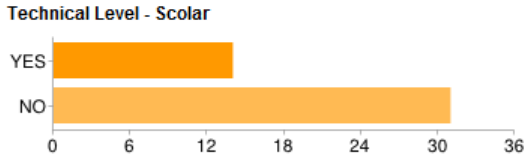
Technical Level of the training person:



YES	**47**	64%
NO	**10**	14%



YES	**61**	84%
NO	**6**	8%



YES	**14**	19%
NO	**31**	42%

1.2 Educational stakeholders

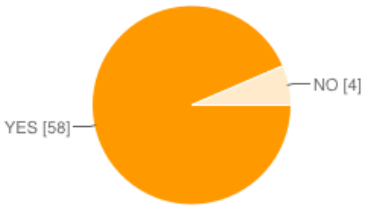
1.2.1 EDU - Geographical and size distribution

From the educational sector 57 stakeholders were collected from 12 countries. The stakeholder sample includes public and private educational centres as well as university involved in vocational training activities.

Country	Total
Austria	1
Belgium	2
Bulgaria	1
Denmark	1
France	6
Germany	15
Hungary	1
Italy	11
Romania	1
Spain	14
Turkey	2
United Kingdom	2
Total	**57**

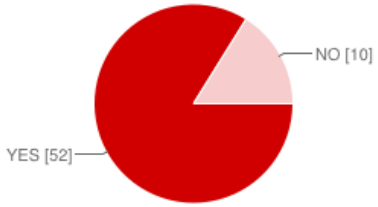
1.2.2 EDU - Assessment of the level of perception on Hydrogen and Fuel cells

Does your insitute have or had in the past hydrogen / fuel cell related activities?



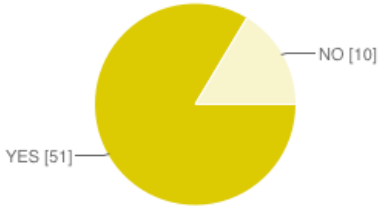
YES	**58**	94%
NO	**4**	6%

Does your insitute have ongoing projects in this topic?



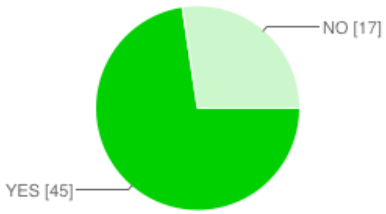
YES	**52**	84%
NO	**10**	16%

Does your insitute have any collaboration with University or Research Centers in the field of H-FC?



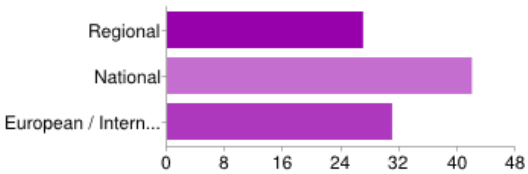
YES	**51**	82%
NO	**10**	16%

Does your insitute have any collaboration with other companies in the field of H-FC?



YES	**45**	73%
NO	**17**	27%

If the company have some kind of collaboration in this field it is:

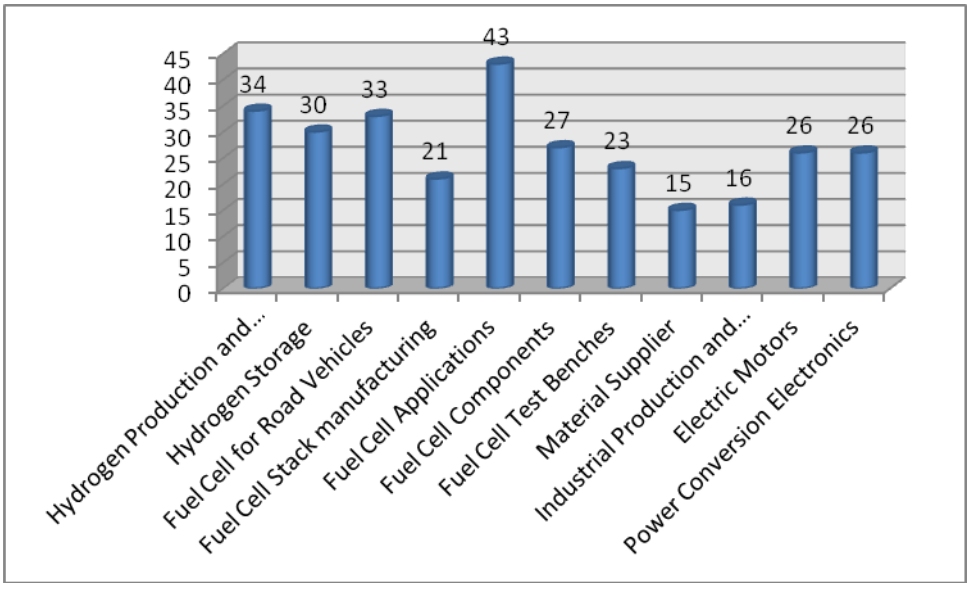


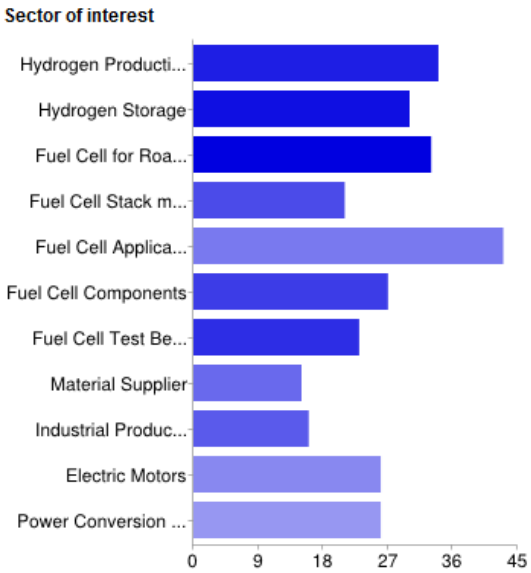
Regional	**27**	49%
National	**42**	76%
European / International	**31**	56%

People may select more than one checkbox, so percentages may add up to more than 100%.

1.2.3 EDU - Hydrogen and Fuel Cell sector of interest

Stakeholders were asked to specify their sector of interest in the hydrogen and fuel cell sector and their possible role in the chain.





Hydrogen Production and distribution	**34**	55%
Hydrogen Storage	**30**	48%
Fuel Cell for Road Vehicles	**33**	53%
Fuel Cell Stack manufacturing	**21**	34%
Fuel Cell Applications	**43**	69%
Fuel Cell Components	**27**	44%
Fuel Cell Test Benches	**23**	37%
Material Supplier	**15**	24%
Industrial Production and Automation technologies	**16**	26%
Electric Motors	**26**	42%
Power Conversion Electronics	**26**	42%

People may select more than one checkbox, so percentages may add up to more than 100%.

Conclusions

A relevant number of stakeholders were collected in 13 countries:

- 57 Educational / Training centres
- 72 Companies

In total 129 contacts and profiles were collected.

From the sector of interest data collection we have found a wide spread of interest in the different topics/aspects of the hydrogen and fuel cell chain. 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.

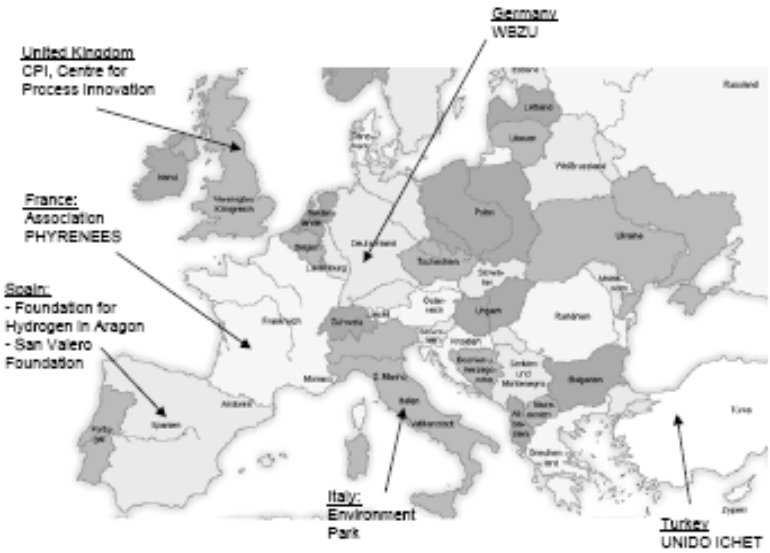
On the other side Hydrogen Production and Storage are somehow related to the renewable energy market which is growing significantly: this overlap is by sure a strong driving force for the development of the sector. Training actions should take into account this relationship between fuel cells and renewable 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 an homogeneous involvement in Regional, National and European level.

2. Report on Funding Analysis in different EU countries for training actions on Fuel Cells

The focus of the report is to map informations on potential funding programs in Spain, France, Germany, Italy and United Kingdom and Turkey as well as EU programs to develop H2 training programs. The focus of the report is to map funding programs for education and training projects in the field of fuel cell and hydrogen technology. The report gives an overview of funding programs in the origin countries of the project partners and first ideas of how to implement projects in the field of education and training.

The focus of the report is to map the funding programs in the origin countries of the partners involved in the task. Partners from 6 European countries were involved, these are:



Countries considered in the analysis of funding programs

The report shows the funding programs in the mentioned countries and opportunities to implement projects in the field of education and training. Also the report delivers a short insight into funding program on a European level.

2.1 Funding Analysis in Different EU Countries

2.1.1 Germany

A short view on Germany's vocational Education and training system (VET)

In Germany children enter compulsory full-time schooling at the age of six. This schooling period lasts nine years. After completing it, young people who do not attend any full-time-school are required to attend part-time (vocational) school for three years. Put simply: in Germany, young people are required to attend school from the ages of 6 to 18. Trainees in the dual system (even those older than 18) are also subject to compulsory schooling.

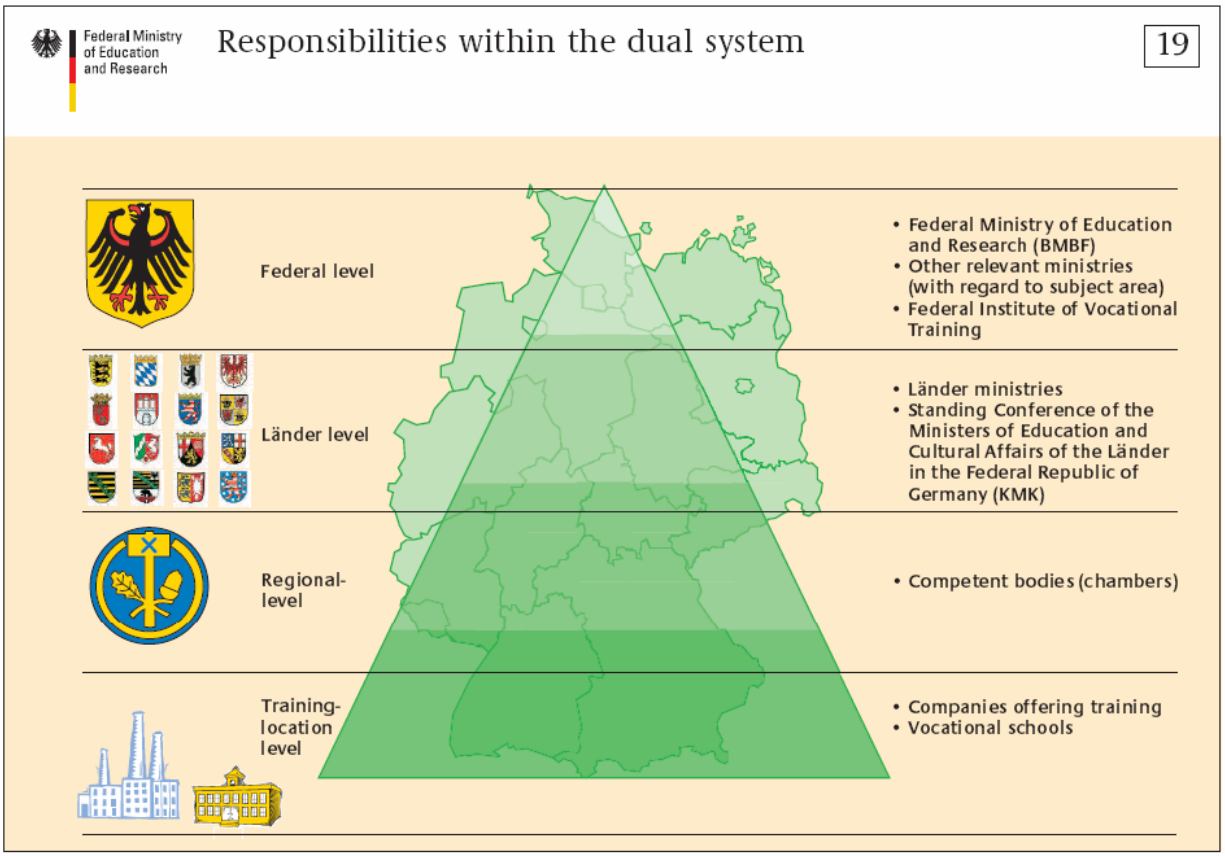
After the four-year primary-school period, which all pupils complete, educational pathways diverge within Germany's "divided school system", which consists of secondary modern schools (Hauptschule), secondary schools (Realschule), grammar schools (Gymnasium) and, in nearly all Länder, comprehensive schools (Gesamtschule). The different pathways often reconverge within the dual system, which accepts graduates of special schools, secondary-modern schools, secondary schools, comprehensive schools, vocational schools and grammar schools.

The dual system is far and away the largest educational area within secondary sector II: two-thirds of each age group learn a recognised occupation requiring formal training. The great majority of graduates of dual-system training then work as skilled employees – and many later make use of opportunities for vocational further training. [BMBF 2003,1].

In the dual system, a combination of learning and working provides the basis for teaching vocational skills. The system seeks to teach theory and practice, and to impart structured knowledge and active competence, in their proper context. The different learning sites involved, the company and the vocational school, interact in keeping with their different emphases, but their tasks are not rigidly divided: school is not reserved solely for teaching theory, and in-company training involves more than simply practice.

Under the dual system, vocational schools and companies have a joint educational responsibility. Trainees spend one or two days in vocational school and three or four days in their company [BMBF 2003, 4].

Figure 2 shows the responsibilities in the German dual VET-System. These will be explained from the bottom to the top.



The German dual system and its responsibilities [BMBF 2003, 19]

On the **training-location level**, the PPP (Private Public Partnership) of companies and vocational schools are shown in the diagram. They are mostly the beneficiaries. In the context of the report we will focus on the vocational schools.

On the **regional level** the chambers of industry and commerce (Industrie- und Handelskammer, IHK) and the craft chambers (Handwerkskammer, HWK). They are among other things charged with registering training agreements and with establishing examination boards for intermediate and final examinations in vocational training and further training.

The German Federation consists of 16 Bundesländer (**Länder level**). The Länder are largely responsible for education and cultural affairs for that every Bundesland has its own funding programs and instruments.

The guiding and co-ordinating ministry on the **federal level** is the Federal Ministry of Education and Research (BMBF). Other relevant federal ministries also issue ordinances and co-ordinate with the BMBF (their provisions are subject to the approval of the BMBF)

From this short introduction into the German VET-System and its responsibilities the next section focuses on the funding opportunities.

Funds and programs for vocational education and training (VET)

In the following principle funding opportunities in the field of VET are shown. Very often these funds are not specified on a certain technologies (e.g. fuel cells), in fact they mostly support actions or investments for infrastructure (e.g. funding of seminars, workshops, laboratories etc…). This means: The subsequent listed programmes are 'technology-open' and offer a chance for implementing the fuel cell topic. In section "c" we will go the other way round and will have a look at how education and training measures can be considered in R&D funding programmes for fuel cells.

The following statements are based on a new and comprehensive analysis of VET-funding and further training on federal and Länder level [BMBF 2011]. The analysis identified 195 programs [BMBF 2011, 10). These are split into grants on European-, Federal- and Länder-Level. Depending on the program individuals persons, enterprises or institutions can place proposals. Funds are mostly available for specific measures or for investments in infrastructure. For this reason most of the calls only exist in German and the translation for this deliverable intends to give an idea what is behind the program. It doesn't claim to be an accurate word by word translation. At first funding opportunities on federal level will be presented:

2.1.1.1 Funding by the Federation

On the federal Level 34 VET-program (out of 195) are mapped in the analysis [BMBF 2011, 64-66]. Most of them are not specific for a certain technology. The opportunities to submit proposals concerning fuel cells and Hydrogen have to be discussed with the providers of funds. The three suggestions below can be seen as examples in the wide and broad field of funding opportunities for VET.

- ✓ *Informations- und Schulungsveranstaltungen sowie Workshops (Information- and training courses plus workshops)*

• Ministry: Federal Ministry of Economics and Technology (BMWi), co-financed by ESF (European Social Funds)

• Responsible department / project agency: Federal Office of Economics and Export Control (BAFA)

• Tasks supported: Information meetings, training courses, workshops (e.g. congresses for know-how transfer, Entrepreneurship seminars). A wide range of events on setting up in business. The consultations and training focus in particular on the craft sector, the liberal professions, the retail trade and other services.

• Who can be beneficiary? Provider for trainings and seminars, e.g. chambers for trade (HWK) or chambers for commerce and industry (IHK), private enterprises and consultants

• Budget and duration: Seminars and training can be subsidized with 50 € per hours with a maximum of 1.200 € for seminars over 24 hours). Workshops are supported with 300€ per participant.

•details:http://www.bafa.de/bafa/de/wirtschaftsfoerderung/informations_und_schulungsveranstaltungen/index.html

✓ *Seminarförderung im Handwerk 2010 (Funding of seminars in the trade sector)*

• Ministry: Federal Ministry of Economics and Technology (BMWi),

• Responsible department: Zentralverband des Deutschen Handwerks (ZDH)

• Tasks supported: Trainings for management and decision makers in the trade sector and in SME.

• Who can be beneficiary? Commercial providers for training and seminars, vocational trainings offered by chambers and unions

• Budget and duration: The maximum support is 528 € per day (10 participants). The maximum share of funding is at 33 %.

• Details: http://www.bmbf.de/pub/band_zwoelf_berufsbildungsforschung.pdf

✓ *Förderung von Vorhaben zur Weiterentwicklung und zum Einsatz von Web 2.0 Technologien in der beruflichen Qualifizierung (Funding of projects to advance Web 2.0 Technologies in vocational training)*

• Ministry: Federal Ministry of Education and Research (BMBF),

• Responsible department:/ project agency: Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)

• Tasks supported: Among others, the advance of Web 2.0 technologies with the aim to improve processes in learning, training and qualification.

• Who can be beneficiary? Educational institutions, R&D centres, universities, enterprises, Networks, Unions and consortia

• Budget and duration: Up to 100% of eligible expenditure for universities, R&D centres and comparable institutions. Maximum of 50% for project-related costs for enterprises. Calls can be submitted until June 2012.

• Details: http://www.bmbf.de/foerderungen/15087.php

2.1.1.2 Funding by the German 'Länder'

Because of the important role of the 'Bundesländer' (usually simply called 'Land') in the German federation every Land has its own funding mechanism. The mentioned analysis by BMBF identified in 152 programmes in the 16 Länder of Germany. An allocation which program runs in which Land can be found in BMBF 2011, p.67-77.

To get an access for this deliverable we choose as an example the Land of "Baden-Württemberg". For Baden-Württemberg 9 programs are listed. On the portal "Forbildung-bw" (www.fortbildung-bw.de) all funding programs in Baden-Württemberg are clearly presented. For vocational further-training the ESF-Funds play an important role. Next, one ESF-program will be presented as an example.

✓ *Förderprogramm Fachkurse (Funds for vocational training courses)*

- Ministry: Ministerium für Finanzen und Wirtschaft Baden-Württemberg, ESF-Fund
- Responsible department:/ project agency: L-Bank
- Tasks supported: Vocational training courses (Fachkurse) with a minimum of 8 persons and a maximum of 240 lessons.
- Who can be beneficiary? Public and private providers for vocational training. The offers of the provider must on the market for three years.
- Budget and duration: Grants to the participation fees of 30%. Participants over 50 years are subsidized with 50%.
- Details: http://www.fortbildung-bw.de

2.1.1.3 Funding by the National Innovation Programme for Hydrogen and Fuel Cell Technology" (NIP)

The German Federal Government supports the further development and introduction of fuel cell and Hydrogen technologies through targeted funding under the "National Innovation Programme for Hydrogen and Fuel Cell Technology" (NIP) drawn up jointly by the Federal Ministries of Transport, Building and Urban Affairs (BMVBS), Economics and Technology (BMWi), Education and Research (BMBF) and Environment, Nature Conservation and Nuclear Safety (BMU).

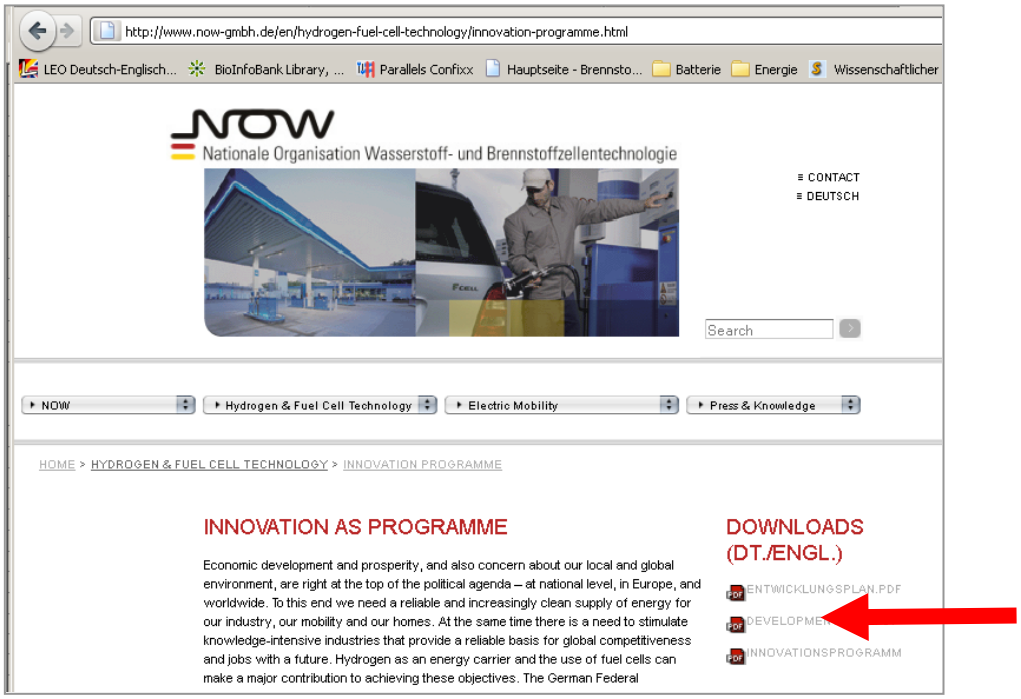
Under the NIP, additional €500 million assistance has been earmarked for this technology over the next ten years. Assuming continuation of the federal R&D assistance which has been running successfully for years for fuel cells and hydrogen – above all from the Federal Ministry of Economics and Technology – up to €1.4 billion is available during the period 2007 to 2016, taking into account the complementary funds from industry and users. To these resources must be added funds from the Federal Ministry of Education and Research for basic research and institutional assistance for major research establishments in this field. This means the intensive continuation and marked expansion of existing activities of the Federal Government, industry and research, and the setting of new priorities.

The activities of the NIP are described in the "National Development Plan", which represents the basis for the Federal Government's measures to promote hydrogen and fuel cell technologies.

There is no specific call under the NIP for education and training projects. But measures can be considered as tasks or work packages in demonstration or lighthouse projects. For example in the lighthouse project CALLUX, a project for demonstration CHP-units run by fuel cells, a working group is developing training materials and courses for technicians in this field.

The facts of the NIP are summarised below:

Name of the funding program:	**NIP - National Innovation Programm Fuel Cell and Hydrogen Technologies**
Name of the call:	Calls exist for demonstration and lighthouse projects in four areas: 1. Transport, including hydrogen infrastructure 2. Household energy applications 3. Industrial applications 4. Special markets for fuel cells
Start and End of the funding / duration:	2008 - 2016. 1.4 Mrd. EUR for the whole programm. 48% from the German government, 52% from the project partners.
www-Link to the program / contact information:	www.now-gmbh.de
Short descriptuion:	There is no specific call for education and training. But the topic can be considered as a WP in the demonstration and lighthouse projects. See above.
Comments:	WBZU is currently partner in the NIP-project "Callux". In a WP in this projekt teaching materials for fuel cell CHP are developed. First results are availible on: www.callux.net/home.Marktpartner.html



As shown there are many different funding opportunities for VET on the federal and on Länder-Level that exist in Germany. The presented analysis of the Federal Ministry of Education and Research (BMBF) identified 195 programs [BMBF 2011, 10). These are split into grants on European-, Federal- and Länder-Level. Depending on the program individuals persons, enterprises or institutions can place proposals. Funds are mostly available for specific measures or for investments in infrastructure. For an established vocational school which already has experience in VET-funding programs it might be easier to place proposals in these programs.

On the other hand for training centres with an academic focus (e.g. institutes for further training at universities or R&D centres) they will be more familiar with the in section mentioned National Innovation Programme for Hydrogen and Fuel Cell Technology" (NIP). The NIP program a R&D and demonstration program with no specific calls for education and training.

Sources to the chapter:

BMBF (2003): Germany's Vocational Education at a glance.

Website: http://www.bmbf.de/pub/germanys_vocational_education_at_a_glance.pdf.

BMBF (2011): Bestandsaufnahme und Konsistenzprüfung beruflicher Weiterbildungsförderung auf Bundes- und Länderebene. Band 12 der Reihe Berufsbildungsforschung. Website: http://www.bmbf.de/pub/band_zwoelf_berufsbildungsforschung.pdf

2.1.2 Spain

First, it is worth mentioning that there are no funds or specific funding programmes for training and educational in the field of hydrogen and fuel cells. This type of programmes do not exist neither in local, regional or national institutions.

The possibilities of funding for this type of training are two-fold:

2.1.2.1 Financial support from the educational administration

On the one hand from the Ministry of Education and Science (http://www.micinn.es) exists financial supports that are available for different curricula.

In this case, it does not depend much on the course content but on the different training levels that can be offered and the different course formats or types that can be designed, whether they are accredited, postgraduates, short training courses, seminars, etc.

The financial support is organized in two major groups: university and non-university studies.

http://www.educacion.gob.es/educacion/becas-y-ayudas/centros-docentes.html

Here we can access the various funding programs to schools in three areas:

- University: http://www.educacion.gob.es/educacion/becas-y-ayudas/centros-docentes/universitarios.html
- No University: http://www.educacion.gob.es/educacion/becas-y-ayudas/centros-docentes/no-universitarios.html
- Other entities: http://www.educacion.gob.es/horizontales/servicios/becas-ayudas-subvenciones/centros-docentes-entidades/entidades.html

Each of the mentioned programs has a specific link to it in order to review the terms of the call and funding opportunities. The format consists of presentations of the different funding programmes with the most varied purposes, whether strictly educational or complementary to teaching, such as training of teachers, work experience, etc.

Following we present programs that can provide financing options in training projects in hydrogen technology and fuel cells.

- ✓ *Addressed to non-university educational centers.*

a. Programa de centros de educación ambiental (Environment educational program)

http://www.educacion.gob.es/horizontales/servicios/becas-ayudas-subvenciones/centros-docentes-entidades/no-universitarios/becas-educacion-ambiental.html

- Objectives: Environmental awareness and energy saving
- Addressed to: Training Centres of compulsory secondary education
- Economic: 161.000 €

b. Programa de rutas científicas 2011-12. (Scientific routes program 2011-12)

http://www.educacion.gob.es/horizontales/servicios/becas-ayudas-subvenciones/centros-docentes-entidades/no-universitarios/becas-rutas-cientificas.html

- Objectives: Collaboration between training centres in technical and scientific release
- Addressed to: Training Centres of compulsory secondary education
- Economic: 650.000 €

- ✓ *Addressed to other entities.*

a. Ayudas económicas para la realización de actividades estatales de formación permanente del profesorado durante el año 2011, por asociaciones e instituciones sin ánimo de lucro (Training for teachers in technical areas)

http://www.educacion.gob.es/horizontales/servicios/becas-ayudas-subvenciones/centros-docentes-entidades/entidades/ayudas-entidades-estatal.html

- Objectives: Training programs for teachers in technical knowledge
- Addressed to: Associations and non profit entities.
- Economic: 650.000 €

b. Ayudas económicas para la realización de actividades de formación permanente del profesorado en el ámbito de gestión del Ministerio de Educación durante el año 2011, por asociaciones e instituciones sin ánimo de lucro. (Training for official teachers in technical areas)

http://www.educacion.gob.es/horizontales/servicios/becas-ayudas-subvenciones/centros-docentes-entidades/entidades/ayudas-entidades-ambito-gestion.html

- Objectives: Training programs for ministry of education teachers in technical knowledge
- Addressed to: Associations and non profit entities.
- Economic: 80.000 €

2.1.2.2 Financial support from the science and technology administration

On the other hand, there is the possibility of non-strictly educational funding, through research plans or research cooperation, invoking different possibilities of funding to R+D from different institutes that depend on official entities such as the Spanish Government and the different autonomous governments.

All of them are included by the Ministry of Science and Technology in three development platforms of R&D&I as follows:

- ✓ *R&D&I National Plan*

The Ministry of Science and Technology (http://www.micinn.es) has a full line of support through R&D&I National Plan.

The National Plan for Scientific Research, Technological Development and Innovation (R+D+I National Plan) is the planning tool that the Spanish System of Science, Technology and Enterprise counts on, for the achieving of aims and priorities of research and technologic development and innovation policies in our country in a medium term, according to the Law on Science and the National Strategy of Science and Technology (in Sp. ENCYT).

http://www.micinn.es/portal/site/MICINN/menuitem.7eeac5cd345b4f34f09dfd1001432ea0/?vgnextoid=83b192b9036c2210VgnVCM1000001d04140aRCRD

Different funding programmes directed to research and development are organized through this plan, in which plans for hydrogen and fuel cells research can be found.

http://www.micinn.es/portal/site/MICINN/menuitem.94f5cc1dd5adb3dc81ebe01001432ea0/?vgnextoid=fae4b9746e160210VgnVCM1000001034e20aRCRD&vgnextchannel=fae4b9746e160210VgnVCM1000001034e20aRCRD

We present programs that can provide financing options in training projects in hydrogen technology and fuel cells:

a. LIA de Recursos Humanos (Human resources) Programa nacional de formación de Recursos Humanos (National Program of Human Resources training).

Subprograma de Formación de Personal Investigador (Research staff training)

http://www.micinn.es/portal/site/MICINN/menuitem.dbc68b34d11ccbd5d52ffeb801432ea0/?vgnextoid=07ffe142b621d210VgnVCM1000001d04140aRCRD&vgnextchannel=8da5b9746e160210VgnVCM1000001034e20aRCRD

- Objectives: Training programs for research staff
- Addressed to: Research and development entities
- Economic: 78.725.680 €

b. LIA de Proyectos de I+D+I (Research and development projects)

Programa Nacional de Proyectos de Investigación Fundamental (National program of Research and Development).

Subprograma de Acciones complementarias a los proyectos de investigación fundamental no orientada (Complementary actions program).

http://www.micinn.es/portal/site/MICINN/menuitem.dbc68b34d11ccbd5d52ffeb801432ea0/?vgnextoid=f02093ee6b80d210VgnVCM1000001d04140aRCRD&vgnextchannel=3acb282978ea0210VgnVCM1000001034e20aRCRD

- Objectives: Complementary actions to research programs
- Addressed to: Research and Development entities
- Economic: 21.000.000 €

c. LIA de Utilización del Conocimiento y Transferencia Tecnológica (Knowledge application and technology teaching)

Programa Nacional de Transferencia Tecnológica, Valoración y Promoción de Empresas de Base Tecnológica (Supporting of technological based entities).

c.1: Subprograma de Apoyo a la Función Transferencia en Centros de Investigación (INNCIDE) (Supporting of technology teaching from research entities).

http://www.micinn.es/portal/site/MICINN/menuitem.dbc68b34d11ccbd5d52ffeb801432ea0/?vgnextoid=59f1e6a2308ee210VgnVCM1000001d04140aRCRD&vgnextchannel=6dd089cd0f687210VgnVCM1000001d04140aRCRD

- Objectives: Funding program to support training actions from research centres.
- Addressed to: Official technology training offices.
- Economic: 7.000.000 €

c.2: Subprograma NEOTEC. NEOTEC program.

http://www.micinn.es/portal/site/MICINN/menuitem.dbc68b34d11ccbd5d52ffeb801432ea0/?vgnextoid=c618c30a4b2f1210VgnVCM1000001d04140aRCRD&vgnextchannel=5f77d3342fee1210VgnVCM1000001d04140aRCRD

- Objectives: Funding program to support technology based projects
- Addressed to: Technological products or service providers.
- Economic: Invest founds.

✓ *Centre for Industrial Technological Development (in Sp. CDTI)*

The Centre for Industrial Development Centre (in Sp. CDTI, http://www.cdti.es) is a Public Business Entity accountable to the Ministry of Science and Innovation, which promotes the technological development and innovation of Spanish companies. From 2009 is the entity of the Ministry of Science and Innovation that channels the applications for funding and support for R+D+I projects of Spanish companies in national and international ambits. Thus, the aim of CDTI is to contribute to the improvement of the technological level in the Spanish companies through the development of different activities.

Through this public enterprise there are articulated several fundings aimed at the research and development promotion in technology and in all type of institutions and companies.

http://www.cdti.es/index.asp?MP=7&MS=17&MN=2

We present programs that can provide financing options in training projects in hydrogen technology and fuel cells:

Resoluciones CENIT. CENIT agreements.

http://www.cdti.es/index.asp?MP=7&MS=23&MN=3&r=1280*800

- Objectives: Project financing of public-private research and knowledge management in future technological areas
- Addressed to: All kind of entities
- Economic: Investments in 2006-2010. 1.071.000.000 €

✓ *Spanish Foundation for Science and Technology (in Sp. FECYT)*

The Spanish Foundation for Science and Technology (in Sp. FECYT, http://www.fecyt.es) is a Foundation of the State Public Sector constituted on 5th June 2001. FECYT is tool of the Ministry of Science and Innovation (in Sp. MICINN), to strengthen the value chain of knowledge by promoting science and innovation and its integration and approach to the society, meeting the needs and expectations of the Spanish System of Science, Technology and Enterprise (in Sp. SECTE).

FECYT is an institution more aimed at the training and dissemination of knowledge than CDTI, which is more aimed at the direct company application.

Through this public institution there are articulated several fundings aimed at promoting the transfer of technical and scientific knowledge.

http://www.convocatoria2011.fecyt.es/Publico/Bases/Bases.aspx

We present programs that can provide financing options in training projects in hydrogen technology and fuel cells:

a. Línea de actuación 3 (Funding line 3)

Redes de divulgación y comunicación de la ciencia y la innovación (Release networks to science and innovation)

http://www.convocatoria2011.fecyt.es/Publico/Bases/__Recursos/BasesConvocatoria.pdf

- Objectives: Funding of collaboration projects between researchers, training entities and media to release technological knowledge.
- Addressed to: Training and research entities
- Economic: 4.000.000 €

There are several ways to access support programmes for hydrogen and fuel cells teaching plans but there are not specific channels that favour particularly the transfer of knowledge of that technology.

This leads us to state that there exist possibilities but they are not guaranteed and are always subject to fulfilling certain requirements which are not exclusive of this technology but relative to the type of training offered or the Research and Development programme where they can be incorporated.

Finally below is a brief summary of the current state of funding opportunities:

Economics:

Analyzed by adding all possibilities we can access funding schemes which in total manage:

- From educational institutions: 1.491.000 €
- From science and technology institutions: 110.000.000 €. Specially signed CENIT agreements with 1.071.000.000 € in the period 2006-2010

Funding programs available nowadays:

- 12-15 programs

Funding programs by addressed:

- 40% Research entities
- 30% Training centres
- 30% All kind of entities

Duration of funding programs:

- 90% annual.

2.1.3 Italy

Vocational training in Italy is mainly the responsibility of the Regions: the scholar path is parallel but in some way different from schooling, directed by the National Ministry of Instruction (MIUR, http://www.miur.it). In Italy the vocational training centers provide a two / three years of study with a prevalence of practical subjects specialized in the sector in order to achieve a professional qualification.

An important contribution to vocational training is also provided by private training institutions offering specialized training content on specific areas of professional learning. Many courses offered by private institutions are free of charge as financed from the resources of the EU European Social Fund.

The accreditation of training centers has been initiated by the Ministry of Labour Decree No 166, May 26, 2001, implemented by the Regions, pursuant to art. 117 of the Constitution, are then applied independently, and often in a quite different way, the general criteria for the recognition of training centers.

State vocational institutions (National Ministry of Instruction, MIUR) are characterized by a more complex path. In particular, a curriculum that can be up to 5 consecutive years with intermediate skills. It begins with a two-year basis, shared with other colleges, followed by one year (the third) of competency in a specific professional field.

The purpose of the initial two year period is to orient and make the student more aware in the specialty choice of business address, as provided in the third year of attendance.

The course can be completed at the end of the third year with the acquisition of a diploma or qualification, acquired the professional qualification, it is possible to access a subsequent two-year course, called post-qualification, which concludes with an examination State. In this case, the course ends like every other secondary school, with the possibility of access to degree courses.

Global structure of funds for vocational training in Italy can be divided is the three following streams:

1. System lifelong training (Inter-professionals funds)
2. European Social Funds
3. IFTS (Instruction for High Professional Training)

Each stream of funds follows specific rules, time, budget and topics.

2.1.3.1 Inter-Professional Funds

In Italy the concept of lifelong learning stems from a Social Pact, and it is defined as an individual, company, or sector learning plan and translated into educational projects financed by the Fund for Inter-professional Lifelong Education. In order to access training the employees working for companies associated to an Interprofessional-Fund are paying every year a 0.3% fee to the National Institute for Social Security (INPS, Istituto Nazionale per la Previdenza Sociale).

Companies and accredited training agencies may propose projects in education, contributing to the use of these important resources.

The objectives of the training financed by the Inter-Fund are set out in the public notices that each Fund issued on the basis of the collected resources. These objectives can be recognized by professional and work organization of the company, or be aimed at acquiring information and / or skills required type (health and safety in the workplace) or skills / interests of individual type where the employee can also be accessed individually. Any educational objective recognized and funded by an Inter-Fund must still be subject to an agreement between the training agency and the fund manager. A third party will be in charge for the technical evaluation of the training projects content.

Every company can choose different managers of the Equal Interprofessional Fund (Fondi Paritetici Interprofessionali) depending in general on the field of activity. Most of the fund managers are promoted by organizations representing the Social Pact through specific agreements concluded by unions of employers and workers at national level.

Each sector of industry, agriculture, commercial and crafts can set up its own fund; “inter-confederal” Agreements may provide for the establishment of funds for different sectors and, within them, the establishment of a special section for the training of managers.

In 2003, with the establishment of the first ten joint funds, is made as provided by law 388 of 2000, which allows companies to allocate the share of 0.30% of contributions paid to INPS (the so-called "contribution required for involuntary unemployment ") to the training of their employees. Employers will be able to apply to transfer to INPS contribution to one of joint funds, which will finance training activities for employees of member companies.

Funds to date constituted and authorized representative of a large part of the business community and workers, are:

- Fondo Artigianato Formazione – Fondo per la formazione continua nelle imprese artigiane
- Fon.Coop – Fondo per la formazione continua nelle imprese cooperative
- Fondimpresa – Fondo per la formazione continua
- Fondo Dirigenti PMI – Fondo per la formazione professionale continua dei dirigenti delle piccole e medie imprese industriali
- Fondo Formazione PMI – Fondo per la formazione continua per le piccole e medie imprese
- FONDIR. – Fondo per la formazione continua dei dirigenti del terziario
- FOR.TE. – Fondo per la formazione continua del terziario
- Fondirigenti – Fondirigenti Giuseppe Taliercio (Fondazione per la formazione alla dirigenza nelle imprese industriali)
- FON.TER. – Fondo per la formazione continua dei lavoratori dipendenti nelle imprese del settore terziario: comparti turismo e distribuzione servizi
- Fondoprofessioni – Fondo per la formazione continua negli Studi Professionali
- Fond.E.R. - Fondo per la formazione continua degli Enti Religiosi
- Fon.Ar.Com. - Fondo per la formazione continua nei comparti del terziario, dell'artigianato e delle piccole e medie imprese
- For.Agri. - Fondo di settore per la formazione professionale continua in agricoltura
- Fondazienda - Fondo per la formazione continua dei quadri e dipendenti dei comparti commercio-turismo-servizi, artigianato e piccola e media impresa.
- Fondo Banche Assicurazioni - Fondo per la formazione continua nei settori del credito e delle assicurazioni
- Formazienda - Fondo per la formazione continua nel comparto del commercio, del turismo, dei servizi, delle professioni e delle piccole e medie imprese
- Fonditalia - Fondo per la formazione continua nei settori economici dell'industria e piccole e medie imprese
- Fondo Formazione Servizi Pubblici - Fondo per la formazione continua nei servizi pubblici

Each company is free to ask for joint funds for its employees following specific needs of the sector, for industry and commerce, and of the territory (for tourism sector). The choice of the topic is free and open, giving the companies a good and fast opportunity to fulfil their training plans for the employees.

In addition to finance, in whole or in part, the training plans, with the changes introduced by article. 48 of Law 289/02, the Inter-professional Funds will also support individual training plans, as well as other activities in preparation for or related to educational initiatives.

The Ministry of Labour and Social Policy is due to perform alongside the tasks of supervision and control, a strategic monitoring of funded activities.

More detailed information on Inter-Professional Funds can be found on http://www.fondinterprofessionali.it/

Name of the funding program:	Inter-Professional Funds
Name of the call:	Fondi Interprofessionali
Start and End of the funding / duration:	Annual
www-Link to the program / contact information:	www.fondiinterprofessionali.it
Short descriptuion:	*These funds are directly allocated by the companies with the national institute for social security. Company can choose different fund manager closer to the type of activity.*
Comments:	

2.1.3.2 European Social Fund

The European Social Fund (ESF) is the main financial instrument for which the EU uses to support employment in the Member States as well as to promote economic and social cohesion. The ESF funds amounted to about 10% of the total EU budget.

The ESF is one of the EU Structural Funds, which are dedicated to improving social cohesion and economic prosperity in all regions of the European Union. The Structural Funds are financial instruments that support re-distributive cohesion in Europe by focusing on their contributions to less developed regions. The specific objective of the ESF budget, or support the creation of more and better jobs in the EU, is pursued by co-financing national projects, regional and local levels aimed at increasing employment, job quality and inclusiveness of labor market in the Member States and their regions.

The level of ESF funding differs from one region to another depending on their relative wealth. EU regions are divided into four categories of eligible regions according to their regional GDP per capita compared to the EU and divided between the two objectives.

The convergence objective includes:

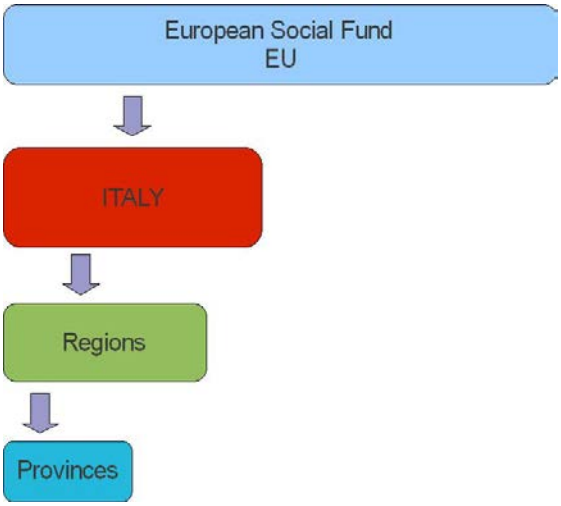
- Convergence regions with a GDP per capita of less than 75% of the EU-27 average;
- the "phasing-out", with a GDP per capita above the EU average at 75% but less than 75% of the EU-15 average.
- the "phasing-in", with a GDP per capita of less than 75% of the EU-15 average in 2000-2006, but higher in 2007-2013;
- regions of competitiveness and employment, or any other EU regions.

In the convergence regions, the project co-financing from the ESF can reach 85% of total costs, while in the competitiveness and employment is more common for co-financing of 50%. In the case of the regions and the richer Member States, the ESF funds complement existing initiatives for employment at the national level, whereas in the poorer Member States ESF funding may be the main source of funding for initiatives in employment.

In Italy ESF are managed by the Regional Government through the quinquennial Regional Operative Plan (POR FESR 2007-2013), and each Region delegates the Provincial Government for the operative handling of the training courses:

At Province Level all the Institutions recognized as training center can present training projects, on annual basis to access the funds.

The approval of the training Projects is done by the Provinces, using an external independent entity for the evaluation. Evaluation committee, which in general is a public entity (Industrial Union, Chamber of Commerce, and so on) is called to give feedback on the received training project proposals.



Funding flow simplified model

Name of the funding program:	FSE
Name of the call:	Fondo Sociale Europeo
Start and End of the funding / duration:	Annual call over a 5 years general program.
www-Link to the program / contact information:	www.fondosocialeeuropeo.it
Short descriptuion:	*Training centres can propose training programs every year in different topics. Evaluation of technical proposal is done by an external public body as Indistrial Union (Unione Industriale).*
Comments:	These funds are available all over Europe, but managed in different ways country by country.

2.1.3.3 IFTS (Istruzione Formazione Tecnica Superiore)

IFTS funds are managed at National Level by Indire (public entity, www.indire.eu) and then allocated to the Regions. These funds are partly co-financed by the Ministry of Education. In some Regions these funds are assigned to the so called IFTS Poles organized by categories like energy, agriculture and so on.

IFTS courses (minimum 1200 hours) are addressed to specialized technicians, young people with high school “diploma” and also workers.

Funds requested are managed by Provinces with the same structure of ESF following the roadmap indicated in the Regional Operative Plan (Piano Operativo Regionale, POR). In order to achieve more information on each Province offer in term of courses the province web sites publish more detailed information: www.provincia.xyz.it

whereby “xyz” is necessary to specify the name of the province for example “Torino”, “Milano”, “Venezia”, and so on (for example www.provincia.torino.it).

Each Region has its own budget, available from the official Regional Government portal www.regione.xyz.it, where "xyz" is the name of the Region, as Piemonte, Lombardia, Liguria, Lazio and so on (for example www.regione.piemonte.it).

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Even if there are many roads to reach the target, the Inter-Professionals Funds seems to be the best option for SMEs to request and be funded on a specific and dedicated program. Economic availability of Inter-Professional Funds depends on the annual turnover of the company that is requiring the training service.

On the other side funds from ESF are available also on this topic, but it must be organized by a professional/vocational training centre and not directly from an Industrial body.

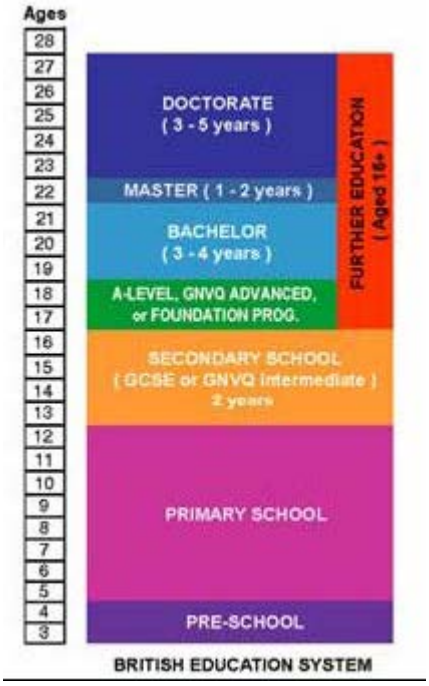
ESF funds are established at European level on a 5 year plan: 2007-2013 plan is actually running. Interaction on the future ESF plan is strongly recommended in order to highlight the need of training action in the hydrogen and fuel cell field.

2.1.3 United Kingdom

This section starts with a short review of the UK Education System

2.1.1.3 England

The education system in the UK is divided into four main parts, primary school education, secondary school education, further education and higher education. Children in the UK have to legally attend primary and secondary education which runs from about 5 years old until the student is 16 years old (see below).



The British educations System

Students are assessed at the end of each stage. The most important assessment occurs at age16 when students pursue their General Certificate of Secondary Education (GCSE). Once students complete their GCSE's they have a number of options to choose from.

- Find employment
- Academic Qualifications
- Vocational Qualifications

If students opt for carrying on with their education this will take two forms, either by pursuing further academic qualifications or by following a more vocational pathway.

Academic Qualifications

Full-time continuous education at colleges leading to A-levels (Advanced Level) then on to university for a degree followed by employment or post-graduate studies leading to an M.Sc or MA (Master degree in Science or the Arts) or PhD. The PhD can be funded by a variety of Research Councils such as, BBSRC, EPSRC, STFC of which more information is provided below or via sponsorship from an employer.

Name of the funding program:	**Engineering & Physical Sciences Research Council (EPSRC)**
Name of the call:	EPSRC operate a small number of flexible funding schemes. Open calls can be found at www.epsrc.ac.uk/funding/calls/open/pages/default.aspx
Start and End of the funding / duration:	Information can be found at the web address above.
www-Link to the program / contact information:	www.epsrc.ac.uk/default.aspx
Short description:	*EPSRC is the main UK government agency for funding research and training in Engineering and the Physical sciences. EPSRC has and continues to fund Hydrogen and Fuel Cell programmes*
Comments:	EPSRC leads the Research Councils UK Energy programme in which a number of the other research councils work together to develop & deliver energy research & training

Name of the funding program:	**Biotechnology & Biological Sciences Research Council (BBSRC)**
Name of the call:	BBSRC operate a number of research grant areas such as strategic longer and larger grants, new investigation scheme to assist early career researchers and Industrial partnership awards, plus other
Start and End of the funding / duration:	Calls issues on the website and others such as Industrial Partnership awards can be applied for at any time.
www-Link to the program / contact information:	www.bbsrc.ac.uk/home/home.aspx
Short description:	*BBSRC supports world-class research of contemporary science. BBSRC funds research in Plants, Microbes, Animals, Tools & technology underpinning biological research.*
Comments:	BBSRC's current budget is £470m, it supports a total of around 1600 scientists and 2000 research students in universities & institutes in the UK

Name of the funding program:	**Natural Environment Research Council (NERC)**
Name of the call:	NERC funds investoment through 3 funding streams, natural capability, research programmes and responsive modes. See www.nerc.ac.uk/funding/introduction.asp
Start and End of the funding / duration:	www.nerc.ac.uk/funding/
www-Link to the program / contact information:	www.nerc.ac.uk
Short description:	*NERC is the UKs main agency for funding and managing research, training and knowledge exchange in the Environmental Sciences ie climate change, environmental influences in human health etc*
Comments:	

Name of the funding program:	**The Science and Technology Facilities Council (STFC)**
Name of the call:	Funding & Grants: Fellowships, Joint grant scemes, funding for public engagement, research grants, research in industry funding etc
Start and End of the funding / duration:	www.stfc.ac.uk/funding+and+grants/501.aspx
www-Link to the program / contact information:	www.stfc.ac.uk/home.aspx
Short description:	*The Science & Technology Facilities Council keeps the UK at the forefront of international science addressing areas such as UK future energy needs, monitoring & understanding climate change,*
Comments:	The council has a broad science portfolio and works with the academic & industrial communities in areas such as material science, microelectronics, alternative energy production etc

2.1.3.2 Scotland

Scotland also has its own educational system - the SQA (Scottish Qualifications Authority). In England they study for GCSE's and A-levels, and in Scotland they study for Standard Grades, Highers, and Advanced Highers. That also means it usually takes two years to study for an advanced level qualification in England, and three years in Scotland. A university education is free in Scotland however in England students still have to pay their university fees.

Traditionally, the Scottish system at secondary school level has an emphasis on breadth across a range of subjects, while the English, Welsh, and Northern Ireland systems emphasis greater depth of education over a smaller range of subjects.

Following this, Scottish universities generally have courses a year longer (typically 4 years) than their counterparts elsewhere in the UK, though it is often possible for students to take more advanced specialised exams and join the courses at the second year.

Individual Learning Accounts Scotland

Individual Learning Accounts Scotland (ILA Scotland) is a Scottish Government scheme for anyone aged 16 or over who lives in Scotland. If they earn £22,000 a year or less or are on benefits, they can apply for an ILA account that will give up to £200 a year towards a wide range of courses from learning providers throughout Scotland.

If on a low income or benefits and want to study part-time at college or university, they may be able to get an award of up to £500 a year. More information about the ILA Scotland scheme from the ILA Scotland website at: www.ilascotland.org.uk

Vocational qualifications

Scotland's further education colleges provide education for those young people who follow a vocational route after the end of compulsory education at age 16. They offer a wide range of vocational qualifications to young people and older adults, including Scottish Vocational Qualifications (SVQs), Higher National Certificates (HNC) and Higher National Diplomas (HND). Frequently, the first two years of higher education, usually in the form of an HND can be taken in a further education college, followed by attendance at university.

2.1.3.3 Vocational Qualifications

For students who are not so academically minded, they still have the option to further their education by studying a vocational course that will provide them with a more hands on experience and education.

The most popular vocation programs include:

(a) The Business and Technology Education Council (BTEC) Awards

(b) National Vocational Qualification (NVQ)

(c) City and Guilds Qualification

(d) Apprenticeships

(a) **The Business and Technology Education Council (BTEC**) is the British body which awards vocational qualifications. BTEC qualifications are undertaken in vocational subjects ranging from Business studies to Engineering. They are equivalent to other qualifications such as the GCSE (levels 1 to 2), A Level (level 3) and university degrees (levels 4 to 6).

(b) **National Vocational Qualifications (NVQs**) are work based awards in England, Wales and Northern Ireland that are achieved through assessment and training. In Scotland they are known as Scottish Vocational Qualification (SVQ).

To achieve an NVQ, candidates must prove that they have the ability (competence) to carry out their job to the required standard. NVQs are based on National Occupational Standards that describe the 'competencies' expected in any given job role. Typically, candidates will work towards an NVQ that reflects their role in a paid or voluntary position. For example someone working in an administration office role may take an NVQ in Business and Administration. There are five levels of NVQ ranging from Level 1, which focuses on basic work activities, to Level 5 for senior management.

(c) **The City and Guilds of London Institute (City & Guilds)** is a leading United Kingdom vocational education organisation. City & Guilds offers more than 500 qualifications over the whole range of industry sectors through 8500 colleges and training providers in 81 countries worldwide. Two million people every year start City & Guilds qualifications, which span all levels from basic skills to the highest standards of professional achievement (Honours, Master and Doctorate levels equivalent).

(d) **Apprenticeship** is a system of training a new generation of practitioners of a particular skill. Apprenticeships have a long tradition in the United Kingdom and apprentices build their careers from apprenticeships. Most of their training is done while working for an employer who helps the apprentices learn their trade, in exchange for their continuing labour for an agreed period after they become skilled. Theoretical education may also be involved, informally via the workplace and/or by attending vocational schools while still being paid by the employer.

In the 1970's Apprenticeships used to be the main route from secondary school to skilled training in professions such as fitters, electricians, plumbers etc. Over the years apprenticeships declined nationally in many cases being replaced by other Government initiatives such as the Youth Training Scheme (YTS).

Apprenticeships are now experiencing something of a renaissance and there is currently much more interest in the development of apprenticeships in the UK, this may provide opportunities for Hydrogen and Fuel Cell technologies.

With respect to vocational training in the UK there are numerous institutions and organisations who have specific involvement generally and also those who focus on particular business sectors i.e. sport, social care IT, Process Industries etc (see below for examples) again potential opportunities for the development of Hydrogen and Fuel Cell courses, modules.

Current examples of vocational training organisations

Cogent (www.cogent-ssc.com) is the Sector Skills Council (SSC) for the Chemicals, Pharmaceuticals, Nuclear, Oil and Gas, Petroleum and Polymer Industries. They are licensed by the British Government to help employers in these science-using industries to address their workforce development needs so that they can compete successfully.

What they do?

- The voice of employers on skills: are providing the collective voice of employers on skills to influence Government and public providers of skills, education and training.
- Designing qualifications: develop fit-for-purpose and future focused, standards based qualifications.
- Attracting young people into the sector: work to attract young people into the Cogent sector; helping to shape the STEM (Science, Technology, Engineering and Mathematics) curriculum and promoting careers.
- Understanding industry skills needs: through in-depth labour market research providing an industry-by-industry picture of skills.

Train to Gain Funding & the Cogent Sector Compact

In direct response to priorities indicated by employers, the Cogent Sector Compact secured government funding for sector-specific qualifications for employees who already have Level 2 qualifications (known as "additional" qualifications under Compact flexibilities). The Sector Compact is integral to the Train to Gain offer to employers and is a cornerstone in their drive to raise skills levels in the Sector. These additional full Level 2 and 3 qualifications previously fully-funded through Train to Gain are now co-funded by employers (with an expected employer

contribution of 50%). These fall under the new banner of "eligible retraining qualifications". This provision is available from providers with delivery contracts with the Skills Funding Agency, subject to availability of places.

Joint Investment Programme

Cogent and the Academy for the Process Industries secured over £2m of support for training in the sector from the Government. Only 5 Sector Skills Councils have been given the go ahead to deliver innovative co-funded programmes critical to the UK economy and in direct response to employer demand. In reflection of the current economic climate, it is clear that employers will be encouraged by government to co-fund training that is supported by government initiatives. Thus, the Joint Investment Scheme will partner Academy assured providers with sector employers with proven demand. Employers and Providers who expressed early interest in the programme have already received allocations of funding for the first year.

Part of Cogent is the National Skills Academy (NSA) – (www.process.nsacademy.co.uk)

The National Skills Academy

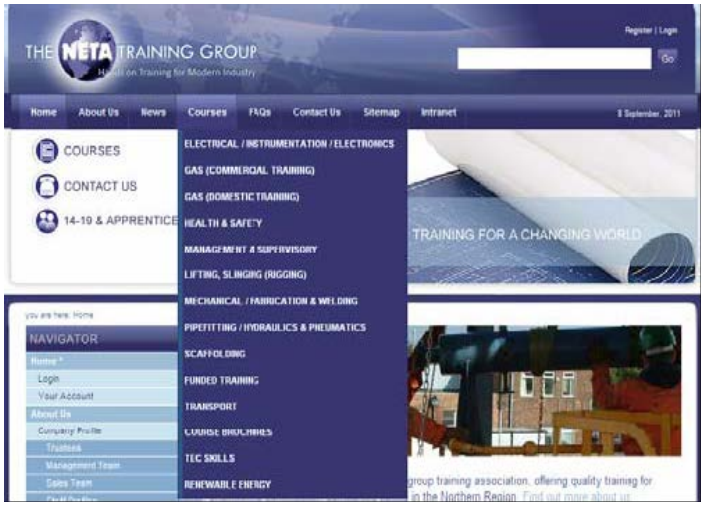
The National Skills Academy network is a unique structure of employer led centres of excellence for skills training. The network consists of a diverse range of business sector specialists

For example:

- NSA -Sport & Active Leisure
- NSA -Social Care
- NSA -IT
- **NSA -Process Industries**

The National Skills Academy for **the Process Industries** is an employer-led centre of excellence launched to address skills and training needs throughout the Chemical, Polymer, and Pharmaceutical Manufacturing sectors. The academy works alongside training providers and educational bodies to ensure that more people enter the industry equipped with the skills the industry needs.

A range of UK organisations delivering Vocational training



Funding

Apprenticeships

Apprenticeship funding is available from the National Apprenticeship Service (NAS). The size of the contribution varies depending on the sector and the age of the candidate. If the apprentice is aged 16-18, they will be eligible for 100 per cent of the cost of the training; if they are 19+, they will be eligible for up to 50 per cent. NAS are also prepared to consider funding upskilling an individual from level 2 to level 3 as a "Mature Apprentice", which may be critical for employers with an aging workforce. The funding is paid direct to the provider and supporter of the apprentice, unless you are a large employer with a direct contract with the National Apprenticeship Service.

For more about apprenticeship programmes in England, go to: www.apprenticeships.org.uk.

For more about apprenticeship programmes in Wales, go to www.careerswales.com

For more about apprenticeships in Scotland, go to www.skillsdevelopmentscotland.co.uk

Skills Funding Agency – in partnership with the UK Government Department for Business, Innovation and Skills (BIS)

The Skills Funding Agency welcomes approaches from training organisations wishing to be considered by the Skills Funding Agency for the provision of education and vocational training services. As a starting point, new providers are advised to consult the 'How we work with you' and 'Our programmes' pages of the Skills Funding Agency's website (http://skillsfundingagency.bis.gov.uk/providers/newproviders) to ensure that the programmes and qualifications organisations wish to offer are among those that are funded.

Within the UK the main route for training in Hydrogen and Fuel Cells is via academic qualifications leading to a degree and/or PhD in Fuel Cells or another technical subject such as chemical Engineering with a fuel cell component in it.

There are currently no known vocational training courses specific to hydrogen or fuel cells, there are however a number of organisations such as the Pure Energy Centre who hold reasonably regular short courses on fuel cell and hydrogen related subjects.

That said there are current vocational routes in the UK such as NVQ's, apprenticeships etc and specific organisations which provide vocational training on subjects related to fuel cells, for example chemical, mechanical, electrical, engineering etc, therefore opportunities exist for modules to be developed on Hydrogen and Fuel Cells that could be added to current training courses.

With respect to funding and support in education and training projects in the field of Fuel Cell and Hydrogen technology in the UK. There are currently no known funding programmes, however within the UK there are a number of Government and non Government organisations who do have funding and support specific to Fuel Cells and Hydrogen although not targeted at the education/training side.

2.1.4 France

Hydrogen and fuel cells (H-FC) technologies have begun to be more and more studied in France in universities and technical schools, however there is no specific funding programs dedicated to their training. The field of H-FC is not a strategic priority of the French government, we were disappointed to notice that among the projects of "institutes and laboratories of excellence" presented in the framework of the "large loan" none of the one related to the H-FC technologies has been accepted.

The system of education in France is structured as follows:

2.1.4.1 Main Education:

The public universities, technical schools, engineering schools are financed by the State. There is no national program of teaching for the higher education: each institution decides of which education program will be proposed to the students.

Some masters, or professional courses are developed in cooperation with industry,and the financing is shared between the different stakeholders. For example, the Master Renewable Energy Science Technology excellence proposed by the polytechnique school regroups several industrial partners like TOTAL, EDF, PSA, St Gobains, Schneider Electric etc, and includes a module on hydrogen for energy storage. Indeed in most of the formation concerning renewable energies, we can find a course on hydrogen and fuel cells.

2.1.4.2 In-service Training:

Regarding the in-service training, the financing can come from a number of different sources both public or private. An employee can benefit from a "formation plan" proposed by their company or employer, or from an "individual vacation of formation" if they want to follow an external formation. The funding organisms of the in-service formation are the FONGECIF (http://www.fongecif-idf.fr/) or OPACIF.

A technician can be trained to the new technologies of hydrogen and fuel cells if his company asks him to follow an adequate training course or if he finds one by him-self. Large companies like Air Liquide, Helion (subsidiary of AREVA dedicated to hydrogen technologies) or the Commissariat at the Atomic Energy have their own internal courses which deal with hydrogen and fuel cells; unfortunately, it is not easy to obtain information about these training courses.

Associations or clusters dedicated to hydrogen try to promote the organisations of short courses. Anyone (with a minimum of scientific knowledge) who would like to have strong understanding on H-FC technologies can apply. But with the poor number of registrations, these sessions are sometimes cancelled.

2.1.4.3 Research Centers:

Despite the poor interest from the government for the hydrogen community, the H-FC research field still has strong activity. The laboratories of Grenoble, Belfort, Nancy and Toulouse have developed specialised competences, and benefit from the support of the industrial field. The national funding organism for research is the ANR: the National Agency of the Research. But funds can provide from other organisms such as Europe or industrial partners.

As education is very much linked to research, we expect that the advanced development of the latter will drive to the stronger presence of the H-FC technologies in the formation programs.

We can cite the association AFHYPAC : the French association for hydrogen and fuel cells which supports and communicates on formation in hydrogen and fuel cell and proposes documentation on hydrogen and fuell cells on their website.

Name of the funding program:	**afh2 - association française pour l'hydrogène**
Name of the call:	french platform HyPAC for hydrogen and fuel cells. cofinanced by ADEME : agence de l'envirronement et de la maitrise de l'énergie
Start and End of the funding / duration:	creation of HyPAC in 2009
www-Link to the program / contact information:	http://www.afh2.org/
Short descriptuion:	There is no specific call for education and training. But the association support formation or educational programs (communication, dissemination)
Comments:	

Name of the funding program:	**Pan-H : Plan d'Action National sur l'Hydrogène et les piles à combustible,** held by the CEA (commissariat de l'énergie atomique) and the ANR (agence nationale de la recherche)
Name of the call:	4 calls have been presented: 1. fuell cells system 2 hydrogen storage 3 hydrogen transport and distribution 4 hydrogen production
Start and End of the funding / duration:	2005-2099. 84 M€ for the whole programm.
www-Link to the program / contact information:	http://www-anr-panh.cea.fr/
Short descriptuion:	There is no specific call for education and training. But many documents have been published which can constitute a support available on their website.
Comments:	

Different kinds of fundings are available for a formation depending if it occurs in the framework of the main education or of an in-service training.

Most of the formations dealing with hydrogen and fuel cell are included in program of master on renewable energy or professional courses. The fundings come from the ministry of the higher education.

Short formations are also proposed by independent organisms (industrial, foundations), they are usually financed by the participants them-selves. However, financial support can be asked to ADEME the Agency for Environment and Energy Management.

2.1.5 Turkey

Most of the educational activities are sponsored by the Ministry of Education as proposals submitted to them. Hydrogen and fuel cell research in Turkey is mainly funded by Turkish Scientific and Technical Research Council (TUBITAK) on national and international level. Various funding were provided under different programs to universities, industry and others. Since the year 2000, more than 10 million Euro funding was provided for hydrogen and fuel cell research in Turkey. There is no specific funding scheme for education but one can submit proposals to cover hydrogen and fuel cell education as well.

ICHET (International Centre for Hydrogen Energy Technologies) was supporting, till the end of 2012, educational activities through various mechanisms:

- More than 70 university students part-time employed to work on hydrogen and fuel cell technologies.
- Quarterly short courses organized with total participation of 200+ people. Summer schools on PEM fuel cells have been organized with 120+ participation in the last 3 years.
- High school fuel cell vehicle competion organized along with 20+ high school visits and seminars.
- Several nationwide hydrogen and fuel cell education workshops were organized with total attendance of more than 800 physics, biology and chemistry teachers

All the above activities have been mentioned to give an idea for better and continuing implementation.

The following tables provide contacts to funding in Turkey.

✓ *ICHET - International Centre for Hydrogen Energy Technologies*

Name of the funding program:	**Sponsorship, Education & Training (ICHET)**
Name of the call:	Call includes internship opportunities, quarterly short courses, workshops and project support.
Start and End of the funding / duration:	Open through out the year.
www-Link to the program / contact information:	Link to ICHET-Funding: http://www.unido-chet.org/index.php?option=com_content&view=category&layout=blog&id=25&Itemid=44&lang=en Link to ICHET-Education: http://www.unido-ichet.org/index.php?option=com_content&view=category&layout=blog&id=26&Itemid=43&lang=en
Short descriptuion:	*Specific to hydrogen and fuel cells, all form of training, education and student sponsorships carried out and funded through ICHET.*

✓ *TUBITAK-Turkish Scientific & Technical Research Counci / European Programs*

TUBITAK funding programs are not objectively specific to give opportunity for every application. TUBITAK funding on hydrogen and fuel cell education can be obtained either on a national basis by interested parties submitting a proposal or as part of a European base initiative. There is no funding limit specified.

TUBITAK has a willingness to participate in any European wide action.

Name of the funding program:	**ALL EUROPEAN PROGRAMS** Scholorship Programs for Undergraduate, Graduate and Psot-doctoral Education
Name of the call:	All level of funding (Undergraduate, graduate, post-doctoral and research) under several different names as available in the link.
Start and End of the funding / duration:	Open though out the year.
www-Link to the program / contact information:	http://www.tubitak.gov.tr/sid/1022/pid/547/index.htm
Short descriptuion:	In addition to National funding activities, TUBITAK pprogrammes are divided into three general categories. ▪ *Bilateral Cooperation* ▪ *Cooperation with the Regional and International Organizations* ▪ *Cooperation with the European Union (EU)*
Comments:	Undergraduate, graduate and Posdoctoral educational activities are supported national and international level.

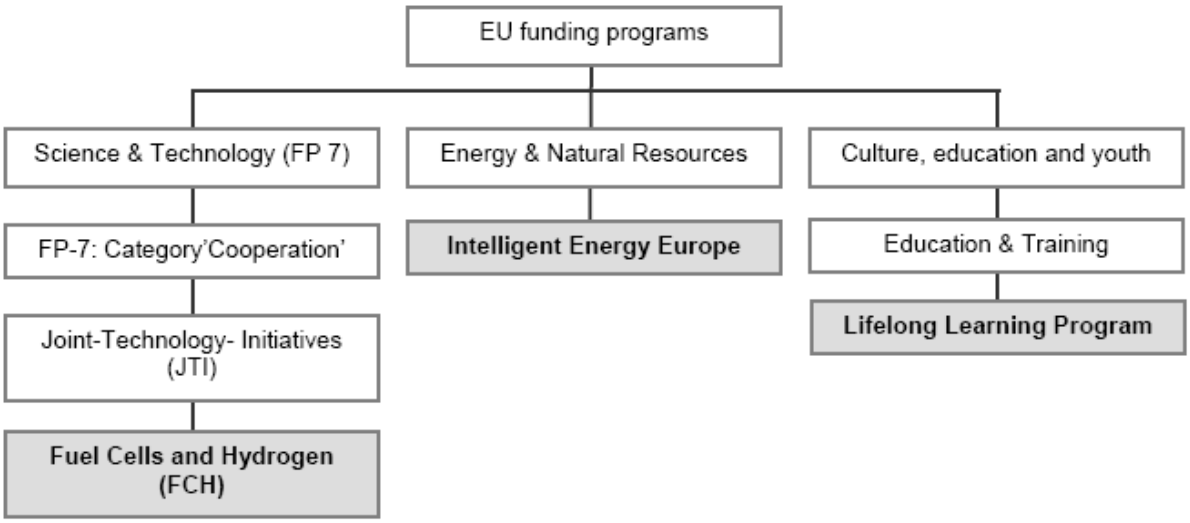
Any national organization can submit proposals for educational funding in Turkey. Turkey is awaiting steps taken by the European side on technology specific actions. Any educational effort on hydrogen and fuel cell has to be European wide and encourage member countries to specifically allocate funding for this specific action. Prerequisite here is to have industry driven efforts for their specific need.

If the roadmap and interest exist for hydrogen and fuel cell technology training, there will be enough funding from Turkey.

2.2 Funding programmes by the European Commission

In 2007 the European Union launched a new set of funding programmes up to € 975 billion over a seven-year period. Approaches for submitting proposals which focus education and training topics for fuel cells and hydrogen technologies are in several European funding programs present. Basically there are two principal options for proposals: The first is to try the implementation in research & science programmes, the second is a consideration in learning and educational programs.

The next figure shows possible funding programs and specific calls for implementing new educational projects / initiatives in the context of fuel cells and hydrogen.



Overview funding opportunities by the European Union

The funding schema of the EU is very sophisticated and definitely more calls for submitting educational proposals exist. The three mentioned opportunities appear the most obvious ones. These will shortly be discussed in the following.

2.2.1 JTI FCH (Joint-Technology- Initiatives, Fuel Cells and Hydrogen)

Name of the funding program:	**Fuel Cells and Hydrogen Joint Undertaking (FCH JU)**
Name of the call:	actual call: FCH JU 2011 call http://www.fch-ju.eu/content/launch-fch-ju-2011-call-proposals
Start and End of the funding / duration:	Start in 2008. End: 2013
www-Link to the program / contact information:	http://www.fch-ju.eu
Short description:	The Platform was launched under the 6th Framework Programme for Research (FP6) as a grouping of stakeholders, led by companies representing the entire supply chain for fuel cell and hydrogen energy technologies.
Comments:	The Fuel Cells and Hydrogen Joint Undertaking (FCH JU) is a unique public private partnership supporting research, technological development and demonstration (RTD) activities in fuel cell and hydrogen energy technologies in Europe. Total budget 2008-2013: 940 M, EC budget 467 M

A best practice example for considering the education topic in funding programmes is the Fuel Cell and Hydrogen JTI of the EC. In the last JTI-call besides this Hyprofessional project there were another two educational projects (HyTrain and HyFacts) which were funded. In the current call (2011) educational tasks are considered e.g. under the cross cutting issues, in particular the call SP1-JTI-FCH.2011.5.3 'First responder educational and practical hydrogen safety training'.

However that said it would be desirable that funding for education and training actions for fuel cells increasingly comes from existing educational programs and less from tasks in R&D programs

like the JTI call. With the foreseeable market introduction of fuel cells there will be more of a shift from R&D programs to “origin” VET programs (e.g. like LLP).

2.2.2 Intelligent Energy Europe (IEE)

Name of the funding program:	**intelligent Energy Europe (IEE)**
Name of the call:	Relevant calls for FC and H2 proposals: 1. ALTENER, e.g. Electricity from renewable energy sources 2. STEER, e.g. Clean and energy-efficient vehicles 3. Integrateted initiatives: e.g. Training and Qualification Initiative http://ec.europa.eu/energy/intelligent/call_for_proposals/doc/call_2011_en.pdf
Start and End of the funding / duration:	2007 - 2013
www-Link to the program / contact information:	http://ec.europa.eu/energy/intelligent/
Short description:	With € 730 million funds available between 2007 and 2013, the IEE programme reinforces EU's efforts to meet its 2020 energy targets to ensure a secure and cost competitive supply of energy while fighting climate change
Comments:	The programme runs annual calls for proposals and its funding covers up to 75% of the eligible project costs. To date, nearly 450 projects have been co-financed by the programme.

The Intelligent Energy - Europe (IEE) progamme is shared into three financing streams to getting funds which will benefits different types of needs to succed projects. Majority appointment is to funding projects across EU that support and promote energy efficiency and renewable energy. Second financing part is concerned with procurement of products and services from private companies and organisations with the aim to achive objectives underlying the IEE Programme via calls of tender. Cities and regions across the EU which want to invest in sustainable energy will

benefits through the third financing stream called ELENA. These European Local Energy Assistance (ELENA) covers a part of costs for technical support that is necessary to prepare, implement and finance the investment programme, such as feasibility and market studies, structuring of programmes, business plans, energy audits, preparation for tendering procedures.

2.2.3 Lifelong Learning Programme

Name of the funding program:	**Lifelong Learning Programme (LLP)**
Name of the call:	Comenius: for schools Erasmus: for higher education Leonardo da Vinci: for vocational education and training Grundtvig: for adult education
Start and End of the funding / duration:	2007 - 2013
www-Link to the program / contact information:	http://ec.europa.eu/education/lifelong-learning-programme/doc78_en.l
Short description:	With a budget of nearly €7 billion for 2007 to 2013, the programme funds a range of actions including exchanges, study visits and networking activities.
Comments:	Programm Guide and link to actual calls: http://ec.europa.eu/education/llp/doc848_en.htm

The Lifelong Learning Programme established from the European Commission enables people at all stages of their lives to take part in stimulating learning experiences, as well as helping to develop the education and training sector across Europe. The four sub-programmes mentioned in figure above will funds projects at different levels of education and training and are therefore addressed to individual students and learners, but also for teachers, trainers and all others involved in education and training. Other projects in areas that are relevant to all levels of education are funded through the 'transversal' part of the programme.

Conclusions

The main message of the mapping of funding programmes in the partners' countries is that usually there are no direct calls for supporting education and training activities in the field of fuel cells and Hydrogen.

Extensive R&D programmes, partly own fuel cell and Hydrogen programmes, exist in most of the countries. Also funds for educational measures are available. Finding relevant calls which combine these 'different worlds' is very often a hard undertaking.

In R&D programmes the education and training topic (e.g. further training for service and maintenance) very often is of minor priority because it is settled at the end of the value chain. Mostly there are no direct calls and if at all the topic is considered as a work package in a R&D project.

In Vocational Education and Training programmes the topic is currently only marginally considered because fuel cell technology is only available in a few niche markets, therefore there is a perception that there is little need for any specific qualification at the moment. **Nevertheless the start of the qualification process for key-personal, such as trainers and mulitplicators has to start now before mass production begins in the current pre-marketing phase.**

The report showed that there are many different funding opportunities for vocational education and training in the European countries. These are very often technology-open and a submission of proposals including fuel cells and Hydrogen topics should be intensively promoted. Currently helpful in the pre-market stage are proposals for funding pilot actions for trainers, the support for investment for infrastructure and equipment for vocational schools (e.g. test benches and experimental kits for vocational schools etc) and measurements that are building bridges from academia to handcraft (e.g. support of networks).

It would be desirable that with the further market introduction of fuel cells the funding of education and training actions in this field increasingly results more and more out of the 'origin' VET programs in the different European countries.

3. Report on Pilot Training actions during Hyprofessionals project in different countries (with feedback collected)

The objective of this report is to review the pilot actions which were carried out by project partners INTERNATIONAL CENTRE FOR HYDROGEN ENERGY TECHNOLOGIES (UNIDO-ICHET) in Turkey, ENVIRONMENT PARK in Italy, WEITERBILDUNGSZENTRUM BRENNSTOFFZELLE ULM E.V (WBZU), Germany and FOUNDATION for HYDROGEN in ARAGON (FHa) / FUNDACIÓN SANVALERO GRUPO SANVALERO (FSV), Spain.

The report highlights the success of these pilot actions which in total were attended (both physically and virtually) by over 350 students.

Feedback (via the feedback questionnaires) from the students showed that the courses were of interest specifically the knowledge attained, the practical application and the potential for future career development.

3.1 Pilot Actions

3.1.1 Pilot Action – UNIDO-ICHET

The International Centre for Hydrogen Energy Technologies (ICHET) is a project of the United Nations Industrial Development Organization (UNIDO) founded in Istanbul in 2004 and supported by the Turkish Ministry of Energy and Natural Resources (MENR). Its role is to support, demonstrate and promote viable hydrogen energy technologies with the aims of enhancing future economic development, particularly in emerging countries, and of preventing the widening of the energy and technology gap while helping skipping over the fossil fuel phase.

UNIDO-ICHET carried out a 2 day pilot study on at UNIDO-ICHET facilities Turkey on the 8th and 9th October targeting Alternative Fuel and Renewable Energy Departments at Vocational Schools in Turkey.

Rational & Objectives:

Hydrogen technologies in the market place are still in small numbers and further infusion into common life require knowledge base and understanding at all public levels. There is a need for fundamental education of students, technicians and engineers about what these systems are and how to integrate them.

- ✓ Principles of electrochemistry and hydrogen
- ✓ Hydrogen production, storage, distribution and utilization technologies
- ✓ Laboratory experience with hydrogen and fuel cell technology

- ✓ Equipment, vehicles and their integration

Ten schools from eight different cities participated in the activity, these included the following:

School	City/Town	Student numbers
Can vocational school	Canakkale	7
Erciyes University vocational school	Kayseri	6
Dokuz Eylul University vocational school	Izmir	4
Erzincan University vocational school	Erzincan	4
Duzce University vocational school	Duzce	4
Izmir Economy University	Izmir	3
Yildiz Technical University Vocational School	Istanbul	7
Okan University	Istanbul	7
Eskisehir Technical and Industrial High School	Eskisehir	3
Ministry of Energy, Renewable Energy Division	Ankara	2
Total		47

Outline of pilot action:

Conclusions:

The vast majority of the students who attended the pilot action believed the training had reached its purpose. With the most interesting and beneficial parts being the 'Hand-on' training and the fuel cell vehicles. The least beneficial part of the training being the presentation on fuel cells. All in all students considered that they were much more knowledgeable and better trained afterwards.

3.1.2 Pilot Action – Environment Park

In an area where there are major production centres of knowledge and an industrial structure characterised by many small and medium-sized enterprises, the role of Environment Park is to stimulate and collect the demand for innovation by promoting project initiatives that involve the Piedmont academia, research centres, technology parks and innovation centres. Environment Park is divided into two business units, which are dedicated to property management to the complex and 'research and innovation'. The business unit dedicated to the research has historically developed around the concept of eco-efficiency, with a typical cross-sectional approach to the environment.

Environment Park carried out a pilot study at Environment Park 'Hysylab' facilities Italy on the 11th December 2012 targeting vocational training of technical students involved on industrial & energy sectors.

Rational & Objectives:

Educational action focused on vocational training students, technical staff from industry and teachers of every school. Training courses and workshops to graduate students about hydrogen technologies, hydrogen production, storage, safety, fuel cell technologies and system integration.

- ✓ Production of hydrogen
- ✓ Storage of hydrogen
- ✓ Fuel cell fundamentals
- ✓ Application of fuel cells (UPS, micro CHP….)
- ✓ Safety
- ✓ Fuel cell technologies & system integration

Practical test activities:

- ✓ Polarisation curves on single cell
- ✓ Polarisation curves on fuel cell stack
- ✓ Test of a 10 kWe natural gas reformer
- ✓ Adsorption/desorption test on metal hydride

For this pilot action there were a total of 70 students from the industrial and energy sectors.

Conclusions:

The pilot action was based on theory and practical activities creating a real physical contact with the fuel cell technology. It also gave the students the opportunity to gain 'hands-on' activities on fuel cells. There was also a notable acknowledgement by the students on the future potential of this technology with a view to its implementation and with that potential career opportunities.

3.1.3 Pilot Action – WBZU

The Fuel Cell Education and Training Centre Ulm (WBZU) is a registered non-profit society with well-known partners from industry, trade, universities and research centres.

The focus of the centre is to offer information and training courses concerning fuel cells and hydrogen. The courses are especially adapted for technicians, engineers, scientists and students. To ensure hands on technology and practical training, different fuel-cell testing systems und demonstration units are featured in the new building of the WBZU-society. The centre opened in 2004.

WBZU carried out pilot studies at WBZU facilities Ulm Germany on the 8th & 9th November and 22nd & 23rd November 2012 targeting vocational training in the fields of fuel cells and hydrogen, the training was structured to ensure that no prior knowledge of electrochemistry or fuel cell technology was required.

Rational & Objectives:

- ✓ Basics and fundamentals of PEFC and Hydrogen technologies
- ✓ Polymer electrolyte Fuel Cell applications
- ✓ Hydrogen system and infrastructure
- ✓ Hydrogen handling safety aspects

Outline of pilot action:

Fuel cell & hydrogen electrochemical fundamentals	Porous media
Fundamentals of Electro catalysis	Lifetime aspects of PEFC
Hydrogen safety aspects	Fuel cell systems
Components & design of a fuel cell stack	Fuel reforming and applications
Basic fuel cell stack testing	Practical training on various fuel cell systems
Extended stack characterisation	

For these pilot actions there were a total of 38 students for the 8-9th November 2012 training and a total of 18 for the 22-23rd November 2012 training these were all from the vocational Robert-Bosch school Ulm, Germany.

Conclusions:

From the feedback questionnaires the vast majority of the students found that the training objectives had been met. The positives from the pilot actions were knowledge about fuel cells and how they work, also other applications for the technology. However there were some who would have liked more practical based training.

3.1.4 Pilot Action – FHa/FSV

San Valero Foundation is a non experience in initial, continuing and occupational technical has more than 3000 students per year. It has an educational agreement with the Government of Aragon and its commitment to innovation has led it to promote numerous pilot projects in an international level, related to the technical training linked to companies and its developments have been subject of several international awards.

FHa and FSV carried out an E-learning online training course from September to December 2012, including one day (practical) attendance at the Foundation Hydrogen, Aragon.

E-learning platform:

Rational & Objectives:

- ✓ Understand the basic principles in terms of hydrogen (production, distribution and storage).
- ✓ Teach general concepts of architecture and components of FCEV.
- ✓ Acquire the knowledge necessary for the maintenance and repair of FCEV.
- ✓ Establish basic knowledge in hydrogen and high voltage safety.

Outline of pilot action:

- ✓ General concepts and history
- ✓ Vehicle architecture: components and type
- ✓ Component maintenance (HV-battery, electric motor, inverter, power electronics, etc)
- ✓ HV and hydrogen safety
- ✓ Vehicle examples
- ✓ Practical training (optional)

Group	Number of students
Automotive teachers	47
Automotive students	57
Other vocational training teachers	56
Other vocational training students	11
Automotive workers	27
Total	**198**

Conclusions:

From the feedback questionnaires the vast majority of the students thought the training satisfied their hydrogen training needs and also had the correct base of knowledge and was of interest. A large proportion would use the knowledge gained in their current and future job roles.

3.2 Conclusions

The pilot actions highlighted in sections 3.1.1, 3.1.2, 3.1.3 and 3.1.4 with student feedback were carried out by four different project partners in four different countries and showed the rational and objectives, the outline of the study, the method of delivery and the results. In total some 350 students were trained in hydrogen and fuel cell technologies. The pilot studies have shown the versatility of the different modes of delivery, i.e. face-to-face training, E-learning and a combination of E-learning with practical 'hands-on' experience, and the potential opportunities that are available for training organisation.

As hydrogen and fuel cell technologies become more commercial and applications increase its use there will be an increasing need for good 'short term' vocational training course on hydrogen and fuel cell technologies and these four pilot actions have shown that these are available and that there is a market even at the currently low use of the technologies. Apart from the modes of training delivery highlighted in the pilot studies there are also opportunities for the use of new technologies and methods of training such as Just-intime training, Interactive training, Use of 'Gamification' also smart phones, tablets etc.

In conclusion in the short to medium term there will be an increasing requirement for 'short' vocational training as hydrogen and fuel cell technologies increase in usage.

The four pilot actions have shown that these are available, are in demand and have proven to be successful as the conclusions from each pilot study has shown.

4. Report on proposed actions for developing training actions in the future

The objective of this report 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.

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 an homogeneous involvement in Regional, National and European level.

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

4.1 Methodology

Proposals from the partners were first collected using an on-line questionnaire, shared by the partners. All the partners were asked to describe some specific initiatives and then the collected material was processed and merged in this document.

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.

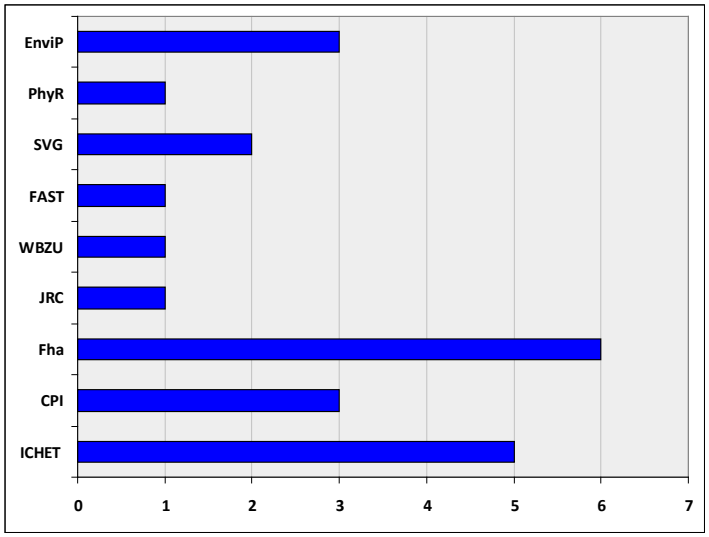
The "Gap and Need Analysis" for automotive market has highlighted the need of workforce trained in hydrogen and fuel cells technologies between 5 and 10 years for the sector (hydrogen mobility). For this application the hydrogen demand by 2015 will only be very small (a few thousand vehicles per year). 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

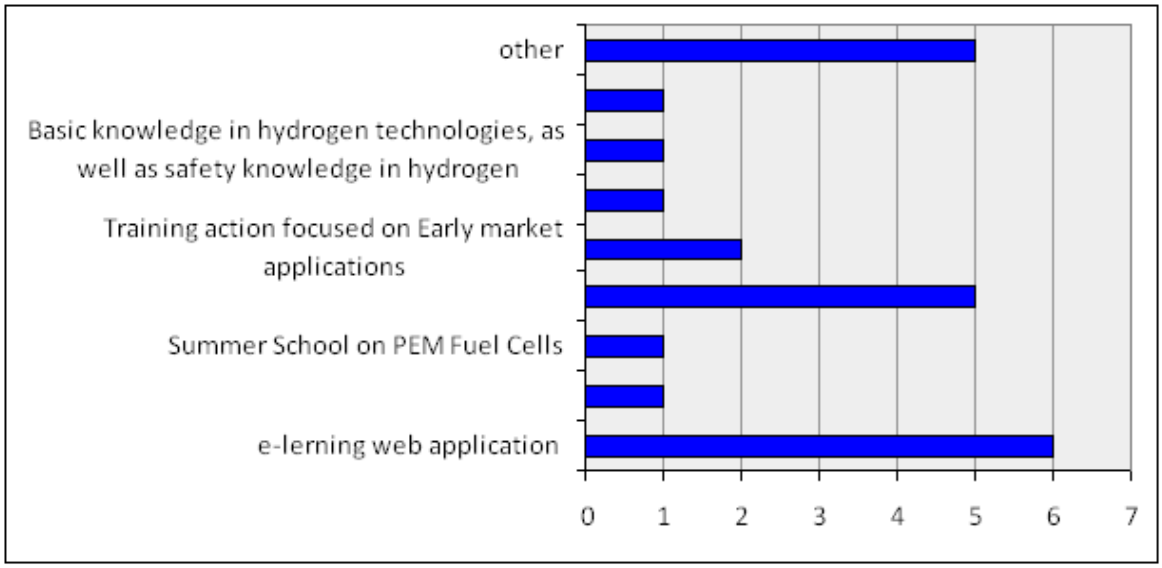
4.2 Proposals overview and analysis

21 proposals from the partners were collected and analyzed.



ICHET	5	22%
CPI	3	13%
Fha	6	26%
JRC	1	4%
WBZU	1	4%
FAST	1	4%
SVG	2	9%
PhyR	1	4%
EnviP	3	13%
Total	23	

Proposals distribution



e-lerning 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

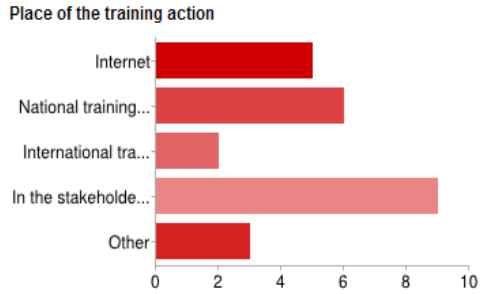
Duration of training actions

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.

Short (1 month or less)	**11**	73%
Medium (1 to 6 months)	**4**	27%
Long (6 months to 1 year)	**0**	0%
Lifelong (multiple years)	**1**	7%
Other	**1**	7%

People may select more than one checkbox, so percentages may add up to more than 100%.

Place of the actions



Internet	**5**	29%
National training centre	**6**	35%
International training centre	**2**	12%
In the stakeholder facilities	**9**	53%
Other	**3**	18%

People may select more than one checkbox, so percentages may add up to more than 100%.

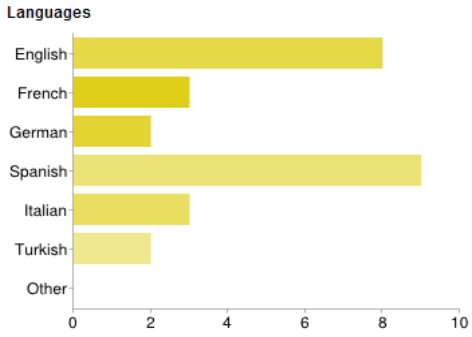
The proposals show the need to carry out training actions directly in the stakeholder facilities, in order to focus the possibility of assemble and disassemble the main parts of a electric fuel cell vehicle, CHP and UPS system. The implementation of the courses directly in the stakeholders facilities 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.

Language



English	8	47%
French	3	18%
German	2	12%
Spanish	9	53%
Italian	3	18%
Turkish	2	12%
Other	0	0%

People may select more than one checkbox, so percentages may add up to more than 100%.

4.2.1 Proposals descriptions and target stakeholders

4.2.1.1 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) bechtest 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.

4.2.1.2 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).

4.2.1.3 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

4.2.1.4 Training action focused to mantein 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

4.2.1.5 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.

This 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.

4.2.1.6 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.

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.

<u>UPS systems</u>

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 many comparative informations related to maintenance of devices and lifelong duration.

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 will consist on 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

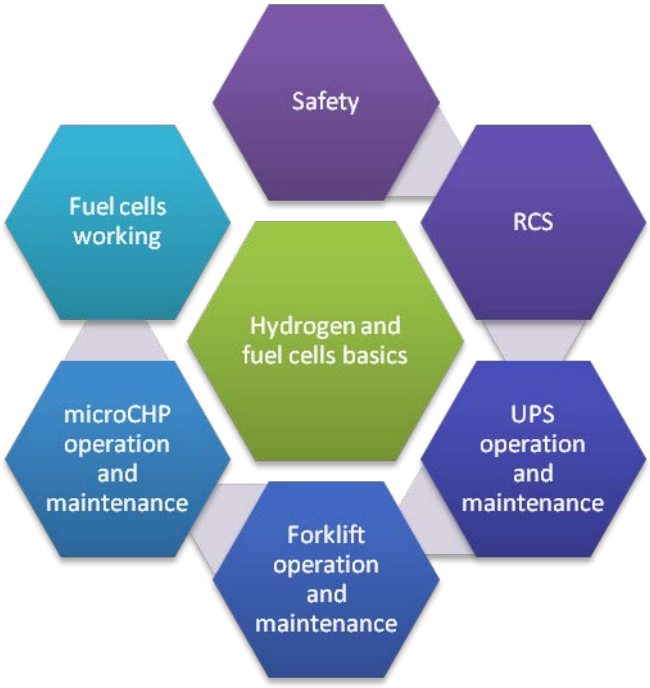
1. Make the documentation related to teaching material
2. Take contact to possible collaborators or centers to get places where make the training actions, for example nationals centres, local business associations

Conclusions

Several different proposals where 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).

5. Report on training courses contents developed in past projects within Leonardo Agency Framework

Leonardo da Vinci programme

The Leonardo da Vinci Programme funds practical projects in the field of vocational education and training. Initiatives range from those giving individuals work-related training abroad to large-scale co-operation efforts.

Part of the European Commission's Lifelong Learning Programme, this programme funds many different types of activities of varying scales. These include 'mobility' initiatives enabling people to train in another country, co-operation projects to transfer or develop innovative practices, and networks focusing on topical themes in the sector.

The people able to benefit from the programme range from trainees in initial vocational training, to people who have already graduated, as well as VET professionals and anyone from organisations active in this field.

Leonardo da Vinci enables organisations in the vocational education sector to work with partners from across Europe, exchange best practices, and increase their staff's expertise. It should make vocational education more attractive to young people and, by helping people to gain new skills, knowledge and qualifications, the programme also boosts the overall competitiveness of the European labour market.

Innovation projects are key to the programme. They aim to improve the quality of training systems by developing and transferring innovative policies, courses, teaching methods, materials and procedures.

5.1 Leonardo H2 training Project

http://www.h2training.eu/

The Project has allowed to define a European curricular design of an educational profile related to renewable energies and hydrogen technologies and to promote and reinforce the contribution of professional training to the innovation process in order to improve competitiveness and create new employment possibilities.

In particular:

- has been published a basic manual with educational contents for training of trainers and professionals from related sectors;
- have been developed two pilot "training of trainers" pilot actions, at international level, one in presence modality and another one in e-learning;
- have been published specific dissemination products in several languages (web, CD ROM, leaflets, video);
- has been organized a final congress with participation of authorities and experts from the EU in education and sectors related to renewable energies and the new hydrogen technologies.

H2 training manual _ CHAPTERS and MAIN TOPIC

- ✓ *Ch 1: Hydrogen Economy Background*

In the chapter you get a brief overview of: 1. World Energy Supply and Demand, 2. World Energy Reserves, 3. Development of Renewable Energy in Europe, 4. Environmental Problems like Global CO2-Challenge, Green House Effect and Local Air Pollution.

And it gives an outlook on possible solutions: 5. Reduction of Demand before Supply and 6. Hydrogen Economy: Visions, System Components, Benefits and Challenges.

- ✓ *Ch 2: Alternative Vehicle Concepts*

The chapter gives an overview of working-principles and concepts of alternative drives and presents exemplary cars. The focus is on fuel cell vehicles.

- ✓ *Ch 3: Alternative Fuels*

The chapter gives an overview and a description of alternative fuels: Natural Gas, Biofuels, Synthetic Fuels, analyzing production and origin; applicability; ecological aspects.

- ✓ *Ch 4: Hydrogen-Technology*

The chapter analyze the state of the art of the H2 tecnology.

- ✓ *Ch 5: Fuel Cell Technology*

In the chapter you get a brief overview of: Fuel Cell Basics; Fundamentals of Electrochemistry; Fundamentals of Thermodynamics; High and Low Temperature Fuel Cells; Fuel Cell System Integration; Operations of Fuel Cells; Health and Safety Aspects.

- ✓ *Ch 6: Auxiliary Equipment*

The chapter gives an overview of the principles of fluid dynamics and auxiliary equipment.

- ✓ *Ch 7: Gas Technology*

The chapter gives an overview of compressed gases and deep cold liquid gases; training requirements and competency assessment for users of compressed gases, correct welding of gas pipes in particular hydrogen pipes, correct leak tests.

- ✓ *Ch 8: Hazard of electricity*

In the chapter there is an overview of the effects of electric current; technical terms and characteristic values and in particular a detailed description of accident prevention and safety rules.

- ✓ *Ch 9: CHP plants*

An overview of the cogeneration principle and a comparison between different cogeneration technologies.

- ✓ *Ch 10: Regulations, codes and standars*
- ✓ *Ch 11: Gender Mainstreaming*
- ✓ *Ch 12: Practical training*

Overview of the Manual and Practical Advice for Training.

5.2 Leonardo LDV-H2 employment Project

http://www.h2employment.eu/

Therefore, the international results "H2 training" project initially aimed at training of trainers and significant job demand detected in more than 50 organizations and companies integrating their international observatory to identify the main priorities of the manual transfer of and curricula for training and employment for the employability of workers and professionals. As an extra added value to support the transfer, are:

- The interest of this new project for a variety of sectors that were affected by the crisis situation have been brought forward to the implementation of new products and developments integration of hydrogen technology as a strategic response against the state of current economic crisis (automotive, electronics, renewable energy, construction, engineering components and systems ...). He has adopted a strategy in advance of the European workforce marked in accordance with EU rules and strategies (Directive 32/2006 EC and IP/03/1229: European roadmap for hydrogen).

- The geographical balance of the consortium, made up of countries of northern Europe and southern Europe to act as driving forces for the exploitation of the labor market of a transfer project basing on the quality of the results and obtained great international impact training of trainers. These issues make a transfer directed to the specific training of professionals, workers and unemployers through professional associations and public authorities with responsibility for

employment to ensure exploitation of results (see products for the trainers of the proposed current transfer field workers).

And the experience of the association, who participated in the development of "H2 Training" project.

The Project has allowed:

- To transfer to the continuous vocational training and the occupational one, the results validated by the “h2 training” project initially aimed at the training of trainers.
- To adapt the manual of training in hydrogen technologies as basis of the transfer to elaborate a didactic material (ES, EN and DE) of great interest for engineerings and professional associations and for the continuous training and occupational of workers and unemployers of intermediate technical degree for which the consortium is excellent.
- To validate the didactic material adapted through the development of two pilot actions from the international cooperation of training (distance and presential) aimed at professional associations, workers and unemployers. The labour insertion of the new professional profile will be analysed (200 beneficiaries).
- To guarantee the exploitation and valorisation of results through the very same regional public authority competent in the matter of employment and occupational training and the active participation of the technical engineers professional association integrated in the partnership themselves.
- Permanent dissemination at great scale differentiated by target levels and with an impact higher than 5.000 recipients for the benefit of a subsequent effective transfer.

Products: Manual updated in 4 languages, adapted to the target sectors defined; updating and reorientation of the “e-learning” virtual platform; expansion of the prospective cell to the target sectors and adhesion of 50 new collaborators; web, video, leaflets, mass-media, final dissemination congress.

H2 Employment training manual _ CHAPTERS and MAIN TOPIC

- ✓ *01 Environment, Energy and Hydrogen*
- ✓ *02 Production of Hydrogen*
- ✓ *03 Storage of Hydrogen*
- ✓ *04 Handling of Hydrogen*
- ✓ *05 Fuel Cells Fundamentals*
- ✓ *06 Application of Fuel Cells)*
- ✓ *07 Battery Fundamentals*
- ✓ *08 Hydrogen Internal Combustion Engines*
- ✓ *09 Regulations and Codes*
- ✓ *10 Exam*

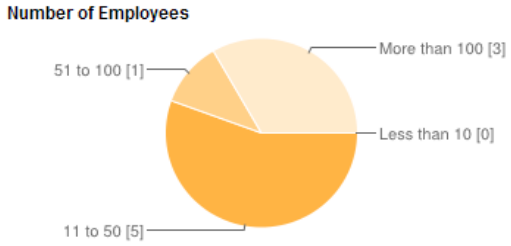
6. Report on Ene.Field manufacturers collected experience on technicians training

6.1 Methodology

The objective of this report is to collect information about technicians training: primary aim of this action is the identification of training needs for the people involved in the installation of the CHPs. Informations from the manufacturers were first collected using an on-line questionnaire, shared by the partners and a web conference/interview to complete the required informations.

6.1.1 Manufacturer information

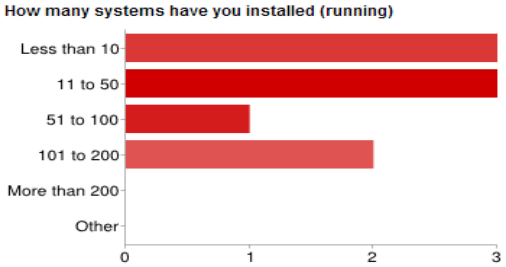
Size of the manufacturers:



Less than 10	0	0%
11 to 50	5	56%
51 to 100	1	11%
More than 100	3	33%

More than 50% are SMEs, with specific training needs.

Number of running CHPs:



Less than 10	3	33%
11 to 50	3	33%
51 to 100	1	11%
101 to 200	2	22%
More than 200	0	0%
Other	0	0%

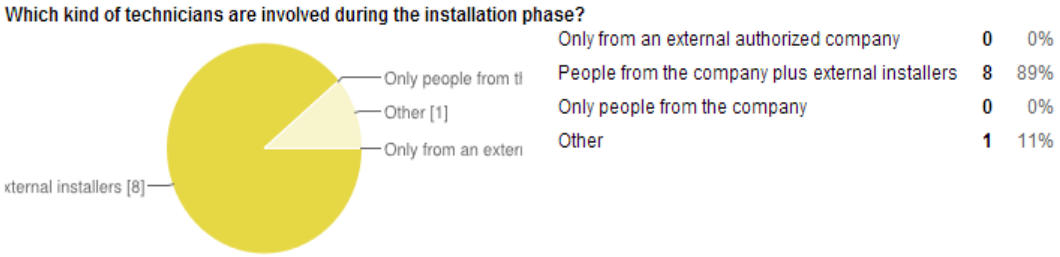
Actually, 1/3 of CHPs manufacturers has installed less than 10 systems and about 1/3 between 11 and 50 systems.

6.1.2 Technicians training

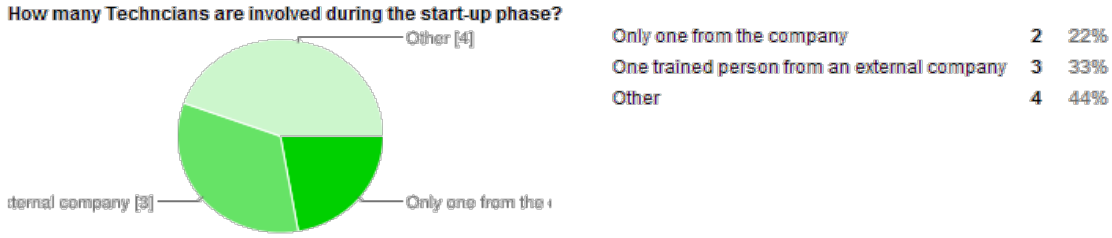
It is necessary to distinguish two phases during the installation and start-up of the systems:

- initial phase of deployment handled by the Company;
- second phase that will be handled by external parts (external installers, local plumbers, in general local technicians).

Technicians involved during the installation phase



Technicians involved during the start up phase



According to the agreements with the Utilities technicians involved in the start up phase can be internal staff or external. The manufacturers certify external staff.

Profile of the technicians

The system is designed to be a plug-in and easy to install, so the basic idea is to simplify the installation process (with a step by step procedure).

There is the need of a new technician profile, covering multy-disciplinary aspects: plumber, electrician, basic ICT competence.

Residential maintenance

Now the residential maintenance depends on different requirements in EU Countries.

It is necessary to have homogeneous requirements, in order to create a network of partners able to handle installation and maintenance.

In the initial phase of deployment there is the need to have skill with remote control and advanced diagnostics, in order to limit manufacturer direct activity only on critical components.

In the future required skills would be:

- Use sampling equipment for fuel gas
- Sample water quality with conductivity sensors
- Perform leak test as on boiler but with few add-ons as closing test valves inside system
- Knowledge of house heating system to verify optimum performance
- Personal skills for communication with system owner to communicate requirements for optimum performance
- Computer skills, testing internet connection for system

Multi-level Certifications are necessary: for handle, start up and maintenance installation.

Technicians training

In this initial phase there in mainly internal training; afterwards is necessary also rely on external vocational training centres.

Implication of external training centres:

- To be involved in the process of demonstration
- Common basic module on CHP concept to be translated from Callux and implemented for National Specific Requirements
- Specific modules from the manufacturers (specific agreements required).

It is necessary to create a training network to create a diffused knowledge of the technology at all levels. Train the trainers is essential to extend the basic knowledge of the technology.

Skill shortages

These skills shortages, that characterize the technicians involved in the different installation phases, have been identified:

- Understanding of CHP concepts and optimization
- Difficulties in using Troubleshoot guides
- Low ICT knowledge
- Interfacing the electric grid operator (prepare documents…)
- Low multi disciplinarity (plumbers vs electricians).

Conclusions: Training activities implementation

On national (regional) level, staff should be trained regarding:

- funding possibilities for the end user (house owner)
- regulations and procedures for connection to the electric grid.

General information about customer benefit of fuel cells is required in the consulting and planning phase in order to convince end users of the advantages of the technology.

General/basic knowledge about the fuel cell technology, for example about long start up times, in order to avoid errors in handling.

It is necessary to create a certification of the installers with more levels for installation, start-up and maintenance.

7. Conclusions

The analysis carried out in this document, which contains the identification of more specific courses on fuel cells, highlights the need of specific courses, at both European and International level, on CHP's systems.

More specific courses on CHP's technology may cover:

- General information about CHP technology (electricity generation as a by-product of heat);
- Advantages on CHP technology:
- *Carbon savings*: by generating electricity on-site you could be saving carbon dioxide compared with using grid electricity and a standard heating boiler),
- *Easy installation:* if you already have a conventional boiler then a micro-CHP unit should be able to replace it as it's roughly the same size.
- *Servicing costs and maintenance*: estimated to be similar to a standard boiler
- Financial income;
- Certification for installers

Therefore it is essential to make a more accurate analysis of what are the specific requirements of the end users to the manufacturers.

A specific objective of the Project is to support the relationship between end users (utilities) and manufacturers, working in relation with the utilities that is of great importance at this early stage of the project.

In particular were collected:

- Data sheet for all manufacturers' systems
- Deployment models
- Contractual documents (minimum systems' number for installation, products included and excluded, warranty, responsibility….)

- Commercial cost (now and after x years)+ any additional costs (monitoring system and data reporting)

in order to facilitate contacts between demand and supply.