



H2-international – e-Journal

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Ballard: Good Start with Strong First Quarter



Rendering model of the H2-driven T680, © Kenworth

One good piece of fuel cell news after another: Businesses on the stock exchange, such as the ones discussed in these news articles, have announced a series of large orders, new strategic partnerships, technological advances and new investors (also strategic ones), and some (quarterly) results or forecasts promise interesting times ahead on the way to a hydrogen society. Share prices are gradually starting to reflect the positive development – slowly but surely, even if after a long-term slump from 2002 through 2017, some seem not very steady but show large fluctuations (temporary profit-taking, technical responses). That's the stock market for you. But: The trend is your friend.

The figures for 2017's first quarter provided a perfect start to the current fiscal year at Ballard: USD 22.7 million in total revenue and an adjusted net loss of around USD 0.02 per share. Revenue growth by 39 per cent and a gross profit margin spiking to 42 per cent speak for themselves. Since the first three months are usually the weakest, positive surprises may be in store for the next. Cash reserves are at around USD 68 million despite Ballard's R&D investment of around USD 10 million.

The conference call offered encouraging prospects for the company's industry segments. Canadian-based Ballard (NASDAQ: BLDP) had made "great progress" in partnership with the world's largest railroad manufacturer, Chinese-based CRRC. There had already been an order for eight hydrogen trains that Ballard has helped develop. Important to note: Management went on a week-long trip across China in April to speak with strategic partners, customers and government representatives in

person. The outcomes were said to have been excellent and would leave much wiggle room for other positive surprises.

Trucks was another field in which Ballard said it had invested. The Canadian manufacturer is collaborating with Paccar's subsidiary Kenworth for a two-year test run of special fuel cell trucks transporting containers off ports such as the one in Los Angeles. Even Toyota is testing heavy-duty trucks equipped with fuel cells in the States.

The collaboration with Protonex (drones, fuel cell systems in military use) will still require some time to yield results, since all testing stages will have to be completed before any orders can be placed. That should happen in the third quarter, though. Additionally, it is said that Ballard had gained another partner or customer in this field – like Boeing, a top-tier company, but one that does not want to be named. Another thing not to neglect is that Ballard's major stakeholder and strategic partner Broad Ocean has upped its order of 10,000 heavy-duty vehicles to 16,000.

Ballard is now working on more than 35 projects, with many renown, globally operating carmakers among them. And it received special recognition on May 12, 2017, in Berlin during the GreenTec Awards for its groundbreaking project deploying fuel cell buses in Aberdeen, UK.

The press has begun to take notice of fuel cells and green hydrogen. There are now numerous reports, opinion pieces and product descriptions about the technology. It wasn't always like this and it shows that there is increasing momentum for generating and using hydrogen in many fields.

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, written May 2017

Plug Power: Big Amazon Order and Investment



Amazon also has interest in solar, © Amazon

First-quarter figures this year differed from expectations. You could say: They were abysmal. A net loss of USD 24.1 million attributable to common shareholders, meaning a loss of USD 0.13 instead of USD 0.07 per diluted share. Plug's possibly very disadvantageous Walmart business (forklift retrofits financed through leasing) is still making an impact that shows on the balance sheet. But a change in contract terms sometime this year seems very likely and would take the pressure off Plug.

In contrast, the conference call that took place after the publication of the figures seems to have brought back some optimism in that the second half of the year would be entirely different and that the positive outlook was here to stay. The revenue guidance of USD 130 million for 2017 was left unchanged and the profit margins are said to increase considerably. The good news could not completely prevent a fall in prices, but shares remained above USD 2.00, trading much higher than just a few days prior, when stock quotes plummeted below USD 1.00. You could also say: Leave the past behind to focus on the future.

Amazon recognizes potential

Then there was this bombshell: Amazon made it clear that fuel cell forklift trucks have great potential by not only placing a years-long order worth more than USD 600 million with Plug Power (NASDAQ: PLUG), but by additionally being granted the right to purchase a 23 per cent stake in the fuel cell manufacturer. This could mean around USD 70 million.

Last year, Amazon started operating a test unit of an H₂ filling station that should be viewed as the reason for placing an order with Plug. While shares had been under pressure only a few days before, dropping below USD 0.90, the Amazon deal was the start of a run to the top, with trades peaking at USD 2.80 in between. What should be highlighted about this transaction is that a large corporation such as Amazon intends to make broad use of fuel cells in day-to-day operations, putting its “green conscience” into practice. It may be understandable now why the exercise of early-issued warrants had led to USD 36.6 million in new capital, after Plug had invested more than USD 35 million (e.g., because of a swift expansion of H₂ filling stations). The plan is to add 5,500 systems and 25 filling stations this year. The cash required ranges from USD 25 million to USD 35 million. Bookings are expected to top USD 325 million in 2017.

FedEx collabo underway

The collaboration with FedEx seems to make good progress in the test-stage retrofit of courier vans. A battery would offer a range of around 100 kilometers or 62 miles, while a fuel cell range extender could increase mileage to more than 275 kilometers or 171 miles. In around 12 months’ time, Ballard expects to ramp up deployment (bookings) from this project.

[Hydrogenics](#) is collaborating with UPS in this field. Deutsche Post relies on its in-house battery developments – StreetScooter – and on Daimler.

Will Amazon soon get to Ballard too?

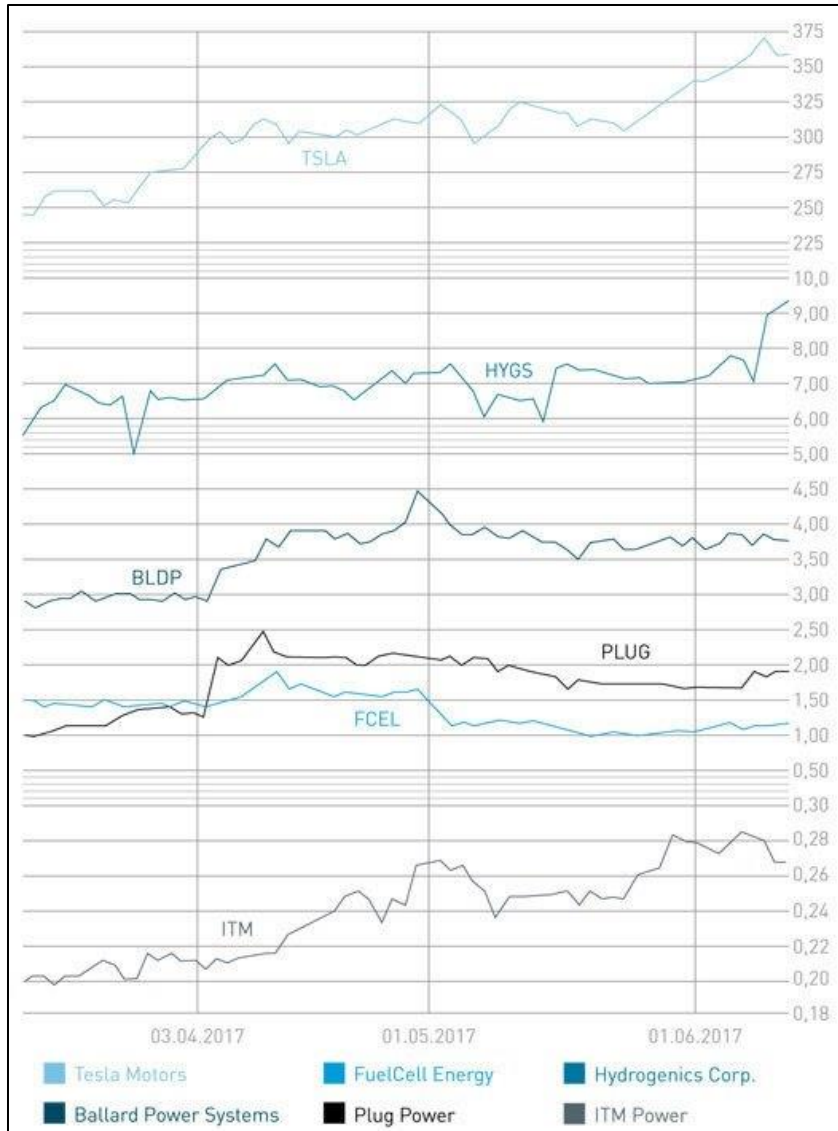
Since large corporations such as Amazon – as well as Apple, Facebook, Google and others – are also large consumers of energy because of their IT centers, the Amazon-Plug deal lets me assume that additional corporate departments could be interested in fuel cell use. The obvious choice for Amazon would be Ballard Power, Plug Power’s supplier of fuel cell stacks for forklift trucks and indirectly already tied into the deal. And New York based Plug Power has a subsidiary in Protonex with important know-how of drones, another application for fuel cell use. Here, too, Amazon has taken the lead globally, with intentions to use drones in as many logistic tasks as possible.

Forging a Plug-like deal with Ballard would not just be a theoretical scenario. It would be possible for Amazon to request Ballard’s services in drone research, seek a stake in the stack manufacturer (for the many important patents) and secure drone supply (bookings) through Protonex. I could imagine the same to unravel if a deal were struck with Apple, as the corporation has interests in various potential fuel cell markets, considering the patent portfolio it has acquired over the years. Reportedly, Apple is planning to design its own electric car; it’s not known yet whether it will be a purely battery-driven one or a fuel cell hybrid.

Risk warning: see page 4

Author: Sven Jösting, written May 2017

FuelCell Energy: Unexpected Capital Raise



© www.wallstreet-online.de, May 20, 2017

On April 27, 2017, FuelCell Energy (NASDAQ: FCEL) took everyone by surprise when it announced that it intended to raise USD 15.4 million in capital through an underwritten public offering. The net proceeds amounted to USD 13.8 million at USD 1.28 per share, meaning 15 per cent above current stock quotes. At the same time, it issued one-year warrants priced at USD 1.28 per share, exercisable at any time, and five-year ones at USD 1.60 per share, including the same option (convertible into shares). Both warrants account for 12 million shares each.

The raise is diluting the stock of existing shareholders to a considerable degree. But it also leads to the conclusion that the fresh capital and the one-to-be (option to exercise) could – theoretically – rake in about USD 50 million. The stock price would have

to be way above USD 1.60, though, to make the scenario attractive to investors. Considering all of this, it would make sense to assume that, in addition to the other large available amounts of cash, capital was raised to finance part of a planned large-scale project – perhaps Beacon Falls? – so that the investors/initiators themselves would have a great interest in seeing the share price be pushed up, so that they could benefit from the warrants.

In short: I recommend that you look past the current situation and temporary price fluctuations and for possible signs of a deal. Consider Plug Power, where a capital raise had initially led to a slump in prices, but little later to a surprising turnabout.

Risk warning: see page 4

Author: Sven Jösting, written May 2017

Hydrogenics: Chinese Investor Confirmed



Presenting the new electrolysis stacks

Before the capital raise, a Chinese-based investor, Fuzhou Bonded Zone Hejili Equity, made a private placement to Hydrogenics (NASDAQ: HYGS) at a price that was 10 per cent above the average stock quote, meaning USD 7.83 per share. This has all the hallmarks of a good deal for Hydrogenics and shows the trust that the strategic investor has in its decision. Hejili paid USD 21 million for those shares and the outcome looks roughly equal to what Ballard Power got from its deal with Chinese-based

Broad Ocean and Synergy, as it's not only about capital and shares, but especially about technological advancements and the establishment of a joint production of fuel cell stacks. Hydrogenics is a good catch, as it manufactures power-to-gas systems, H₂ filling stations and fuel cell modules for trucks, buses and railroad vehicles (see [Alstom Transport](#)).

Backlog rose to around USD 110 million, a good baseline for the current fiscal year and the years that follow. The gross profit margin is at a robust 30.3 per cent. Encouraging side note: In the United States, Hydrogenics has inaugurated the country's biggest H₂ filling station for filling up the latest-generation UPS courier vans based on fuel cell hybrid technology.

Risk warning: see page 4

Author: Sven Jösting, written May 2017

Tesla: Squeeze, Bull Trap, Hangover?



Model 3, © Tesla

Profit from 2017's first quarter was less than persuasive, as a minus of USD 1.33 per share (before extraordinary items/losses) was a much higher fall than the, on average, USD 0.81 in loss analysts had expected. First-quarter net loss added up to around USD 330 million. That revenue grew strongly by 69 per cent (compared to the same quarter last year) to USD 2.7 billion is a positive. Because of the mood on the stock exchange – which remained optimistic after the latest figures were published – prices rose to more than USD 325 (is this the short squeeze I expected?) and the market cap temporarily shot up to USD 53 billion, surpassing Ford's.

Tesla (NASDAQ: TSLA) touted its first-quarter sale of more than 25,000 vehicles as a big success and is certain that it can get Model 3 ready for the market on time, in smaller volumes from July and at more than 5,000 units per week late this year. In 2018, the number is planned to rise to 10,000. What is curious, though, is that the corporation intends to skip the important beta test – a stage that is typically used to detect possible issues with new models and correct them before a car enters series production. Is it due to the ambition of Tesla head and visionary Elon Musk?

The first Model 3 vehicles will reportedly be tested by Tesla's employees. Are they going to be the guinea pigs? Why not take the normal route? To save time?

Unfortunately, there was no update on the number of reservations for the new model at a deposit of USD 1,000 each. Analysts think it is likely that many potential buyers would want to use the option to get the federal income tax credit of USD 7,500 per vehicle. But what if the 200,000-unit threshold for grant approval is exceeded and the tax credit void?

Tesla is reportedly more than USD 8 billion in debt compared to USD 4 billion it has in cash and cash equivalents, plus an increasing number of supplier credits going into billions. This means that more capital raises are very likely, especially considering the launch of Model 3.

Goldman Sachs believes the stock to be priced at USD 190 in the long run. The assumption is that demand for Model X and S will gradually decrease because of stronger competition and the market launch of Model 3 could be followed by ups and downs. Some people who have preordered Model 3 might have bought Model S, but saw the difference in price and may expect Model 3 to be just as well equipped. Musk made clear that this wasn't the case to avoid deterring any potential Model S customers.

Last: Analyst Adam Jonas from Morgan Stanley downgraded his rating on May 15, 2017, to neutral. He now expects a capital demand of USD 3.1 billion in 2017 (previously: USD 2.3 billion) and the corporation being in the red until the end of 2019. The last point should be seen in comparison with other, rather optimistic opinions held by analysts who believe Tesla could already turn a small profit this year and forecast generous profit margins in the coming years due to Model 3 and successful developments in power storage (SolarCity & Powerpack).

Visionary founders of Tesla and SolarWorld – any parallels?

Could SolarWorld and Tesla or, more to the point, their founders, respectively Frank H. Asbeck and Musk, have something in common? German stock market magazine *Der Aktionär* tried to find an answer to that question in a May 2017 article and has found some similarities between those two, namely their visions, behavior and communication style. And both “make a lot of noise” to cover up weak spots in company operations, it seems.

Some of the authors' findings are interesting, to say the least: The force behind SolarWorld was Asbeck, an entrepreneur and darling of the stock exchange, who mainly shared in the solar boom by receiving subsidy money for his business (Asbeck was

co-founder of The Greens and has been one of the drivers of devising a renewable energy law.). SolarWorld then acquired Solarparc, its major shareholder having been the Asbeck family; at Tesla, it was SolarCity operated by Musk's cousins, one of which exited the business not too long ago. Asbeck and Musk are both darlings of the press and have helped bring about the breakthrough in their respective fields – the former in solar energy, the latter in electric transportation. And they have cashed in at some point, transferring money to their private accounts: With Musk, it was USD 600 million during a capital raise and later by pledging more than 7 million of his own shares in exchange for a USD 1.7 billion loan. As a sign of goodwill, they have participated in subsequent capital raises – but with amounts that look “cosmetic” in nature, I'd say.

Last: Analyst Adam Jonas from Morgan Stanley downgraded his rating on May 15, 2017, to neutral. He now expects a capital demand of USD 3.1 billion in 2017 (previously: USD 2.3 billion) and the corporation being in the red until the end of 2019. The last point should be seen in comparison with other, rather optimistic opinions held by analysts who believe Tesla could already turn a small profit this year and forecast generous profit margins in the coming years due to Model 3 and successful developments in power storage (SolarCity & Powerpack).

Risk warning: see page 4

Author: Sven Jösting, written May 2017

ITM Power: New to the Market



Shell station by ITM Power in the UK, © ITM

ITM Power (NASDAQ: ITMPF) is the first R&D fuel cell business from the UK making the jump onto the British stock exchange. ITM manufactures power-to-gas systems, H₂ filling stations and electrolyzers. Currently, it is working on a module-based electrolyzer that could allow for combinations offering up to 100 MW capacity.

The British-based business designs hydrogen filling stations for renown customers such as Shell, Toyota and others. Backlog is at GBP 27 million, but ITM's revenue is only at around GBP 2.3 million, which means it doesn't turn a profit (yet). The market cap is at around EUR 53 million. I expect the growing interest in fuel cell companies on the stock exchange to benefit companies such as ITM Power. I think in some fields, it compares well with Hydrogenics.

www.itm-power.com

Risk warning: see page 4

Author: Sven Jösting, written May 2017

Mr. Hydrogen in Brussels

Jorgo Chatzimarkakis, Secretary General of Hydrogen Europe

Georgios “Jorgo” Chatzimarkakis was born in Duisburg, Germany, in 1966. He holds German and Greek nationality, a degree in agriculture and politics from the University of Bonn, and even back then, he had already showed a strong interest in economic history and international and European law, making his entry into politics an easier one. He went on to work for Germany's Foreign Office, as a business consultant, as an associate professor in the field of European Politics and until 2014 for Germany's Free Democrats – as member of the national party's executive board from 1995 through 2011 and as secretary general of Saarland's state party from 2002 through 2010. From 2004 to 2014, he was a member of the European Parliament and was appointed special envoy for the Greek government during the financial crisis. In 2016, he became head of the European industry association Hydrogen Europe.

HZwei: Mr. Chatzimarkakis, is it true that it was the idea of storing solar energy in the form of hydrogen that prompted you to go into politics in the 1980s?

In fact, I had already taken notice of hydrogen when I was still a student. I just couldn't stop reading “In the beginning, there was hydrogen” by Hoimar von Ditfurth. The subsequent Chernobyl catastrophe in 1986 was the driving force behind getting involved in politics as a student. I followed the call of a new, small party that wanted to use Saharan solar energy to create hydrogen via electrolysis and transport it to Europe. Hydrogen was thought of as an alternative to nuclear power and the people putting forth the idea were members of the Ecological Democratic Party, founded by Herbert Gruhl, a former member of the Christian Democratic Union of Germany. It was indeed the fuel that had me going into politics. Years later, the youth organization of another political party “won me over,” which is how I ended up at the Free Democrats.

HZwei: After joining a new party, you first concentrated on your political career before coming back to hydrogen. What were the reasons for your “return” to the energy sector?

Not only on my political career, no. I had been given the opportunity to work for Klaus Kinkel, Germany’s then-foreign minister and vice chancellor, from 1996 through 1998. Shortly thereafter, I represented Infineon Technologies in Brussels for several years. It was a job that required me to “interpret” between the realm of technology and politics. Even now, I’m partly relying on the experience I gained during this crucial time in my life. One of my main tasks nowadays is again to explain complex technical issues in a way that is understandable to political decision makers. My expertise also impacted my time as a member of the European Parliament, where I was part of the industry, energy and research committee. One of my first activities as a committee member was to support the first FCH JU, which the parliament had to approve. I was very pleased that I could actively assist in the development of my “old passion” – hydrogen – in my new role as an MP in Brussels.

Fig. 1: Jorgo Chatzimarkakis



Source: Hydrogen Europe

HZwei: What exactly did you like so much about hydrogen that you switched jobs, from politician to political consultant?

I think you can easily see based on my job history that I don’t care much for the widespread notion of a straight-line career path. I am suspicious of people who went from school through student parliaments right into politics and have made it their only job since then. That’s where I favor the American system – it pretty much drives you to

switch continually between business, research and politics. It's the only way I see to get to know how businesses work and how complicated political decision making can be.

What I find so interesting about hydrogen is that since encountering the vision of a hydrogen economy more than 30 years ago, we now do have a big opportunity to realize it. The "sector integration" people are talking about these days is basically an energy transformation process that has the use of hydrogen at its core. It's really fascinating to think that using the technology could allow us to skip entire stages of development and utilize renewables for the decarbonization of many industries. Our objective is not just to offer political consulting in the sense of "advocacy," but primarily to establish new partnerships to advance our goals. That's where we see much progress being made in Brussels right now.

HZwei: What exactly does your association stand for?

In short: We intend to make the use of hydrogen and fuel cells a normal part of daily life. First and foremost, we need to close gaps in knowledge. One crucial message is that you get an alternative fuel that produces zero emissions while you don't have to compromise on anything. The current aim in the wake of the European energy transformation and particularly considering the so-called "winter package" [Clean Energy for all Europeans] is to showcase the versatility of hydrogen as an energy carrier, fuel and raw material to advance decarbonization. What poses a crucial dilemma for EU stakeholders is the slow winter season and the fact that we need to store the excess energy from the summer months. When it comes to seasonal storage, we as Hydrogen Europe need to communicate a clear objective and are, of course, pleased that storage systems have finally been specified at EU level.

HZwei: Hydrogen Europe succeeded the industry initiative New Energy World Industry Grouping (NEW-IG) in late 2015. Did only the name change or are we talking about a completely different organization?

NEW-IG had been established based on a hydrogen and fuel cell platform, the first FCH JU. This new kind of collaboration between the public, research and industry had meant that the latter needed to undergo some changes. Many SME manufacturers joined forces with some well-known hydrogen and fuel cell businesses, a first essential step toward the creation of an "eco-system" of hydrogen use. The ties that were established over those many years will be crucial in the ramp-up of many market-ready products. But NEW-IG tended to focus on internals, meaning on strengthening the industry itself. When we made the transition to Hydrogen Europe, we also wanted to improve the public image of a now established sector.

HZwei: What was new about that approach?

What was new was that the association had to communicate its interests to people outside the industry. In the beginning, there were only a few position papers on political issues at EU level and most of them were research-driven. With the EU's energy transformation and especially since the Paris agreement reached in December 2015, the demand for accelerated decarbonization has moved to the forefront. This is where hydrogen comes in, particularly in a joint effort with other lobby groups, not only wind and solar. They will need it to expand their capacities, but niche technologies such as heat pumps or battery-electric transportation could also benefit and

grow their potential. Last, even fossil fuel-based industries, such as gas or steel, have realized that “green hydrogen” could help them achieve decarbonization on a massive scale. And that’s the new approach: to articulate one’s positions and align them with the interests of other groups.

HZwei: When you started at Hydrogen Europe, you said that you were looking forward to explaining the technological benefits to politicians, lobby groups and the press in Brussels as “Mr. Hydrogen.” Are you still viewing that as your main task?

Hydrogen technologies indeed lacked name recognition in Brussels. Every day, there are conferences, podium discussions and events to showcase technologies and industries, develop synergies and, arguably, to further accomplishments. Hard facts are important to convince political decision makers. But they need to be communicated properly. So, yes, it is still one of my main tasks to improve the knowledge base. Currently, this works well because there’s much to catch up with.

Fig. 2: Chatzimarkakis in Hanover



HZwei: You were at Hannover Messe, where you and industry representatives met with Maroš Šefčovič, vice president of the European Commission and in charge of the Energy Union. Is that one of the other tasks you spoke of, to bring together representatives from businesses and EU politicians, as you used to be a member of parliament yourself?

It's one of my core responsibilities to familiarize as many members of the European Commission as possible with the technology. That I know a representative of the Energy Union, Vice President Šefčovič, personally from my time as a member of parliament can only further the cause. All in all, I was able to establish a well-functioning network in ten years of being an MP. What may be even more important is that I have intimate knowledge of the processes and procedures leading to EU decisions. That, too, helps with arguing my points.

HZwei: Any current projects you're trying to advance?

Regarding the winter package driving the EU's energy transformation, our most important agenda item is the inclusion of sector integration throughout all parts of the legislation. There are eight directives in total. We suggested the term "sectoral integration" and a definition for the new directive on renewables, RED II, a definition that runs like a thread through all our proposed amendments. Additionally, it is our job to make our ideas sound appealing to as many member states, members of parliament and associations as possible.

Another important project is the agreement on a third subsidy period for FCH JU, our technology platform. The EU Commission is currently evaluating program performance. We are confident that if we work hard, we can convince the decision makers in this process of our ideas.

HZwei: And where do you see the greatest potential for hydrogen use?

In a "sector-integrated" energy industry, hydrogen will be the link between the complex processes of different sectors. What that means for applications is the topic of a current study by Professor Ad van Wijk: "Green Hydrogen Economy in the Northern Netherlands." The Dutch have created a far-reaching initiative by the Northern Netherlands Innovation Board to illustrate Europe's future. Hydrogen is at the core of their model.

HZwei: Do you agree that the hydrogen industry should become more independent of individual transportation? An increasing number of people are saying that we should finally stop waiting for fuel cell cars. Both commercial and railroad vehicles could be used for a much earlier market ramp-up; the same was true for forklift trucks and stationary systems. What do you think?

These are two developments that continue to go hand in hand. Many people need the model of a fuel cell car to picture the role of hydrogen in transportation. These cars have already been available on the market. The use of test vehicles and particularly commercial versions shows that the technology works. And that's what's important – to demonstrate market maturity. It will be one of the main topics of the upcoming climate change conference COP23 in Bonn and Hydrogen Europe intends to showcase the full range of market-ready technologies as part of UNFCCC's shuttle service.

HZwei: There is another organization on hydrogen in Europe, the European Hydrogen Association. What is the difference between Hydrogen Europe and EHA?

First, Hydrogen Europe is a business coalition, whereas EHA is an umbrella organization. But because we're stronger together, we have invited the national associations to join us and increase their visibility, also at EU level. Ten associations have

accepted our invitation. They are directly represented by Werner Diwald, who became part of the board through a change in our rules.

HZwei: You're not the only German on the Hydrogen Europe board. There is also Werner Diwald, whom you have already mentioned, and Nils Aldag. Could this not make other nations feel underrepresented?

When I became secretary general of Hydrogen Europe, the six-member board had four people from Germany. That was indeed a clear dominance by one nation. Now, there's only Nils Aldag, since Werner Diwald was added to the board and represents the national associations. I don't see a risk of feeling underrepresented, though, as there had always been someone from France chairing the board. All in all, the French H₂ community has considerable influence on Hydrogen Europe. But that's a good thing. No other project is better suited for a German-French initiative than sector integration with green hydrogen at its core. Berlin and Paris could jointly lay the foundation for a revolution in energy policy. And I am more than happy about any other impulses from important countries such as Denmark or the Netherlands. Both are putting into practice what others only talk about.

HZwei: Last question. When will we be able to speak of an established hydrogen economy in Europe?

We will need to lay the groundwork between 2020 and 2030 if we intend to meet the climate change targets agreed upon in Paris. After that's done, the industry will grow rapidly.

Don't Count on It

In late March, Dieter Zetsche's words on electric transportation and the future of fuel cells caused quite a stir in the automotive industry. During the *auto motor und sport conference* on March 27 in Stuttgart, the head of Daimler was asked about what type of electric transportation his company would favor over the coming years. Instead of the short reply one would expect, he went on to give a long answer to the question and it seemed to have given rise to wildly different interpretations.

Before the day was over, a headline on T-Online read: "Daimler says goodbye to hydrogen." In the article, it said: "The fuel cell is now no longer a central part of Daimler's renewable strategy." As proof, the web portal offered a quote by Zetsche himself: "I believe one would be well advised to focus on battery-electric vehicles over the next ten years." But the second half of the sentence – clearing up the misunderstanding – had been omitted (see long quote [Daimler Stays](#)).

About the benefits of fuel cells – greater range and faster refueling – T-Online wrote: "Recent developments in battery technologies have reduced those advantages. Whereas batteries are getting ever cheaper, hydrogen production is as expensive as ever." But ultimately, the article ended with the conclusion that "fuel cells remain an interesting technological option."

A day later, Automobil Produktion wrote: “Daimler head Zetsche says fuel cell has few benefits.” In the article, it said: “Fuel cells are no longer at the heart of Daimler’s alternative engine strategy.”

In early April, iwr.de wrote: “Daimler and Vaillant turn their backs on fuel cells.” golem.de even speculated about a possible end to the 2013 fuel cell agreement between Daimler, Ford and Renault-Nissan.

The high point, though, was the “Obituary for the Fuel Cell” published in the Wirtschaftswoche business magazine just before Hannover Messe – death notice included (see [Daimler Stays](#)). The authors chose somewhat melodramatic phrases such as: “Hydrogen technology: Rest gently.”

The opinion piece by editors Martin Seiwert and Stefan Hajek did show knowledge of the industry, but left no doubt as to their love for battery-driven electric transportation and their dislike of fuel cells, saying that the automotive industry “paid dearly for its fuel cell mistake.” They deemed Elon Musk a “genius who is very much alive and well,” while “the pretty engineering vision of fuel cell use collides with hard economic facts.”

The authors’ statement that “the electric car has meanwhile caught up with FCEVs regarding range and total environmental impact” seems a bit premature. As does the claim that battery vehicles were “much cheaper.”

When H2-international asked Wirtschaftswoche who’s digging the fuel cell’s grave, Seiwert replied: “We are, based on the reasons and conclusions we presented in our article. Mister Zetsche has said the right thing; others aren’t that courageous, since they have invested billions in the technology.” And the “year of birth” was given as 1966 (see obituary: [Daimler Stays](#)) because that was the year General Motors had unveiled its first fuel cell car.

Journalists seem to use increasingly drastic language and ever more dramatic phrases in their reporting and they have been right on target. The hydrogen and fuel cell community seemed very uneasy during Hannover Messe (see [Confident About Upcoming Commercialization](#)); despite an overall positive mood at the industrial fair, the above-mentioned news did dampen enthusiasm quite a bit.

Even Daimler’s press office was surprised – not by Zetsche’s statement, but by the news that followed. It offered a clarification to H2-international, saying that there “have been no changes to our current strategy. [...] We need hydrogen. [...] Daimler sees a future for the fuel cell.”

In the end, the carmaker will stick with its plan to unveil a new FCEV, the GLC F-CELL, this year and start production in small numbers (presumably around 1,000 units in 2018).

However, it is no longer about Daimler, even if the carmaker’s Stuttgart press office appreciated Hydrogeit Verlag publishing a correction on its HZwei blog.

Zetsche's words and their differing interpretations made it clear that the battle about which was the better, more future-proof technology has already been raging for a while – despite statements to the contrary. For a long time, politicians and NOW have tried to pass off electric transportation as a joint project of battery and fuel cell suppliers. But the fact of the matter is that the potential revenue streams mean everyone will use any means necessary to up their market share. The Wirtschaftswoche editors have realized that.

Whoever or whatever provided the impetus for their opinion piece, their article will only be the first in an ugly fight between battery and fuel cell advocates, something that has already been on full display on social media.

Daimler Stays



Death of a Fuel Cell – invented in 1966 – discontinued in 2017, © Wirtschaftswoche

Daimler head Dieter Zetsche's statement during the auto motor und sport conference in Germany prompted Stefan Hajek and Martin Seiwert, the editors of the Wirtschaftswoche business magazine, to write an obituary for the fuel cell (see also [Don't Count on It](#)).

When asked by one attendee about the future of the fuel cell at Daimler and Zetsche's opinion on the development of both fuel cell and battery-powered engines for electric vehicles, the head of Daimler replied:

"Later this year or early next year, we will offer a growing number of fuel cell cars. Of course, they can't be part of every showroom and whoever needs one can just buy one. He or she may get home on one tank, but that would be it. In today's market, fuel cell engines are only workable in fleet operations as part of a thoroughly planned-out environment.

I believe that we are certainly one of the few carmakers that have made great advances in fuel cell use. The main benefits we imagined FCEVs to have five years ago were a significantly greater range and a dramatically lower refueling time compared to battery-electric cars. But the stronger-than-expected development of the latter has diminished, greatly diminished those advantages.

Additionally, there are cost-related drawbacks to the day-to-day use of fuel cells. I'm not making a value judgment here. The real-life consequences of pouring immense amounts of cash into the development of battery-electric vehicles while devoting few resources to the fuel cell industry [...] have led to a much faster drop in battery prices. We are increasingly using renewable power [...] and this power does, in fact, provide battery-electric vehicles with a carbon-free source of energy, whereas actual zero-carbon hydrogen for FCEVS can only be generated when you take the additional step of generating power via electrolysis – and put in double the effort to achieve the same result.

Considering all of this, I believe one would be well advised to focus on battery-electric vehicles over the next ten years, but without neglecting fuel cell development. The energy industry might advance hydrogen-based renewable storage. If it does, the use of fuel cell vehicles would be the next logical step.

Battery-electric cars could also become so successful that they will reach the limits of their charging infrastructure. This would certainly be a second avenue favoring fuel cells. All in all, there is really no reason to think that fuel cells have outlived their usefulness. They could be the future.

However, I think over the next five to ten years, the focus should be on battery-electric vehicles.”

Transcript of a video recording of the auto motor und sport conference

Only sensible solution

Peter Fuß, senior advisory partner automotive at consultancy Ernst & Young, explained: “Carmakers agree that the fuel cell is the only sensible solution.” Asked why FCEV development seems to have fallen behind, he said: “Right now, carmakers are hedging their bets on battery-electric vehicles because they're afraid that the era of diesel cars may face an abrupt end. They need to rely on a technology that's available – whether they want to or not. It's their only option to meet the CO₂ emissions targets for 2021.”

Confident About Upcoming Commercialization

Industrial Trade Show in Hanover

Germany's chancellor, Angela Merkel, sent a clear signal during her opening tour of this year's Hannover Messe on April 24, 2017. Together with Poland's prime minister, Beata Szydło, she went to Energy hall 27 to take a closer look at a fuel cell bus,

something that created a cheerful mood among the exhibitors at the joint booth Hydrogen + Fuel Cells + Batteries set up right next to the vehicle.

Fig. 1: Prominent figures from industry and politics in attendance: Zarajczyk, Szydło, Merkel, Fenkl (from left); in the back (among others): Günther Oettinger (European Commissioner for Budget and Human Resources), Johanna Wanka (Germany's education minister), Maroš Šefčovič (VP of the EU Commission and in charge of the Energy Union)



To stakeholders from the fuel cell industry, the hybrid bus by Ursus – a Polish manufacturer little known in Germany at that time – was one of the high points of the trade show (see fig. 1). The engine for the vehicle with a passenger capacity of 75 and a length of 12 meters or 39 feet is located at the back axle and consists of two electric, gearless wheel hub motors (ZAwheel, 364 kilowatts) by Ziehl-Abegg, a family business from Künzelsau, Germany. By the company's own account, their efficiency is as high as 90 per cent. Two fuel cell modules (30 kilowatts each) by Dutch-based Hy-Move have been installed on the roof of the bus, together with the hydrogen tank of 30-kilogram capacity. They charge the battery from German BMZ during the ride.

Peter Fenkl, CEO of Ziehl-Abegg, made one thing unmistakably clear during the chancellor's stop: "No one needs diesel buses." He added that German bus manufacturers might still be in the R&D stage, but that this was no reason to delay the overall implementation of fuel cell units promising a range of 450 kilometers or 280 miles (6.8 kg of H₂ on 100 kilometers or 62 miles). The CEO of Ursus, Karol Zarajczyk, said: "H₂ vehicles are the future of road transport. We've noticed an increasing demand for our hydrogen buses in western Europe. These buses are becoming ever

more popular, not least because they've become competitive with conventional drive systems."

The visit by prominent figures from business and politics was a pretty encouraging trade show start for everyone – and for the exhibitors at the joint booth in particular – and a reason for hoping that market-readiness no longer seems to be far behind. On top of that, NIP 2.0, Germany's successor to the National Innovation Program Hydrogen and Fuel Cell Technology, had just been launched.

In five days, Hannover Messe attracted 225,000 attendees – 8,000 more than in 2015 – to trade show premises boasting 6,500 exhibitors. Foreign visitors added up to 75,000, with the biggest group of 9,000 attendees coming from China. The Energy, one of the lead shows on the premises, had 1,200 organizations showcasing their products.

A bit unsettled, but hopeful

However, there was the important matter of Daimler's alleged exit from fuel cell development (see [Don't Count on It](#) and [Daimler Stays](#)). It was some unsettling news to the nearly 150 exhibitors and their attendees and became part of almost every conversation. But as HZwei reported, Daimler never had the intention to exit the business. Still, the rumors dampened the mood and proved yet again how unsure the industry is of its own potential. Although almost everyone we asked was visibly fed up with the repeated back and forth in the automotive industry, the mood leaned more toward the positive than the negative. We did hear statements along the lines of people needing a great deal of patience and perseverance to make it in the industry, though virtually no one in Hanover seriously questioned the viability of the technology anymore.

Instead, you could say many attendees reacted in spite, agreeing with the call for reshuffling priorities in the hydrogen and fuel cell industry and moving away from cars for individual transportation toward commercial vehicles, forklift trucks and stationary applications. Additionally, the majority said that a sole focus on Germany was not in everyone's best interest. In the future, it would become increasingly important to branch out to markets abroad and make this a European venture. The idea has received support from many big European cities, whose city councils are indeed willing to use more fuel cell buses in public transportation. This demand, however, can currently not be met by German carmakers, for example, because MAN had discontinued its development and Daimler was hesitating. Any orders in this field may end up in Belgium at Van Hool, in the Netherlands at Solbus or in Poland at Solaris or Ursus, or even in Asia (e.g., Toyota).

The future is on rails

Participants of the podium discussion during the press conference made precisely the same arguments. Olaf Lies, Lower Saxony's economy minister, voiced his strong support for fuel cells and concluded that employing fuel cells in trucks and buses was a "smart move," in addition to their use in rail vehicles. Jens Sprotte from Alstom said about railroad use: "We're ready with the technology. It works." And Bernd Pitschak, managing director of Hydrogenics, added: "Heavy systems in particular are predestined for fuel cell hybrid designs

Many global players

Another memorable event was IPHE's stop at the joint booth. Dimitrios Papageorgopoulos from the Fuel Cell Technologies Office of the U.S. Department of Energy reported on advancements overseas. One of his examples involved California, where around 1,600 FCEVs had been sold so far, a number that was expected to increase rapidly.

xperion Energy & Environment shared a booth with Norwegian-based Hexagon Composites. What had been two competitors in pressure tank sales merged into one corporation last October, albeit both brand names are said to be kept. Last year was the first in the company history of xperion, formerly part of the Avanco Group, in which it had booked a – comparatively small – booth in Hanover. This time, the Kassel-based business utilized a much bigger space, relatively in the middle of the joint booth, to exhibit its large type IV composite pressure vessels. Hexagon Lincoln, the American subsidiary of Hexagon, supplies corporations such as Daimler with hydrogen tanks for its upcoming fuel cell car, the GLC F-Cell.

Fig. 2: Hexagon and xperion will coordinate their activities from now on



As had been announced last year, Austrian-based Rouge H2 Engineering returned to the joint booth Hydrogen + Fuel Cells + Batteries. Having recently set up an office in Germany, it has designed a compact reformer unit to produce, purify and compress hydrogen (see [Hanover Trade Show: Big H2 Industry Investments](#)). The device called OSOD (On-Site On-Demand) requires gas, water and power hookups. Gernot Voitic, project manager R&D at Rouge, explained that “biogas was the fuel of choice” for this system. But even the use of natural or town gas could be eco-friendlier than the large-scale production and shipment of hydrogen used in industry, he said.

Rouge sees potential for its technology in the intermittent storage of excess energy at biogas systems and in fleet operations of forklift trucks or city buses, where the manufacturer expects the system to be “competitive if we use today’s demand of rather small amounts of hydrogen as a baseline.”

The supplier of pressure vessels is currently setting up a system in Graz, Austria, as a sub-tenant of the university there. The plan is to install six units in total, with each producing five cubic meters or 177 cubic feet of hydrogen an hour. The main funding partner is an Asian investor; additional funds have come from the state budget after Rouge won a bid invitation regarding the project. The managing director of RGH2, Florian von Hofen, told HZwei: “The project based on our OSOD product was nominated by an expert panel as one of the five finalists of the Houska Award 2017. The Houska Award is the highest recognition anyone in Austria can receive for research projects focused on commercialization.” The audience award was presented to RGH2 and Professor Viktor Hacker from Graz University of Technology during a big gala in Vienna.

Sunfire had also been present on the joint booth, showcasing its electrolyzer and fuel cell developments. Asked about the relatively abrupt exit of partner Vaillant from their SOFC collaboration in March 2017, Sunfire’s CEO, Carl Berninghausen, told HZwei that he still believed it was the wrong decision. Berninghausen added that he would offer the SOFC technology developed during the project run to potential partners for it to be used as a platform to design standardized components, as had been done in other industries. Talks with Vaillant had already been ongoing.

Fig. 3: Standard container as 1-ton H₂ storage



The Energy hall

In exhibit hall 27, attendees could find businesses such as Celeroton, EMS, Flexiva, HPS (see [Back to the End of the Line?](#)), Resato and SenerTec. EMS, a German-Dutch engineering business, showed its newly developed H₂ storage system at the joint booth of North Rhine-Westphalia. Equipped with a container housing a type IV pressure

vessel made of a highly durable and lightweight composite material, it can store more than 1,000 kilograms of hydrogen gas at 500 bars.

Resato International, based in Assen, Netherlands, is a supplier of high-pressure vessels. It showcased a so-called H2Refuel Fleet Station, which can fill up four kilograms of hydrogen – a car tank's worth – per hour. Its use may be limited to filling up smaller vehicle fleets overnight, but it does cost only one-tenth of conventional stations and is relatively easy to transport by forklift truck. Rob Castien, CEO of Resato, explained: "Public interest in hydrogen has grown, particularly over the past months." One of Resato's systems was installed by the Holthausen Group in June 2017 in Groningen, Germany, to supply hydrogen buses running between Groningen and Delfzijl in the Netherlands (see also the Netherlands report in the next issue).

MobiliTec

Each year, it is Henning Kagermann, chair of NPE, the National Platform for Electric Mobility, who starts off the MobiliTec and presents a report on the activities of the organization. Electric transportation still has a long way to go, but Kagermann, who is also president of acatech, was optimistic and expects "exponential growth" – starting in 2020. As last year, he no longer highlighted vehicles, their technologies or the related infrastructure, but networking and automation. The trend of looking beyond the cars to smart services in data management has taken hold of the entire electric transportation industry. The head of NPE said: "The battle for the best data services has begun."

Electric transportation: little for consumers

As in past years, the largest trade show booth on electric transportation was Baden-Württemberg's pavilion (600 m² or 6458 square feet; 34 exhibitors). Here, too, the most prominent topic was data platforms, apps for traffic control and automated driving. Potential buyers of electric cars had trouble finding anything of interest at the MobiliTec, except maybe for the booth of the Federal Association of Solar Mobility (see box above).

This year was the first in which Deutsche Messe organized a Young Engineers Day together with the Association of German Engineers. On the fourth day of the trade show, the VDI offered application-specific tours tailored to the needs of young professionals in the industry. Sonia Wedell-Castellano from Deutsche Messe explained: "Each year, thousands of students attend Hannover Messe, but without any overarching objective." The new program now offers an opportunity for direct interaction between exhibitors and young engineers and technicians.

A young talent initiative that was now in its second year was Tec2You, for which Hydrogeit Verlag offered free HZwei issues and learning materials on hydrogen and during which more than 6,000 high-school and college students were taught about technical jobs in the industry.

Next year, Hannover Messe will take place from April 23 to 27; the 2018 partner country will be Mexico. And for the first time, the CeMAT, the world's most important intralogistics trade show, will run parallel to Hannover Messe and every second year thereafter.

No More OTTI

On May 31, 2017, the East-Bavarian Institute for Technology Transfer based in Regensburg, Germany, went out of business. Also known as OTTI, it filed for insolvency on Oct. 27, 2016, when it was on the verge of not being able to meet its financial obligations, and insolvency proceedings commenced on Feb. 1, 2017. No potential investor could be found and four decades of conference organizing came to an end this year. OTTI itself said that being a private-sector association with a regional mission but no public funding was no longer a viable organizational structure in today's world. While the complete shutdown ultimately means a loss of 25 jobs, a consortium had been able to keep several conference dates on the agenda until late May. At that point, however, the decision was made to disband the organization.

Thomas Luck, formerly managing director of OTTI, told H2-international: "Some seminars, particularly the 'technical' ones will be offered in a slightly modified version by Haus der Technik from now on. Others, especially the ones on renewables, will make their way into the offerings of various educational organizations in some form or another. And some seminars just won't be available anymore."

New DWV Position Paper



Diwald, together with representatives from industry (right: [Chatzimarkakis](#)), presenting Šefčovič (left) with the position paper

Maroš Šefčovič, vice president of the European Commission's Energy Union, spend twenty minutes during Hannover Messe to discuss the role of green hydrogen in the energy transformation with representatives from industry. The conversation at NOW's

booth was followed by the DWV and industry representatives presenting Šefčovič with a position paper by the industry. It called on the European Commission to consider a legislative change or, in more concrete terms, a short-term adjustment of European standards and guidelines (pre-2020), so that “renewable gases and liquids of non-biogenic origin (green hydrogen) can meet a refinery’s obligation to reduce fuel-based GHG emissions.”

DWV chair Werner Diwald said during the discussion: “It seems like an unacceptable situation: European guidelines have recognized the GHG reduction value of some questionable biofuels – such as palm oil – but haven’t done the same for green hydrogen.”

DWV: Equal Opportunities for Green Hydrogen

Parliamentary Evening at French Embassy

On March 30, 2017, the German Hydrogen and Fuel Cell Association organized a parliamentary evening at the French embassy in Germany’s capital of Berlin. The embassy had already been the venue for a similar meeting between politicians and industry representatives three years ago. The topic was the economic feasibility of hydrogen transportation, this time including rail and maritime applications besides the much-discussed issue of road vehicles.

Embassy staff reported on concrete hydrogen and fuel cell projects in the French Republic. For example, there is Hype, a project that tested the suitability of twelve fuel cell cars in taxicab operation, and NavHybus, where hydrogen is used to transport 80,000 commuters across a river each year.

“I believe hydrogen will have a key role to play in the successful transformation of the energy market.”

Bernd Westphal, member of parliament and Social Democratic spokesperson on economic and energy issues

“Without hydrogen, expanding the use of renewables makes little sense today.”

Werner Diwald, chair of DWV

“Hydrogen will have its success story if we can offer attractive solutions.”

Guillaume Larroque, service station manager at Total Germany

“For some time, battery-driven transportation will remain insufficient to match vehicle demand.”

Norbert Barthle, parliamentary state secretary at Germany’s federal transport ministry

Most of the representatives from politics, many of whom temporarily rushed for a roll call vote to the Reichstag, pledged their support for developing hydrogen technologies. Norbert Barthle, parliamentary state secretary at the federal transport ministry, said that his boss, Alexander Dobrindt, was a “big believer in hydrogen.” He again mentioned the launch of NIP 2, a EUR 247 million program aimed at facilitating the

market introduction of hydrogen and fuel cell applications until 2019. A first call for subsidy-worthy proposals targeted the development of fuel cell vehicles in public transportation and company fleets and their infrastructure. He added: "There will be more subsidy initiatives. Just wait and see." But he also voiced a note of caution, saying that the change from internal combustion to electric engines must "not be a shock to the system." In his opinion, "the diesel will still be needed in 20 years, particularly for heavy-duty applications."

Fig. 1: Barthle (left) and NOW's chair, Klaus Bonhoff, exchange ideas



Ruprecht Brandis, director external affairs at German BP, was even more blunt: "The diversification of the energy mix will occur over several decades. [...] We haven't changed our stance on hydrogen. Only when it comes to refineries, do we see some potential."

Until 2015, mineral oil corporations had been required by law to mix renewably sourced and normal fuel to meet biofuel quotas. In 2015, this piece of legislation was replaced by the emissions reduction targets, which could likewise be met by adding fuels from renewable sources. If renewable hydrogen, as produced from renewables via electrolysis, were to receive equal treatment to biofuels, it could lower the import numbers of the latter and increase the production of the former, he said.

He estimated that hydrogen could meet around ten per cent of bio fuel demand. The DWV concurred, saying that this approach was a good opportunity for establishing a hydrogen market and cut the costs of electrolysis, a currently quite expensive technology. And all attendees agreed that the gas station price of EUR 9.5 per kilogram was too high. In response, Diwald said: "A first step in the right direction would be to allow 'green' hydrogen to be recognized as lowering the GHG emissions of fuel mixtures sold on the market."

Johannes Schiel Chooses Wind Power



Schiel (right) presented Krieger with a fuel cell stack

Johannes Schiel, formerly managing director of VDMA's Fuel Cells working group, left the German association of machinery and equipment suppliers at the end of April. His successor, Gerd Krieger, used to be his mentor and had been deputy director of VDMA's Power Systems department. Krieger has worked for the association for 25 years.

Schiel, who had a thirteen-year career at VDMA, took on a job at Vestas Central Europe on May 1. He describes his work there as representing the interests of the wind power industry. Besides Schiel, Andreas Frömmel was the second one to leave the Fuel Cells working group.

Linde Wants Praxair

Since last December, industrial gas supplier Linde has been trying in a second attempt to merge with its American competitor Praxair. On June 2, 2017, Linde's supervisory board finally approved the merger, a decision that was not without controversy. As Reuters has reported, one of the six worker representatives had abstained from voting, effectively turning a split decision into six-to-five vote in favor of the deal. Company management has now signed the agreement, but both Praxair and the antitrust authority will need to approve it over the coming months before it can take effect next year.

Wolfgang Büchele, formerly CEO of Linde, had broken off negotiations with the American business in September 2016. The arguments that ensued had led him and CFO Georg Denoke to offer up their positions in the company. Aldo Belloni became the new CEO of Munich-based Linde and the chair of the supervisory board, Wolfgang Reitzle, resumed talks with Praxair shortly thereafter.

The merger of both businesses would create a new corporation with a market value of EUR 65 billion. It would keep the Linde name, but may relocate to Ireland. It would also surpass the current world leader in the industrial gas industry, Air Liquide, a French corporation which has recently bought another American competitor, Airgas.

Run on Fuel Cell Buses

The marketing of fuel cell buses has begun: The successful completion of several showcase projects (see HZwei issues from [January 2011](#) and [2014](#) and [March 2017](#)) and the conclusion of the CHIC conference in London late last year were followed this January by the launch of the Joint Initiative for Hydrogen Vehicles across Europe, or JIVE for short, and MEHRLIN, Models for Economic Hydrogen Refueling Infrastructure.

The objective of JIVE is to support the deployment of 144 fuel cell buses in the public transportation system of five EU member state regions. A total of EUR 32 million was made available through the EU's Fuel Cells and Hydrogen Joint Undertaking to fund bus purchases across Cologne–Wuppertal–Rhein-Main in Germany, London–Birmingham–Aberdeen in the UK, South Tyrol in Italy, Slagelse in Denmark, and Riga in Latvia.

The aim of MEHRLIN is to assist in the construction of seven H2 filling stations in Cologne–Hürth–Wermelskirchen and Wuppertal in Germany, Bruneck in Italy, Oude Tongue and Rotterdam South in the Netherlands, and London and Birmingham in the UK. Project funds add up to EUR 90 million.



Kick-off in Cologne, © HyCologne

Boris Jermer, project manager at HyCologne, said: "We were pleased to find out that JIVE and MEHRLIN will offer us the opportunity to seamlessly continue what we started in the Cologne region in 2009. Now, it is time to expand our fleets in public transportation. Outside the inner cities, there currently is no alternative that could offer the same range at equal passenger capacity."

On May 31, WSW mobil started a bid invitation with the aim of purchasing more than 63 fuel cell buses for its partners Verkehrsverbund Mainz-Wiesbaden, traffiQ Frankfurt, Regionalverkehr Köln and SASA in Bolzano, all of which intend to use these vehicles in public transportation in the years ahead.

read more: www.h2-international.com



Events

- **2nd Asia Battery Sourcing Fair 2017 (GBF ASIA 2017)**, August 16th to 18th, 2017, in Guangzhou, China, www.battery-expo.com
- **China International Hydrogen and Fuel Cell Exhibition (CHFCE 2017)**, August 28th to 30th, 2017, in Beijing, China, <http://en.chfce.com>
- **Hydrogen + Fuel Cells NORTH AMERICA**, September 10th to 13th, 2017, in Las Vegas, USA, www.h2fc-fair.com/usa
- **New Mobility World**, September 14th to 17th, 2017, in Frankfurt a.M., Germany, www.newmobility.world
- **European Summer School on Hydrogen Safety (ESSHS)**, September 18th to 22th, 2017, in Athens, Greece, www.jes-school.eu
- **2nd FC EXPO Osaka**, September 20th to 22th, 2017, Osaka, Japan, www.fcexpo-kansai.jp
- **f-cell and Battery+Storage**, October 9th to 11th, 2017, on the Stuttgart Fair Ground, www.f-cell.de
- **EVS30**, October 9th to 11th, 2017, on the Stuttgart Fair Ground, www.evs30.org
- **eMove 360° Europe**, Mobility 4.0 - electric - connected - autonomous, October 17th to 19th, 2017, in Munich, www.emove360.com

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

Social Media



Facebook 70 Follower, 72 Likes



Twitter 788 Follower



Facebook 1572 Group Members



Xing 729 Followers



Google+ 49 Follower



Xing 1062 Group-Members



LinkedIn 1137 Follower

Companies

Education & Training



- **H-Tec Education GmbH**, Demonstration & Education for Schools, Universities, Maria-Goeppert-Str. 9a, 23562 Luebeck, Germany, Phone +49-(0)451-39941-0, Fax - 799, info@h-tec-education.com, www.h-tec.com

Electrolyzers



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



Diamond Lite SA

- **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



- **Giner, Inc.**, 89 Rumford Avenue, Newton, Massachusetts 02466, USA, Phone +1-(0)781-529-0500, information@ginerinc.com, www.ginerinc.com



- **GreenHydrogen.dk ApS**, Platinvej 29B, 6000 Kolding, Denmark, Phone +45-(0)7550-3500, www.greenhydrogen.dk



- **H-Tec Systems GmbH**, PEM electrolyzers for industry application, Maria-Goeppert-Str. 9a, 23562 Luebeck, Germany, Phone +49-(0)451-39941-0, Fax -799, info@h-tec-systems.com, www.htec-systems.de



- **Hydrogenics GmbH**, Am Wiesenbusch 2, 45966 Gladbeck, Germany, Phone +49-(0)2043-944 141, Fax -6, hydrogensales@hydrogenics.com, www.hydrogenics.com



- **iGas energy GmbH**, Cockerillstr. 100, 52222 Stolberg, Germany, Phone +49-(0)2402-9791600, Fax -7094864, www.iGas-energy.de



- **Proton OnSite**, 10 Technology Dr, 06492 Wallingford CT, USA, Phone +1-(0)203-678-2000, info@protononsite.com, www.protononsite.com

Energy Storage

- **GKN Powder Metallurgy**, GKN Sinter Metals, PO Box 55, Ipsley House, United Kingdom – Redditch B98 0TL, Worcestershire, www.gkn.com/sintermetals
- **HPS Home Power Solutions GmbH**, Carl-Scheele-Str. 16, 12489 Berlin, Germany, Phone +49-(0)30-5169-5810, mail@homepowersolutions.de, www.homepowersolutions.de

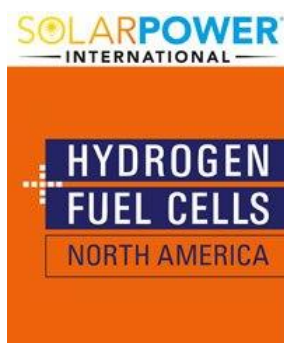


- **Hydrogenious Technologies GmbH**, Weidenweg 13, 91058 Erlangen, Germany, Phone +49-(0)9131-12640-220, Fax -29, www.hydrogenious.net



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

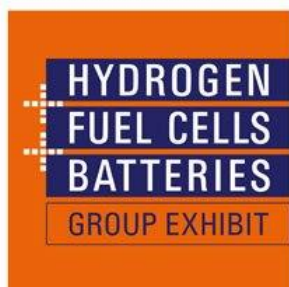
Event Organizers



**September 10-13
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Mandalay Bay
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HANNOVER MESSE



**April 23-27
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Hall 27, C66
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- **24rd Group Exhibit Hydrogen + Fuel Cells + Batteries**, HANNOVER MESSE 2018, April 23 – 27, 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



- **Peter Sauber Agentur Messen und Kongresse GmbH**, f-cell and BATTERY+STORAGE, Wankelstr. 1, 70563 Stuttgart, Germany, Phone +49-711-656960-55, Fax -9055, www.f-cell.de, www.battery-storage.de

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- **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



- **PTEC – Pressure Technology GmbH**, pipelines, screw connections, filters, valves, regulators, TPRD, Linde 11, 51399 Burscheid, Germany, Phone +49-2174-748-722, mail@ptec.eu, www.ptec.eu

Fuel Cells



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Fueling-Recirculation and Air-Supply



- **Gebr. Becker GmbH**, Hölker Feld 29-31, 42279 Wuppertal, Germany, Phone +49-(0)202-697-255, Fax -38255, info@becker-international.com, www.becker-international.com



- **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.busch-cleanair.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



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



- **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



- **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



- **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**
WEKA AG, Schuerlistr. 8, 8344 Baeretswil, Switzerland, Phone +41-(0)43-833434-3, Fax -9, info@weka-ag.ch, www.weka-ag.ch

System Integration



- **Areva GmbH**, Paul-Gossen-Str. 100, 91052 Erlangen, Germany, Contact: Mrs. Gemmer-Berkbilek, Phone +49-(0)9131-90095221, www.areva.de



- **Deutsche 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

Testing



SMART

- **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

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