Development of educational programmes and training initiatives related to hydrogen technologies and fuel cells in Europe

Sprawozdania

Informacje na temat projektu

HYPROFESSIONALS

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Final Report Summary - HYPROFESSIONALS (Development of educational programmes and training initiatives related to hydrogen technologies and fuel cells in Europe)

Executive summary:

As hydrogen and fuel cell technologies are coming to market, the need for a new educational profile related to hydrogen and fuel cell technologies has been identified as a crucial element to ensure that professionals involved at various level of research, development and installation of these technologies receive an adequate training.

The aim of HYPROFESSIONALS project is to develop a comprehensive basic training programme/guideline for different educational levels, focusing on technical schools to ensure an educated workforce that is able to support the development of sustainable industrial hydrogen and fuel cell sector and a commercial market.

This report shows the main results of the tasks of the project, general conclusions, implementation plan and socio-economic impacts.

Regarding project tasks, the objective of this report is to demonstrate the work developed and the main results achieved. Also, an important point is to sum up the problems or changes done during the task life and find out the reason for that and the way to solve the problems.

One of the main goals of the project is the development of the implementation plan, which is the final appropriate guidelines and recommendations that should contribute to support policy definition aiming at training and educational activities in Europe.

The description of the potential impact (including the socio-economic impact and the wider societal implications of the project so far) and the main dissemination activities and the exploitation of results are also explained in this final report.

Project context and objectives:

Today's technicians and students are the next generation of potential fuel cell users and designers, and education now is a critical step towards the widespread acceptance and implementation of hydrogen fuel cell technology in the near future.

Development of training initiatives for technical professionals will be started aiming to secure the required mid- and long-term availability of human resources for hydrogen technologies.

The future initiatives have to be carried out for various educational levels and including industry, SMEs, educational institutions and authorities. Coordination and cooperation are key factors to fulfil the objective: develop a well-trained work-force which will support the technological development.

The general objectives of the project, following the Annex I, are the next ones:

(1) identify existing training programs related to hydrogen and fuel cells in the EU that may provide a good

base for educational activities (Mapping current trainings);
(2) develop specific initiatives, proposals, guidelines and / or projects to get consolidated educational programs for technical training at different levels, implementing the results of this project and involving different stakeholders (industry, small- and medium-sized enterprises (SMEs), educational entities, authorities.);
(3) disseminate the results at different target audiences to facilitate acceptance and implementation of these technologies by means of education. Objective of 2 pilot actions (minimum) involving different European countries is fixed;
(4) increase in the number of state and local government representatives which receive information and understand the concept of a hydrogen economy, and how it may affect them. The participation of different European Union (EU) countries (7) and the celebration of workshops (2 minimum) to involve different stakeholders will favour this objective;
(5) exchange experiences, project results, training initiatives on-going, training courses and good practices (creation of an e-library) to take advantage of the work already done, to maximise the reach of education efforts and avoid duplication. The sought aim is to improve the quality and effectiveness of education and training initiatives related to hydrogen and fuel cells;
(6) achieve a motivating personal and professional identity in future learning and adjustment to the development of the technology and social change;
(7) facilitate access to education and training systems related to hydrogen technologies and coordinate efforts among authorities, industry, educational institutions, universities and other stakeholders. Pursue the development of a suitable European curriculum at different levels;
(8) launch a comprehensive and coordinated public education campaign about the hydrogen economy and fuel cell technology to overcome lack of information barriers.

These general objectives can be translated into more concrete targets, aligned with the work package (WP) description:

(1) mapping of existing training initiatives, materials and funding programmes (WP1);
(2) proposals for new initiatives (WP2), by way of a gap analysis (current training offer vs. industry expectations);
(3) test or implement initiatives (WP3), through 2 pilot actions, 200 person-week trained, and an e-library;
(4) management of the consortium activities and administrative work to report to the European Commission (WP4). Adequate assignment of resources, monitoring, assessment, verification and validation of the results obtained during the project life;
(5) dissemination (WP5) to ensure that project results will be used in as many relevant training programs of European educational institutions as possible, with emphasis in involving public administrations, 2 dedicated workshops and provide hand-over for continuation.

Project results:

WP1

The objective of the WP is the mapping of existing training programs in EU: Identification of projects, actions, initiatives and courses ongoing in EU to provide a good base for this educational action.

This WP includes the identification of funding programmes which allow supporting new educational projects / initiatives to join efforts in the EU. The WP leader is FSV.

No additional time was needed to finish the task of this WP.

Task 1.1: Identification of educational / training programs and initiatives in the EU

In the future today?s students and technicians will be responsible for design and production of fuel cells as well as users too. Therefore education at the moment is an important step forward for an increasing acceptance and successful implementation of hydrogen and fuel cell technology.

The point of the task is to assess hydrogen and fuel cell educational materials which are used in a number of different educational systems at different European levels. Moreover, opportunities to transfer hydrogen and fuel cell information into traditional materials were evaluated.

By the gathered results of evaluation hydrogen and fuel cell educational materials the whole project HYPROFESSIONALS will take advantage to going successful.

The partners from European countries which involved are UK, Spain, France and Germany but there is an overview about European ways to provide the topics hydrogen and fuel cells to the audience.

Significant results
- Very few educational offerings focused exclusively on the technology of hydrogen and fuel cells.
- Hydrogen and fuel cell studies mostly related to renewable energy and graduate or postgraduate level.

Task 1.2: Assessment of educational materials

The aim of the task is to collect the best or excellent educational initiatives on fuel cell and hydrogen technologies which can be replicated.

For that, we review the various educational resources that are currently available to all students who want to begin or deepen knowledge about this set of technologies. We selected those who understand the best educational proposals taking the criterion of length of training, the curriculum and the opportunity to study individually and only training, not as a subject or part of a larger formation.

The study focuses in 6 European countries, which are the countries through institutions involved in the task (Germany, United Kingdom, Turkey, France, Italy and Spain).

Significant results
- Variety of hydrogen and fuel cell educational materials has been found on EU classificated by target groups, language, level.
- A study of how vocational training is configured in each partner country.
- A road map about how introduce new educational materials in the standard curricula.

Task 1.3: Identification of funding programs

The purpose of the task is the identification of European educational programs and other transnational or national programs which can contribute to develop new initiative programs for education and training projects in the field of fuel cell and Hydrogen technology and also implement the project results.

Partners from 6 European countries were involved (Germany, United Kingdom, Turkey, France, Italy and Spain) but there is a short insight into funding program on a European level.

The main conclusion is that in most countries usually there are no direct calls for supporting education and training activities in the field of fuel cells and Hydrogen. Apart from 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 promoted.

Significant results
- Funds for educational measures are available.
- Extensive research and development (R&D) programmes (partly owned H2&FCs) exist in most of the countries, but the education and training topic (e.g. service and maintenance) is often a minor priority as it appears at the end of the value chain.

WP2

The aim of the WP is the identification of the target groups and stakeholders by sectors. Also the development of specific proposals / initiatives to deal with and cover the educational needs identified. The existing programs will be used in an efficient and effective manner for ramping up the obtaining of a well-trained task force and overcome barriers. Phyrenees is the WP leader.

Task 2.1: Identification and analysis of educational gaps and needs

The results of the task show the main gaps and needs to be covered at short, mid and long term. The task defines a European strategic working plan to launch initiatives and proposals which help to solve the situation in a right way.

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

The gap analysis means how does demand (estimations of future labour market) match or mismatch the supply (courses suited to technicians, either official training or not).

For the gap analysis, the work has started on time, although the definition of the methodology has needed much more time than expected, due to the very different visions among the partners. A final methodology has been frozen by April 2012, which leads in turn to a further delay of at least 4 months in the final

delivery of the report. The consortium took measures so as not to incur in additional delay especially in what affects the pilot actions, very sensible in timing, as again the summer period can cause a serious disruption.

Significant results
- Different H2&FC application studies to know the development of its market in order to adapt the best solution of training for each application and sector. The work methodology has been agreed among the partners.
- Demand (Study of current and future market) is analysed through a study of the different H2&FC applications in order to know the development of its market, taking into account the final application:
(a) early markets (forklifts);
(b) back-up solutions;
(c) stationary fuel cells;
(d) electromobility;
(e) production of hydrogen;
(f) hydrogen stations.
- With all this information, estimation of the volume of people necessary to cover all the market needs of each application taking into account the type of enterprise, development phase and professional profile is calculated (based on existing studies and literature or on our own knowledge).
- For the supply side (Study of current educational trainings), the first step is finding out how many people study each vocational training nowadays (the ones related to hydrogen technologies, such as automotive, vehicle maintenance, electrical), how many study by themselves (courses for unemployment, private courses), and how many study hydrogen technologies by continuous training (people who is currently working).
- Finally, the comparison between future supply and demand make a relationship between the current people that study each vocational training and which is the current volume of related jobs.

Task 2.2: Identification of target groups and stakeholders by sectors

The objective of the task is to identify 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.

The method adopted to identify the target groups and stakeholders consists on a questionnaire with a web-form data collection published on the project website and filled in by the contacts of all the involved HYPROFESSIONALS partners.

The identification of stakeholders has started later than predicted in the description of work, mainly because of late freezing of the methodology for that work and due to the summer period, as the basis for it is contacting directly the stakeholders. Because of that reasons and for the delays of the stakeholders in responding to our requirements, the consortium decided to devote more effort and time to this report, which has been finalised by March 2012. This delay did not imply an overall delay for the rest of the tasks, which were running in parallel. Response from industry has been slow and not easy, so more extra time dedicated for doing it.

Significant results
- A relevant number of stakeholders were collected in 13 countries, totalling 129 contacts and profiles:
(a) 57 educational / training centres;
(b) 72 companies.
- A database with all the data from each stakeholder has been created and is available at the project website.

Although this Task should have been finalised by November 2012, lack of certain types of stakeholders and uneven geographical coverage has led the consortium to decide a further effort of three more months.

Task 2.3: Development of educational / training proposals / initiatives

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

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

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

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

Significant results
- 21 proposals / initiatives collected from all partners. Each proposal has a description, the target group, the steps to establish the proposal, possible funding, duration and place, contents and material required.
- Individual conclusions from every proposal are shown.
- General initiatives/proposals are developed from the individual conclusions. These general proposals are the best and more accurate way to establish hydrogen and fuel cells trainings.

WP3

This WP is focus on the implementation of broad, efficient outreach education programmes: Development of the identified actions and activities to cover different levels from technical schools level and covering undergraduate and graduate studies. Training pilot actions for assessment of proposals and/or initiatives are planned. CPI is the WP leader.

Task 3.1: Launching of proposals

The aim of the task is to set up the bases of a European curriculum in hydrogen technologies at different levels but taking into account that training should be offered only by qualified and accredited organisations thus some design and accrediting effort may be necessary to help build confidence.

The initiatives are flexible in geographical scope, timeline and the actors involved. Their commonplace is that they are logical steps towards the assimilation of hydrogen and fuel cells training by the educational system(s). An initiative should define the concrete problem to solve, identify the necessary actors and provide indications of funding for developing it.

For example, some ideas of initiatives can range from how and when to include training units in existing official curricula, development of contents and teaching platforms for continuous training, or new proposals of projects on training.

We delayed this task for one month (after 2on presence meeting on 6 March) in order to have more comments and suggestions from the partners. After that meeting, the methodology was established and the discussion about the contents and differences between Tasks 2.3 and 3.1 was studied.

Significant results
- From these proposals a number were taken forward for pilot actions.

- A review of the current training model together with a brief review of new technology modes of training.
- In order to obtain important information from the pilot studies a Feedback questionnaire was developed and sent to all the project partners delivering a pilot action.

Task 3.2: Pilot action

The objective of the task is implementing and tests the initiatives, educational materials identified and didactic resources. Different methodologies are taken into account (presential and e-learning) due to the competences of the partnership.

The so-called pilot actions need to show how a certain initiative is implemented, and draw conclusions for improvement from this experience.

On 2012, four pilot actions were carried out by 5 partners in four different countries:
- UNIDO-ICHET (Turkey),
- Environment Park (Italy),
- WBZU (Germany),
- FHa & FSV (Spain).

Significant results
- A total of 353 students (it means 253 person/week) attended the four project partner pilot actions and from these 188 completed questionnaires were obtained:
(a) UNIDO-ICHET (Turkey) - 47 people (2 days) = 19 person/week
(b) Environment Park (Italy) - 70 people (1 day) = 14 person/week
(c) WBZU (Germany) - 56 people (2 days) = 22 person/week (d) FHa & FSV (Spain) - 198 people (5 days) = 198 person / week.
- From these questionnaires was a range of both positive and negative comments regarding the training

and content which could be used to refine the courses going forward.
- The pilot actions were delivered by a number of different training delivery mechanisms for example instructor led training and E-learning. One of the positive opportunities with e-learning is the ability to train a large number of people in more convenient timescales to suit the student and also if supplemented with some practical training (i.e. attendance at a facility) this helps further in the training and development.

WP4

This WP is focus on the management and monitoring and assessment: adequate assignment of resources, monitoring, assessment, verification and validation of the results obtained. Foundation for Hydrogen Aragon (FHa) is the WP leader.

Task 4.1: Global management

The main goal of the coordinator management is the administrative and financial affairs relating to the project, with contributions of all partners.

Significant results
- Kicking-off the project, solving the initial administrative tasks and follow-up of the partners have been the main activities on management during the period.
- Periodic report reviewed, taking into account FCH-JU project officer comments.

Task 4.2: Organise and preside project meetings

Organise meetings and teleconferences, as well as elaboration of meeting agendas and minutes of the meetings.

Significant results
- Three face-to-face meeting of all partners (Kick off meeting and second meeting in Brussels and final meeting in Milan).
- Eight general teleconferences to discuss about work developed and agree the methodology of each task.
- All minutes of the meeting are uploaded to the project website (not public).

Task 4.3: Monitoring of project activities

Monitor the quality of all the deliverables submitted and the development of the WPs.

Significant results
- Deliverables quality review.
- Deliverables uploaded to the FCH-JU application and HYPROFESSIONALS website (public).

Task 4.4: Organisation of financial documents and progress reports to be submitted to the EC

Preparation of the financial report and financial statements.

Significant results
- Form C?s submitted on the application.
- No changes on the budget have been submitted to the FCH JU. The final repartition of the budget among partners and among cost typologies has been reported in the final report, showing slight adjustments.

Task 4.5: Control of any external communications

General communication regarded to project activities such as papers, participation in conferences and press releases, etc.

Significant results
- Monitoring of all communication activities (dissemination plan: conferences, presentations, papers).

Task 4.6: Verification, validation and implementation of the results obtained

Evaluate and validate all the project results/deliverables to ensure the performance of the objectives and the quality of its. Ensure the availability of the projects results on the project website.

Significant results
- The projects results (public deliverables) are available on the project website (public).
- Implementation plan with all the results of the project is submitted and available at the website. Its aim is to establish the procedure to follow in order to establish hydrogen and fuel cells in current and future vocational training and industry and it is based on the project deliverables information, beginning from the vocational training configuration and finishing with the experiences of the pilot actions.

WP5

The objective of the dissemination WP is to ensure that the project results will be used in as many relevant training programmes of European educational institutions as possible. Therefore special attention will be given to the identification of the most effective dissemination channels using existing education networks and Organisations in Europe. FAST is the WP leader.

Task 5.1: Dissemination plan

The HYPROFESSIONALS project recognises that educational and training programs for key personnel needed in producing, installing, and operating hydrogen and fuel cell applications are an integral factor in the development and deployment of hydrogen and fuel cell technology. The activities therefore need to facilitate engagement of key stakeholders, at different educational levels, who could facilitate the uptake of hydrogen and fuel cell curriculum integration in relevant educational programs at various levels.

The main points of this task are:

(1) identification of existing training programs related to hydrogen and fuel cells in the EU that may provide

a good base for educational activities;
(2) specific initiatives, proposals, guidelines and/or projects to get consolidated educational programmes for technical training (engaging stakeholders in industry, SMEs, educational entities, authorities, European organisations, and institutions);
(3) dissemination of results at different target audiences to facilitate acceptance and implementation of these technologies by means of education (two workshops are scheduled to be coordinated during the project);
(4) increase in the number of state and local government representatives which receive information and understand the concept of a hydrogen economy, and how it may affect them;
(5) the exchange of experiences, project results, training initiatives on-going, training courses and good practices to take advantage of the work already done, to maximise the reach of education efforts and avoid duplication;
(6) achieving a motivating personal and professional identity in future learning and adjustment to the development of the technology and creating social change. Engaging various student and youth networks in addition to developing strategic partnerships with multinational, local and European level organisations is a significant focus in the dissemination strategy defined;
(7) surpassing information barriers about the hydrogen economy and fuel cell technology are a key focus of all dissemination actions and media tools.

The dissemination plan wants to help to bring all the project result to the different target groups like educational institutions and industry (among others). For that, a publishable report of the project results is done and sent to the stakeholders identified, partners and institutions.

Several European institutions on vocational training were contacted in order to have more dissemination and collaboration.

HYPROFESSIONALS Project had presence in the main H2&FC European Fair and the more important conferences in hydrogen technologies and fuel cells.

Significant results
- boiler plate and standard presentation,
- project brochure,
- press release,
- contact database created:
(a) EU, LLL, DG education etc.;
(b) universities, technical schools;
(c) industry, SMEs;
(d) national Agencies for LLL;
(e) European associations, Strategic Partnerships.
- Presentations:
(a) project presentation at 17th Group Exhibit Hydrogen + Fuel Cells at HANNOVER MESSE, 4 - 8 April 2011
(b) EU Sustainable Energy Week, 9 - 14 April 2011 Brussels
(c) 'La via Italiana all'idrogeno'. Italian conference, June 14, 2011

(d) International Conference on Hydrogen Production (ICH2P 2011) in Thessaloniki, Greece, 19 - 22 June 2011
(e) Workshop Hungarian Hydrogen Association, 29 September 2011 Budapest
(f) F-Cell Stuttgart, 26 - 27 September 2011 Stuttgart
(g) 4th International Sminar: advances in Hydrogen Energy Technology, Nov 10-11, 2011, Valero Portugal
(h) IPHE Educational Group meeting on developing a global FC&H2 curriculum, 17 November 2011 Berlin
(i) FCH JU Stakeholder General Meeting, November 22-23, 2011
(j) 3rd Polish Forum on Hydrogen and Renewable Energy, 29 - 30 November 2011 Warsaw
(k) HYPROFESSIONALS project was an oral presentation at Fourth European Fuel Cell Technology and Applications Piero Lunghi Conference - EFC11
(l) HYPROFESSIONALS update was given at project meetings of:
(i) CHIC, 14 -15 March 2012
(ii) High VLO-City, 22 March 2012
(iii) HyTEC, April 16, 2012
(m) Idrogeno a celle combustibile. Il bando 2012 della FCH JU. Italian conference, Milan, 14 February 2012
(n) FSV-FHa workshop to inform about the project and the pilot action. Target audience - the students of 2nd year of Superior Grade from Fundación San Valero. March 2012.
(o) Event with teachers and maintenance staff to go deeply into FSV-FHa pilot action. May 2012.
(p) World Hydrogen Energy Conference, Toronto, June 7, 2012
(q) Energia e idrogeno. Le esperienze e le strategie europee. Il nuovo bando energia del 7º programma Quadro. Le iniziative in Italia. Italian conference, Milan, 14 June 2012
(r) Hannover Fair April 23 -29 , 2012 Technical forum presentation
(s) EUSEW June 19-22, 2012: roundtable with FCH JU demo projects coordinators and FCH project coordinators on how educational project results can be used in current and future FCH JU projects
(t) European Technical School on Hydrogen and Fuel Cells - HYPROFESSIONALS and WBZU pilot action presentation, Heraklion (Crete - Greece), September 24, 2012
(u) Latvian Hydrogen Conference Riga, 4 October 2012
(v) Educational Encounters, IPHE meeting Seville, 13 November 2012. HYPROFESSIONALS presentations will be part of future Educational Encounters
(w) 5th International Hydrogen Seminar, Lisbon, November 30, 2012
(x) Italian Hydrogen Conference, Milan, 13 December 2012.

Task 5.2 Organisation of annual workshops

Workshops aim is to attract invitees from educational organisations, EU and national level government officials, educational, and industrial associations. Special emphasis is brought to coordinators and developers of vocational training programs, trainers and students as they are seen as the end-users and providers of training programs.

The first workshop was delayed until valuable results from the gap analysis to be explained to the stakeholders.

Significant results

- The first workshop was at the EU Sustainable Energy Week in Brussels (21 June).
(1) 1st Workshop - GAP analysis agenda (Duration approximately 3 hours 30 min).
- Welcome and project introduction: project coordinator (20 min).
- Industry and current state and outlook: Representative from major industrial player (Member of the EHA) (30 min).
- Impact of vocational education on Employability in Europe: Representative of Vocational Training Community (30 min).
- GAP analysis: WP2 project coordinator (45 min).
- Presentation other European projects in hydrogen education and training: HyFACTs (15 min), TrainHy (15 min).
- Closing:project Coordinator.

The second project workshop creates the opportunity to publicise the conclusion of the project, and the presentation of results of pilot actions, proposal of initiatives, and project continuation plan (13 November 2012).

(2) 2nd Workshop - project results and proposals for future hydrogen training agenda:

- Welcome - Official of the School of Engineering of Seville (10 min).
- State of Play of Educational activities in EU FCH JU programme.
- HYPROFESSIONALS: Training of next generation FC and H2 technicians - Luis Correas (Project coordinator) (30 min).
- HyFacts: Informing authorisation officials about FC and H2 state of play - Marieke Reijalt (15 min).
- Future FC and H2 education, panel moderated by Juergen Garche with participation of members of IPHE Education Working Group (45 min).
- End of the meeting.

Task 5.3: Development of a website and multi-media communication tools

The HYPROFESSIONALS website is a key instrument to facilitate the effective involvement of key stakeholders, at different educational levels, who could facilitate the uptake of hydrogen and fuel cell curriculum integration. As a well-trained technical workforce in this new technology is critical to provide the necessary support and maintenance of the first commercial applications, the focus will be on addressing the vocational school community.

The website will therefore need to attract target groups (teachers and students, state and local decision makers, community groups and public citizens), provide links to educational developments and networks to facilitate exchanges, the website format will include areas for specific, educational and political stakeholders and the general public with an attractive interface that invites visitors with easy clicks to the latest news on the project and training activities and it will be also possible to exchange news or other information between partners within the secured Intranet.

Significant results
- website working properly,

- private area on website (only partners) as project work tool,
- online questionnaires for industry and educational institutions (WP2 tasks),
- link to the pilot action platform of FHa-FSV.

Potential impact:

Socio-economic impact and exploitation of results: The socio and economic impact of the project is to set up the road map for conventional educational system in order to add in their educational programs the new hydrogen technologies. This manner, industry and SMEs will have on the mid-term a well-trained work-force.

The expected impacts were listed in the annual implementation plan. They can be separated into short-term impacts and mid- and long-term impacts.

Amongst the first, short-term impacts, the following have been achieved:

(1) promote technological knowledge in Educational sectors;
(2) disseminate the technology and the needs of specific educational programmes. Identify audience education needs;
(3) creation of a website to collect EU education/training resources;
(4) visibility of hydrogen technologies and fuel cells;
(5) launching of new initiatives and projects;
(6) set up the bases for implementation of hydrogen and fuel cells in educational programmes;
(7) involve industry and SMEs as final user of results;
(8) promote links with similar professionals training initiatives in other EU sectors (biofuels, renewable energies, automotive).

Four pilot actions took place where Educational and Industrial sectors were invited and trained in Hydrogen and Fuel Cells Technologies. Same way, the awareness of the students about hydrogen was improved and around 350 people were updated on renewable energies, focusing on H2&FCs.

Two workshops were carried out, in which the results of the gaps and needs analysis and the initiatives and proposals developed were shown and explained. One of the workshops was focus on industrial field (demonstrative FCH-JU projects) and the other on educational centres in order to achieve the most important audience for the project and establish contact with them. Some future cooperation with demonstrative projects and educational centres were discussed.

A publishable report of results is developed in order to disseminate the final results to the SMEs, end users, educational sectors, FCH-JU and contact database from HYPROFESSIONALS project.

With regard to the mid- and long-term impacts, the following should be highlighted:

(1) contribute to the development of educational programmes in Europe focus on hydrogen technologies at different levels, necessary for the deployment strategy;

(2) contribute to improve energy efficiency (Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC);
(3) save on fossil fuels in electric power generation, making it less vulnerable to future problems in the supply of these resources by means of use of hydrogen technologies;
(4) promote the security of energy supplies for the EU;
(5) prepare labour force for the upcoming widespread commercialisation of hydrogen technologies.

The results of HYPROFESSIONALS project will help the EU for the following reasons:

- The EU is heavily dependent on imported fossil fuels for electric power generation. The project will support efforts for implementation of hydrogen technologies by means of training activities.
- Many areas of the EU are highly vulnerable to the contamination produced by emissions. A well-trained task force will facilitate the implementation of clean technologies.
- Many areas of the EU enjoy abundant resources of renewable energies. To join educational programs in renewable energies with hydrogen technologies will favour them.
- Many areas of the EU have imposed quite challenging future greenhouse gas reduction targets which will require the important introduction of many renewable energy technologies including hydrogen and fuel cells in order to hopefully achieve these.

The project will also support existing and emerging EC policies. Clean energy technologies and increase of energy efficiency that reduce the emission of CO2 and pollutants have been successfully developed and demonstrated with the support of Community funds.

Broad market introduction, however, is often hampered by high initial costs and thus insufficient customer demand. Action at the European level is required to create markets of sufficient size to bring down the cost of better environmental performance technologies. One of the actions to facilitate the technology implementation is to create a necessary well trained human resource base.

Educational programmes will contribute and are the way to achieve the levels of penetration of clean technologies foreseen.

Main dissemination activities:

- Project presentation at 17th Group Exhibit Hydrogen + Fuel Cells at HANNOVER MESSE, 4 - 8 April 2011,
- EU Sustainable Energy Week, 9 - 14 April 2011 Brussels,
- 'La via Italiana all?idrogeno'. Italian conference, 14 June 2011,
- International Conference on Hydrogen Production (ICH2P 2011) in Thessaloniki, Greece, 19 - 22 June 2011,
- Workshop Hungarian Hydrogen Association, 29 September 2011 Budapest,
- F-Cell Stuttgart, 26 - 27 September 2011 Stuttgart,
- 4th International Sminar: advances in Hydrogen Energy Technology, 10 - 11 November 2011, Valero Portugal,

- IPHE Educational Group meeting on developing a global FC&H2 curriculum, November 17, 2011 Berlin,
- FCH JU Stakeholder General Meeting, 22 - 23 November 2011,
- 3rd Polish Forum on Hydrogen and Renewable Energy, 29 - 30 November 2011 Warsaw,
- HYPROFESSIONALS Project was an oral presentation at Fourth European Fuel Cell Technology and Applications Piero Lunghi Conference - EFC11,
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- Event with teachers and maintenance staff to go deeply into FSV-FHa pilot action. May 2012,
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- Hannover Fair 23 - 29 April 2012 Technical forum presentation,
- EUSEW 19 - 22 June 2012: roundtable with FCH JU demo projects coordinators and FCH project coordinators on how educational project results can be used in current and future FCH JU projects,
- European Technical School on Hydrogen and Fuel Cells - HYPROFESSIONALS and WBZU pilot action presentation, Heraklion (Crete - Greece), 24 September 2012,
- Latvian Hydrogen Conference Riga, 4 October 2012,
- Educational Encounters, IPHE meeting Seville, 13 November 2012. HYPROFESSIONALS presentations will be part of future Educational Encounters,
- 5th International Hydrogen Seminar, Lisbon, 30 November 2012,
- Italian Hydrogen Conference, Milan, 13 December 2012.

List of websites: http://www.hyprofessionals.eu

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