



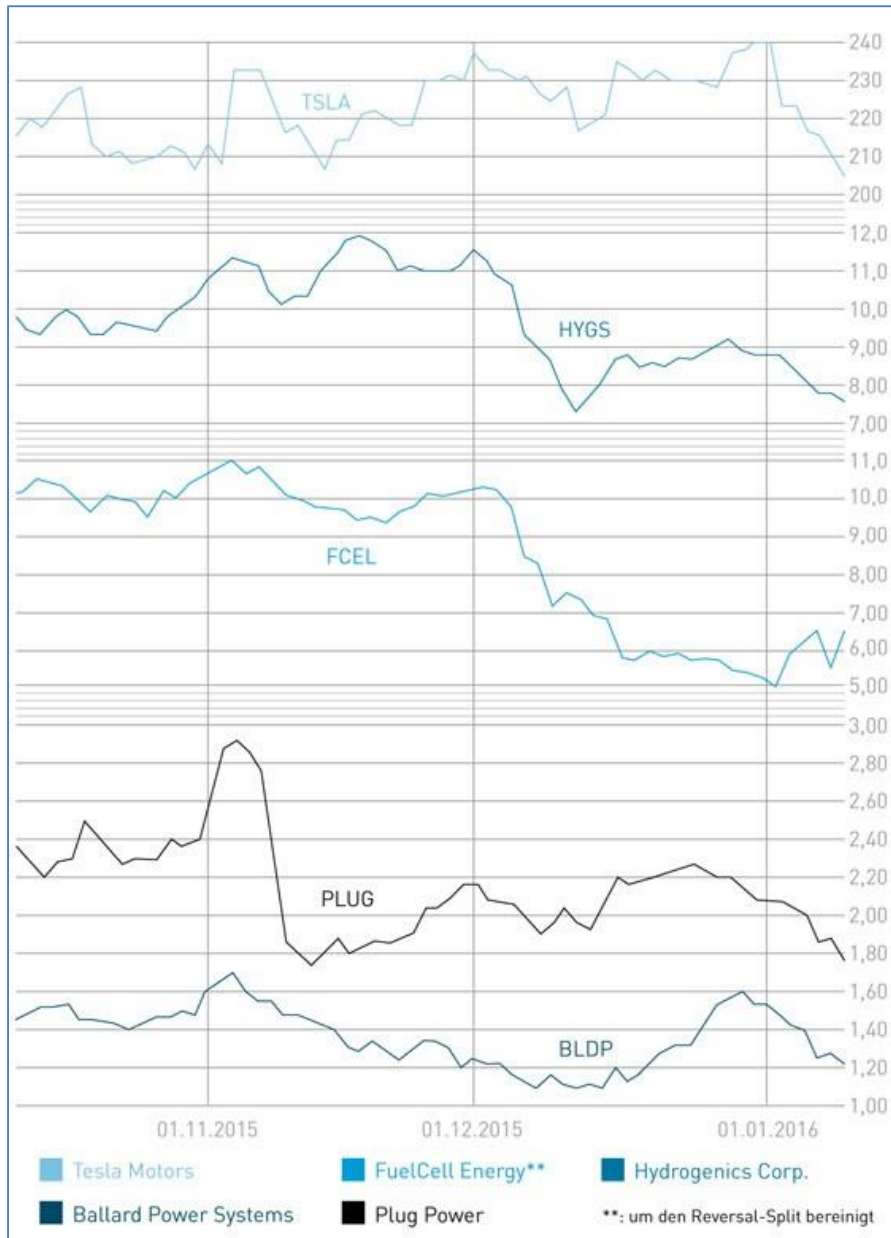
H2-international – e-Journal

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2016 – The Year After Break-Even



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The fuel-cell companies quoted on the stock exchange have used 2015 perfectly to strengthen their market positions. These efforts have resulted in more orders, improved balance sheets, increased capital and some very important strategic collaborations as well trendsetting product developments. This lets us conclude for 2016 that probably most of these companies – if not all – will be able to become cash-flow positive or even generate sustainable profits after many years of preparing for this moment.

First time that fuel-cell businesses could turn profitable

Because of the current combination of expectedly good to even very good news from the fuel cell industry, I feel the need to again stress my expectation that the fuel cell and its many markets can trigger a new megatrend – especially in light of the necessity to produce more clean energy around the globe. A change in the oil price trend – should Saudi Arabia leave behind its chosen policies with a reduced oil production – could at a purely psychological level present the fuel-cell share prices quoted here with an advantage. One will often here the argument that fuel-cell companies aren't able to grab as much the attention of the stock market because of a lower oil price; currently, we are at a turning point. Stay tuned!

Hydrogenics: China Says Hello

Various truly positive news were coming in from Hydrogenics – some of them from China – the stock price of the company began to stabilize at above US\$ 10 after dropping to a low of around US\$ 7. The most recent price drop is related to a gross capital increase by US\$ 17 million (net: approx. US\$ 15 million), which is of course implemented at a certain discount. Still: Growth needs capital and this capital is what Hydrogenics is about to gain, resulting in a temporary lapse but a leap forward in the end.

From a stock exchange point of view, Hydrogenics shares look the healthiest of all fuel-cell shares, even if it is the fuel-cell company with the lowest stock exchange capitalization and the smallest number of shares. Hydrogenics was able to obtain big long-term orders last year, established further collaborations, for example, in China, and complemented its product portfolio, which now ranges from electrolysis systems to the installation of H2 filling stations to fuel-cell module development for trucks and buses.

Noteworthy: A framework agreement concluded with different partners in China is said to be worth US\$ 10 million of turnover in fiscal year 2016 and to have an overall potential of US\$ 100 million. The agreement is about the technology for fuel-cell filling stations as well as electrolysis systems and fuel-cell kits for heavy-load trucks – and the parties to the agreement include Yutong, the biggest bus OEM in China, as well as other “electric vehicle integrators.” Treated as a “certainty” within the next three to five years is the production of 2,000 vehicles driven by fuel cells and H2. This should – as far as my optimistic attitude is concerned – only mark the beginning: China has understood what H2 and fuel cells can do for the country.

Risk warning

Each investor must be aware of his or her own risk assessment when buying or selling shares and consider spreading the risk as a sensible precaution. The fuel-cell companies mentioned in this article are Small and Mid Cap, i.e., these are not default values and the volatility is significantly higher. This article is not be taken as a recommendation 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 assessment made in this article represents exclusively the author's own opinion.

Author: Sven Jösting

Ballard: Year of the “Right” and “Sustainable” Growth



FCvelocity-HD7 module, © Ballard

Ballard Power is placing a bigger focus on China, evidenced by the various agreements with Chinese companies from the field of bus manufacturing and the development of hydrogen-driven rail vehicles. According to company information, the Canadian fuel-cell manufacturer paid special attention to only collaborate with known, reputable partners, whether big or small, which enjoy their own location advantages. Ballard follows a classic multi-partner strategy approach. It seems as if the company intends to use the scaling effects resulting from the production in China to massively expand the number of fuel-cell stacks in production, but particularly to have the edge in pricing. The latter will of course impact world markets as well, should Ballard be able to offer fuel-cell stacks with the help of Chinese partners. Why, is the question, should the Dutch Ballard partner Van Hool not receive its Ballard stacks from China?

In concrete terms, the Canadian company has initiated a project in collaboration with the Foshan Yunfu Eco Environmental Protection Industries International Cooperation Zone, during which hydrogen-driven buses are planned to be manufactured in Guangdong province. The first fuel-cell bus was presented on Dec. 1, 2015, at a special ceremony on-site: It can carry up to 78 passengers, requires a mere 7 kg of H₂ per 100 km (a new record!), has a range of 300 km and contains the most recent fuel-cell module by Ballard: the *FCvelocity®-HD7* stack. The first step of the plan is to

produce 12,000 fuel-cell modules from mid-2016 on and 3,000 fuel-cell buses per year, which could mean that a large chunk of the modules will go to different customers / suppliers / manufacturers.

At the same time, Ballard concluded another agreement: Fuel-cell buses are also planned to be newly designed and built in collaboration with Xiamen King Long United Automotive Industry, the second biggest bus manufacturer in the world. The all-important question is going to be which new and, particularly, which continued and sustainable earnings (licenses, turnover commissions, research projects, stack shipments, etc.) the North American stack producer will be able to generate from the deal. The production and parts manufacturing in China may also provide Ballard with sizable cost advantages in the face of the company's international competition. The R&D department and the manufacturing of extremely sensitive equipment, however, will most certainly remain with the Canadian headquarters. Additionally, there is the present order of 300 fuel-cell bus modules Ballard was able to secure – the largest individual order in this segment so far.

Furthermore, Ballard announced that it had been collaborating with its long-time partner and supplier, the Japanese Nisshinbo Group (over 22,000 employees) to make PEM cells possibly from other materials than platinum or to reduce the share of this expensive catalyst material in favor of high-performance and highly conductive materials, which are less expensive in procurement and production. Here, Ballard has additional research partnerships with different universities and companies besides the aforementioned collaboration. It is safe to assume that Ballard as the global leader in PEM fuel cells will be able to keep and expand its lead. As a sign of the intense collaboration, Nisshinbo also invested US\$ 5 million in Ballard or bought shares at US\$ 1.50 each from its partner. A strong and enduring research partnership, as it seems to me.

In the third quarter, Ballard was furthermore able to finalize the takeover of Protonex. The conditions remained the same, as the majority of Protonex shareholders had already made an early decision in favor of the incorporation. This was one point of initial uncertainty because the price drop of the Ballard shares should have led to the issue of a much higher number of shares than what was provided, in order to correspond to the purchase price. Protonex is expected to contribute already US\$ 5 million to Ballard's turnover in the current fiscal year (12/31/2015). In 2016, the number is expected to grow to US\$ 15 million.

Meanwhile, Ballard customer Plug Power seems to have made considerable progress regarding its in-house production of fuel-cell stacks for forklift trucks. A concern often mentioned on the discussion boards is that Ballard could completely be off the table as a supplier in the long run. I view this as much less of an issue. My expectation is rather that Ballard will supply fuel-cell stacks for, among other things, forklift trucks of other manufacturers besides Plug. There is already a partnership with M-Field in South Korea. Additionally, I believe that Plug will produce certain stacks for big trucks on its own, but still buy stacks from Ballard for smaller versions in sizes Plug does not even want to produce in-house. Thus, my assessment of the situation is that both companies will continue their good collaboration beyond the contract's end in 2017. And even if Plug no longer requests Ballard's services as a supplier at this future point, Ballard should already have targeted much bigger markets by then and be able to offset the losses.

VW #dieselgate

The disaster around manipulated emission values from VW does have one beneficiary: Ballard Power. The company based in Burnaby did sell a patent portfolio to VW, but still works for the Wolfsburg corporation through a multi-year contract (up to 2019 – optionally, up to 2021, CAN\$ 20 million per year), for example, by developing fuel-cell prototypes. After the Audi *h-tron*, the *Passat* and the *Golf*, it will only be a matter of time until other VW models receive a fuel cell, e.g., in order to create a hybrid version. Why not even a Porsche, since they have already had plans for a so-called Tesla Fighter in form of a battery-driven car, or a small truck, etc.

I could very well imagine that VW will try to compensate for Toyota's competitive edge in the fuel-cell market by making greater investments in the future. Ballard, however, would have to be the uncontested favorite for such a scenario. Why not CAN\$ 50 to 100 million per year to Ballard? CEO Randy MacEwen said in reference to the VW scandal: "We expect fuel cells to become the big beneficiary because of the increased awareness."

On a side note: Current low stock prices

In my view, this is an issue of tax-related year-end sales, meaning one wants turn losses on the books into real ones, in order to claim them for taxation purposes. Such a scenario requires the sale and subsequent re-purchase of shares. Former shareholders of Protonex, who received Ballard shares as compensation for their participation in the deal and who had to suffer from high losses on the books, may be inclined to temporarily part with their Ballard shares. In my opinion, it is the most logical reason for the price drop, since Ballard has been able to deliver a bunch of good news that will have a positive impact on 2016.

Conclusion: Ballard enters the new year with high order volume and will be able to increase its capital (with currently around US\$ 55 million in the bank) by another US\$ 9 million (first quarter of 2016 = final payment by VW). The already existing orders for bus stacks in China will be complemented in 2016 by orders from Europe and the US. Plus: The launch of the large-scale production of bus stacks and modules in China will redefine and greatly increase Ballard's revenue sources as well as keep them stable in the long run. Ballard subsidiary Protonex is trusted to acquire larger orders from the US military, especially because the US Army has meanwhile fully acknowledged the benefits of fuel cells and hydrogen (e.g., cooperation with GM for prototypes). Additional strategic acquisitions are certain to be realized, whereas the threshold is a minimum 30% gross profit margin and turnover of US\$ 15 million per year.

In short, as Ballard's CEO, MacEwen, said in 2015: "Transition year / year of building a foundation."

[See also risk warning page 3.](#)

Author: Sven Jösting

Tesla: Much Hype – Much Disagreement Among Analysts



Model X, © Tesla

Many big boys – as the leading US investment banks are called – have given Tesla an unquestionably positive rating. CEO Elon Musk understands how to polarize as well as convince analysts, but at the end of the day only hard facts count. The Credit Suisse analyst specializing in the field already expects a profit of US\$ 4.00 per share for fiscal year 2016, since there had allegedly been so many orders for *Model X*, which would impact earnings. The consensus, however, is at around US\$ 1.85 per share – whereas all numbers for 2015 had to be corrected downward over and over again, which I believe will be the case in 2016 as well. There are too many unknowns which do not originate in the number of sold cars – especially regarding the new *Model X* – but in the costs for building the Giga factory for batteries.

Other analysts (Barclays Bank) expect before any earnings first another huge demand for capital, up to US\$ 11 billion, in order to position the company on the market. The mass production of a cheap purely battery-driven car in 2017 requires massive investments that need to be considered in any assessment. My concern: If the estimated sales figures do not meet the expectations of Wall Street, the break-

even point is reached later than expected or the company even incurs losses in the meantime (still high outflow of capital), the next capital increases will become increasingly hard to implement.

Consider: Tesla has already been rated quite generously at almost US\$ 30 billion. Additionally, the company will find it impossible to keep its unique selling points and the positive first-mover effect in the near future. The competition in this high-price e-car market hasn't fallen into a deep slumber, but is expected to steadily chop away at Tesla's lead and offer many alternatives (plug-in hybrids, fuel cells). That Tesla is planning an inexpensive mass-market product or vehicle for 2017 should be taken with a grain of salt, since many other manufacturers have already been offering their electric cars in this market or segment and are, of course, working on such things as extending the range of the vehicles, so that Tesla may find it difficult to gain larger market shares from the get-go.

In short: The stock price of Tesla may very well increase by a significant margin, which is a result of the news of the day. The interest of large investment banks to present an "enhanced" picture of reality, in order to pave the way for more capital increases should not have one overlook the fact that the stock price is subject to high fluctuations if less positive or even negative news come in. Currently, I see the share price to already incorporate all good and expectedly good news. For example, it is said that 17,000 to 19,000 units will be sold in the fourth quarter!? We will be able to see the actual figures at the end of February this year.

Doubts are also still lingering from the news that Tesla purchased 2,500 [license plates](#) in Denmark, although it could not be said for certain whether the company had also had buyers for all of these cars. Is this about a resale with high exceptional earnings, because the tax-related subsidies there will run out at the end of 2015?

Even if Tesla has a well-founded explanation for what it did, something like that will stick, and the question arises why Tesla had done it at all. And: The competition is closing the gap. Porsche is planning an electric car with the work title Mission E, which is said to have a range of 500 km and can be charged up to 80% within 15 minutes, possibly by an induction coil, i.e., charging without any distracting cables. I think every luxury car manufacturer will follow Porsche's example and enter the electric car market as well as offer alternative hybrid solutions (fuel cell and battery).

My skepticism – and that has to be made clear – is based not so much on this beautifully designed car or on the new SUV *Model X*, but rather on the stock price and the criteria and arguments accompanying the company value: Of course, it is advantageous to avoid power costs as a Tesla user, since it directly impacts operational costs and replaced gas. But the question is how high the resale value of such a car might be and when the battery (especially because of the fast charging) has to be replaced (costs for Tesla!). And then there is the Giga factory: Whether *Powerwall* (for households) or *Powerpack* (for grid stability) – does the giga-mania really justify such a stock price? At full capacity, Tesla's factory would be able to cover probably 80% of the demand for lithium-ion batteries around the world. But the prices of these batteries are falling. How high will the profit margin be in the end? A total value of US\$ 30 billion seems to be quite the enthusiastic assessment here (60% of what GM is worth), even if analysts see the shares rise to US\$ 400 and more.

Last but not least, I wonder why Tesla is reporting so elaborately for all the public to read how it acquires its supplier contracts to provide the required battery silica. There is mention of a new company in Nevada and also South-American companies, such as Codelco (Peru/Bolivia) or Li3 Energy (Chile). I urge caution, since such important supplier contracts should have been made a long time ago. Or did Tesla speculate on better contract terms and wants to pit one supplier against the other? Everything is possible! Finally, Tesla has also lost top talents – such as the manager of the Autopilot division, who left the company for Google – and a lot of employees went to Apple. Quo vadis, Tesla?

[See also risk warning page 3.](#)

Author: Sven Jösting

It is Time to Act – Thoughts on the German Strategy

Dear Reader, I would like to present you with some short number examples: The German *Callux* program installed 474 fuel-cell heating systems within eight years; the original target was 800. Japan currently has over 140,000 of these systems. The German *50 Filling Station* program was supposed to set up 50 H2 filling stations until the end of 2015. In the end, there were only 19. Until the middle of 2016, another 23 are said to be added. Meanwhile, Japan has already had 80 of these stations in operation (On a side note, the CEP predecessor, the *Verkehrswirtschaftliche Energiestrategie VES*, had envisioned 2,000 public H2 filling stations until 2010).

In the light of such comparisons, the question arises whether German subsidy policies have been sensible and effective. The issue becomes even more delicate when the so-called “success stories” of eight years of *Callux* are being lauded to the extreme at the program’s final event, but no-one seems to find the time to analyze why progress has been so slow.

Of course, the establishment of fuel-cell technology and the implementation of an H2 infrastructure goes beyond statistics alone – after all, Japan has invested much more money into stationary applications (around EUR 600 million compared to a mere EUR 36 million for *Callux*). And admittedly, the tests under real-life conditions have brought us some of the way forward: Costs were reduced, efficiency was improved and downtimes were minimized. But wouldn’t that have been possible much faster still – despite hardware issues and bureaucratic hurdles? Many difficulties only arose precisely because of the growing delay, as formerly active suppliers first had their patience tried and beyond before they saw the money not coming in, so they turned their backs on fuel-cell technology. This, in turn, led system integrators time and again on a long and tiring search for new suppliers.

Instead of contemplating about measures to speed up development, such as incentive programs or a possibly more sensible taxation of CO₂ emissions, both politics and business cling on to the path they chose and laud alleged successes, which reveal themselves as Pyrrhic victories when taking a closer look. For example, Norbert Barthle, Parliamentary State Secretary at the Federal Ministry of Transport, praised the establishment of *H2 Mobility* as a “great example of collaboration between leading businesses,” although the organization is grappling with severe delays in implementing their schedule: Nine months passed after *H2 Mobility* was founded until finally the official inauguration date with the minister arrived. No wonder that the timetable for setting up new filling stations is lagging behind as well.

There are numerous examples underlining the less than stellar interest particularly in the transportation sector – but also in the field of stationary units – to actually have state-subsidized products market-ready in a timely fashion. Whereas fuel-cell vehicles especially from German manufacturers have already been technologically advanced enough, their market entry is being delayed again and again. At the same time, the motto for producing electric cars seems to be: no more than the minimum required. The local automotive industry has been benefitting for years from the soft stance toward environmental policies across Europe. Combined with a perfectly set-up network of lobbyists, it means that marketing can advertise green when the “green” is still being earned by fossil fuel technology.

It is more than enough for politicians like Steffen Bilger (I quote: “All in all, I do see that the German automotive industry would like to advance the issue and is putting a lot of effort into it. They, too, will have to comply with the EU-wide CO₂ limits despite their large share in the premium segment.”). What the politician from the Christian Democratic Union neglected to add was that it is entirely enough for the carmakers to sell a few electric cars nowadays, since they are being included several times in the calculations for vehicle fleet consumption thanks to the actions of German politicians and because emission limits will only be lowered to a moderate level from 2021 on.

How well a more stringent political framework can function can be seen in California, where the CO₂ limits have been set to much lower levels. It shouldn't come as a surprise that the most electric cars are being sold there as well (e.g., by BMW). It is the reason why Tesla-Chief Elon Musk suggested during his visit to Germany that whereas the state should largely remain absent from the car market, it should create a suitable regulatory framework for it. During his meeting with the Federal Minister for Economic Affairs and Energy, Sigmar Gabriel, he said: “The wish I have is that you price CO₂ correctly.”

Even Professor Werner Tillmetz, Chairman of the Center for Solar Energy and Hydrogen Research Baden-Württemberg, told H2-international that “Germany has lax regulation.”

Faced with these developments and the statistics mentioned above, it seems more than prudent to explore new avenues in the year that has just begun. Both the carmakers and the federal government must make clear where they stand: The German Chancellor Angela Merkel must finally end her review of “whether and if which” measures are needed to boost the market and fulfill her pledge to present a precise bundle of measures to push the electric car market. A decision has been long overdue – in the end, it is also about whether the agreements reached at the

Convention on Climate Change in Paris find their way into the realm of politics and business. Additionally, the automotive industry has to finally present a convincing argument for not repeating last year's mistakes, again winding up with damage to the environment and a tarnished reputation. No-one needs a second #dieseldgate.

Best wishes, Sven Geitmann
Editor of H2-international

H2 Mobility Officially Launched



Frank Sreball, H2 Mobility

Oct. 13, 2015, was the official start of activities for H2 Mobility Germany. After the joint-venture consisting of six industry partners had already been founded in January last year (see [July 2015](#)), the joint launch came in fall in the presence of the Federal Minister of Transport, Alexander Dobrindt, and all company representatives. This meant that the organization's CEO, Frank Sreball, had nine months to familiarize himself with the issues, so that H2 Mobility can now – in his own words – “go full steam ahead in preparing for the first stage of the action plan.” Furthermore: “It [the plan] relies on a swift installation of an initial 100 filling stations over the next years.” H2 Mobility pledged to fund the project for extending the H2 infrastructure with EUR 400 million.

The joint-venture started out in September 2009 as the H2 Mobility initiative and had originally planned to set up 50 H2 filling stations until the end of 2015 and around 400 until the end of 2023. After the first milestone, the 50 stations, will be expected to be reached only at the end of 2016, it remains unclear whether the 400-station target can still be achieved within the current timeframe.

Sabine Kauper is Heliocentris' new CFO



© Heliocentris

At the end of last year, Heliocentris Energy Solutions selected Sabine Kauper to become CFO of the company. Having graduated in business administration, she has been specializing in taxation and auditing and assumed her new position at the Berlin-based fuel-cell manufacturer on Jan. 1, 2016. She has filled the gap left by her predecessor, Andras Gosztanyi, who parted ways with Heliocentris in 2014. Kauper is regarded in high esteem for her experience in restructuring and turning ailing business around, which helped bring her two previous employers successfully back on track during her time as their CFO. Heliocentris' CEO, Ayad Abul-Ella, had the following to say about her: "With her many years of expertise in this department at companies such as Phoenix Solar and SKW Stahl-Metallurgie Holding, she will be a valuable asset to the Heliocentris Group."

WindGas Project in Hamburg-Reitbrook in Operation



Hamburg-Reitbrook is home to what many consider an extremely compact and efficient Power-to-Gas plant: the WindGas system. It was inaugurated on Oct. 15, 2015, after being set up by a company consortium during a three-year preparation period under the auspices of an NIP subsidy project. Both Hamburg's First Mayor, Olaf Scholz, and the Parliamentary State Secretary of the Ministry of Transport, Norbert Barthle, were missing during the ceremony despite an announcement to the contrary, but WindGas was brought into operation anyway. As planned, "green hydrogen" began to feed into the regional natural gas grid after the push of a button.

It all started in 2010 with a conversation during the Hanover trade show: Some of the current project partners talked about the opportunities of scaling electrolysis systems. Even back then, the ultimate target was megawatt size, although there weren't any plans for a quick realization of that target. The project became a more concrete endeavor only in 2012: At that time, the target was 3,500 MW of electrical energy fed into the power grid each year by solar, bio and wind power systems in Schleswig-Holstein. The number has meanwhile increased to 7,000 MW, and part of it is said to be used to create hydrogen (WindGas) through electrolysis within the EUR 13.5 million research project, in order to feed it into the natural gas grid.

The groundbreaking ceremony for the center of excellence was held in June of 2013 on the premises of HanseWerk and with the attendance of Hamburg's mayor Scholz and the then Parliamentary State Secretary of the Ministry of Transport, Enak Ferlemann. Bringing the system into operation, however, was taken over two years later by Jens Kerstan, who became State Senator for Environment and Energy in

April last year. Pleased with the project results, he said in his opening speech: “The push of a button will turn on an extremely powerful battery for green electricity.”

Actually, regular operation had already been scheduled for the beginning of 2015. This couldn’t quite be achieved, however. But “the plant stayed within the confines of the budget,” Dr. Peter Klingenberger, Chairman of the Management Board of E.ON Gas Storage, was happy to announce.



Figure 2: Boxberger, HanseWerk; Klingenberger, E.ON; Kerstan, Hamburg Senate; Bonhoff, NOW; Schoof, E.ON

In the framework of scientific research accompanying the project, the German Aerospace Center has been testing the degradation of the individual components. So far, the analyses have led to the conclusion that “despite a first stress test, we have not yet found any signs of aging.”

Compact PEM unit

The electrolysis system used in the project is from Hydrogenics and possesses a PEM (Proton Exchange Membrane) stack measuring a mere 55 cm x 70 cm x 90 cm. In spite of its rather small dimensions, the hydrogen generator offers a maximum power input of 1.5 MW. It was installed in a 40-feet container that is 2.5 m in height and is supplied by tap water. The water is cleaned and deionized by osmosis in a special treatment facility. Additionally, there was a voltage transformer installed on-site, which converts the power down to 400 V.

After creation, the H₂ gas in Reitbrook is compressed to 15 bar before being fed into the distribution network. The central monitoring station in Essen controls the plant, as well as its sister version in Falkenhagen. The biggest difference between these two plants is that the latter located in the German Prignitz region had alkaline electrolysis systems installed, whose power density of 0.5 A/cm² is four times lower than the one of the PEM units.

The targets of this northern German subsidy project are the creation of a prototype in the metropolitan area of Hamburg and the testing of this type of PEM electrolysis system for plants above 1 MW over an initial period of one year. Currently available PEM systems possess a power input of up to 100 kW. Above this performance threshold, the preferred units to use are alkaline electrolysis systems (for example in Falkenhagen). That the present plant made it possible to leap into the megawatt field was called “a big step” by Dr. Klaus Bonhoff, Chair of the National Organization for Hydrogen and Fuel Cell Technology, which contributed EUR 6.5 million to the project.

Bernd Pitschak, CEO of Hydrogenics, mentioned the possibility of even bigger plants in the future when talking to *H2-international* about the topic. For example, there is the current installation of a new 2-MW plant in Canada, which could be upped to 5 MW. In his view, plants with a power of 5 to 10 MW could be possible very soon.

WindGas

The sustainably created hydrogen in form of a natural gas and hydrogen mixture (WindGas) is marketed by E.ON. CEO Uwe Kolks explained that the company would increase the “share of regenerative wind gas in our product from ten to fifteen percent” in November of 2015 (which did happen) because the hydrogen could now be retrieved from two plants (Falkenhagen and Reitbrook) and supply a greater number of customers.

Patrick Schnell Leaves CEP



Change in personnel at the beginning of the year at Clean Energy Partnership (CEP): Patrick Schnell, who had worked at the organization since it started out as a demonstration project (which succeeded the *Verkehrswirtschaftliche Energiestrategie VES* in 2002), handed over his chairmanship of CEP to Thomas Bystry. Schnell, whose primary employment is managing the Sustainable Development department at Total Germany, was spokesperson of the transportation initiative for around ten years. In the future, his main focus will be industrial lubricants instead of hydrogen. Bystry has worked for Shell since 1982. Since 2014, the industrial manager has headed the Alternative Energy division at the corporation. The 50-year-old from Hamburg is also project manager of hydrogen activities and deputy of the Global Hydrogen Operations Manager. His first promise as new chairman was that CEP will deliver this year what has been promised.

Heinz Günter “HG” Klug is Dead



Dr. Heinz Günter Klug passed away last fall. On Oct. 12, 2015, the long-time pioneer of hydrogen technology died at the age of 78. The mechanical engineer, who was born in Mainz, provided important contributions to hydrogen engine testing for aircrafts during his time as project head at Airbus. Twenty years ago, he was one of the founding members of the German Hydrogen and Fuel Cell Association. Klug, who last lived in Hamburg, was the coordinator of the Europe-wide *Cryoplane* research project before he retired in 2002. He delivered many groundbreaking ideas, especially regarding hydrogen as aviation fuel. HG – how his name was often abbreviated – spent his spare time travelling the seas, painting and taking photographs.

DWV to Pave the Way for Green Hydrogen



The parliamentary evening organized each year by the German Hydrogen and Fuel Cell Association (DWV) was held at the British embassy in Berlin in mid-November of 2015. More members of parliament than ever showed up to the event dedicated to Green Hydrogen for an Efficient Energy Transformation.

The focus of the evening was on the DWV's call for an integrated energy concept. But what this meant exactly was only clear to those who already possessed in-depth knowledge of the issue, as the concept thought up by the association's president, Werner Diwald, consists of numerous individual measures, some of them of a highly bureaucratic nature. For example, the association called for "the incorporation of the Power-to-Fuel process into Annex 1 of the EU Directive pursuant to Article 7a FQD passed at the end of 2014."

Essentially, however, Diwald and his association wanted merely to pave the way for parliamentary acceptance of "green hydrogen," which is created by renewable energies and could mark an important step forward as a medium for the

transformation of the energy industry, in the power and heat market as well as in the transportation sector.

But, of course, there are plenty of debates about how to achieve such a long-term target. Diwald favors his bundle of measures, which among other things plans to “credit green hydrogen use in refineries toward the GHG reduction quota” as well as “to reduce the renewable heating law charge in case of electrolysis.” Overall, the DWV presented eight measures that would have to be implemented based on a roadmap. As the association’s president shouted out to the politicians: “It is not enough to just say: The market will deal with it. One must act!”

CO2 taxation

What kind of actions should be taken, that’s where opinions differed: Ove Petersen, CEO of GP Joule, called for higher taxes on CO₂ emissions during his speech. Bernd Westphal, member of the Bundestag and spokesperson of the work group Economic Affairs & Energy of the Social Democrats’ Bundestag faction, countered: “Emission trading doesn’t work right now, I already know that.” But Westphal also voiced his hopes for a possible price increase of CO₂ certificates in the future. A reform of the existing certificate system, however, is planned for not earlier than 2018. From 2021 on, some CO₂ could be taken off the market based on current planning, so that the shortage in certificates will raise both demand and prices.

On the other hand, Norbert Barthle, Parliamentary State Secretary at the Federal Ministry of Transport and Digital Infrastructure, held on to the path chosen and affirmed his convictions by saying: “NIP 2.0 has been set on course. [...] We want to ensure continuity.” His statement may indicate that even at ministry level, there is consensus about wanting to continue NOW for the next eight or ten years. And because NOW will be less than useful without a relevant subsidy program, more details about NIP 2.0 may be revealed soon – at the latest before the next general election in fall of 2017, it seems. At least Barthle provided a stark contrast to the preceding fulsome praise with the first clear words of the evening, saying that the “federal government would like to see the German car manufacturers pledging to throw their weight behind fuel-cell technology” and that the “the market presence of German manufacturers would be laudable.”

Here, Professor Robert Steinberger-Wilckens, Chairman of the Centre for Fuel Cell and Hydrogen Research at the University of Birmingham, stressed that a reference to the proverbial chicken-and-egg would no longer apply: “First, you have to invest five years in the establishment of an infrastructure without generating any earnings. It just is like that!” Steffen Bilger, who represented the Christian Democrats’ interests on the podium, showed understanding for the car manufacturers’ situation. He had already stated prior to the event that the automotive industry would have an interest in selling as many electric cars as possible, since they have to adhere to the EU-wide CO₂ limits despite their large share in the premium segment. What he neglected to mention, however, was that in the interest of the German automotive industry, the federal government had used their significant influence to keep the threshold values within the European Union higher than they could be and may have been sensible, which means that the electrification of the transport sector could have been realized much faster.

New E License Plate



There is the next step after introducing the electric vehicle bill (in force since June 12, 2015): Since the end of September last year, i.e., as long as the relevant amendment has been in effect, owners of electric cars have been able to apply for special license plates. The black *E* after the number on the plate could mean they enjoy certain privileges, for example, if a community has approved bus lanes for electric cars to drive on – a measure, however, which has so far only been planned for Essen. In Hamburg and Stuttgart, owners of electric cars and an E license plate have been able to enjoy free parking since November 1 of last year.

Harald Kossow from Delmenhorst was one of the first to put an E license plate on his car – a hybrid version – at the end of October last year. He said: “The introduction of the E license plate by the federal government was a step in the right direction, in order to make the public more aware of electric cars.” The Federal Minister of Transport, Alexander Dobrindt, calls it “a real standout.”

Launch of Emission-Free Passenger Aircraft Hy4

A unique aircraft with a distinctive design and innovative engine technology – that is how one could sum up the features of the *Hy4*, which the German Aerospace Center (DLR) had already showcased at the [World of Energy Solutions](#) on Oct. 12, 2015. The new concept study was presented by project head Professor Josef Kallo, who had already been responsible for developing its predecessor. This time, he collaborated with the project partners to design a four-seater run by fuel cells and accommodating up to three passengers.

The Hy4 is the next logical step in the evolution of the hydrogen aircraft based on its predecessors: The model that started it all was called *HyFly3000*, which had been envisioned around ten years ago by Frieder Herb from the ExtraEnergy association and Lange Aviation, but was never constructed (see *HZwei* magazine from April 2006). A project based on this first model was only implemented after the DLR took

over at the helm and showcased the *Antares DLR-H2*. The prototype of this power glider was presented in Stuttgart in September 2008 and took off from Hamburg in July 2009. It was considered to be the first pilot-controlled aircraft with a fuel-cell engine.



Hy4, © DLR

Shortly thereafter, the *Antares-H3* project was launched in August 2010. Initially, it was said that this successor model was to “set new standards in flight duration and range.” There was even mention of a transatlantic trip and the use of the model for unmanned aerial surveillance. The first flight had already been scheduled for 2011, but never happened.

Twin fuselage and hybrid engine

Now in his position as DLR Coordinator Electric Aviation, Kallo is making another attempt at realizing the dream of eco-friendly flying. This time, however, he partially relies on a new team. After many years, Kallo parted ways with Axel Lange, who had great influence on the development of the previous versions, but the ideas of both technicians seemed to have been too far apart to be reconciled.

Instead of the *Antares* base version used so far, the new team will now employ a Pipistrel Taurus G4. This model by the Slovenian manufacturer with the same name, which up to now had been merely used for technology testing as well as during competitions, consists of two Pipistrel Taurus Electro G2 and was awarded the Green Flight Challenge of the CAFÉ Foundation in September 2011. According to a DLR statement, the aircraft’s unusual twin fuselage design should enable an optimal distribution of engine components and allow for a higher load in general. The base

model, which will incorporate the fuel-cell and H₂ components, is already in the hangar.

The engine of the trendsetting flight objects is said to consist of a low-temperature fuel cell (45 kW) from Hydrogenics, as Kallo considers this fuel-cell type to be more efficient and powerful than systems used previously, which mainly focused on a long lifespan. As a backup, the aircraft is said to contain a high-efficiency lithium battery (21 kWh) for peak loads. Both units together will supply the 80-kW electrical engine, which can accelerate the *Hy4* to a maximum speed of 200 kilometers per hour (travel speed: 145 km/h).

The gaseous hydrogen stored in the pressure container should make for a range of 750 km. There are plans, however, to switch to liquid hydrogen, which would enable the aircraft to travel greater distances (around 1,500 km).



Josef Kallo during the Hy4 presentation

Air cab

Kallo sees an air cab service as one of the potential application areas: “It is our aim to use aircrafts such as the *Hy4* as electric air taxis to provide more scheduling flexibility when linking destinations and offer faster alternatives to existing transport routes and means.” Professor André Thess, Director of the DLR Institute of Engineering Thermodynamics, said: “The four-seat electrical aircraft *Hy4* is a perfect fit to our strategy of exploring synergy effects between electrical transport means on the road and in the air” because electrical engines would be very well suited for shorter distances. They are low on noise and other emissions and can take off and land even on small airstrips because of their high torque. Bernd Pitschak, CEO of Hydrogenics, added that the intention was to elevate “electric drives to the next level.”

To implement this newest project, *H2Fly* was established, a spin-off of the German Aerospace Center, which as the operator of the *Hy4* will take care of realizing and approving the aircraft, as well as making sure that research (DLR, Ulm University) and technology (Pipistrel, Hydrogenics) work hand in hand. The Stuttgart airport is also onboard – it had already supported the project with EUR 180,000 when it was launched. The funding did not only ensure that the program got off to a good start, but it also underlined how Stuttgart was “the most ecologically sustainable airport,” as the head of the airport, Professor Georg Fundel, put it (see next e-Journal). Further financing of the project has not been secured yet, although Kallo was confident that this would be done in time.

As aviation visionary, Kallo sees the potential of transporting more than four people (pilot and three passengers) this way in the future. He believes that a 40-seater could be realized from 2020 onward. But right now, plans are to have an initial trip in the summer of 2016, which could be followed by the first long-distance flights in 2017 and 2018.

“We are spearheading the development here and are at the limit of what can be done.” Professor Joseph Kallo, DLR

World of Energy Solutions 2015 in Stuttgart

When the *World of Energy Solutions* took place in Stuttgart from Oct. 12 to 14, 2015, the emission scandal surrounding Volkswagen was still a fresh memory. The *#dieselfgate* was the topic of many conversations and even an issue in a lot of the presentations held at the trade show. During his opening speech, Franz Untersteller, Baden-Württemberg’s Minister of the Environment, Climate Protection and the Energy Sector, was confident that the scandal about manipulated emission tests would provide a “new drive” to the electric car industry. He said that the fuel cell was “the technology of the future.”

Untersteller’s aim is to “take a pioneering role in the energy transformation.” To achieve that aim, he clearly relies on electric cars to be the driver, whereas he has not been satisfied with the role that the German automotive industry has played so far: First, the minister noted that “Tesla has left the German competition behind.” Then, the Green Party politician added that he had ordered an electric car offering a range of 240 km, but voiced his regrets that the vehicle had not been manufactured in Baden-Württemberg.

He also elaborated on the state program *Heat Transformation in the Boiler Room*, which has led to 180 requests so far. The program, however, was discontinued at the end of September 2015 because a federal subsidy program was planned to take its place at the beginning of this year (see the interview).



In 2016, STORM Pulse should start its global tour.

Bonhoff announces ten-year plan

There was a remarkable speech by Dr. Klaus Bonhoff on the evening of the first event day. It was remarkable in two ways: On the one hand, it has to be duly noted how the current NOW President managed to properly finish his dinner speech despite the ever ongoing loud mumbling filling the room, which seemed to leave the impression that no-one was listening to him anymore. Actually, the fault may have more likely been the extremely bad acoustics of the Old Riding Hall at Stuttgart's Maritim Hotel. On the other hand, the ones who did listen were able to hear how Bonhoff cautiously announced "a new ten-year plan." According to his statements, the ministerial department was about to establish the regulatory framework for their own program in order to introduce fuel cells to the market until the end of the year.

Partner country: Netherlands

A unique sight was the joint booth together with The Netherlands, the partner country from whose North Brabant region companies showcased their products in Hanover. One of the things on display was the electric bike *STORM Pulse* (see figure 1). Young engineers from the Eindhoven University of Technology designed this electric motorbike, which is said to have a range of 380 km, in less than a year.

InnoROBE



Figure 2: Scrutinizing the fuel-cell tractor unit by Bosch Engineering: F. Loogen, e-mobil BW; W. Hermann, State Minister of Transport; B. Pauli, Governor of North Brabant; U. Kromer v. Baerle, Stuttgart State Fair; R. Bütikofer, European Parliament (from right)

Where visitors entered the trade show, Bosch Engineering presented its baggage tractor, which had been equipped with a fuel cell for range extension during the subsidy project Innovative Regenerative Onboard Energy Converter (InnoROBE). According to company information, the tractor unit with a fuel-cell hybrid engine would be tested at an airport in 2016, although it wasn't clear yet at which airport the tests would be conducted.

15. f-cell Award

Baden-Württemberg's *f-cell Award 2015*, for which as many as 29 developers had applied this year and which was twice endowed with a prize money of EUR 10,000, went to ElringKlinger and the University of Freiburg. ElringKlinger won in the category products & market with its fuel-cell module *BZM 5*. The jury's decision for choosing the stack based on metal bipolar plates was "its readiness for mass production and its impressive performance data and the maturity of its technology." In addition, the end plate assemblies created through injection molding already incorporate essential system functions, thus offering great saving potential for stack and system. According to ElringKlinger, the company has been working on fuel cells for around 15 years,

which almost no-one seemed to know about. In the meantime, it has begun to call itself the “only German stack manufacturer.”

The *f-cell Award research & development* went to the Institute for Microsystems Engineering or IMTEK at the University of Freiburg. There, under the auspices of the MEMS Applications Development department headed by Professor Dr. Roland Zengerle, the young talent group Porous Media simplified the manufacturing process of membrane-electrode assemblies. As the doctoral students Matthias Breitwieser and Matthias Klingele explained during the award ceremony, they had just been “brainstorming” for their doctoral thesis and thought about how to “print” membrane material directly onto the electrode. The first idea was glass and then a direct print onto the electrode. They added that the process “worked at first try.” The colleagues from ElringKlinger liked the coating used to “spray” the PEM membrane directly onto the micro-porous carrier layer (the gas diffusion layer) so much that they immediately agreed to a first meeting with the students on the day after the award ceremony (see figure 3).

e-fleet airport

On the afternoon of the second event day, the e-fleet was showcased at the nearby airport; [read more in March 2016](#).

DLR unveils H₂ aircraft

One highlight of the event was the presentation of a new hydrogen aircraft called *Hy4* by the German Aerospace Center (DLR); [read more](#).

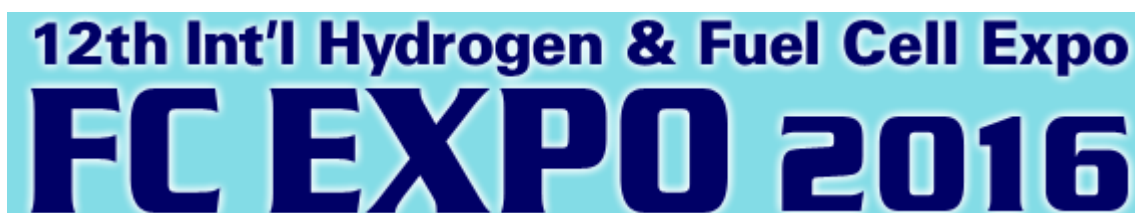
IMTEK receives *f-cell Award*

Matthias Breitwieser and Matthias Klingele presented their prize idea during the *WES* event and have written about it, [read more in April 2016](#).

read more: www.h2-international.com

Events

- February 4th to 5th 2016, **HyVolution**, in Paris, France, www.hyvolution.fr
- February 16th to 18th 2016, **E-world energy & water**, in Essen, Germany, www.e-world-essen.com
- March 2nd to 4th 2016, **International Hydrogen and Fuel Cell Expo**, at Tokyo Big Sight, Japan, www.fcexpo.jp



- March 15th to 17th 2016, **Energy Storage Europe**, Düsseldorf, Germany, www.energy-storage-online.com
- March 15th to 17th 2016, **International Renewable Energy Storage Conference (IRES 2016)**, Düsseldorf, Germany, www.eurosolar.de
- March 16th 2016, **5th Conference Power-to-Gas & Power-to-X for Europe's Energy Transition**, at Messe Düsseldorf, Germany, www.otti.eu
- April 13th to 14th 2016, **Grove Conference Fuel Cells Science and Technology**, in Glasgow, United Kingdom, www.fuelcelladvances.com
- April 25th to 29th 2016, **Group Exhibit Hydrogen + Fuel Cells + Batteries**, in Hannover, Germany, www.h2fc-fair.com, www.hannovermesse.com
- April 27th to 28th 2016, **Electric Vehicles Europe 2016**, in Berlin, Germany, www.idtechex.com/electric-vehicles-europe/
- June 13th to 16th 2016, **World Hydrogen Energy Conference 2016**, in Zaragoza, Spain, www.whec2016.com

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Energy Storage

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

Event Organizers



- **22nd Group Exhibit Hydrogen + Fuel Cells + Batteries**, HANNOVER MESSE 2016, April 25 – 29, Tobias Renz FAIR, Phone +49-(0)30-60984556, tobias@h2fc-fair.com, www.h2fc-fair.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

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- **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
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- **Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie**
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