Intelligent Energy Europe

RES-FC Market

Distribution: WP Leader 6

Report on Dissemination Activities

Brennstoffzellen-Allianz Baden-Württemberg

Contents

1. Introduction to the Task

The focus of this report is on the dissemination for

- different renewable energy sources and
- on the corresponding geographic areas.

The emphasis is supposed to be on the availability of *bio methanol resp. bio ethanol for Baden-Wuerttemberg* and on *low cost excess wind electricity* to produce hydrogen through electrolysis for Schleswig-Holstein. - The progress in fuel cells for residential heating within the past year is also monitored. Especially this year's Hanover fair was a good place to gather information – and to inform the expert visitors of the fair about our project.

Bio methanol/bio ethanol

As lined out earlier, biogas with about 60% of CH_4 could be a suitable precursor for *bio methanol*. However, to our knowledge this isn't done anywhere in Baden-Wuerttemberg or in Germany. *Bio ethanol* is produced by Südzucker Bioethanol GmbH – Europe's leading producer - in Saxony-Anhalt in Eastern Germany, but not in Baden – Wuerttemberg. However, with its bio ethanol production, Südzucker Bioethanol GmbH aims at the automotive sector (s. attached memo).

Low cost excess wind electricity for hydrogen production

The three German states Mecklenburg-Vorpommern, Niedersachsen, and Schleswig-Holstein with coastlines contribute to about 50% of the installed wind energy. However, Schleswig-Holstein ranks only 5th in Germany. According to all stakeholders in wind energy, who were interviewed, a further investment into the power grid should have absolute priority to prevent surplus wind energy. Where this can't be avoided, hydrogen should be used for mobility, but not for residential heating (s. attached memos from BEE, BWE, dena, and Vattenfall).

Work Shop on excess wind electricity for hydrogen production

Taking into consideration that Schleswig-Holstein is not the most important German state in this sector, it has been much more effective to inform the major stakeholders in wind energy at this year's Hanover fair instead of conducting a work shop in Schleswig-Holstein (s. also attached memos from BEE, BWE and dena).

Outlook

Upgraded biogas (SNG) as a renewable energy source (for fuel cells etc.) could play a role in the future, if the grids are opened for SNG by law (see e. g. memos from BEE, BWE and dena).

2. Summary on Regional Dissemination Activities

- Board of KIBZ resp. BzA-BW

The board of KIBZ (, which was renamed BzA-BW in September 2007) consisting of 7 renowned members of R+D-institutes and enterprises, was informed on a regular basis about the progress of the project. The board on the other side gave information valuable to the RES-FC Market project.

- Hanover Fair

In April, 2006 information was gathered and given to conversational partners.
In April, 2007, major stakeholders were interviewed and information was given especially to these conversational partners.
In April, 2008, these major stakeholders were interviewed again and information was given to these conversational partners and visitors to our booth. More than 100 German project brochures (40 in English) and 50 flyers of the work shop in Coimbra were distributed.

- f-cell congress in Stuttgart

In September, 2006 as well as in September, 2007 we informed the participants of this international congress (more than 500) about the project. In 2007 we had a poster of the project in our booth.

- Additional activities

Information about the project was also given in numerous conversations and events of our network, whenever there was an opportunity to do this.

3. Stakeholders/Germany

- **Producers of Fuel Cell Systems**

The biggest producers of fc – heating installations in Europe in 2005/2006 are

- BBT Thermotechnik GmbH/Germany (1)
- Vaillant GmbH/Germany (2)
- BAXI/Great Britain (3)
- MTS/Italy (4)
- Ferroli/Italy (5)

(s. attachment Bosch_20070326_marktreport_dt_final.pdf, page 47)
Out of these, BAXI INNOTECH GmbH, BBT Thermotechnik GmbH, and Vaillant GmbH are members of the “Initiative Brennstoffzelle” – and they are potential suppliers of fuel cell systems. In addition to these companies the following producers of fcs (also members of the Initiative Brennstoffzelle) have been contacted:

- Hexis AG/Switzerland
- RWE Fuel Cells/Germany
- Viessmann Werke GmbH & Co KG/Germany

- **Users of these Systems**

The following utility companies are also members of the Initiative Brennstoffzelle. They are:

- E.ON Ruhrgas AG, Essen
- EnBW Energie Baden-Württemberg AG
- EWE AG Oldenburg
- MVV Energie, Mannheim
- RWE AG
- VNG Verbundnetz Gas Aktiengesellschaft, Leipzig

E.ON, RWE, and EnBW are among the biggest power suppliers in Germany. So is Vattenfall, even though the company is no member of the Initiative Brennstoffzelle. EWE and MVV are smaller suppliers. VNG is a gas supplier.

- **Producers of Energy Carriers from Sustainable Sources**

Bio Ethanol/Bio Methanol

No bio *methanol* is or will be produced in the middle-term future from bio-resources in Germany. *Südzucker Bioethanol GmbH produces bio-ethanol* on a technical scale in Zeitz in East Germany. The company is the biggest producer of bio ethanol in Germany. It aims at the automotive sector, which competes with fuel cells for this renewable.

Biogas

Upgraded biogas (SNG) as a renewable energy source (for fuel cells etc.) could play a prominent role in the future, if the grids are opened for SNG by law. So far, some energy suppliers (mostly middle sized with own grids) are interested (e. g. VNG Verbundnetz Gas Aktiengesellschaft, Leipzig, see below).

Hydrogen from Wind Energy

The production of hydrogen from *surplus wind energy* isn't much of a topic for the utility companies. First choice for such hydrogen would be in the mobility sector (e. g. Vattenfall, but EWE/Oldenburg doesn't rule out that surplus power might be used to produce hydrogen for residential fuel cells in individual cases in the future.)

- **Result**

The following spreadsheet shows the stakeholders as well as their preconditions.

	Stake	Interest	Power	Organisation	Information	Access	Knowledge
BAXI INNOTECH	fuel cells	√	√	√	√	√	√
BBT Thermotechnik	fuel cells	limited	√	√	√	√	√
Hexis	fuel cells	√	√	√	√	√	√
RWE Fuel Cells	fuel cells	Declining	√	√	√	√	(√)
Vaillant	fuel cells	√	√	√	√	√	√
Viessmann	fuel cells	√	√	√	√	√	√
E.ON Ruhrgas AG	utility comp.	(√)	√	√	(√)	(√)	(√)
EnBW AG	utility comp.	√	√	√	√	√	√
EWE AG	utility comp.	√	√	√	√	√	√
MVV Energie	utility comp.	√	√	√	√	√	√
RWE AG	utility comp.	Declining	√	√	√	√	√
VNG Verbundnetz Gas AG	utility comp.	√	?	?	√	√	√
Südzucker Bioethanol GmbH	bio-ethanol producer	Emphasis on mobility	√	√	(√)	(√)	(√)

The evaluation was gained through interviews and may be subjective.

More details can be found in “Report KIBZ 070702” in WP 3. The information on stakeholders has been updated for this report (see e. g. the memos in the attachment).

4. Regional Operational Plan

For *producers of fuel cells*, the engagement seems to be considerable, except for RWE Fuel Cells, where it seems to be declining. It’s difficult to judge BBT Thermotechnik, since the company works very reticently. Through their partnership with the utility companies (Initiative Brennstoffzelle) all producers have a good market access.

This engagement has even encreased lately, because of the push of companies, which have successfully participated in Japan’s NEDO program in residential fuel cells. These – mainly Japanese – companies are expected to enter the Japanese market by 2010. Therefore the European fuel cell producers have reconsidered their market entry, planning for 2012 to 2013. The German national innovation and development program will be a welcome help in achieving this target (s. below).

As for the interviewed *utility companies*, including the biggest ones in Germany, the engagement seems to be considerable, too. Only the interest of RWE AG seems to be declining.

The joint effort of users and producers (of fc – systems) in Germany (Initiative Brennstoffzelle) has led to a defined plan of market penetration with targets, costs and estimated number of fuel cells (Phase I/2007 - 2010: 450 systems, phase II/2011 – 2015: 2250 systems, see attachment 2, figure 1), which will be subsidized by the German national innovation and development programm (NIP).

As mentioned in earlier reports, Südzucker Bioethanol GmbH, the biggest *bio ethanol* producer in Germany seems to aim at the automotive sector. Very recently a prototype of a fuel cell system with an ethanol reformer has been presented by ZSW (Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg = Center for Solar Energy- and Hydrogen-Research Baden-Württemberg), a renowned institute from Stuttgart – and the Fraunhofer institute ICT in Karlsruhe is working on a direct ethanol fuel cell with promising results.

SNG from biogas could play a prominent role in the future, if the grids are opened for SNG by law. So far, some energy suppliers (mostly middle sized with own grids) are interested (e. g. VNG Verbundnetz Gas Aktiengesellschaft, Leipzig, or Stadtwerke Esslingen). IBBK may have more information on this topic.

The production of *hydrogen from surplus wind energy* isn't much of a topic for the utility companies for the near future. First choice for such hydrogen would be in the mobility sector again, except for residential fuel cells in individual cases (e. g. Vattenfall, EWE/Oldenburg).

So the efforts on the side of fc – systems (users and producers) for residential areas are considerable, and for sustainable feed they seem to be picking up, but more has to be done.

The interviews of

- fuel cell producers
- utility companies
- and the main actors for renewable energy sources (wind, bio ethanol)

are attached. Most of them have been updated recently.

Our network – the *BzA-BW* – will keep a close eye on the fc-market for residential heating via EnBW. EnBW is the leading utility company in Southern Germany as well as a member of the Initiative Brennstoffzelle (= Initiatve Fuel Cell) – and has a seat in our board.

One major emphasis of our continuing activities will be on the BoP of the fc systems. Here we can imagine effects of scale, while talks between the major producers to cooperate have failed about ten years ago – as it is said.

And we will watch closely the activities and results in the field of renewable energy sources. The support of promising activities will continue to be a focal point of our network, since this will be an essential for the breakthrough and success of fuel cells.

5. Conclusion

Looking at renewable energy sources from organic matter,

- No *methanol* is or will be produced in the middle-term future from bio-resources in Baden – Württemberg or Germany.
- *Bio ethanol* is produced by Südzucker Bioethanol GmbH on a technical scale in Zeitz in East Germany, but not in Baden – Württemberg. The company aims at the automotive sector, which competes with fuel cells for this renewable. The company is not interested in the use of ethanol for residential fuel cells.
- The **Bundesverband Erneuerbare Energien e. V. (BEE** = Federal Associatioin for Renewable Energies**)**, a non-profit association, which represents the interests of the "renewable energies industry" made the following statements:

1. Biogas through fermentation or gasification should be used as such in CHP plants (e. g. MCFC or SOFC) or should be upgraded to natural gas quality (SNG), which could be fed into the grid (, as soon as regulations are in effect). This SNG could be used for mobility or for fuel cells in households. It should not be processed to bio methanol.
2. Energy plants (corn, sugar beets) should only be used to make biogas. The synthesis of liquid fuels from plants doesn't make sense, since the "energy harvest" of biogas per acreage is about twice as high as for liquid fuels (e. g. bio ethanol, btl,…)

- **dena** (**Deutsche Energie - Agentur GmbH** = German Energy Agency), the German center of competence for energy efficiency favours efficient and at the same time ecological ways of providing energy with the emphasis on renewable energies. dena prefers any carrier of renewable energy suitable for fuel cells (e. g. upgraded biogas, and bioethanol – depending on the application).

Looking at wind energy as a renewable energy source,

- the BWE (Bundesverband WindEnergie e. V. = Federal Association for Wind Energy), a non-profit association, is lobbying for wind energy. Hydrogen from excess wind does't seem to be on its agenda for the near future.
- E.ON, EWE and Vattenfall, the big utility companies in the coastal region of Germany make about the same statement:

1. Basically the power from these parks will be fed into the grid.
2. Surplus power – especially from future offshore wind parks - can be stored as hydrogen.
3. From today's point of view, this hydrogen will be used to sustain mobility.

Bottom line:

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 drawback seems to be the additional investment into a hydrogen grid.

6. Summary

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 electrolysers.
- 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:

<u>Fuel Cells for Residential Heating</u>

- 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 availibility, 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.

7. Attachments

Attachment 1: List of stakeholders, who were interviewed

- **Contacts with Producers of Fuel Cell Systems:**

BAXI INNOTECH GmbH/Manufacturer (PEM/1,5 $kW_{el.}$) [1)]

Ausschläger Elbdeich 127 20539 Hamburg

BBT Thermotechnik GmbH/Manufacturer

Sophienstraße 30-32 35576 Wetzlar

Hexis AG/Manufacturer (1 $kW_{el.}$ SOFC) [1)]

Hegifeldstrasse 30 CH-8404 Winterthur

Vaillant GmbH/Manufacturer (with Plug Power plus app. 1 $kW_{el.}$ SOFC with Webasto) [1)]

Berghauser Straße 40 42859 Remscheid

Viessmann Werke GmbH & Co KG/Manufacturer (2 $kW_{el.}$ PEM system) [1)]

Viessmannstr. 1 35107 Allendorf

- **Contacts with Utility Companies:**

EnBW AG[1)]

Durlacher Allee 93 76131 Karlsruhe

E.ON Ruhrgas AG, Essen/Utility Company (1,5 bis 4,5 $kW_{el.}$ PEM-BZ der Fa. Vaillant)

Huttropstraße 60 45138 Essen

EWE AG Oldenburg/Utility Company[1)]

Tirpitzstraße 39 26122 Oldenburg

MVV Energie/Utility Company

Luisenring 49 68159 Mannheim

RWE Fuel Cells/Utility Company (4,6 $kW_{el.}$ PEM system from IdaTech)

Gutenbergstraße 3 45128 Essen

Vattenfall Europe Hamburg AG

Überseering 12 22286 Hamburg

VNG Verbundnetz Gas Aktiengesellschaft/Gas Provider

Braunstraße 7 04347 Leipzig

- **Contacts Renewables:**

Bundesverband Erneuerbare Energien e. V. (BEE) [1)]

Reinhardtstr. 18 10117 Berlin

Bundesverband Windenergie e. V. (BWE) [1)]

Bundesverband Windenergie e. V. (BWE) **Landesbüro Schleswig-Holstein**

25813 Simonsberg Querweg 4

Deutsche Energie-Agentur GmbH (dena) [1)]

Chausseestraße 128a 10115 Berlin

Südzucker Bioethanol GmbH/CropEnergies AG

Dr. Jörg Bernard Tel.: 06359/803-483

joerg.bernard@suedzucker.de

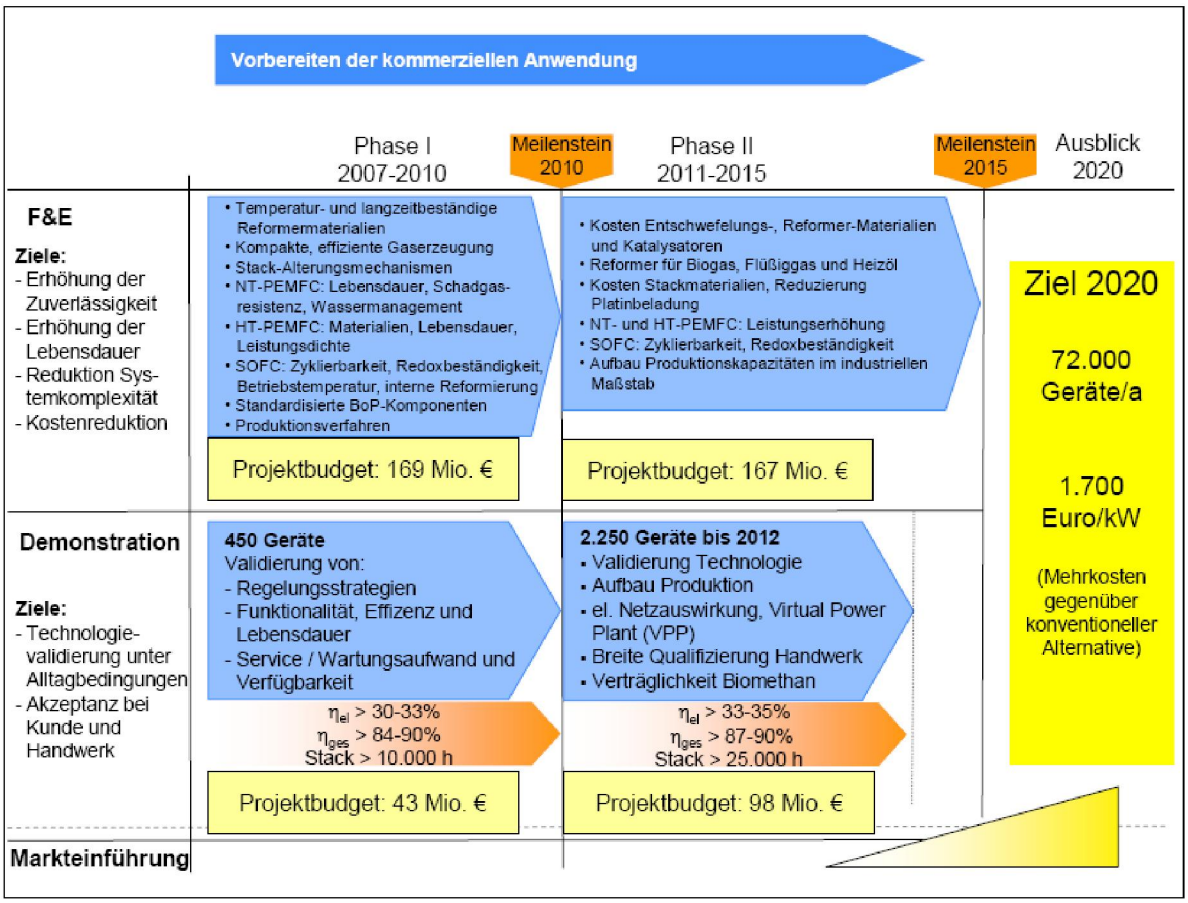
- **Further Contacts:**

New Energy and Industrial Technology Development Organization (NEDO)/Japan[1)]

[1)] These organizations were interviewed during this year's Hanover Fair in April, 2008.

Attachment 2: Figure 1: German national development plan

(Nationaler Entwicklungsplan, Version 2.0 of February, 2007, pp. 12 - 16.)



The updated German national development plan (Nationaler Entwicklungsplan, Version 2.0 of February, 2007, pp. 12 - 16.) assumes 450 fuel cell units for households by 2010, 2.250 units by 2012, and 72.000 units p. a. by 2020 for Germany. *The energy output of these systems is between1 and 5 $kW_{el.}$ unlike the assumed range of 0.5 – 1 $kW_{el.}$ in our project.* For 2020 the price target is 1.700 €/kW in addition to comparable costs of conventional systems (see figure 1). This should give fuel cells a fair chance.

These figures were aggregated by a survey done with the producers of fc – heating installations and utility companies, which have closed ranks (www.initiative-brennstoffzelle.de).

The following German companies are members of this initiative:

BAXI INNOTECH GmbH	BBT Thermotechnik GmbH
Deutsche Energie-Agentur GmbH (dena)	E.ON Ruhrgas AG, Essen
EnBW Energie Baden-Württemberg AG	EWE AG Oldenburg
Hexis AG	MVV Energie, Mannheim
RWE Fuel Cells	Vaillant GmbH
Viessmann Werke GmbH & Co KG	VNG Verbundnetz Gas AG, Leipzig