



H2-international – e-Journal

November 2016

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German Government Launches FC Subsidy Program

Gabriel Announces the Boiler Room's Energy Transformation

Domestic Market



Financial support elates consumers, © SOLIDpower

On August 1st, 2016, the heating industry got the certainty they wanted with regard to the future policy framework for state-of-the-art fuel cell heating systems: The German Federal Ministry for Economic Affairs and Energy (BMWi) announced two new subsidy programs, one providing an investment grant for fuel cell heating systems and one for optimizing heating technology by replacing old pumps. Both financial measures are part of the Incentive Program Energy Efficiency (APEE), which will run until 2018, and are thought to advance the transformation of the energy market from inside the boiler room.

The fuel cell industry had been waiting a long time for this day, but it finally arrived: In summer, the EU Commission approved the subsidy programs, so that the implementation of new heating technology could still start ahead of this year's heating season. Erik Schumacher, head of the Stationary Fuel Cells division at NOW, told H2-international: "We are pleased that the EU notification came so quickly." Just

in time for the establishment of the financial framework, numerous heating companies had previously announced to have their fuel cell devices on the market this fall (see table on page 9 & 10).

Subsidizing residential buildings

Private owners of residential buildings can now receive an investment subsidy of 40% of the eligible costs when buying a fuel cell heating unit for newbuilds or during the energy-efficient renovation of existing building stock. Applications are to be submitted to the KfW Development Bank through the program Energy-Efficient Construction and Refurbishment – Fuel Cell Grant with the number 433 (www.kfw.de/433). The base grant is EUR 5,700 plus a performance-based amount of EUR 450 per 100 W_{el} or part thereof (by performance rating: 0.25 to 5 kW_{el}; can be combined with CHP Act subsidies; see [Financial Support for Efficient Heating Systems](#)). The owner of a 1 kW unit could thus benefit from a total of EUR 10,200 in investment grants.

The Mechanical Engineering Industry Association (VDMA) has meanwhile criticized the restriction placed on applicants: Only natural persons are allowed to apply for grants, which means that organizations owning residential or commercial properties are currently excluded from the benefits. Johannes Schiel, director of VDMA Fuel Cells, told H2-international: “We support the inclusion of buildings that are not in private ownership, such as commercial properties and multi-family buildings, and of SMEs and contracting companies. We have entered into a constructive dialog with the BMWi about the topic and hope that the ministry considers our suggestions and aims for a swift improvement of the program.”

Incentive Program Energy Efficiency

The German economy ministry's APEE received notification from the EU Commission at the end of July 2016. The first two components of it were the heating and ventilation package, which were launched on Jan. 1, 2016. They were followed in mid-May 2016 by the efficiency initiative “Deutschland macht's effizient” (“Germany shows how to be efficient”). The support of fuel cell heating systems is the last component of APEE, which will run until 2018 with a budget of EUR 165 million a year. The heating industry, however, had hoped that in order to get 150,000 units sold, the market deployment of fuel cell heating systems alone would have been supported with EUR 350 to 666 million over a period of eight years.

Said Gabriel: “By subsidizing fuel cell heating systems, we intend to establish a new and forward-looking technology on the market with as much support as possible.”

Timm Kehler, chair of Zukunft Erdgas, explained: “The technology represents the most efficient form of combined heat and power. [...] It not only guarantees low costs of consumption, but also sets new benchmarks in terms of efficiency and CO₂ emissions.”

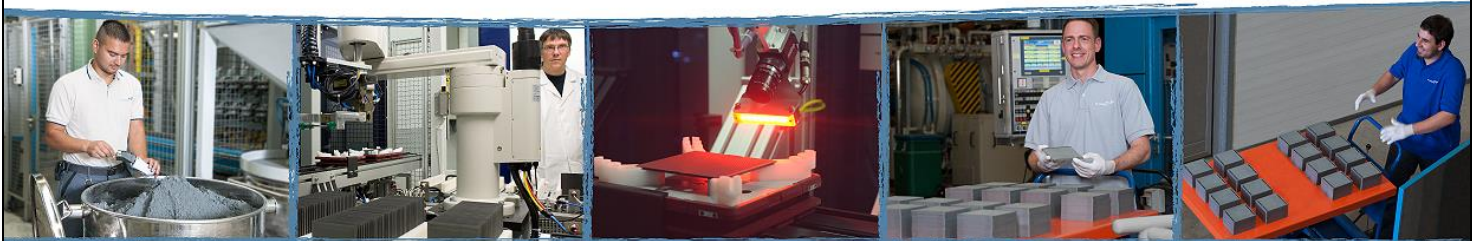
NOW chair Klaus Bonhoff had already announced during the Hanover trade show in April 2016 that with the introduction of the Technology Rollout Program (TEP), there would still be a program this year to ensure the coverage of “today's differential cost between fuel cell heating systems and conventional ones.” However, Frank Heidrich from the federal economic ministry remarked that quality assurance would require appropriate maintenance: “The installer has to offer a ten-year maintenance contract. Otherwise, there won't be any funding.”

Energy-efficient pump technology

The second subsidy program covers 30 percent of the building owner's net investment cost when replacing old heating technology with highly efficient pumps. As the BMWi explained: "By 2020, two million pumps are to be replaced per year and 200,000 hydraulic calibrations performed, saving around 1.8 million tons of CO₂ emissions." The measure – embedded in the efficiency initiative of the BMWi – will be managed by BAFA.

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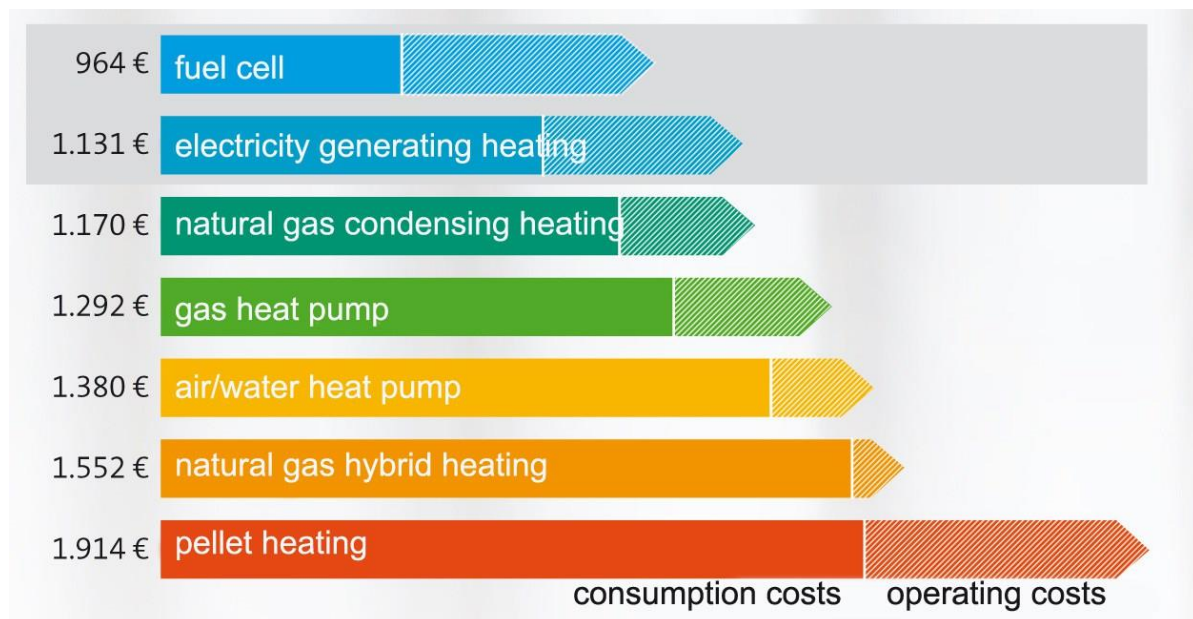


Support for Efficient Heating Systems

To Be Combined with CHP Subsidy

Domestic Market

Around 40% of the final energy in Germany is consumed by the building sector. About 85% of it is used for heating and hot water preparation. However, many heating boilers both in the private and commercial sector are outdated. Installing an efficient fuel cell heating system could save a great deal of energy and reduce CO₂ emissions.



© ASUE

In 2015, a total of 710,000 heating systems was sold on the German market, four percent more than in the previous year. In light of the tremendous size of the market, the federal government chose to act and support the integration of state-of-the-art heating technology, whether this has meant providing financial assistance for installations of gas, wood or pellet boilers, heat pumps or mini-CHP plants – and now also fuel cells. In principle, the grant amount in support of the retrofit is the higher the greater the energy saving will be. The right government agency to ask about the numerous already established support programs is the Federal Office for Economic Affairs and Export Control (BAFA). It will even subsidize the recommended first consultation at one's local energy consultant.

Mini-CHP grants

Fuel cell heating systems are typically eligible for more than one type of funding: For example, buyers of CHP systems with an electrical capacity of up to 20 kW can receive a one-time investment grant. But since the new KfW program no. 433 was specially designed with fuel cells in mind (see [German Government Launches FC Subsidy Program](#)) and because its financial support cannot be added to the one-time grant offer, customers should choose the new "Fuel Cell Grant" from now on.

The existing mini-CHP grant, however, is still suitable for systems which are not eligible for funding through program no. 433. The financial assistance depends on the system's electrical capacity and ranges from EUR 1,900 to EUR 3,500 (see Table 1). This base support comes in the form of a fixed and non-repayable grant. Additionally, there is the "Heat Efficiency" bonus of 25% of the associated base grant for heating systems which are equipped with a condensing heat exchanger and had their hydraulics calibrated. Systems such as fuel cell heaters, which also possess high electrical efficiency, will receive an additional bonus for "Power Efficiency," which is 60% of the base grant. Overall, buyers of 1 kW modules can take up to EUR 3,515 off the purchase price.

However, first of all, a system needs to be on the BAFA list showing all eligible CHP plants of up to 20 kW_{el} capacity. Additionally, the grant application must always be submitted prior to the purchase.

Table 1: Base grants since Jan. 1, 2015

<u>Capacity [kW_{el}]</u>	<u>Grant amount per kW_{el} [in EUR]</u>
0 ≤ 1	1,900
1 ≤ 4	300
4 ≤ 10	100
10 ≤ 20	10

Table 2: Eligibility for "Power Efficiency" bonus

<u>Capacity [kW_{el}]</u>	<u>electrical efficiency at rated output</u>
0 ≤ 1	> 31%
1 ≤ 4	> 31%
4 ≤ 10	> 33%
10 ≤ 20	> 35%

CHP Act 2016

Because of Germany's CHP Act, system operators also receive money for the power that their CHP plants feed into the public grid. This payment is entirely separate from the mini-CHP grant and is the only measure that can be combined with the KfW program's "Fuel Cell Grant."

Jan. 1, 2016, was the day when the revised version of the CHP Act came into force. The second sentence in section 6, paragraph 3, stipulates a claim to payment for power from retrofitted CHP plants (< 50 kW) if plant efficiency has increased considerably. This kind of CHP price is paid if the electricity is used for self-

consumption in the house or if it is fed into the grid – but the amount is capped at 60,000 full-load hours. The difference is that four cents are paid per kilowatt-hour of self-consumption of electricity and eight cents per kilowatt-hour of grid feed-in.

Whoever feeds power into the grid will also receive feed-in remuneration based on typical trading prices at the Leipzig energy exchange. For example, if someone has a fuel cell heating system generating 7,500 kilowatt-hours of electricity per year and uses two-thirds of this power for self-consumption in the house, EUR 400 will be available through the federal government plus a feed-in remuneration, which would amount to another around EUR 100.

The new regulations, however, had until recently been awaiting approval by the EU commission. BAFA was able to accept applications, but could not issue preliminary and regular permits for CHP plants going online after Jan. 1, 2016, until EU approval became available.

EnEV 2016

There are still other reasons to consider fuel cell heating systems for energy supply: For example, the new Energy Savings Ordinance (EnEV) stipulates that principals must have new residential buildings constructed in an energy-efficient manner, something that will be verified in conjunction with the building application. The key energy efficiency figures limited by EnEV 2016 are the annual primary energy demand and the heat loss of the building envelope. The allowed demand for primary energy was cut down by another 25% in 2016.

For example, the maximum for the primary demand of a building with a living space of 150 m² is now 66 kWh/m². This figure can be reached by setting up a solar thermal system for hot water preparation as well as a supply and exhaust ventilation system with heat recovery, or by a gas heat pump plus the same kind of ventilation system as before. However, to meet the standards of a KfW Efficiency House 55, the homeowner would have to choose a more efficient technology, for instance, a fuel cell system plus the aforementioned ventilation system (48 kWh/m²).

The Working Group on Efficient and Environmentally Friendly Energy Use (ASUE) dedicated to the utilization of efficient natural gas technology showed that the investment was worthwhile even without financial support, as the cost of consumption and operation play important roles in addition to the price of the initial purchase. ASUE estimates these costs to be the lowest for fuel cell systems (see image). They had been comparably high until now, but the new grant program has reduced those costs considerably.

SOLIDpower steps on the brake

SOLIDpower has postponed the marketing of its fuel cell heating system Engen-2500 for the moment. After the takeover of Ceramic Fuel Cells, managing director Guido Gummert has put the focus on the further marketing of BlueGEN. This was also the reason behind IBZ's decision to take the 2.5 kW unit by the Italian manufacturer off its device list.

Elcore leaves IBZ

Elcore leaving the Initiative Fuel Cell this summer came as a surprise to many. The company announced it was rethinking its business model and was planning to "try out a new strategic approach" as well as "look for new collaboration partners." This means that the IBZ does no longer include any fuel cell-only manufacturers, but only traditional heating system producers.





inhouse5000+ without grants

A product that has been mostly overlooked so far is inhouse5000+ by Riesaer Brennstoffzellentechnik (RBZ), based in Glaubitz in the German state of Saxony. The unit developed in-house has a capacity of 5 kW_{el} (gross) and was designed in particular for the use in multi-family buildings and commercial properties. Its output is much higher than the one of any other system, which also means it comes with a higher price tag (around EUR 60,000). Additionally, it has not yet been eligible for any public funding. Said the previous managing director of RBZ, Katrin Grosser, who left the company at the beginning of this year: "To our knowledge, we are worldwide the only business that manufactures a fuel cell system with 5,000 watts of electric and 7,500 watts of thermal capacity." Christoph Hildebrandt took over as managing director this February.

Japan to deploy 1.4 million heating systems

Japan's aggressive financial support policy has so far resulted in the installation of more than 150,000 stationary fuel cells. The aim of the Japanese government is to have around 1.4 million units on the market by 2020. In Germany, the Initiative Fuel Cell plans to have 175,000 units available by then.

LIST OF FUEL CELL HEATING DEVICES

				
MANUFACTURER	BUDERUS	ELCORE	HEXIS	INHOUSE ENGINEERING
TYPE OF FUEL CELL	SOFC	HT PEM	SOFC	LT PEM
MODEL	Logapower FC10	Elcore 2400 Max	Galileo 1000 N	inhouse5000+
CAPACITY (EL/TH)	0.7/0.62 kW	0.3/0.7 kW	1.0/1.8 kW	4.2/7.5 kW
THERMAL CAPACITY OF ADDITIONAL BURNER	7.3–24 kW (minimum: 0.2 kW _{th})	2.8–20 kW Customer choice	7–21 kW	external, chosen by customer
STORAGE	Hot water tank 75 L, Buffer tank 140 L	Stratified combi buffer tank 550 L	external, chosen by customer	external, chosen by customer
ELECTRICAL EFFICIENCY	46 %	32 %	30 – 35 %	28 – 34 %
OVERALL EFFICIENCY	85 %	104 %	95 %	85 – 92 %
ENERGY LABEL	A++	A++	A++	n/a
SIZE IN MM (WIDTH-DEPTH-HEIGHT)	1200 x 600 x 1800	600 x 550 x 1050	620 x 580 x 1650	740 x 1159 x 1500
WEIGHT IN KG	Module: 112 Entire system: 304	115	210	around 380
FIELD TESTS, COLLABORATIONS, DEMONSTRATION PROJECTS	ene.field (EU)	ene.field (EU), different partners from the energy industry and home construction	Callux (DE), Pharos (CH), ene.field (EU)	ene.field (EU)
AVAILABLE ON MARKET	Third quarter 2016	2014	End of 2013	2017
AVAILABLE FOR	One- and two-family homes	One-family home	One- and two-family homes	Multi-family buildings, small-scale commercial
PRICE [in EUR]	25,500 excl. VAT	19,500 – 25,000 excl. VAT incl. assembly	19,000 excl. VAT	around 60,000

Sources: Fuel Cell Initiative, own research

AVAILABLE IN THE GERMAN-SPEAKING REGION

				
JUNKERS	SENERTEC	SOLIDPOWER	VAILLANT	VISSMANN
SOFC	LT PEM	SOFC	SOFC	LT PEM
Cerapower FC10	Dachs InnoGen	BlueGEN	xellPOWER	Vitovalor 300-P
0.7/0.62 kW	0.7/0.95 kW	1.5/0.61 kW	0.7/1.3 kW	0.75/1 kW
7.3–21.8 kW (minimum: 0.2 kW _{th})	5.2–21.8 kW	external, chosen by customer	5.8–27 kW	5.5–19 kW
Hot water tank 75 L, buffer tank 140 L	Buffer tank 300 L	external, chosen by customer	external, chosen by customer	Hot water tank 46 L, buffer tank 170 L
46 %	37.7 % (full load)	Up to 60 %	33 %	37 %
85 %	90 %	Up to 85 %	93 %	90 %
A++	A++	A+	A++	A++
1200 x 600 x 1800	Fuel cell module: 453 x 728 x 1054 Entire system: 1250 x 1060 x 1800	600 x 660 x 1100	599 x 693 x 1640	1085 x 595 x 1998
Module: 112 Entire system: 304	Entire system: 355	around 200	150	Module: 125 Entire system: 290
ene.field (EU)	Callux (DE), ene.field (EU), company field tests in collaboration with energy utilities	Different customers, e.g., from the energy industry, cooperation with Gas Heat Institute Essen (InnovationCity Ruhr) and gas utilities	Field test in Callux (DE), small series in ene.field (EU)	Jan. 2013 pre-test; July 2013 – March 2014 large field test
Third quarter 2016	June 2016	2012	End of 2016	April 2014
One- and two-family homes	One- and two-family homes	Private and commercial use	One- and two-family homes	One- and two-family homes
25,500 excl. VAT	20,000 excl. VAT	25,000 – 30,000 excl. VAT	n/a	19,500 excl. VAT

Heliocentris Files for Bankruptcy

Research & Development

As expected, German Heliocentris Energy Solutions filed for bankruptcy at the beginning of October 2016. After there had been a delay of several days before the required quarterly figures were finally published, an ad hoc notification was sent out on Oct. 11, 2016, saying that the management board of the Berlin-based fuel cell manufacturer would open bankruptcy proceedings before the Berlin-Charlottenburg municipal court for all group companies headquartered in Germany. The reasons for the business's inability to pay its debts were said to be the loss in revenue, which had already been reported at the end of August 2016, as well as an insufficient amount of time to acquire enough fresh capital. The message also stated that the many old liabilities in particular had created headaches for the company along the way.

Prior to the bankruptcy filing, the shares had been in free fall, losing more than 90% of their value in one year compared to their price on the issue date. Some funds had divested all of their shares in the business and the company's international activities had not picked up as expected. There had also been some changes in management (see [Heliocentris – Profile of a Listed Fuel Cell Company](#)). This summer, [www.aktiencheck.de](#) recommended: "Just sell your shares and do it fast." The web portal referenced [Vorstandswoche.de](#), where experts had warned "of this share since the company went public and had warned again against buying shares before the capital increase [in May 2015; editor's note]."

Aktiencheck believes that Ayad Abul-Ella deserves much of the blame for the company's failure: "This CEO has been known to not having met any targets for years." His salary was said to have been raised from EUR 180,000 to around EUR 230,000 as late as 2015, an increase of almost 30% compared to the previous year – plus a bonus payment of EUR 100,000.

Now, the team of company founder Henrik Colell intends to take matters into their own hands in order to restructure the business. There is said to be no outside intervention to ensure sustainable restructuring and financing, a plan that the municipal court approved on Oct. 14.

Joachim Voigt-Salus was appointed interim trustee for Heliocentris Energy Solutions as well as the German subsidiaries Heliocentris Academia, Heliocentris Industry and Heliocentris Fuel Cell Solutions. "Home Power Solutions won't be affected by the bankruptcy filing. Heliocentris only has an investment in the company and otherwise, HPS has its own capital," Colell replied when asked about the situation by H2-international in Oct. There have been no bankruptcy filings for foreign subsidiaries.

Even though company operations will continue for now and Heliocentris vowed to complete outstanding customer orders, its bankruptcy will have an impact on the entire fuel cell industry. The business, which was founded in 1995 as a specialist in fuel cell teaching materials, employed 200 staff by the most recent count and was revered as one of the pioneers of the fuel cell community. Over the years, however, the Berlin-based business has increasingly favored industrial applications over offerings to academics, focusing especially on the energy management of off-grid supply systems in the Middle East and Asia. However, there has been no word on what will become of the BOS Digital Radio Network sites at which fuel cell-based emergency power systems were planned to be installed.

Profile of a Listed Fuel Cell Company

Heliocentris was founded in 1995 as a supplier of teaching materials. After a successful takeover bid for P21 in 2011, the company headquartered in Berlin, Germany, diversified its business activities and has since expanded its product portfolio to include hybrid power solutions for energy management, particularly for customers in the telecommunications sector. The expressed aim of the business – “Substitute diesel units by fuel cells” – has remained and has likewise sparked much investment in electrolysis systems. In 2012, Heliocentris entered into a cooperation with Italian Acta, which manufactures non-platinum electrolysis systems. The cooperation has resulted in a number of new emergency supply systems equipped with either H₂ cylinder packs or electrolysis units.



Ayad Abul-Ella, © Heliocentris

The shares of Heliocentris, however, have suffered a sharp drop in price over the past year. Company founder Henrik Colell told H2-international that one of the reasons was the company's development, which could not meet the expectations of some investors who had thought growth to exceed 17% in 2015. “When it comes to a small-cap stock like Heliocentris, one single fund looking to divest its shares can be enough to exert immense pressure and push the stock into free fall,” the CTO said. A London-based fund had sold half of its shares in the company at the end of 2015 and the other half in June 2016.

Another difficulty was last May's switch of the fuel cell manufacturer from entry to prime standard listing, which heightened investor pressure. Colell explained: “The low revenue is primarily a result of delays in orders from the Middle East and Asia because of the low diesel price and the post-election market uncertainties in Burma, which have led to a halt in business activities there.” And they had underestimated the “crazy long product life cycles,” Colell added.

In January 2016, Sabine Kauper became the new CFO of Heliocentris and has since been working to implement a number of “restructuring efforts.” Some personnel were let go last year, after the company had “grown to 200 employees in a pretty short time.” Another strategy was to concentrate on fewer markets (countries) to minimize the impact of political decisions. And there was to be a “focus on more in-house products, in which we had poured a lot of money over the last three years.” Shortly before the bankruptcy filing, Colell said: “We haven’t been profitable yet, so we had to reduce our fixed costs.” On June 30, 2016, forty-five employees left the company. Despite a smaller team, the intention of the Berlin-based business has been to “grow further – with a higher margin.”

A recent partial success that Heliocentris was able to achieve was the April 2016 follow-up order about 22 emergency power systems for locations of the BOS Digital Radio Network. In the second quarter, the company also entered into a framework agreement with a leading network equipment supplier and concluded a contract to provide hydrogen solutions for 50 cell phone towers of the Etisalat mobile phone network in the United Arab Emirates. However, these agreements valued at around EUR 4 million in total did not stop the downward trend of the share price. Ayad Abul-Ella, CEO of Heliocentris, concluded during this year’s annual general meeting: “We are in a very difficult spot.” His aim was to “lead the company into a sustainable future.” Still, Heliocentris had to revise its forecast for fiscal year 2016 at the end of August, cutting expected revenue in half from July’s figure of between EUR 20 to 25 million.

Spontaneous change on the supervisory board

Additionally, Heliocentris Energy Solutions announced at the end of May 2016 that Oliver Borrmann, a long-time associate, had decided to pursue other ventures. Borrmann, who had chaired the supervisory board since May 2006, said: “Since bmp is no longer a shareholder, it is now – after ten years – time to leave the supervisory board.” Colell explained that bmp had supported Heliocentris since 1999, which was a comparably long period for a venture capital fund.

The prospective successor to Borrmann had been Bernd Brunke, senior vice president of Hypovereinsbank from 2014 through 2016. Brunke was supposed to be elected to the supervisory board during the annual general meeting on July 5, 2016, and then to its chair. But in the end, the job went to Klaas de Boer, who had already been part of the board since Oliver Krautscheid’s exit in 2015. De Boer is managing director of Entrepreneurs Fund Management Services as well as managing partner of Entrepreneurs Fund Management. Michael Stammler, who has been on the supervisory board since 2008, was elected as its chair. From 2011 on, he had worked as a freelance consultant until he became chair of the Swiss Taunus Trust Group and managing director of German Taunus Trust in May 2013. He is also deputy chair of the supervisory board of bmp Holding.

The establishment of Home Power Solutions in December 2014 under the management of Henrik Colell and Zeyad Abul-Ella has produced a spin-off in a presumably profitable field (energy management as well as residential market fuel cells). In contrast, further education (Academia) continues to require plenty of personnel and is not particularly profitable, which means its future will remain in doubt.

Tesla: Nothing More Than Visions?

Market

With great fanfare, Tesla head Elon Musk announced what he had devised as a second masterplan. The corporation is not only to produce battery for its Powerpack and Powerwall, but should also supply the added solar modules (takeover of sister company SolarCity is in progress). The new plan additionally includes aims to design several other electric cars – from trucks and smaller transport vehicles to buses. Considering the many unanswered questions about the production of Model 3, the “new” goals seem even more ambitious than the old ones (= 0.5 million in 2018 and even 1 million electric cars in 2020).

Moreover, the Gigafactory will require many more cash infusions. The latest report puts construction progress at 14%. The entire complex is said to require a total investment of USD 5 billion. Tesla partner Panasonic has invested there as well, although it is not quite clear what type of investment was planned. Because: Panasonic’s co-funding appears to be the supply of machinery and plants, which Tesla would have to finance on its own. There has been no communication about this so far. Maybe it’s a type of supplier credit and not a direct investment of up to USD 1.6 billion? Meanwhile, Panasonic will continue to deliver battery cells to Tesla, even if this arrangement raises questions of its own – for example, based on which terms Tesla accepts delivery (volume, price).

An interesting side note may be that Tesla is said to have told the SEC that there could be delays in the construction of the Gigafactory and that the company’s financial means would have to be increased. New shares? Further increases in capital are certain to occur by the end of 2016 is what the company says. Right now, the corporation has more than USD 3 billion in the bank, a figure which needs to be reduced by USD 668 million for recently paying off a credit line and by USD 422 million for a convertible bond (third quarter). But even such a figure should not have one brush off the fact that Tesla will require enormous amounts of cash to elevate Model 3 production to the level envisioned by Musk. There are said to be 375,000 pre-orders, but I could imagine that the number is trending downward.

SolarCity and a lot of unanswered questions

Tesla has formally submitted its bid in the amount of USD 2.6 billion to take over SolarCity in exchange for its own shares at a ratio of 1 to 0.11. SolarCity, in which Musk has an above 20% stake as the biggest individual shareholder, manufactures solar modules and is managed by Musk’s cousins. However, the company is also around USD 3 billion in debt, which would have to be taken over as well (do Tesla’s creditors have a right to object?) and incorporated into Tesla’s balance sheet. Since SolarCity has recently announced a quarterly loss of around USD 250 million (based on GAAP, Tesla posted a loss of nearly USD 300 million in the second quarter), the close timing of the takeover bid has to be viewed with a healthy dose of skepticism.

Another Musk company, SpaceX (which uses rockets to send satellites into orbit), has loaned SolarCity USD 250 million by buying Solar Bonds. Does Musk maybe want to take over SolarCity to kill two birds with one stone by a) ensuring SolarCity pays off SpaceX and b) getting SolarCity out of debt? As a mere 13 funds and Musk

together hold the majority of shares in Tesla (viewed more narrowly, it's actually only four funds), which means they can rubber-stamp all important decisions, the close ties invite certain kinds of questions. Fidelity Funds alone is the largest individual shareholder of both SolarCity and Tesla.

Considering the remarkably high quarterly losses of SolarCity and the run time of the credits (it is said there are still 2016 due dates for repayment – only what I've heard, no guarantee it's true), it begs the question whether SolarCity would even have survived if the Tesla bid hadn't arrived. Tesla's shareholders must be shocked at the prospect of having to accept more than ten million shares as a purchase price for a company with less than one billion dollar in revenue and USD 3 billion in debt adding onto Tesla's. The threat of class action lawsuits is real, but they are mostly coming from cunning lawyers, who – at the end of the day – will receive the bulk of the settlement amount. The takeover, however, seems to already be a done deal considering Musk's statements and the interests of the major shareholders.



Elon Musk, © Tesla

Convertible bonds

Tesla's USD 3 billion debt was mainly incurred in convertible bonds. To convert borrowed capital into equity, some of the bonds would need to become due. Repayment will not involve cash but shares. Their number will depend on the conversion ratio – and on the conditions of the bond, whether Tesla itself or the bondholders are able to push for conversion. Expectations are that the holders of certain bonds will make them available for bond repayment/conversion at a relatively low value (around USD 160/share) compared to Tesla's current share price, allowing for non-recurring gains (share profit plus interest). The total amount is rumored to be USD 422 million. That there is a willingness to repay these bonds now indicates that there needs to be a fallback position before the debt of SolarCity is included into Tesla's balance sheet after the takeover of the sister company.

My conclusion: Official sources see the next increase in capital occurring still somewhere in 2016, as experts say that even the cash reserves of more than USD 2 billion will not be enough to self-finance the growth of the company. Above USD 3 billion more in new debt after the takeover of SolarCity could also increase the pressure on Tesla to cover the debt by again emitting new shares. The upcoming quarters will show whether or not Tesla will achieve its goals. In my opinion, the current stock price is being maintained “artificially” until the SolarCity takeover is complete, since there is a fixed conversion ratio between SolarCity and Tesla shares. The takeover should be finalized in the fourth quarter.

Strategy

What's noticeable is that four funds (but more than one fund from the same umbrella fund) bought another bundle of Tesla shares worth USD 4 million in the second quarter alone, despite already being heavily involved in the company and basically possessing the majority of shares together with CEO Musk. Maintaining such a high percentage and stake in a business is not something really common for funds. But it's perfect for Musk, as he could converse solely with the managers of the big four. The next increase in capital is right around the corner and is said to be made before the end of the year – my gut tells me, it might even be here in October. Yes, the stock market can be thrilling sometimes!

The catalyst for higher share prices at short notice could be the number of electric cars produced in the third quarter. The numbers floating around range from 20,000 to 22,000 units – independent of the expected loss posted (or even a fictitious profit according to non-GAAP?) this quarter.

Theoretical course development

After capital increase, a further drop in share price. Share prices of below USD 150 seem like a possible scenario. It all depends on whether Tesla can deliver some good news (sales figures) or whether the losses increase. Because of SolarCity – if the company should be consolidated into the Tesla balance sheet in the fourth quarter – the losses posted could even be much higher. The suspense will continue.

Thoughts: High book profits should either be used to secure against increasing share prices (puts) or be realized. Long-term sell options (in 2017/18) with a very depressed price development (USD 100 – 200) are highly speculative (risk of losing the total invested), but could be interesting as an addition for experienced investors who like speculating – with lower limits based on the assumption that the share price will be pushed up for some time.

Please consider: At the beginning of this year, Tesla shares fell from above USD 240 to as low as USD 140 within only one-and-a-half months. What's it to keep from happening again? There are signs that it may do so.

[Risk warning see also next article](#)

Author: Sven Jösting

FuelCell Energy: Decision on Beacon Falls

Market



Power plant in Riverside, © FuelCell Energy

The final decision on which company will be awarded the contract for the 63 MW Beacon Falls project should have already been made by the end of July 2016, but has since been moved to Sept. 5 and then to Oct. 26. The delays seem to be the result of additional bids that include wind and solar energy. In my opinion, the fuel cell plant offers significant benefits, since it's not only about the efficiency of electricity and heat generation, but also about the size of the plant. If the contract were awarded to a bidder offering wind and/or solar farms, I'd personally have doubts about the feasibility of such a project, if only because of the space required.

Meanwhile, FuelCell Energy has also procured "funds on demand," which I believe will be utilized if the Beacon Falls deal is decided in favor of the company, as the money could be used to pre-finance certain parts of the project. After all, the contract is worth up to USD 80 million, an amount the company could cover by emitting shares. What's interesting about the situation is that the potential fund giver does not want to be named until the project's a done deal.

Third-quarter figures

At first glance: disappointing. Compared to the third quarter of last year, revenue dropped from USD 41.4 million to USD 21.7 million. The posted loss (USD 11.8 million) was a hard pill to swallow. Still: FuelCell Energy is a project developer, which means there will inevitably be large differences in project billing from one quarter to the next. Cash and restricted cash add up to an impressive USD 129 million and the additional financing availability offered is above USD 50 million. But the intention of a so far unnamed investor to buy FuelCell shares in the amount of up to USD 80 million – which has already occurred to a certain extent at prices of above USD 5 per share

– is a sign that the company is expected to receive several large orders in the future. Revenue backlog is at a very high level, amounting to USD 392 million (in particular, from service contracts). I will explain the numbers in more detail in the next issue because by then, there should be a decision on now three large projects totaling 127 MW. Today, you'd say at the stock exchange: Buy on bad news.

Risk warning

Investors must understand that buying and selling shares is done at their own risk. Consider spreading the risk as a sensible precaution. The fuel cell companies mentioned in this article are small and mid-cap ones, i.e., they do not represent stakes in big companies and the volatility is significantly higher. This article is not to be taken as a recommendation of what shares to buy or sell – it comes without any explicit or implicit guarantee or warranty. All information is based on publicly available sources and the assessments put forth in this article represent exclusively the author's own opinion. This article focuses on mid-term and long-term perspectives and not short-term profit. The author may own shares in any of the companies mentioned in this article.

Author: Sven Jösting

Eco-Bonus Not (Yet) Appealing

Electric Transportation



Critics of the economic incentive for electric cars have had their I-told-you-so moment for now: The “eco-bonus” has been attracting little interest so far. Within two months (from Sept. 5, 2016), the Federal Ministry for Economic Affairs and Export Control received a mere 3,027 applications. Registration figures, however, paint a slightly

more optimistic picture of the market: For example, August 2016 showed around 900 newly registered, purely battery-driven cars as well as almost 4,000 hybrid versions.

The US market, however, has seen an average of 11,600 electric cars being sold per month during the first half of 2016, around 25 percent more than in the same period the year prior. Even in August, the majority of these cars were “real” electric cars (8,601 purely battery-driven and 6,372 plug-in hybrids), bringing the total number of electric vehicles to more than 500,000. In China, the Center of Automotive Management reported on average 30,000 electric and hybrid cars hitting the road each month, doubling the number of new electric car registrations compared to the same period in the previous year. Even in European countries such as Norway, France and the UK, the number of electric cars sold in the first half of 2016 climbed faster than in Germany (e.g., sales in Norway were at 3,600 a month).

Critics complain that the low demand was among other things the result of some car dealers using the national incentive program to drop previously granted discounts. Andreas Knie from the Innovation Center for Mobility and Societal Change (InnoZ) said that the difference in price between conventional and electric cars was still EUR 15,000 despite the economic incentive, so buying an electric car was just not appealing enough considering the currently low price of gas.

H₂ Train for Stade

Immense Potential of Fuel Cell Railcars

Research & Development

Trains running on hydrogen could be used in the future as an alternative to diesel-driven railcars on non-electrified parts of the railroad system. Although railroad cars with fuel cell-battery engines still cost up to a million euros more than today's diesel models, the efficiency gains of fuel cells and the lower maintenance requirements could lead to cost savings of 25% over the medium term, an economic analysis found. The first tests of the new technology are said to be conducted in the German states of Lower Saxony and Hesse.

After Alstom had already announced in 2015 that it intended to put fuel cell trains to the test (see [Hydrogenics, Alstom and H2 Trains](#)), the French corporation reported that it would present an H₂ railcar at the InnoTrans, the leading trade show for transportation technology, in September 2016. It also said during a trade conference in Lower Saxony that the first test track would be one in the rural district of Stade. The pilot-stage version of the railcar is based on Model 54 of the Coradia LINT family of railroad vehicles for inter-city lines and could run from Buxtehude via Bremervörde and Bremerhaven to Cuxhaven starting in 2018. If the test runs are successful, there could be a total of 50 to 60 units in daily operation by 2021.

Based on calculations by Jens Sprotte, business development manager at Alstom, such a fleet of fuel cell-driven LINT 54 trains will require around ten to twenty tons of hydrogen per day if they were used for 600 to 800 kilometers (373 to 497 miles) daily. Sprotte had proven the feasibility of integrating fuel cell engines into trains during the

BetHy project (fuel cell-run hybrid railcar), which was supported by EUR 8 million from the National Innovation Program Hydrogen and Fuel Cell Technology and ended this summer.



Fig. 1: Fuel cell-driven railroad car of the Hermann Hesse Train – G. Brunnhuber, Stuttgart-Ulm rail project; M. Lange and J. Sprotte from Alstom Germany; county commissioner H. Riegger (from left), © Alstom

BMVI study on fuel cell trains

The results of another study, for which NOW commissioned the German branch of the Ernst & Young accounting firm on behalf of the BMVI, complemented the ones of the first study perfectly. It showed that hydrogen technology did not place any restrictions on railroad operations. The research accompanying the project also pointed to a notable reduction in diesel emissions. “A route to emission-free train transportation,” yet another study conducted from the end of 2015 to March 2016, analyzed the infrastructure requirements for the use of fuel cell railroad cars in Germany in collaboration with partners such as Ludwig Bölkow Systemtechnik and Becker Büttner Held.

When the study findings were presented, the state secretary at the German transport ministry, Rainer Bomba, explained: “We have made railroad transportation one of our key funding areas within the National Innovation Program.” The economy minister from Lower Saxony, Olaf Lies, sees “immense potential for sustainable transportation” in this kind of technology. Representatives from other German states

(Hesse – see box, North Rhine-Westphalia, Baden-Württemberg) are meanwhile thinking about utilizing it as well.

H₂ railroad cars in Hesse

From 2020 on, Rhein-Main-Verkehrsverbund intends to use up to 20 fuel cell-run regional trains in the Taunus network. Tracks for test runs in Hesse could be the German railroad hub of Frankfurt a. M. Main Station to final stops in the Taunus region. The relevant lines have already been running right next to the Höchst industrial park, where chemical plants generate large amounts of hydrogen.

A feasibility study commissioned by HA Hessen Agentur and completed at the end of 2015 found the Griesheim industrial park to be an appropriate location. One thing rated particularly beneficial by InfraServ Höchst, which resides in the neighboring industrial park of Höchst and conducted the study, is the connection to the 6 bar H₂ pipeline, to which the hydrogen center in Höchst is hooked up as well. Other benefits include the favorable geographical location considering the vicinity of the railroad network and the already existing tracks as well as a maintenance facility of Deutsche Bahn on the northern outskirts of the industrial park.

A first cost estimate put the investment in the lower or mid-range of a two-digit million figure for realizing a suitable refueling infrastructure, including the required track system. This investment could pay off within a few years because of the expected (and comparably high) hydrogen consumption of up to four tons a day, even if the price of hydrogen remained below ten euros per kilogram. What has not yet been included in the calculation are possible subsidies granted by the European Union and / or the German federal government.

Quo Vadis DWV?

Comment

Ever experienced a similar situation? You've been following the same principles for years and you always think you're doing exactly the right thing. But then one day you realize that something doesn't feel right and you need to ask yourself: Have you strayed from your path or have the circumstances changed?

This is how it must have felt like for the avid supporters of solar energy: At the beginning, they were visionaries intending on saving the world through clean energy. And then all of a sudden, they were starting to get vilified as the ones enriching themselves and causing the rise in power prices.

Some of them may be rightly blamed for having abandoned their principles over the years. But there have always been others who stayed true to their values, but were put in a difficult position because of changing circumstances.

How many people are or were part of one group or the other I cannot say and it's not the point I'm trying to make either. The more important question is whether hydrogen and fuel cell technology as well as electric transportation have gradually gone down the same path. How far have we already strayed from our ideals?

There actually are still some inventors and tinkerers left who had already developed catalytic hydrogen combustors many years ago, who converted the trunk of their Fiat 500 models into a storage area for oversized power converters and travelled across Germany, or who are still reporting today about the efficiency gains of fuel cells day in and day out. But the question is: What happened to all the platforms on which they could turn their ideas into projects?

Twenty years ago, the Germany Hydrogen Association was a network of researchers who founded an organization which welcomed both visionaries and pragmatists ([see DWV Celebrates 20th Anniversary in Berlin](#)). Its members have worked tirelessly time and again to make people aware of hydrogen and the potential it offers. Their efforts certainly paid off: The association grew, made fuel cells part of its name, and increasingly focused its activities on the fields of new members.

Although numerous individuals (currently, more than 200) remain part of the DWV, its policy focus has shifted mainly to accommodate today's 88 member companies. Since companies and organizations pay considerably more member fees than individuals, business interests have been pushed to the forefront, now more than ever.

This kind of thematic shift seemed to have clearly been intended by the board of the DWV, as physicist Johannes Töpler, who had been at the helm of the association for ten years, was followed in the 2014 elections by Werner Diwald, a business college graduate. Since then, the association's activities have revolved less around technology and more around policy, something which isn't that surprising given the nature of a lobbying association.



DWV chairman Werner Diwald

Now, the crucial question for the DWV is how successfully it will be in balancing effective lobbying and vision-driven activities.

Should the organization become more business-focused by setting up its own office and hiring staff for it? This would require changes in membership fees, as the current annual budget has already been proven woefully insufficient for publicity events. Or should it try and establish new industry committees to rake in money?

To buy “access” to politicians and pay for the implementation of one’s own interests may be a day-to-day activity of some companies and may also not be atypical for a lobbying association. But it runs the risk of creating conflicts of interest and undercutting transparency, the small extent of which has already been criticized by some members.

Whatever plans management and members have for the future – the time until the next board election should be used sensibly. One day there will be a generational transition on the board, and at the latest by then will we see how close to the industry and how much of a visionary organization DWV has become.

Someday, we will have to answer one question: Are we still following our principles or have we long since thrown our original intentions and ideals under the bus to follow other goals? Depending on what decisions are made today, hydrogen could later suffer the same fate as the solar and wind energy industry, which have had their image greatly tarnished within a few years. Or it could follow a development similar to the computer, Internet and smartphone, which undoubtedly have had a great impact on people’s lives.

Author: Sven Geitmann

Twenty Years and Counting

DWV Celebrates Anniversary in Berlin

News

1996 was the founding year of the German Hydrogen Association (DWV). After now more than 20 years of actively contributing to the development of the German and European H₂ and fuel cell industry and a change in name, the members of the German Hydrogen and Fuel Cell Association, their guests and some of the founders met in Berlin, Germany, on July 6, 2016, to celebrate the two-decade anniversary with representatives from politics and business.

The anniversary celebration took place between the 7th H2Congress (see [Seventh H2Congress in Berlin](#)) and the meeting of the DWV membership assembly, which meant a busy week in Berlin for many of the event participants. Both the anniversary celebration and the annual assembly meeting were held in the Turbine Hall at Moabit in Berlin, Germany, which used to be owned by one of the association’s members, Vattenfall, and has become a popular event location.

More than a work of fiction

At the start of the celebration, current DWV chair Werner Diwald first thanked all attendees and supporters for the years of good and close collaboration and said he hoped that many more would follow: “Hydrogen – it’s more than just a fictitious idea.” He added: “It can’t go fast enough for some. I think that now is the time to establish a

reliable framework in collaboration with partners from politics and business. We need to decarbonize our energy industry.”



Five of the organization’s founding members are still on the board of directors today (from left): E. Behrend*, R. Wurster*, J. Töpler, U. Schmidtchen*, M. Schaloske, O. Weinmann*, W. Diwald, S. Frank (moderator); J. Lehmann* is not on the picture*

The first opening remarks from the politics section came from Norbert Barthle, parliamentary state secretary at the BMVI. He quoted the head of his ministry, Alexander Dobrindt (“No prosperity without transportation”) and explained: “We at the ministry believe hydrogen presents a promising way ahead.” After a detailed account and acknowledgment of the association’s achievements, Barthle said: “Hydrogen has the potential to become the energy carrier of the 21st century.”

The industry representatives attending the celebration then offered their own congratulations and pledged to continue with their support of the DWV. For instance, Total made a surprisingly clear announcement, saying that “electricity is the energy source of the 21st century.” The spokesperson of the mineral oil corporation said that the company was currently reshuffling priorities and would shift the focus primarily toward gas, renewable energies and electricity.

And the innovation prize goes to...

After the speeches, it was time for deputy chair Johannes Töpler to present the winners of this year’s DWV innovation prizes. The award for best master’s thesis went to Florian Becker, who in collaboration with the DLR had tested the use of PEM fuel cell systems in aviation at HAW Hamburg. His thesis described numerical models and experiments in supplying low-oxygen cathode emissions for tank and freight space inertization in airplanes.

Martin Robinius received the innovation prize for best doctoral thesis. At the FZ Jülich, he had examined what a market design with a high share of renewable energies, including hydrogen, could look like in the transportation sector. His analysis showed that there was no money shortage for financing a hydrogen infrastructure, but rather that capital could be acquired through long-term sustainable business models. He also devised a precise model of the 2050 power and gas market, in which H₂ transportation by pipeline plays a critical role. TH Köln's Fabian Rosenau, who was awarded the prize for best bachelor's thesis, was not in attendance.

DWV board confirmed

On July 7, 2016, the same location was used to hold this year's annual meeting of the membership assembly. The biannually held elections for the board of directors confirmed all candidates. A key resolution of the assembly was the change in membership at European level: The members who attended the meeting followed the directors' board proposal to have the DWV exit EHA and become a part of Hydrogen Europe. see also [Quo Vadis DWV?](#)

Phil Doran Crosses the Channel

News



Phil Doran, © H2FC Fair

ITM Power has appointed a new managing director to oversee business activities in Germany. The British company announced in mid-September 2016 that Phil Doran would leave Frankfurt and Calum McConnell would take over management of ITM Power. McConnell worked for 19 years at Parker Hannifin, a large US machinery manufacturer, in field such as renewable energy and energy storage.

Doran, who built up the German subsidiary entirely on his own within four years and of whom company management said he had “achieved some great early successes,” will now work at ITM in Scotland. Graham Cooley, CEO of ITM Power, expressed his profound thanks to Doran for developing the German business and said that the country was “a key market for our products.”

New Hydrogen Europe Board

News



Raphaël Schoentgen, © Hydrogen Europe

Hydrogen Europe has a new board. The European hydrogen association, formerly known as New Energy World Industry Grouping until it changed its name in November 2015, elected three new board members at the end of this June. Its chair has since been Raphaël Schoentgen, director of research and technologies at French energy supply company Engie. He followed in the footsteps of Pierre-Etienne Franc, the previous chair of Hydrogen Europe. The new treasurer is Didier Pflieger, vice president of Germany/Austria at Alstom. Michelin's Valérie Bouillon-Delporte is now responsible for the transportation market. Andreas Frömmel from FuelCell Energy Solutions was promoted to deputy chair in addition to his responsibilities as manager for energy transformation solutions.

Frömmel stressed that it was now time to go full speed ahead when it comes to commercializing the technology: “The technology is mature and ready for upscaling. To get to the next level, we need to continue using large sector-crossing demonstration projects to illustrate its potential.”

Hydrogen Europe has meanwhile grown into a network of nearly 100 large and small member companies from 23 European countries. All of them share the goal of deploying hydrogen and fuel cell technologies across Europe. To grow further, the newly elected board decided on opening its membership ranks to state associations. Talks with the relevant organizations from France and Germany are underway.

www.hydrogeneurope.eu

Seventh H2Congress in Berlin

Tradeshows / Conferences



Norbert Barthle

The German Hydrogen Congress is gradually turning into the most important event of the German hydrogen and fuel cell industry. Held in the Berlin office of North Rhine-Westphalia for two half days on July 5 and 6, 2016, it attracted as many as around 200 attendees this year. Compared to the last H2Congress at the same location two years ago, the number has increased by about 50 percent.

The main theme of this year's event was hydrogen as a path to advancing decarbonization. Frank-Michael Baumann, managing director of EnergieAgentur.NRW, said in his opening speech: "Hydrogen will play an important role in the energy industry and the transport sector of the 21st century with regard to the planned and approved expansion of renewables, the related consequences for storage and for climate protection."

Similarly, Sönke Tangemann, managing director of Greenpeace Energy, said that the use of hydrogen certainly made sense economically. In great detail, he explained during his presentation why he thought it was necessary to deploy power-to-gas technology and further expand the use of renewable energies. In concrete terms, he estimated that one gigawatt of electrolysis power would need to be set up from 2020 on to make Germany entirely self-sufficient by 2050.

The parliamentary state secretary at the Federal Ministry of Transport and Digital Infrastructure, Norbert Barthle, did claim in his opening remarks that “together with Japan and California, Germany is the leader in testing H₂ transportation technology,” but he also warned that “we must not surrender the market to manufacturers from Japan – our domestic industry needs to catch up as quickly as possible.” Considering that Barthle is hardly known for openly criticizing projects, it was indeed remarkable what he had to say about the achievements of the H₂ and fuel cell industry: “There could be some more, but they are definitely something to show for.”

Asked whether there is not something more that could be done to promote alternative fuels by removing the EUR 7 million of tax privileges for diesel fuel per year, Barthle responded in a Solomonian way: “You should do one thing without abandoning the other.” He then added in much clearer terms: “At present, minister Dobrindt does not intend to make changes to diesel taxation.”

21st WHEC in Zaragoza

Tradeshows / Conferences



WHEC in Zaragoza, © Calvera

From June 13 to 16, the World Hydrogen Energy Conference (WHEC 2016) took place in Spanish Zaragoza. It was the twenty-first time that hydrogen experts from all around the globe met to discuss the potential of H₂- and fuel cell technology as well as power-to-gas. In the words of Javier Brey, this year's WHEC chair and head of the Spanish Hydrogen Association (AeH2), the conference was primarily about, “making people aware to the fact that others work on hydrogen strategies, while we're lagging

behind,” although it remained unclear whether he meant Spain or Europe with his statement. He added that currently, the main aim of global activities was “to continue cutting costs and extending the economic life of fuel cell and hydrogen systems.” Talking about his country, Brey also said: “Spain must become aware of the opportunities hydrogen presents in establishing a local source of sustainable fuel to supply the transport and industrial sector as well as private households.”

All in all, the event attracted 800 people to the Congress Palace in Saragossa. The World Hydrogen Technology Convention (WHTC) will be held in Prague next year and the biannual WHEC will come to Rio de Janeiro in 2018.

read more: www.h2-international.com

Events

- November 3rd to 5th, 2016, **23. Energiesymposium** - Nutzung regenerativer Energiequellen & H2-Technik, in Stralsund, Germany, www.stralsund.de
- November 8th to 10th, 2016, **gat + wat** - , Conference and Fair for Gas and Water, in Essen, Germany, www.gat-dvgw.de
- November 10th, 2016, **Hydrogen and Fuel Cells in the Ports Workshop**, in Wilmington, CA, USA, www.californiahydrogen.org
- November 10th to 11th, 2016, **New energy world** - The next energy era, in Berlin, Germany, www.neue-energiwelt.de
- November 21st to 23rd, 2016, **9th FCH JU Stakeholder Forum** - Fuel Cells and Hydrogen 2 Joint Undertaking, in Brussels, Belgium, www.fch.europa.eu
- November 28th to 30th, 2016, **China International Hydrogen and Fuel Cell Exhibition (CHFCE2016)**, in Beijing, China, <http://en.chfce.com>
- December 12th to 14th 2016, **H2FC Researcher Conference**, H2FC SUPERGEN, in Belfast, Northern Ireland, www.h2fcsupergen.com

read more: www.h2-international.com/events/

Companies

Electrolyzers

AREVA H₂Gen

- **AREVA H2Gen GmbH**, Maarweg 137, 50825 Cologne, Germany, Phone +49-(0)221-888244-88, Fax -67, www.arevah2gen.com



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- **Diamond Lite S.A.**, Rheineckerstr. 12, PO Box 9, 9425 Thal, Switzerland, Phone +41-(0)71-880020-0, Fax -1, diamondlite@diamondlite.com, www.diamondlite.com



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- **GKN Powder Metallurgy**, GKN Sinter Metals, PO Box 55, Ipsley House, United Kingdom – Redditch B98 0TL, Worcestershire, www.gkn.com/sintermetals



- **Hydrogenious Technologies GmbH**, Weidenweg 13, 91058 Erlangen, Germany, Phone +49-(0)9131-12640-220, Fax -29, www.hydrogenious.net



- **MicrobEnergy GmbH**, Specialist in Methanisation, Bayernwerk 8, 92421 Schwandorf, Germany, Phone +49-(0)9431-751-400, Fax -5400, info@microbenergy.com, www.viessmann.co.uk

Event Organizers



- **23rd Group Exhibit Hydrogen + Fuel Cells + Batteries**, HANNOVER MESSE 2017, April 24 – 28, Tobias Renz FAIR, Tobias Renz, tobias@h2fc-fair.com, www.h2fc-fair.com




- **European Fuel Cell Forum**, Obgardihalde 2, 6043 Luzern-Adligenswil, Switzerland, Phone +41-4-45865644, Fax 35080622, forum@efcf.com, www.efcf.com
- **GL events Exhibitions**, 59, quai Rambaud, CS 50056, 69285 Lyon Cedex 02, France, Phone +33-(0)478-17633-0, Fax -2, www.gl-events.com



- **Peter Sauber Agentur Messen und Kongresse GmbH**, World of Energy Solutions, Wankelstr. 1, 70563 Stuttgart, Germany, Phone +49-(0)711-656960-55, Fax -9055, www.world-of-energy-solutions.de

Fuel Cells

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- **SerEnergy A/S**, Reformed Methanol fuel cell systems for stationary and e-mobility, Lyngvej 8, 9000 Aalborg, Denmark, Phone +45-8880-7040, www.serenergy.com



- **Tropical S.A.**, 17 Krokeon Str, 10442, Athens, Greece, Phone: +30-(0)210-5785455, Fax: -7, info@tropical.gr, www.tropical.gr

Fueling-Recirculation and Air-Supply



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- **Busch Clean Air S.A.**, Chemin des Grandes-Vies 54, 2900 Porrentruy, Switzerland, Phone +41-(0)32-46589-60, Fax -79, info@buschcleanair.com, www.buschcleanair.com

Gas Diffusion Layers (GDL)



- **MeliCon GmbH**, Metallic Lightweight Construction, Porschestr. 6, 41836 Hückelhoven, Germany, Phone +49-(0)2433-44674-0, Fax -22, www.melicon.de



- **SGL Carbon GmbH**, Werner-von-Siemens-Str. 18, 86405 Meitingen, Germany, Phone +48 (0)8271-83-3360, Fax -103360, fuelcellcomponents@sglgroup.com, www.sglgroup.com

Hydrogen Distribution



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- **Wystrach GmbH**, Industriestraße 60, Germany – 47652 Weeze, Phone +49-(0)2837-9135-0, Fax -30, www.wystrach-gmbh.de

Membrane and Separator



- **FUMATECH BWT GmbH**, Carl-Benz-Str. 4, 74321 Bietigheim-Bissingen, Germany, Phone +49-(0)7142-3737-900, Fax -999, www.fumatech.com



- **Plansee SE**, Bipolar Plates, Interconnects and Metal Supported Cells, 6600 Reutte, Austria, Phone +43-(0)5672-600-2422, www.plansee.com

Organization



- **Deutscher Wasserstoff- und Brennstoffzellen-Verband**
German Hydrogen and Fuel Cell Association, Deutscher Wasserstoff- und Brennstoffzellen-Verband e.V. (DWV), Moltkestr. 42, 12203 Berlin, Germany, Phone +49-(0)30-398209946-0, Fax -9, www.dwv-info.de
- **hySOLUTIONS GmbH**, Steinstrasse 25, 20095 Hamburg, Germany, Phone +49-(0)40-3288353-2, Fax -8, hysolutions-hamburg.de



- **Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie**
National Organisation Hydrogen and Fuel Cell Technology (NOW GmbH), Fasanenstr. 5, 10623 Berlin, Germany, Phone +49-(0)30-3116116-15, Fax -99, www.now-gmbh.de

Reformers

- **WS Reformer GmbH**, Dornierstraße 14, 71272 Renningen, Germany, Phone +49-(0)7159-163242, Fax -2738, www.wsreformer.com

Research & Development

- **Fraunhofer ICT-IMM**, Reformer and Heat Exchanger, Carl-Zeiss-Str. 18-20, 55129 Mainz, Germany, Phone +49-(0)6131-9900, info@imm.fraunhofer.de, www.imm.fraunhofer.de



- **Fraunhofer ISE**, Heidenhofstrasse 2, 79110 Freiburg, Germany, Phone +49-(0)761-4588-5208, Fax -9202, www.h2-ise.de

Suppliers

- **Anleg GmbH**, Advanced Technology, Am Schornacker 59, 46485 Wesel, Germany, Phone +49-(0)281-206526-0, Fax -29, www.anleg-gmbh.de



- **Borit NV**, Bipolar plates and interconnects, Lammerdries 18e, 2440 Geel, Belgium, Phone +32-(0)14-25090-0, Fax -9, contact@borit.be, www.borit.be



- **ElectroChem Inc.**, 400 W Cummings Park, Woburn, MA 01801, USA, Phone +1-781-9385300, www.fuelcell.com



- **HIAT gGmbH**, Schwerin, Germany, CCMs / MEAs / GDEs for PEFC, DMFC & PEM-Electrolysis, www.hiat.de



- **Kerafol Keramische Folien GmbH**, Koppe-Platz 1, 92676 Eschenbach, Germany, Phone +49-(0)9645-884-30, Fax -90, www.kerafol.com/sofc



- **Member of the ARCA Group**
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System Integration



- **Deutsches Zentrum für Luft- und Raumfahrt (DLR) / German Aerospace Center**, Institute of Engineering Thermodynamics Energy System Integration, Pfaffenwaldring 38-40, 70569 Stuttgart, Germany, Phone +49-(0)711-6862-672, Fax -747, www.dlr.de/tt, www.dlr.de/tt



- **FLEXIVA automation & Robotik GmbH**, Power Electronics – Hybrid Energy System Solutions, Weißbacher Str. 3, 09439 Amtsberg, Germany, Phone +49-(0)37209-671-0, Fax -30, www.flexiva.eu

Testing



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- **TESTSOLUTIONS**
SMART Testsolutions GmbH, Röttestrasse 17, 70197 Stuttgart, Germany, Phone +49-(0)711-25521-10, Fax -12, sales@smart-ts.de, www.smart-testsolutions.de



- **TesTneT Engineering GmbH**, Schleissheimer Str. 95, 85748 Garching / Munich, Germany, Phone +49-(0)89-237109-39, info@h2-test.net, www.h2-test.net

Valves



- **FLUID CONTROL SYSTEMS**
Bürkert Werke GmbH, Mass Flow Controllers, Christian-Bürkert-Str. 13-17, 74653 Ingelfingen, Germany, Phone +49-(0)7940-10-0, Fax -91204, www.burkert.com



- **OMB Saleri SpA**, Via Rose di Sotto 38/c – 25126 Brescia, Italy, hydrogen@omb-saleri.it, www.omb-saleri.it

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AVAILABLE IN THE GERMAN-SPEAKING REGION				
MANUFACTURER	BAUER	ELCONE	NEOS	WISNET ENGINEERING
TYPE OF FUEL CELL	SOFC	SOFC	SOFC	SOFC
MODEL	FC1000-1000	FC1000-1000	FC1000-1000	FC1000-1000
CATALYST	Carbon	Carbon	Carbon	Carbon
THERMAL CAPACITY OR ELECTRONIC BURNER	1000 W	1000 W	1000 W	1000 W
STORAGE	1000 W	1000 W	1000 W	1000 W
ELECTRICAL EFFICIENCY	40%	40%	40%	40%
OVERALL EFFICIENCY	40%	40%	40%	40%
ENERGY LABEL	A++	A++	A++	A++
SIZE IN MM	1000 x 1000 x 1000	1000 x 1000 x 1000	1000 x 1000 x 1000	1000 x 1000 x 1000
WEIGHT IN KG	1000	1000	1000	1000
FIELD OF APPLICATIONS (COMMERCIAL PRODUCTS)	Commercial products	Commercial products	Commercial products	Commercial products
AVAILABLE IN MARKET	Yes	Yes	Yes	Yes
AVAILABLE IN THE GERMAN-SPEAKING REGION	Yes	Yes	Yes	Yes
PRICE IN EUR	1000	1000	1000	1000

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