

REPORTING ON WP6

W6: Dissemination activities

According to the contract three main types of dissemination activities have been foreseen:

1. Trans regional dissemination
2. Regional dissemination
3. Sectoral dissemination

A description of the activities carried out in the scope of WP 6 is presented below:

1) Trans-regional dissemination activities

In the scope of the Trans regional dissemination activities the following documents and or events have been prepared and organized:

- The first draft of the **information brochure**, with 5 pages, has been issued in english by ISR-UC. This draft was released for comments among the partners, and a final version of the English brochure with a good design was then released by HIRC. Each partner translated the brochure for its own regional language, which are available for download from the project website: Portuguese, English, Spanish, Polish, Dutch, German, Dansk.
- ISR-UC is finalising one paper with the main results of the project, which will be submitted to the conference: IEEE International Conference on Sustainable Energy Technologies 2008, <http://www.icset2008.org/>. A copy of the paper is being sent in attach.
- the paper is also being submitted for an online publication
- Two Seminars have been organised, one organized by ISR-UC in Coimbra on May 27, 2008, and another was organized by HIRC in Herning on June 24, 2008. The objective of the workshops was to disseminate the results of the project. The seminars attracted the most important stakeholders, like building owners and constructors, FC manufacturers, policy makers, energy services providers and researchers, etc.

Workshop carried out in Coimbra on May 27, 2008

- A one day workshop was carried out in Coimbra on May 27, 2008 (see attached agenda). Although the narrow subject of the workshop, it attracted 46 persons belonging to different stakeholders and target groups. Research institutions, energy service providers, building companies, networking, associations and fuel cell manufacturers. Because of the very specific issue and in order to have a broader and larger audience the workshop was organised in collaboration with the Portuguese fuel cell manufacturer SRE and with the Portuguese Association for the H2 Promotion. The workshop has been disseminated through emailing lists, specific groups related to energy, announcements in previous seminars carried out in Portugal, and direct contacts to invite specific expert people to attend the workshop or give a lecturer. In this relation, the AJUSA, fuel cell Spanish manufacturer company has been invited but informed us about their unavailability to attend the workshop.
- The seminar was very informative and interesting. About half of the participants had never had any experience with fuel cells.
- The Work programme of the Coimbra Workshop is shown below:

9:00 – 9:30	REGISTRATION
9:30 – 9:40	WELCOME BY THE DIRECTOR OF ISR-UC <i>Prof. Aníbal T. de Almeida, ISR-University of Coimbra, Portugal</i>
9:40 – 10:00	OPENING BY THE DIRECTOR GENERAL OF ENERGY “PORTUGUESE INITIATIVES REGARDING THE INTEGRATION OF RENEWABLE ENERGY” <i>Director General of Energy</i> <i>Directorate General of Energy and Geology, Portugal</i>
10:00 – 10:30	PRESENTATION OF THE PROJECT RES-FC MARKET <i>Frans Bjørn-Thygesen, Hydrogen Research Centre, Denmark</i>
10:30 – 10:45	HYDROGEN PROMOTION IN PORTUGAL <i>Rei Fernandes, IDMEC, Portugal</i>
10:45 – 11:00	Coffee break
11:00 – 11:30	OVERVIEW AND PERSPECTIVES OF FUEL CELL TECHNOLOGIES AND REGIONAL MARKET DEVELOPMENT <i>Gerard Kraaij, ECN, Netherlands</i>
11:30 – 12:00	10 REGIONAL MARKET DEVELOPMENT PLANS <i>Poul Ostergaard, Alborg University, Denmark</i>
12:00 – 12:30	DEVELOPING AN AGGREGATED MARKET OF 3000 RES-FC UNITS – ECONOMIC ANALYSIS <i>Claus Torbensen, HIRC, Denmark</i>
12:30 – 13:00	SOCIAL REPRESENTATIONS OF HYDROGEN IN PORTUGUESE POPULATION <i>Judite Campos Rodrigues, AP2H2, Portugal</i>
13:00 – 14:00	Lunch
14:00 – 14:30	HYDROGEN PRODUCTION FROM RENEWABLE ENERGY SOURCES <i>Thorsteinn Sigfusson, University of Iceland, Iceland</i>
14:30 – 15:00	MAKING BUSINESS OUT OF ELECTROLYSERS <i>Lars Yde, BIC, Poland</i>
15:00 – 15:30	MAKING BUSINESS OUT OF RES-FC SYSTEMS Jesper Thomsen, Dantherm Power, Denmark
15:30: 16:00	PORTO SANTO – CASE STUDY <i>Luis Alves, IDMEC, Portugal</i>
16:00 – 16:15	Coffee break
16:15 – 16:45	MARKETING STRATEGIES TO DEVELOP REGIONAL MARKETS <i>Campos Rodrigues, SRE, Portugal</i>
16:45 – 17:00	FUEL CELL FOR HIGH POWER QUALITY APPLICATIONS <i>Aníbal T. de Almeida, ISR-University of Coimbra, Portugal</i>
17:00 – 17:30	PANEL DEBATE – DISCUSSION AND SUGGESTIONS <i>Moderator: Prof. Thorsteinn Sigfusson, University of Iceland</i>

Prof. Thorsteinn has not coming for the workshop because he got sick, and Dr. Bernhard Schaible has replaced him in the Panel Debate.



The main conclusions arising from the workshop were:

- Fuel cells can be used for CHP in houses, based on renewable energy systems. An important challenge is to improve the reliability of the FCs and to achieve reasonable costs.
- In addition, there is a need for subsidies and for harmonized legislation among EU. To gather the 10 regional markets in order to push manufacturers to decrease the price was a great strategic idea, and manufacturers involved in the project were very interested in such interesting approach.
- One big problem is to get the permission from the authorities to agree with a H2 network that is not built for industrial purposes. A good example to follow to overcome this barrier is the Danish example. The authorities establish some minimum requirements but they give permission to install H2 grids for residential use. If this is not illegal in DK we should push our governments, legal institutions, to enable us to build such H2 networks.
- It is very important to know how fast manufacturers can produce Fuel Cells at a reasonable price.

List of participants in the workshop carried out in Coimbra: 27 May 2009-01-05

Surname	Name	Position	Company
Delgado	Teresa	Researcher	ISEC
Alves	João		INOPOWER
Constantino	Pedro Miguel Pereira		INOPOWER
Lima	Ricardo	Researcher	ISR-University of Coimbra
Murtinheira	Marco	Engineer	Iberfer – Equipamentos e Construções Técnicas S.A
Fonseca	Paula	Senior Researcher	ISR-UC Renewable Energies Grid Integration Department Centro Nacional de Energías Renovables
Alzueta Ibáñez	Beatriz	Researcher M.Sc., Sales	CENER
Mangru	Vick	Development Manager	IRD A/S BzA-BW (Fuel Cell Alliance Baden-Wuerttemberg)
Schaible	Bernhard	Senior Consultant	
Patrão	Carlos	Researcher	ISR-University of Coimbra Chemistry Department-University of Coimbra
Barroso	Mónica	Researcher	
Neves Dias	Paulo Alexandre	Project Manager	Martifer Inovação e Gestão IBBK -International Biogas and Bioenergy Centre of Competence
Pietzsch	Katrin		
Moller	Martin		Dong Energy, DK
de Diego	Joaquim		Praxair- Portugal Gases, S.A.
Catarino dos Santos	Jorge Manuel	Manager of building company and energy company	Oryzon Energias S.A
Saraiva Pires	Mafalda		MASAPI, Lda
Lima	Fernando		Praxair- Portugal Gases, S.A.
Bjørn-Thygesen	Frans	Director	HIRC
Fernandes	Rei	Professor	IDMEC
Kraaij	Gerard		ECN Hydrogen & Clean Fossil Fuels
Ostergaard	Poul	Professor	Aalborg University
Torbensen	Claus	International Project Manager	Hydrogen Innovation & Research Centre - HIRC
Pinto	Judite	Researcher/ Social aspects	AP2H2

<i>Sigfusson</i>	<i>Thorsteinn</i>	<i>Professor</i>	<i>University of Iceland</i> <i>Hydrogen Innovation & Research</i>
<i>Yde</i>	<i>Lars</i>	<i>Technical Manager</i>	<i>Centre - HIRC</i>
<i>Themsen</i>	<i>Jesper</i>	<i>Technical Director</i>	<i>Dantherm Power A/S</i> <i>Research Group on Energy and</i> <i>Sustainable Development</i>
<i>Martins</i>	<i>Rui</i>	<i>Researcher</i>	<i>EDP Inovação</i>
<i>Andrés</i>	<i>Rui</i>	<i>Project Manager</i>	
<i>Campos</i>			
<i>Rodrigues</i>		<i>Director</i>	<i>SRE- Soluções Racionais de Energia</i>
<i>Pereirinha</i>	<i>Paulo</i>	<i>Professor / Researcher</i>	<i>ISEC-Coimbra</i>
<i>Bandeirinha</i>	<i>Rui</i>	<i>Researcher</i>	<i>ISR-University of Coimbra</i>
<i>Oliveira</i>			
<i>Quaresma</i>	<i>Nuno Augusto</i>	<i>Master student</i>	<i>University of Coimbra</i>
<i>Marques Lopes</i>	<i>Marco Wilson</i>	<i>Master student</i>	<i>University of Coimbra</i>
<i>Martins Pinto</i>	<i>Bruno Jorge</i>	<i>Master student</i>	<i>University of Coimbra</i>
<i>Valente</i>			
<i>Machado Alves</i>			
<i>Morais</i>	<i>João Guilherme</i>	<i>Master student</i>	<i>University of Coimbra</i>
<i>Rodrigues</i>			
<i>Almeida</i>	<i>Cristina Patrícia</i>	<i>Master student</i>	<i>University of Coimbra</i>
<i>Pinto Godinho</i>	<i>Ricardo</i>	<i>Master student</i>	<i>University of Coimbra</i>
<i>Lopes</i>			
<i>Agostinho</i>	<i>André Gonçalo</i>	<i>Master student</i>	<i>University of Coimbra</i>
<i>Ribeiro Tavares</i>			
<i>França</i>	<i>Ana Filipa</i>	<i>Master student</i>	<i>University of Coimbra</i>
<i>Pereira</i>	<i>António</i>	<i>Researcher</i>	<i>LGE- University of Coimbra</i>
<i>Tainha</i>	<i>Pedro</i>	<i>Master Student</i>	<i>University of Coimbra</i>
<i>Rebelo</i>	<i>Márcio</i>	<i>Master Student</i>	<i>University of Coimbra</i>
<i>Tibério</i>	<i>Marco</i>	<i>Master Student</i>	<i>University of Coimbra</i>

Workshop carried out in Herning on June 24, 2008

The workshop in Denmark attracted 46 persons as well, and attracted attendants from most of the target groups including energy utility companies and FCHS manufacturers. The workshop was disseminated through a leaflet which was sent to 350 people of the HIRC network and subsequently placed at the HIRC website.

RES-FC Market

NEED HEAT AND POWER?
Microgeneration with Fuel Cells

Herning 24th of June 2008

Time and place:
The workshop will be held at Innovatorium,
Birk Centerpark 40, DK-7400 Herning.

June 24th 2008, 9.00-15.30

Enrolment:
There is no registration fee, but enrolment is binding.

You can sign up on the website of Hydrogen Innovation & Research Centre: www.hirc.dk, or call us: +45 70 20 46 13

The last date for signing up is June 17th

Renewable Energy Sources
FUEL CELL
Market


WORKSHOP

FUEL CELL MARKET HIRC

To attract as many attendants as possible the workshop was supplemented with a guided tour to H2College which is a complex of the first hydrogen apartments in Denmark and a part of the aggregated market in the RES-FC Market analysis. H2College is the biggest residential hydrogen project of its kind in Europe. Apart from lecturers from the RES-FC Market following lecturers attended: Poul Müller, Chairman of the Board at HIRC and member of the Counsel of Central Region Denmark and Palle Larsen, Sales Manager at Syd Energi, Denmark.

All the presentations from the workshop can be seen also on HIRCs website: <http://www.hirc.dk/Default.aspx?ID=570>

Copys of Agenda and participation list:

EU-PROJECT	RES-FC Market	PROGRAMME	RES-FC Market
<p>Renewable Energy Sources – Fuel Cell Market</p>		<p>9.00 – 9.30 Registration and breakfast</p>	
<p>The EU-project Renewable Energy Sources – Fuel Cell Market (RES-FC Market) wants to contribute to the market introduction of fuel cell household systems (FCHS) that use renewable energy sources (RES) because the contribution of these systems to global warming is very small.</p>		<p>9.30 – 9.45 Welcome and opening <i>Paul Müller, Chairman of the Board, HIRC</i></p>	
<p>For the market development it is essential that the system cost decreases and initial customers can be identified. Lessons from the successful European technology and market development of wind turbines will be transferred into the RES-FCHS sector.</p>		<p>9.45 – 10.05 Presentation of the project RES-FC Market <i>Frans Bjørn-Thygesen, HIRC</i></p>	
<p>This means that 10 regional markets will be described that have an aggregated market of 1200 RES-FCHS units to be realised in the near future.</p>		<p>10.05 – 10.25 Overview and perspectives of fuel cell technologies and regional market development <i>Gerard Krauß, ECN</i></p>	
<p>The cooperation between the regional RES-FCHS markets shall be used for driving down the costs of RES-FCHS due to acceleration of development and mass manufacturing possibilities.</p>		<p>10.25 – 10.50 Coffee break</p>	
<p>The main aim of this workshop is to present recent technological developments of Fuel Cell Technologies for stationary applications and increase awareness among potential users.</p>		<p>10.50 – 11.10 10 regional market development plans <i>Paul Østergaard, Aalborg University</i></p>	
		<p>11.10 – 11.30 Developing an aggregated market of 3000 RES-FC units – economic analysis <i>Claus Thorhøvsen, HIRC</i></p>	
		<p>11.30 – 11.50 Making business out of RES-FC systems <i>Jesper Thomsen, Daetherm Power</i></p>	
		<p>11.50 – 13.00 Lunch</p>	
		<p>13.00 – 14.00 Walk talk: H2College and electrolyzers <i>Søren Jørgensen, Fruehøjgaard, and Lars Yde, HIRC</i></p>	
		<p>14.00 – 14.20 Second generation bioethanol <i>Martin Møller, DONG Energy</i></p>	
		<p>14.20 – 14.40 Project "Dansk mikrokraftvarme" <i>Palle Larsen, Syd Energi</i></p>	
		<p>14.40 – 15.00 Questions and discussions</p>	
		<p>15.00 – 15.30 Drinks and snacks</p>	



Participants of the workshop at the building site of H2College

NEED HEAT AND POWER?

Microgeneration with fuel cells

COMPANY:

AgroTech
AU-HIH
AU-HIH
Baltic Sea Solutions
BIC
BIC
Bjerregaard Consulting
Boligselskabet Fruehøjgaard
Dansk Landbrugsrådgivning
Dantherm
Dantherm Power
Den canadiske ambassade
DONG Energy
ECN
Ecofys S.L
Energi Randers
Energinet.dk
GreenHydrogen.dk
Grontmij-Carl Bro
H2 Logic A/S
Herning Gymnasium
Herning Kommune
Herning Kommune
Herning Kommune
HIRC
HIRC
HIRC
HIRC
Hvide Sande Fjernvarme
Innovation Midtvest
IRD A/S
JK Maskinsalg A/S
Naturgas Midt Nord I/S
Poul la Cour Museum
Poul la Cour Museum
Privatperson
Region Midtjylland
Regionsrådet Region Midtjylland
Samsø Energy Agency
Strandmøllen A/S
Strandmøllen A/S.
Sun Wind
Syd Energi
Teknologisk Institut
Teknologisk Institut
Aalborg Universitet

NAME:

Mathias Andersen
Mads Friis Jensen
Alina Protsyk
Nini Hass
Lucja Kalkstein
Jens-Chr. Møller
Hans Bjerregaard
Søren Jellesø
Olav Rasmussen
Kim Kølhed
Jesper Thomsen
Suzanne Steensen
Martin Møller
Gerard Kraaij
Laura Bailón Allegue
Ole Schou Nielsen
Inger Byriel
Jørgen K. Jensen
Johnny Iversen
Per Koustrup
Michael Jørgensen
Dorte Langborg-Hansen
Merete Gammelmark
Jan møller Iversen
Claus Torbensen
Frans Bjørn-Thygesen
Lars Yde
Line Riisgaard
Jørgen Bukholt
Peter Smedegaard
Søren Wichmann
Carl Einer Leonhard
Carsten Rudmose
Povl-Otto Nissen
Jette Nissen
Jacob Fentz
Flemming Wennicke
Poul Müller
Jens Peter Nielsen
Per Frølich
Gøsta Andersen
Monie Jacobsen
Palle Larsen
Johan Hardang Vium
Anders Tønnenes
Poul Østergaard

PARTICIPATION LIST

- Another trans-regional dissemination activity was the setup and preparation of a network cooperation group done by HIRC, but with the collaboration of all the partners supplying contacts for the network. The focus of this EU network on RES-FCHS was regional market development and dissemination of project achievements. The network cooperation group consists of the main stakeholders. HIRC has been the secretariat of the network group and released two newsletters, which were prepared with the collaboration of all the partners. The first issue was issued on September 2007. The second newsletter was issued on March 2008.

2) Regional dissemination activities

In the scope of the regional dissemination activities the partners of RES-FC Market prepared a short report in their regional language, including a 2 pages executive summary in english, describing the activities carried out within each region for the dissemination of the project. The report entailed details on how, when, where and with which arguments the stakeholders such as suppliers of RES-FCHS, suppliers of renewable energy sources, end-users, being the domestic housing sector, regional and national authorities which are defining the framework conditions and finally utilities dealing with electricity were addressed. Furthermore, a regional plan on how to involve the regional stakeholders in the implementation of the regional market development plan for RES-FCHS was made, comprising some thoughts on how to promote the development plan from a marketing point of view.

ISR-UC and HIRC have released the following Template for the preparation of the reports:

- 1. Introduction to the task (no more than ½ a page)**
- 2. Summary on regional dissemination activities carried out (no more than ½ a page)**
- 3. Stakeholders (no more than 3 pages).**

[How, when, where and with which arguments has following stakeholders been addressed?: Suppliers of RES-FCHS, suppliers of renewable energy sources, end-users, being the domestic housing sector, regional and national authorities which are defining the framework conditions and finally utilities dealing with electricity?]

- 4. regional operational plan (4-6 pages)**

[A plan on how to involve the regional stakeholders in the implementation of the regional market development plan for RES-FCHS (which strategies should be used?). This paragraph will also comprise some thoughts on how to promote the development plan from a marketing point of view]

- 5. Conclusion (1 page)**
- 6. English summary (2 pages)**

The responsible for each regional market is as follows:

- HIRC-Jutland-DK
- UoI-Reykjavik, IC
- ISR-UC-Coimbra-PT
- AAU-Jutland-DK
- CENER-Navarra-ES
- ECN-North Friesland, NL
- IBBK-Wurttemberg-DE
- Dong Energy-Jutland-DK
- KIBZ-Schleswig-DE
- KIBZ-Baden-Wurttemberg, DE

After the completion of the first part of the project, WP2 and WP3, each of the above partners has been involved in dissemination activities as summarized in the following Table. All pdf articles, presentations and the national reports are available for download from the project web-site.

		Short ppt Presentation	Short ppt Presentation	Short article
	10-20 pages report about the regional dissemination activities	1 st regional seminar	2 nd regional seminar	Regional news media
HIRC-Jutland-DK	OK	Hydrogen and Fuel Cells seminar at HIRC in Herning addressing regional politicians. 23 October. 2007 afternoon session.	Hydrogen and Fuel Cells seminar at HIRC in Herning addressing regional politicians. 23 October. 2007, evening session.	Herning Folkeblad
Uol-Reykjavik, IC	OK			
ISR-UC-Coimbra-PT	OK	Fuel Cells for Households – Presentation of the RES FC project - Seminar in ISR-University of Coimbra May 2008; ppt in Portuguese	Fuel Cells for Households – Presentation of the RES FC project - Seminar in ISR-University of Coimbra – Energy Lab. June 2008; ppt in Portuguese	Paper in “REVUE” Special issue about Renewable University of Évora Press
AAU-Jutland-DK	OK			Comparative Energy System Analysis of individual House Heating in Future Sustainable Energy Systems, "International Journal of Hydrogen Energy"
CENER-Navarra-ES	OK	An oral presentation was presented at: World Hydrogen Technologies Convention 2007 Montecatini Terme – Italy, 4-7 November 2007	A poster is accepted: HYLCETEC 1 st Iberian Symposium on Hydrogen, Fuel Cell and Advanced Batteries Bilbao del 1-4 July 2008	Building Journal
ECN-North Friesland, NL	OK	Although there were some regional workshops for hydrogen, we haven't put our result of RES-FC Market on the agenda since we do not want to emphasize that the proposed solution of wind-hydrogen- μ -CHP is not viable in our view, neither do we want to promote the solution as an opportunity for the industry. ECN has made a presentation at both workshops: Coimbra and Herning.		A paper will be prepared presenting the wind - hydrogen - micro-CHP on fuel cells results at a conference next year, however the conference we haven't decided upon.
IBBK-Wurttemberg-DE	OK			
Dong Energy-Jutland-DK	OK		Micro-generation with fuel Cells – ethanol and methanol Workshop Herning, HIRC, 24 June 2008	
KIBZ-Schleswig-DE	OK	An updated English project-poster has been developed in September, 2007 together with the Institute of Systems and Robotics/University of Coimbra and was presented at the f-cell congress in September 2007 in Stuttgart	Presentation of a fermentation site in combination with a high temperature fuel cell (240 kWel. MCFC) to an international group of experts in connection with an information about the RES-FC Market project , Leonberg/Germany, July 5, 2007.	Dr. Bernhard has been a really good disseminator but lacked this article. The project officer accepted this deviation from the workprogramme, because they did more dissemination than asked for
KIBZ-Baden-Wurttemberg, DE				

NOTE: KIBZ in the person of Dr. Bernhard Schaible did more dissemination than asked for especially at this year's Hanover fair, probably being more efficient than by publishing a paper. Besides that they are willing to inform about the project and its results at the f-cell congress in Stuttgart in September (we are co-organizer and have a booth there), where we expect 600 fuel cell experts:

1. An **English project-flyer** has been developed in April, 2007 (see attachment).
2. The flyer was used at the **Hanover fair** in April 2007 to inform about the project as a means to inform the general public and the leading European producers for central heating (single – family houses up to apartment houses and small office buildings / small business applications). This has been documented in memos and a corresponding report.
3. **Presentation** of a fermentation site in combination with a high temperature fuel cell (240 kW_{el.} MCFC) **to an international group of experts** in connection with an information about the **RES-FC Market** project.

Location: Leonberg/Germany

Date: July 5th, 2007

A Memo has been written.

4. An updated **English project-poster** has been developed in September, 2007 together with the Institute of Systems and Robotics/University of Coimbra (see attachment).
5. The English and German flyers were used at the **f-cell congress** in September 2007 **in Stuttgart** to inform the international experts about the project. This congress hosted about 600 participants.
6. Preparation of a short presentation for the Hannover fair at our booth. Besides that we will diestribute the German and English brochure. Besides that I will organize a meeting in Hanover with the "Bundesverband Windenergie e. V." (Wind Energy Association of Germany), which is a non-profit association, representing the interests of the "wind industry". The association publishes excellent statistics among other things. The emphasis will be on the information of the Schleswig-Holstein members.
7. Attendance of the Hanover Fair with an emphasis on RES-FC Market. He included the project in their power point presentation (the information has been taken from the brochure) and they printed the brochure as a hand-out for interested visitors as a means of dissemination. Besides that he interviewed the major players of the "Initiative Brennstoffzelle" about the progress achieved since last year and about their future outlook. (see regional report).

In relation to the regional dissemination activities in **Denmark**, because it is a small country with many partners involved in the project, it was not feasible that each partner carry out two dissemination activities.

Following there is a short summary of the regional activities carried out in each country by each partner, as well as regional action plans foreseen:

HIRC: Denmark

5.1. Dissemination activities

The employees of HIRC have carried out following regional dissemination activities:

Activity:	Articles in Herning Folkeblad
Time:	9th of April, 2008
Place:	Central Denmark Region
Participants:	13.000 numbers printed and distributed pr. day
Responsible:	Line Riisgaard and Claus Torbensen

Activity:	Presentation to the local political association of the party Radikale Venstre
Time:	23th of October, 2007
Place:	Herning, Birk Centerpark 40
Participants:	40
Responsible:	Claus Torbensen

In these dissemination activities following target groups have been addressed:

Suppliers of RES-FCHS

Suppliers of renewable energy sources

End-users

Regional and national authorities

The target groups have been addressed with following issues and arguments:

The environmental benefits of introducing MCHPs in private households

The logical connection between fluctuating renewable energy and hydrogen as energy storage

The need for national subsidies for MCHPs and the cost reductions obtained by pooling all the MCHPs together from all the demonstration sites

The international interest in hydrogen technology as pointing out the power of penetration of the new technology

Projection of cost reductions

The project of RES FC Market as a player in the introduction of MCHPs to the market by the gathering of information about the different regional markets around Europe and doing joint purchase

The political decision makers have been addressed with arguments of the need to handle the excess wind mill electricity by making hydrogen. In Denmark windmills contribute with ca. 15-20 % of electricity to the overall electricity consumption.

The political decision makers were also told about the need for extra funding for demonstration projects which are the best way to introduce the technology to the market.

5.2. Regional action plan

In this paragraph of the report some considerations on how to bring the MSHP-technology to the regional market is made. One of the most promising ways is to demonstrate the technology which is why the description takes its starting point in the H2College-project that consists of 66 households with MCHPs using hydrogen generated from electrolysis using wind mill power. In this part all the parameters that play a part in the market introduction of hydrogen technology are outlined.

Apart from that the strategy and goals of the Danish Energy Agency (DEA) are presented. The focus in this report is on the short term goals (0-5 years). The specific recommendations on how to introduce the technology to the market were formulated by a working group within the DEA:

Internationally competitive economic public support to demonstration and market development of systems up to 25 kWe primarily based on RES fuels but also temporarily for fossil fuels.

Introduction of subsidies (tariffs/feed in tariffs and environmental regulation) to overcome barriers for the introduction of hydrogen technologies.

Pull products to the market by increased cooperation between Danish technology providers, the energy sector and private consumers through a series of demonstration projects.

R&D and demonstration of storage and production of hydrogen and hydrogen carriers primarily based on RES.

Decentralized plants shall be actively incorporated in the electricity grid.

Establishment of common conditions for decentralized plants building on various technologies.

All together the main conclusions are that it is important to pay attention to the connection between renewable energy and fuel cell technology. This can be done by exhibiting the technology in demonstration projects or by dissemination by the end users. It is also important to underline that in some cases the hydrogen technology can be implemented in the existing energy infrastructure without enormous new investments. At the political level it is of crucial importance that subsidies for demonstration and ripening of the technology are being made. At last but not least it is of great importance that the market introduction of the fuel cell technology is done in cooperation between the technology providers, the energy sector and industrial and private end users in order to cover all aspects.

UoI - Iceland:

The RES-FC project has a very special purpose in Iceland where demonstration experiments with hydrogen in transport have a long tradition. After having decided to focus on the geothermally "cold" Western Fjords, the Innovation Centre of Iceland led by Professor Sigfusson has been working on the RES-FC as a part of its activities.

In the work of a governmental group on wedging down CO₂ from Iceland Prof. Sigfusson has shown RESFC as a small part of a solution for saving use of oil for heating in Iceland.

We did go a long way comparing the use of oil based heating in the Western Fjords with our solutions. It can not be said, however that our solutions have presented a great new benefit and we have had to promise the potential users reductions in prices as the technology matures. In this way it can be said that this part of the dissemination has not broken any ground for our technology replacing the traditional systems used previously.

Using the results from our Danish partners as regards wind energy we have been successful in promoting its use in Iceland and recently the Energy Fund of Iceland decided to support a wind generator system in the West of Iceland where the use of hydrogen is a part of a longer term plan for the development.

The Innovation Centre plans a fact finding excursion to Denmark in late 2008 or early 2009 to learn from the experience of our Danish colleagues about the success of their interesting demonstrations in Herning. The Icelandic delegation will consist of energy experts, energy producers and regional leaders in the field.

In association with the project a fuel cell was purchased, a Nexa fuel cell intended for demonstrations. The system did not arrive in Iceland before towards the end of the project but is, as this is written being prepared for demonstrations and experiments.

Based on the outcome of the trip to Hering and the experiments with the Nexa fuel cell the Icelandic team expects to be able to take the next step in adding demonstrations of fuels cells for domestic use to the range of demonstrations already under way in the transport sector. This result is very much linked to the important cooperation within the RES-FC project and must be seen as one of its crucial deliverables in Iceland.

ISR-UC – Coimbra Portugal

ISR-UC is in an excellent position for dissemination of the results of the RES-FC project. On one hand while being part of the University the students have the opportunity to get involved in research and marketing approach studies thus being good vehicles for the dissemination of the results of the project, increasing the impacts of the action. It is very often that old students that are now in the “real world” get back to us to ask for opinions and news about energy technologies, the state of the art, the developments going on, etc. On the other hand, ISR-UC is a technology transfer Institute with close relations with many companies in Coimbra region, being in a good position to make recommendations to those companies for the solutions to adopt in different situations.

The University is by excellence a good place for dissemination activities, because it has a long track record of knowledge, good contacts, has the appropriate and adequate means available to reach the targeted stakeholders.

In addition ISR-UC has a vast experience in training and consultancy studies for energy agencies, for the Electric Utility and energy companies, among others.

The activities carried out at regional level, in order to disseminate the project and involve other potential interested parties in the project, are listed below:

- Direct contacts, through meetings with the city hall council of Lousã, a small town nearby Coimbra, where the closest wind power plant to Coimbra, is located.
- Direct contact with ENERNOVA, that is the wind farm promoter exploring the wind power plant at Lousã.
- Several meetings with Air Liquide – Portugal, a company leading with production, storage and sales of H₂.

These contacts involved a short presentation of the project focusing all the details of the RES-FC project, in particular its objectives, potentials and advantages.

- First contact with the most advanced builder of Coimbra BASCOL, in order to evaluate the potential market introduction of Fuel cells in a new building

residential area. The buildings being constructed in this area are all 4 to 5 floors, and only very few houses will be constructed. This is mainly because the price of land in Coimbra is prohibitively high, and therefore the preferable construction is vertical buildings, to be more cost effective for builders. This builder has agreed to collaborate with us for the analysis of potential market.

- One paper has been produced and was published in the magazine of the University of Évora: ano V, nº 9, June 2008. This issue was a special focus on Energy Alternatives and is being sent as annex.
- The key stakeholders have been identified, and whenever appropriate contacts have been made: electrolyser manufacturers, utilities, wind power plant promoters, hydrogen tanks, fuel cell manufacturers, distribution company, regional, municipal and national licensing authorities, and the regulator.

Market development plan

Nowadays the majority of the fuel cell manufacturers are very reluctant to offer fuel cells for the residential sector with competitive prices. As far as there is not a large demand for fuel cells, the manufacturers cannot decrease the production costs of the technology, and fuel cells will remain very expensive. On the other hand, while the prices of the technology are high, the end-user is not going to switch from secure grid electricity to an immature expensive technology. This is the chicken and egg problem. One of the most promising ways to bring the fuel cells for the residential sector is with pilot demonstration projects. Demonstration projects together with the large-scale R&D effort being carried out worldwide to decrease costs and to improve the performance of FC systems are necessary to the appearance in the market of FC with much lower costs, longer lifetime and smaller maintenance requirements. One way is to collaborate with the only Portuguese Fuel cell manufacturer, Soluções Racionais de Energia, who is interested in collaborate with ISR-UC in future demonstration projects that involves the implementation of fuel cells in several kinds of applications, namely, fuel cells for households, different kinds of stationary applications, robotic applications and electric motion applications.

Like the example in Japan shows, this technology needs financial incentives from the government to take off, to become more attractive for end-user. The questions however still remain: What will happen once the incentives are canceled? Will the market be established by then? Hopefully the prices will have dropped significantly, allowing their purchase even in the absence of incentives. If the prices of electricity will increase fast in the future, as the actual economic framework and fossil fuel prices sharply increase as projections show, then FC technology may have room for a successful market development. Proper legislation (feed-in tariff, H₂ production and storage, etc.) is also an important step for the development of the FC market.

Aalborg University:

As a part of the RES FC Market project, it has been investigated how biogas can be used as fuel for domestic RES FC units for the supply of electricity and heating. A number of issues pertaining to this have been identified.

An important element in the work has been the establishment of contacts to stakeholders within the energy area to create an awareness of the technology, and this ambition has been fulfilled as described in the following.

Particularly the Danish branch of the project has been affected by the circumstance that a number of the relevant actors within energy and fuel cells in Denmark already were partners of the project. This applies to IRD Fuelcells, which produces fuel cells, Danterm, which produces furnaces for e.g. dwellings, Dong Energy which is the largest utility company in Denmark and HIRC – an innovation company within hydrogen and fuel cells.

During the project, articles have been written for publication in both an academic peer-reviewed journal and for a magazine targeting also people with a more practical approach to energy.

Project partners have participated in a large meeting with owners of biogasplants where it was discussed how biogas could be used in RES FC units in the future.

Results of the project have also been presented at a fuel-cell meeting at the Danish national laboratory Risø with more than 100 participants from within the fuel cell community in Denmark

Parallel to the present project, there are other activities in Denmark. Aalborg University is also involved in a large demonstration project where it is expected that 10 houses will be supplied with either biogas or ethanol/methanol fuelled fuel-cells. Other houses will be supplied with fuel cells based on other fuels giving a grand total of 100 houses. This project has a total budget of 50 million DKK – approx €7 million and thus has a considerable more momentum than the present project. As a demonstration is quite important for the introduction and expansion of the RES FC technology, the said project is thus very much in line with the recommendations of the present project.

This project has also identified barriers against the introduction of the RES FC technology.

As the analyses also have demonstrated, the economy is the main barrier against the implementation of the RES FC technology, so some sort of economic assistance is required as described in the deliverable titled "Ten regional RES-FCHS market

development plans: Report on the 10 market development plans of RES-FCHS - Regional Market Development Plans Biogas in Jutland, Denmark”

Such assistance include

- Establishment of an innovative market for FC, with high feed in tariffs for a certain annual quota in an introductory period.
- Tax deduction for firms engaging in risky renewable energy technology development projects
- Support for R&D and demonstration
- Lower VAT on bio-resources as well as on technologies using these
- Same tax and rules for all Renewable Energy sources.
- Measurement of the consumption of fossil fuels in the production of Renewable Energy. The above incentives should only be allocated to Renewable Energy technologies with a consumption of fossil fuels lower than a certain percentage. Here a tentative percentage span could be 10- 20. So if the percentage of fossil fuel is higher than 10%-20%, the incentives should be lowered proportionally.

As seen from the number of actors already involved in this technology in Denmark, it is not so much a matter of attracting their attention – they already have an eye on this emerging market, it is more a matter of whether it is economically attractive for them to engage in producing RES FC units and promote these. Particularly as it also requires establishment of systems to produce and distributed fuels for the units.

One element that may assist the stakeholders in committing to the technology is the establishment of national goals for the use of bio-resources in RES FC units; goals that will demonstrate to the stakeholders that there is a public attention on this area – and which indirectly will also imply that the public attention will manifest itself into specific promoting measures if targets are not being met.

CENER:

This report is a summary about dissemination activities carried out by CENER during the whole project.

First of all, the activities carried out during WP6 are summarized:

- An oral presentation was presented at “World Hydrogen Technologies Convention- WHTC 2007”.
- A poster was accepted and will be presented at “HYLCETEC -1rst Iberian Symposium on Hydrogen, Fuel Cell and Advanced Batteries”.
- A chapter was written in the book “Fuel Cell and Distributed Generation”.
- A chapter was written in “Building Journal”; this journal is in its final printing stage and will be published soon.

Three renewable sources of energy to produce hydrogen have been studied in this project: biogas, biomass and "excess wind". CENER has studied the last option, so the most important stakeholders for this market are wind farms promoters, electrolyzers and fuel cell suppliers, utilities, households promoters (mainly, promoters who develop sustainable buildings integrating renewable energies), hydrogen suppliers and regional authorities.

We have tried to contact stakeholders related to Navarra in some way, or related to Spain at least, with the aim of developing hydrogen technologies within our region.

In some cases there were companies located in Navarra and, in other cases, there were foreign companies related to the hydrogen technologies with one of their sales divisions in Navarra. In the same way we made contacts with national companies.

We made the first contact by emails. We sent some emails introducing CENER and specifically the "RES-FC Market" project, explaining our task and the specific goal of this project. With these emails we meant to collect information about the level of knowledge and the future stakeholder's collaboration, and in this way we could appreciate the involvement in the project.

During these years working in the project, we have seen that there is an important lack of knowledge about hydrogen technologies within the residential sector. This is a critical aspect as that is the market the project is focused on.

Household promoters are not interested in integrating fuel cells into their houses yet. When we told them about the advantages of this technology, they have focused on problems like high prices, short lifetimes and lack of legislation related to the use of hydrogen in the residential sector.

Moreover some of the companies related to hydrogen technologies, with technical knowledge, focus their interest in other sectors as transport. For those reasons, stakeholders have demonstrated a small involvement in this project.

We are facing the famous "chicken and egg" problem; suppliers have to manufacture their systems by hand, because there is not enough market to develop a manufacturing process or to launch mass production, and end users are not interested in those technologies because the prices are very high and their availability and reliability are low.

In September, the third meeting of the "RES-FC Market" project took place in Pamplona. As a result of this meeting, some activities have been carried out to disseminate the project within the community: articles in different newspapers, in television and in some web pages. We have seen a growing interest about hydrogen and its introduction into the residential sector from then on.

Some household promoters are now finding out the advantages of installing fuel cells into their houses. The Government, as well, has started to study the viability of introducing hydrogen in some of its projects.

Therefore, overcoming some of the barriers that exist today, it would be possible to develop a market in Navarra for hydrogen technologies into the residential sector.

In CENER, we have tried to involve some public organizations to contribute with some funding to carry out demonstration projects. In this way, those projects can be a showcase for the hydrogen advantages, achieving a deeper interest from household promoters and end users to integrate fuel cells into their houses and, finally, developing a niche market for the manufacturers.

As it happens with every new technology, it is necessary to obtain financial support from the Government to introduce the first units in the market. Otherwise, it would be difficult to consider starting its development.

If the Spanish Government promoted hydrogen and fuel cells in the same way as photovoltaic energy, those systems would be competitive for the end users.

We have to try that Government sets aside an important amount of funds for R&D about hydrogen technologies. In this way it would be possible to improve systems efficiency, to find new materials to reduce costs, and suppliers could see a business opportunity to start mass production.

One way to achieve those objectives is promoting and financing research projects in technological centres, training centres, and universities to develop this kind of systems.

The Government, for example, should include in his syllabus post graduated courses related to hydrogen technologies through its Ministry of Education.

It is necessary to achieve a general knowledge about hydrogen technologies. This way, household's promoters would be encouraged to introduce fuel cells and household owners would be encouraged to making use of these technologies.

Due to the current lack of knowledge about hydrogen and fuel cell technologies in the society, a computer application, named HYNTEGRA 1.0, has been developed in CENER. This tool makes possible to evaluate in an easy way the viability of integrating hydrogen and fuel cell systems into the residential sector.

HYNTEGRA 1.0 aims to make hydrogen and fuel cells closer to the whole society and to make residential fuel cells introduction easier, providing the needed technical and economical data to carry out this kind of systems.

To conclude this summary, we can say that the hydrogen market is nowadays in an early stage of commercialisation. However, with an important work in dissemination activities, governmental support, and fed in tariffs, it is possible to awake the interest of household promoters in those technologies, and also manufacturers identify a possible market to start mass production. In such case, it would be possible to achieve a reduction in costs, making this technology competitive from the technological and the economical point of view.

Thanks to the advantages of this technology we will obtain a more efficient use of the energy, taking advance of the natural resources in our region, in this case wind energy, and reducing fossil fuels dependency and greenhouse gas emissions.

ECN - the Netherlands

Introduction

The EU-project RES-FC-Market aims to encourage the application of hydrogen fuelled fuel cell CHP units in houses by identification and bringing together regional initiatives around Europe. By using hydrogen produced from renewable energy sources (RES) this option can contribute to the greening of the energy system for houses. In the case of the Netherlands the production of hydrogen from water using wind electricity is considered as the most obvious option because wind power is the most abundantly available renewable energy source in the Netherlands.

In addition to contributing to the greening of the energy system for houses the option may help to resolve grid balancing problems at relatively high wind penetration levels thus offering a way to increase wind power penetration in the energy system. Also the wind energy sector is interested in systems that can improve the predictability of the electrical output of the wind turbine system, e.g. by energy storage systems. This will increase the price for which they can sell their electricity.

Characteristics of the concept

As hydrogen is reconverted into electricity in houses by means of a fuel cell, essentially, the system considered is an electricity storage system. The round-trip efficiency of the system could be about 30%. In addition, about 20% of the energy could be recovered as useful low temperature heat resulting in an overall efficiency of maximum 50%.

To reduce conversion losses and maximise avoided emissions in power plants, wind electricity should be used as electricity directly as much as possible. Ideally only excess wind should be used for the production of hydrogen for this application. The advantage of excess wind could be low electricity prices. On the other hand, the number of full load hour of the equipment required for the concept will be low. Excess wind will only be available a limited number of hours per year while the CHP unit should never operate together with the hydrogen production unit as this would lead to additional excess electricity. A low number of full load hours will result in high specific fixed cost even when considering future cost targets for the equipment.

Dissemination activities

Considering the current views of the stakeholders, an active stimulation and market development of fuel cell CHP systems for houses using renewable wind hydrogen that is produced from excess wind electricity using an electrolyser can not be justified for the Netherlands.

Instead of active encouragement of the concept via presentations on regional seminars and publications in general specialist literature, a scientific article on the assessment of concept for the Netherlands is foreseen.

Stakeholder views

This RES-fuel cell household system is discussed with a number of stakeholders. Their views on the concept can be summarized as follows:

- SenterNovem, the Dutch organization that stimulates sustainability through advise, networking, information and subsidies. Mainly because of the low round-trip efficiency for the application considered, they refrain from stimulating this system as a solution for excess electricity from wind.
- Province Friesland and community Leeuwarden. They have a limited budget for the stimulation of sustainable energy systems e.g. through demonstrations or exposure. They want to know the market potential before they will stimulate, especially because of the round-trip efficiency.
- Nedstack, the Dutch PEM fuel cell systems manufacturer. They consider the low round-trip efficiency of the process and the high system costs for these small systems a too high barrier for this market. They will not develop these small systems; however they see market potential for larger stationary PEM fuel cell systems.
- ECN, the energy research centre of the Netherlands. They consider the economics of this stationary system not attractive to customers. Alternative electricity storage systems with a round-trip efficiency higher than 80% are possible. When hydrogen from excess electricity is produced, it should first be used in (passenger) vehicles for transportation.

Regional operational plan

Household CHP systems operating on natural gas will enter the Dutch market in 2009 and will be subsidized. These are Stirling engines and high temperature fuel cell (SOFC) systems. These systems have the advantages of independence of fuel production, an existing infrastructure and control by the customer in contrast to the considered hydrogen fuelled household CHP system.

The Stirling engines have a low power/heat ratio and will be used in heat following mode and are best suited for existing houses with high heat demand.

The SOFC systems have a high power/heat ratio and will preferably be operated continuously. The electricity company Nuon has ordered 10.000 of these units per year.

The market introduction and penetration of these household CHP systems on natural gas will be actively followed, especially the high temperature fuel cell system. The CO₂ emission reduction from these household CHP systems will be assessed in relation to centralized electricity production and local heating using natural gas as fuel.

Fuel cell systems will be promoted that are cost-effective and lead to greenhouse gas emission reductions.

IBBK- Wurttemberg:

Within the scope of the EU funded project "RES-Fuel Cell Market" the International Biogas and Bioenergy Centre of Competence (IBBK) is responsible for studying the production of biogas and its conversion into hydrogen as well as for determining the market potential for fuel cell household systems (FCHS). The latter was achieved by talking to a regional gas utility and an architect who coordinates and supports cooperatives of house builders during the planning and construction phase. Both agreed that no basic objections exist towards applying FCHS. Nevertheless improvements – e.g. with respect to increased operational times, improved technical performance and reduced system costs – are required in order to make the FCHS attractive for house builders. Provided that the improvements are given a house builders' cooperative could be a starting point for introducing FCHS to the market. House builders' cooperatives comprise averagely ten persons and hence it can be assumed that a minimum of ten FCHS could be applied. During the project "RES-Fuel Cell" market IBBK has also calculated with 10 systems as minimum number of systems to be applied. Ideally 300 systems should be installed and operated within the scope of a demonstration project.

In order to implement a demonstration project in Germany that aims at validating the applied technology and at preparing the mainstreaming of FCHS it is suggested to make use of the "National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)" which has been launched by the Federal Republic of Germany in 2006. This programme aims at enhancing and promoting fuel cell technology and does so by supporting concerted national actions to further develop this technology and to introduce it into the market. Raising other funds apart from the NIP is expected to be difficult. In total the German NIP provides approximately 141 Mio. Euro for demonstration projects in the field of stationary appliances for energy generation. All supported projects are required to "test the applied technology's suitability for daily use and to use the results for improving the system's market

maturity". Applications for funds must be filed to the "National Organisation Hydrogen and Fuel Cell Technology (NOW)" – the organisation responsible for coordinating and conducting the NIP.

Planning the demonstration project and applying for funds as well as designing a successful market development and a marketing strategy requires at least one fully employed staff. An organisation or a consortium working mainly in the field of fuel cell technology should best employ this person. This way both the organisation's/ consortium's know-how and the contact could be used in the best possible way. If special knowledge aside from fuel cells is required – e.g. with respect to biogas related topics – external experts like IBBK could be called in.

A demonstration project should be developed together with a (supra-)regional utility company, that has – based on its field of work and expertise – contacts to people interested in new heating devices. This demonstration project gives the utility company the opportunity to build its own know-how and competence regarding fuel cell technology and thus gains a competitive and knowledge advantages. A utility company as partner is also an ideal multiplier that is able to disseminate information and knowledge about FCHS within the scope of its everyday advisory activities regarding different household appliances for heat generation.

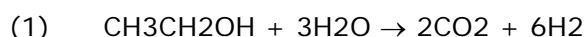
During the course of the project development contacts should be made with communities inside the supply area that have a high amount of new constructions sites in the residential sector. A community could become a "hydrogen community" and support the project e.g. within the scope of its communal advisory service on how to best save energy.

An important aspect of such a project is promotion and public relation activities. At least a website as well as brochures and articles published in the general and the professional media should inform about the demonstration project. Beyond that regular events like "Open days" might be considered. Open days could take place at the utility company or at the house of a pilot operator of a FCHS. They allow for example a direct contact with an operator and give interested house builders the opportunity to exchange experiences regarding the FCHS. Additionally the project should be presented at (supra-)regional trade fairs where visitors look for information on the latest developments in the field of housing technology.

DONG ENERGY:

The Results of disseminating the ethanol reformation Technology

Important factors to consider when evaluating use of bioethanol as fuel or feedstock is the overall economy of the processes involved as well as the energy-efficiency from biomass to wheel. Fuel grade bioethanol needs to be water-free, thus the production requires distillation beyond the azeotrope point, and this is one of the major production costs of fuel-ethanol . On the other hand, the ethanol reforming process requires a significant amount of water (1), which superfluous the expensive distillation. Only a simple flash distillation to some 50-70% is necessary - considerable lowering the production costs of bioethanol



Before ethanol can be used in Fuel Cells it needs to be reformed into hydrogen, and as earlier argued this requires development of new catalyst. DONG Energy has been in contact with catalyst experts from the Technical University of Denmark, in order to discuss the development of such new catalyst. The bioethanol examined was

received from Dong Energy's subsidiary Inbicon's 2nd generation bioethanol pilot plant in Skærbæk, Denmark. The Ethanol-Water mixture was taken direct from the top of the stripper column, and has not been passed through the rectifier column.

The results of the test showed how steam reforming of bioethanol (1) for hydrogen production can be effectively carried out over different heterogeneous catalysts. Moreover, the university have illustrated some of the challenges for implementing this process into industrial applications.

Some heterogeneous catalysts based on ruthenium and nickel shows interesting potentials for the reforming of technical bioethanol, though some challenges still exist in e.g. reducing coke depositions on the catalysts. A major factor in limiting carbon formations is the temperature. Higher temperatures decrease the carbon formation significantly. Seeing as the activity of the catalysts are high at the temperatures used in steam reforming the most important parameter to monitor would be catalyst lifetime, the use of technical bioethanol is decreasing the lifetime of the catalysts and this must be addressed in the design of this process. As long as the deactivation issues are accounted for it is apparent that the use of fuel grade ethanol is not required; a simple flash distillation of the fibre beer to remove the sugars and other non volatile substances from the feedstock seems to be sufficient. Therefore the economics in a biorefinery can be improved by minimizing the process heat (steam) for the energy intensive distillation along with the capital costs for the distillation equipment.

Details of the experiments will be presented in a scientific Journal, and is presently under submission

DONG Energy will continue the cooperation with the university, and hopefully it will be possible to develop some inexpensive catalyst with a reasonable lifetime, as this is needed if fuel cells based on ethanol reforming has to succeed.

KIBZ- Scheleswig-Baden Wurttemberg:

The Hanover Fair offers a good opportunity to monitor the changes and the progress in fuel cells for residential heating – and future renewable energy sources. Therefore the chance has been taken to visit this year's fair in April for three days to carry out the following activities:

- Visit, inform, and interview the members of the "Initiative Brennstoffzelle" (= Initiative Fuel Cell) to get informed first handed by these major players (fc producers for residential heating and utility companies).
- Get a broader view on recent developments on fuel cells and the corresponding balance of plant (BoP) in general, such as reformers and electrolyzers.
- Get a chance to interview and to thoroughly inform the major German actors in the field of renewable energy sources about the RES-FC Market project. Especially for wind energy the Hanover fair was a very good opportunity,

being much more efficient, than doing a work shop in Schleswig – Holstein on a limited regional basis.

- Distribute our brochure in German (about 100) and English (app. 40) as well as flyers about our work shop in Coimbra (app. 50).
- Integrate our project into our non stop power point presentation at our booth.

In addition to earlier memos, the results of the interviews and conversations at the Hanover fair have been recorded in principle and compared to last year's interviews. The results can be summed up as follows:

Fuel Cells for Residential Heating

- The major German/European fc producers for residential heating are making progress in their field tests, but haven't achieved their targets yet (better durability availability, lower costs of the system).
- It is expected that the German national development plan (s. attachment 2) with its funding will help to achieve these targets.

- The Japanese NEDO program for fuel cells in residential heating seems to be quite successful. Therefore it is expected that the participating Japanese companies will start producing standard fuel cells for their home market in 2010.
- Because of this background the German/European fc producers have revised their timetable by shortening market entry to 2012 – 2013. Therefore the support of the German national innovation program to realize the German national development plan for fuel cells for central heating is even more important.

Feed

- In the midterm future SNG from Biogas will be the most likely renewable energy source for fuel cells in residential heating. Apart from its favourable efficiency, it can be transported to the point of use through the natural gas grid.
- Surplus power might only be used on a minor scale in the vicinity of (offshore) wind parks to produce hydrogen for residential fuel cells in the midterm future. One draw back seems to be the additional investment into a hydrogen grid.

Our network – the BzA-BW – will continue its activities on the fc-market for residential heating, including fuel cell systems as well as feed from renewable energy sources. Since cooperation between major fc producers seems to have

failed about 10 years ago, we will put a special emphasis on standard modular BoP parts to see, whether effects of scale are possible in this field.

3) Sector dissemination activities

According to the proposal, the sector dissemination activities include the following sectors:

- **Fuel Cell Sector** (Fuel Cells, Fuel Cell Systems, Electrolysers)
- **Renewable Energy Sector** (Wind/H₂ and Biogas)

The following materials have been produced and disseminated in the scope of this sub-task:

- Preparation of one presentation on Fuel Cells. **IRD** has prepared and presented this presentation (available on the project web-site) that was orally presented at the Danish Meeting: **Danvak dagen, 18/04/2007**. In addition there was a need to also prepare the article to be published in relevant media of the respective sector. Because the project results, so far, do not justify a publication on fuel cells solely, IRD suggested preparing a publication on dimension (el/heat in North Europe) and lifetime issues of stationary LT PEM CHP systems based on results obtained in this project and in national Danish project acknowledging both funding. An article published in the Proceedings from the IGRC conference 2008 in Paris.
- **Dantherm** has prepared two short publications which have been integrated in relevant publications in Denmark. The publications from Dantherm can be found at page 57 of bright and green "Danish technologies for sustainable growth", and page 42-43 in virksomhedspræs which is a part of the climate handbook (klimahåndbog)". (See Annex 1).
- **BIC** has already prepared a ppt presentation on Electrolysers (available on the project web-site, members area), that was presented at VE-Net; 13-3-2007, Hotel Plaza, Østre Stationsvej, 5000 Odense, Denmark. BIC has also prepared **an article** related to this presentation that will be published in the magazine "**Naturlig Energi**", **issue October 2007, with the title: "Brint det fremtidige energiråstof"**. This article can be download from the project web-site.
- **CENER** has prepared one book chapter on for a Technical Specialized Journal: "**Residential Fuel Cell for Distributed Generation**". Fuel Cell and Distributed Generation, 2007: 1-26 ISBN: 978-81-308-0179-7, Editor: Francisco Jurado Melguizo.

Sector Dissemination Activities					FINAL
		Responsible	Seminar	Journal	Deadline
Fuel Cell Sector	Fuel Cells	IRD	<p>Oral presentation at: Danvak dagen, 18/04/2007.</p> <p>Roll-up poster at a micro CHP summit, March 2008, in Dusseldorf, Germany. http://www.delta-ee.com/delta_summit_briefings_microchp.asp</p> <p>IGRC conference in Paris, Okt. 2008</p>	<p>An article on FC published in Proceedings from IGRC konferencen 2008 (8-10 okt, 2008 i Paris).</p> <p>The article can be downloaded on web-site: http://www.dgc.dk/publikationer/konference/2008/IGRC_dmkv.pdf.</p>	June 08
	FC Systems	Dantherm		<p>- Bright and green: Danish technologies for sustainable growth, page 57</p> <p>- Virksomhedspræs (which is a part of the climate handbook (klimahåndbog), page 42-43.</p>	June 08
	Electrolyser	BIC	VE-Net; 13-3-2007	"Brint det fremtidige energiråstof", Naturlig Energi	Oct 07
Renewable Energy Sector	Wind/H2	CENER, IBBK, ELSAM UoI		<p>A chapter was written in this book: Fuel Cell and Distributed Generation</p> <p>The chapter is: Residential fuel cells for distributed generation http://www.reassign.com/UserBookDetail.aspx?bkid=651&catid=149</p>	June 08
	Biogas				
	Methanol				

Annex 1:

Bright and green "Danish technologies for sustainable growth:

DANTHERM POWER A/S / 57

DANTHERM POWER A/S



Fuel cell solutions for heat and power

The Dantherm Power products are developed with focus on commercial exploitation of the hydrogen- and fuel cell technology from development and production to sale and support of complete power backup solutions for telecommunication equipment and Micro Combined Heat- and Power units for private homes.

Power backup

The Power backup Solutions are designed for telecom- and IT communication networks immediately takes over the power supply to the electrical equipment in case of power interruptions in the primary power supply. This solution replaces batteries and diesel generators.

Micro Combined Heat- and Power

The Combined Heat- and Power Solutions are domestic units the size of a small refrigerator running directly on hydrogen or natural gas. The units can be connected to existing natural gas supplies and electrical grid.

Environment friendly technology

The contribution to the overall CO₂ reduction from small decentralized fuel cell systems replacing large power plants and district heat-

ing plants is immense. These systems produce no pollution or harmful substances running on hydrogen. Oxygen is simply taken from the air and the only by-product is humid air and the process is noiseless making fuel cell technology a clean and very environment friendly source of heat and power. Transmission loss of energy is virtually non-existent contributing to the overall extreme high heat- and electrical efficiency.

Fuel cells?

Fuel cells are electrochemical energy conversion units, producing electricity and heat from hydrogen and oxygen. If hydrogen is not available they can also run on reformed alcohol, bio fuels or fossil fuels like natural gas from an integrated fuel processor.



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Hydrogen and fuel cell technology ensure that 170.000 Danes can surf the internet at breakneck speeds even if the main power supply fails:

Dantherm Power A/S and EnergiMidt have put fuel cell technology to commercial use



Many believe that the future inside energy conversion will be commercially viable solutions based on hydrogen and fuel cell technology. If that is the case then the future began on September 5th 2007 in the central part of Jutland, Denmark. On this date Dantherm Power A/S put the first commercial solution ever based on this clean and safe technology – a UPS-system - into service on the fiber-optic broadband network operated by the electrical power company EnergiMidt.

UPS is short for Uninterruptible Power Supply. It is an emergency power backup system that takes over immediately in case of failure in the main power supply. UPS-systems are crucial in maintaining steady uninterrupted power for the electronic equipment, transmitters and cooling systems inside the radio base stations taking care of the distribution and steady flow of data and information in IT and telecommunications networks.