

H2-international – e-Journal

October 2015

This is the first official issue of the new H2-international e-Journal.

Here you will find all the detailed information about hydrogen and fuel cells in one pdf-document.

Content

- [News](#) – Published in August & September 2015
 - [Timetable](#) – Events Worldwide – Trade Shows, Conferences, etc.
 - [Companies](#) – Global Manufacturer, Suppliers, Sellers
 - [Specials](#) – Free Entrance & Discounts
 - [Imprint & Social Media](#) – Stay in Contact
-

Alstom and Ballard approach the railroads

[7. October 2015](#) by [Hydrogeit](#)



FCvelocity® (Source: Ballard)

Until recently, fuel cells have been of little importance in rail transport. This spring, however, the company CSR Qingdao Sifang Co., Ltd., which is based in eastern China, presented a tram which is driven with hydrogen. The new H₂ tram, which features a fuel cell system from Ballard, left the production line in the port city of Qingdao on 19th March 2015. In comparison with this, all of the previous attempts to bring fuel cells onto the railroads seem to have been shaky first efforts.

CSR Qingdao Sifang is a subsidiary company of the China South Locomotive & Rolling Stock Corp. Ltd. (CSR), which is viewed as being the biggest manufacturer of electrical locomotives in the world. The employees at its production and testing location in Qingdao developed a fuel cell tram which has a range of 100km, and is able to travel at up to 70km/h with up to 380 passengers. According to Liang Jianying, the firm's Chief Engineer, the refueling time is similar to that of a FC car: the tanks are full in three minutes.

The fuel cell system for this tram is based on the *FCvelocity®* from Ballard Power Systems and is integrated in the low-level floor. At the start of April 2015, Randy MacEwen, President of the Canadian FC manufacturer commented on it as follows: "This is a highly interesting demonstration of our world leading fuel cell module in a new application. Clean urban mobility is now a high priority in China, and this zero emissions prototype of a fuel cell tram is an important step in demonstrating a solution." MacEwen was also extremely pleased that it had proven possible for the tram to be completed just a few months after signing the cooperation agreement and after the receipt of the order.

In recent times, there have also been noteworthy attempts to use FC systems in rail transport in Europe. For instance, at the *InnoTrans 2014* in Berlin, the leading trade fair for transportation technology, the French company Alstom announced its intention to begin operating emissions-free railcars in four German states. To sign the declarations of intent, the corresponding ministers from Baden-Württemberg, Hesse, Lower Saxony, North Rhine-Westphalia, and the executive directors of the transportation firms met in Berlin.

This project is being supported by the National Innovation Program for Hydrogen and Fuel Cell Technology (NIP). Enak Ferlemann, Parliamentary State Secretary at the Federal Ministry for Transportation and Digital Infrastructure made the following comments: “In the scope of the national innovation program, this is a pioneering project: the initial use of the fuel cells technology in rail transportation. If it succeeds in providing proof of the suitability of the technology for general and daily use, it means we will have a genuine, emissions-free alternative form of propulsion.”

Michael Groschek, Transportation Minister in North Rhine-Westphalia, said: “The fuel cell train designed by Alstom is travelling in exactly the right direction!” Transportation Minister of Hesse, Tarek Al-Wazir, added: “Propulsion systems which use energy storage devices such as hydrogen are set to become the binding link in a networked energy supply system.” Henri Poupart-Lafarge, President of Alstom Transport, had originally said that: “Our trains are set to be the first in the world to use fuel cell technology for regular passenger transportation operations.” Apparently, when making this statement in September 2014, he did not yet know about the aforementioned Canadian-Chinese railcar.

The practical testing of two FC rail prototypes from Alstom is scheduled to take place in Lower Saxony in 2018. The development and construction will take place at Alstom’s competence center for regional trains in Salzgitter. Hydrogenics will be supplying the fuel cells. A corresponding declaration of intent was signed on 27th May 2015, in which it was agreed that over the next ten years, the development and the commercialization will be completed together by Alstom Transport and Hydrogenics. The volume of the order is estimated to total 50 million Euros and will consist of at least 200 propulsion systems which will be based on Hydrogenics’ *HD series*, including their servicing and maintenance. The first FC systems are set to be delivered to Alstom in 2016.

Daryl Wilson, Director of Hydrogenics, explained: “Hydrogen is continuing to grow in importance in terms of reducing the energy-related and pollution problems which are caused all over the world by transportation that is based on fossil fuels. The electrification of heavy goods transportation, in comparison, enables efficient, clean, hydrogen-based energy solutions.”

In addition to these projects, which are to be realized soon, there are also examples which were announced to the public but were eventually abandoned. For example, on 10th August 2009, in the presence of the then Federal Minister for Foreign Affairs Dr. Frank-Walter Steinmeier, the Deutsche Bahn AG held a launch event prior to the construction of its new DB Eco Rail Center. The competence centre which, according to the DB, was to be “one of the most modern in the world for railroad technology,” was to be built in Kirchmöser, Brandenburg. One of its first areas of research was to be the New Energy Train, a train operating with the help of solar energy and hydrogen. However, nothing has been heard of it since.

There were also temporally limited individual projects in Japan, for example, where some initial boxcars that had been converted to run on fuel cells went into operation as part of a test project. In South Africa, FC mining locomotives were tested, while in 2009, an FC shunting locomotive went into use in the USA. Once again, nothing more has been heard of these projects.

No electrification?

The announcement from Alstom led to a discussion in Hesse, Germany, about whether the planned electrification of the rail network would be continued with or not. When asked during an interview where the new trains would be used in the future, Prof. Knut Ringat, Director of the Rhine-Main Transportation Association (RMV), said the following: “If you look at the RMV rail network there are three lines which aren’t electrified.” These include the two lines on the Taunus railroad to Königstein and Grävenwiesbach. An RMV spokesperson said the following to the *Taunus-Zeitung* newspaper, however: “The pilot project for the testing of the fuel cell technology is taking place independently of the planned electrification of the Taunus railroad. That is still on the agenda.”

Interview with Walter Huber from H2 South Tyrol

7. October 2015 by Hydrogeit



Walter Huber

Numerous European countries are working hard – to a greater or lesser extent – in the field of hydrogen and fuel cell technology. Since 2006, one region has been particularly active: South Tyrol. In September 2009, in Bolzano, Italy, the ground-breaking ceremony was held for the construction of the first production and distribution system for green hydrogen in the country. The site adjacent to the Bolzano South freeway exit is now home to the biggest center for hydrogen in Europe, which is operated by the Institute for Innovative Technologies (IIT) and the Brenner A22 freeway. *H2-international* interviewed IIT President Walter Huber about the previous, current and future activities in South Tyrol.

H2-international: Mr. Huber, as President of the IIT you also have lead responsibility for the new hydrogen center in Bolzano. In the past, you have stated that this is the biggest center for H2 in Europe. Can you back this claim up with figures?

Huber: We aren’t boasting about being the biggest plant in Europe. To be honest, this isn’t something that we care about. The most important thing is for the plant to

fulfill its purpose; with the production the plant also consists of a visitors' center with educational facilities – it therefore has a multifunctional purpose. This is the only thing that is important to us. We have constructed a hydrogen center with a production capacity of 180Nm³ H₂ per hour – all of which is produced with renewable energy. Connected to this is a public filling station with two gas pumps, one with 350 bars for buses, and one with 700 bars for cars. It is situated in a strategic location adjacent to the Bolzano South freeway exit. Around 60,000 vehicles pass the site every day, see our emblem, and become curious about what we are doing here. We want to make use of our electricity resources ourselves, and make them available for mobility. It is from this site that we are developing hydrogen technology, spreading information, focusing on technical training and education, and developing strategic plans, and so forth.

H2-international: What exactly do the three building sections house (see image, p. 2)? Laboratories, workshops, offices, seminar facilities?

Huber: Three buildings and one filling station have been built. In the first building, the production using electrolysis and the compression takes place. The second building is a storage facility – and primarily serves the storage of the hydrogen. The third building is home to the offices and visitor information center, and is also where the education and training takes place. The entire complex also serves a demonstration purpose toward the general public, who are also included in the developments here, because they should and must know what both they can expect to gain from this new hydrogen technology, and the personal benefits that they can each draw from it.

H2-international: The ground-breaking ceremony was held in late 2009, but the site only opened on 5th June 2014. Why did it take so long?

Huber: Firstly, there were a lot of bureaucratic obstacles to overcome. Hydrogen is a new topic. Nobody was certain which specific approvals were required or which specific safety precautions were necessary, etc. In addition to this, there was a Europe-wide tender for the technology. This proved to be highly complicated – we weren't able to simply do everything at once because no standards were available for previously completed systems, which meant that we had to put everything together first and secure everything with the necessary contracts.

H2-international: The construction of the H2 center was initially expected to cost 16 million Euros. How expensive has it actually been, and how much has been financed by the European Regional Development Fund (ERDF)?

Huber: Please let me correct you here: the buildings were constructed by the company Brennerautobahn AG at its own expense. The IIT has leased the buildings at the current market price. The technical fittings cost € 5,210,000, and were financed by the ERDF to the tune of 95%. The price was stuck to without additional costs and was paid on time as agreed in the contract.

H2-international: Was a photovoltaic system also installed as planned?

Huber: A 17kW photovoltaic system was constructed, and so was a small pond. This serves the purpose of explaining to the visitors that hydrogen only requires sunshine and water, that there's no need to buy raw materials from foreign countries, and that the only end product is water again. This makes it a sustainable fuel which we can produce ourselves.



(Sources: H2 South Tyrol)

H2-international: According to your information, the hydrogen you use is green. Does this mean it is produced on site via electrolysis and solar power?

Huber: South Tyrol is a hydro power region where more electricity is produced using hydro power than is actually required locally. The electricity which our solar power system produces is used for the offices and the building's technical systems. The electrolysis takes place with certified renewable electricity from the local network. The use of new sources of electricity in direct form has been planned. We are currently ascertaining where the potential for cheaper electricity is since the costs of the electrolysis depend almost exclusively on the costs of the electricity: cheaper electricity produces cheaper hydrogen. During the winter, the heat from the electrolysis is used to heat the office buildings.

H2-international: You now have five H2 buses which are used in scheduled transportation operations as part of the CHIC project, as well as ten Hyundai ix35 Fuel Cells, whereby the cars are also available for hire. Does this mean that anyone can hire out an FC car from you?

Huber: The five buses are used in the public transportation system in Bolzano and are very popular with the passengers, the bus drivers and the local residents. The cars are leased to those who are interested in using them on a monthly basis. Companies which attach their logos and information to them, and in doing so advertise for a technology of the future, have shown an especial level of interest in them. We are happy about this, and it also adds to our success. Those who only need a car for a day or two can borrow our company car, but only in exceptional cases. The other nine vehicles are on long-term lease, with waiting lists for them of several months.

H2-international The then South Tyrol Governor, Luis Durnwalder, said the following at the ground-breaking ceremony: "South Tyrol views hydrogen to be an important source of energy for the future, and one which is also produced locally." However, it subsequently appeared to be the case that the support in South Tyrol might be starting to fall away. What is the current situation regarding the support from the region?

Huber: The support from the world of politics in South Tyrol has never fallen away. A new state government has been in office since the start of 2014. It has been setting new standards, but they are appropriate. We are also working with the state government on a general strategy which requires detailed work and time.

H2-international: The "for and against" discussions were sometimes extremely noisy. There were repeated criticisms as to whether such a high-cost project was

necessary. Have the critics now been silenced?

Huber: Discussions of this kind always take place when new technology is introduced. We always take those who raise critical enquiries seriously and respond to them in detail, which also includes arranging visits to our plant, where we can then provide personal explanations. It is necessary to clarify that hydrogen not only means the replacement of a fossil fuel with a renewable one, but also that hydrogen constitutes a system, fulfills an energy storage function, and also facilitates the efficiency of renewable sources of electricity which would not otherwise be able to operate efficiently. Last year, around 2,500 visitors convinced themselves of the system's efficiency. This has made it a hands-on technology. In the second half of 2014, over 240 articles, interviews and portrayals were published in the public media – and not one of them was negative, which is a positive development. Criticism is inevitable – but constructive criticism is to be taken seriously and improves the situation. Recently, however, the critics seem to have become aware of our positive approach.

H2-international: In addition to other points of criticism, with five fuel cell buses costing 9 million Euros, your project has been accused of being very expensive, and that the buses have suffered frequent breakdowns and require constant repair. In addition to this, they are only suitable for routes that have a gradient of less than one percent. What is your response to these points?

Huber: The 9 million Euros is the total cost of the five buses for five years of operation, including the costs of the fuel, insurance, personnel and the conversion of a bus depot. These are equivalent to the costs accrued by diesel buses in the same time frame. It is necessary to assess costs of this kind properly before leaping to the wrong conclusion. Incidentally, the buses have now attained an availability of 95% and have proven no more susceptible to faults or repairs than the diesel buses. And as regards the 1% gradient: in the run-up to this project we completed test drives with hydrogen buses that were fully loaded from Bolzano to the Seiser Alm which is 2,000m above sea level on a route taking in 16% gradients without experiencing any problems, although the buses are designed for city operations. Plenty of trash is reported in the media these days which is read by many people – the end of the world was predicted according to the Maya Calendar and read by lots of people, but I don't think many believe it!

H2-international: In 2005, it was announced that this location was going to be part of a "hydrogen mile" from Munich to Verona with several H2 stations (every 100km). The talk is now of a "green corridor". What is the position with this corridor? Are there any more stations now?

Huber: In southern Germany, there are now filling stations in Stuttgart and Munich. Bolzano has been operating for a year. On 21st May 2015, a [hydrogen filling station operated by OMV opened in Innsbruck](#). Plans are under way to open one in Rovereto at Lake Garda. Verona and Modena are set to follow. The hydrogen mile is part of a green corridor from Munich to Verona and Modena. One filling station is set to be completed along the freeway every 100km. The project isn't a dream; there is a genuine will to make it happen. But it will take some time.

H2-international: Your location is a partner of the project HyFIVE (Hydrogen For Innovative Vehicles) that was financed by the EU and began in April 2014. What is your role in this project?

Huber: IIT is helping to develop a fleet of cars, but above all else to push ahead with the construction of filling stations along the Munich-Verona-Modena route, thereby connecting southern Germany with northern Italy. At the same time we are planning to link in the South Tyrol region up with local companies so that the H2 technology leads to the development of a hydrogen economy from which South Tyrol then benefits.

H2-international: Together with Stuttgart, Munich and Innsbruck you are creating the Cluster South. Is this Hydrogen Cluster South in a state of competition with Copenhagen and London, or is it more of a collaboration?

Huber: There is no competition, only collaboration, with every partner setting and pursuing their own priorities. We exchange our results and experiences on a regular basis. This means we all benefit from one another. Different H2 starting points are developing, becoming known and slowly growing together. It is important to understand that the fuel cell cars produced by most of the car companies will be available on the free market over the next five years. They will only go into use, however, where the appropriate infrastructure exists, such as filling stations, service stations, etc. We want to benefit from this and we want local industry to be included as a user and above all else as a producer of the components.

H2-international: What are your further plans right now?

Huber: After our initial steps in the area of mobility, which is set to grow with additional filling stations and the expansion of the bus and car fleets, we will be focusing on the stationary area, such as building services. The training in the technical colleges and vocational schools is set to be strengthened, as we need well-educated people so that the developments can continue and lead to success. Hydrogen technology isn't created on its own and requires considerable levels of hard work and dedication.

H2-international: Thank you very much for this interview Mr. Huber.

Second hydrogen filling station in Austria

[6. October 2015](#) by [Hydrogeit](#)



H2-station (Source: OMV)

On 21st May 2015, the first hydrogen filling station opened in Tyrol, Austria. The new station, on the Andechsstraße in Innsbruck, is situated on one of the most important transit routes in Europe and is part of an existing OMV crude oil filling station at which it will be possible to refuel six fuel cell cars per hour with hydrogen in the future. On the occasion of the official opening, Austrian State Minister Patrizia Zoller-Frischauf made the following comment: “As a heavily used transit country which has to deal with CO₂, particulate and noise pollution, we view an emissions-free future with hydrogen extremely positively.”

Alois Wach, Director of the OMV and Avanti filling station business in Germany and Austria, said: “I am convinced that the mobility of the future will offer a wide range of opportunities: from efficient diesel and gasoline vehicle to the urban electric vehicle to the fuel cell vehicle. We are focusing our development work on fuel cells and therefore on hydrogen. This is an innovation which chimes with our core business since we are already producing large quantities of hydrogen for industry at our refineries.”

Dr. Walter Huber from the IIT (see also [interview](#)) reported: “Innsbruck also links up the east-west route between Vienna and Liechtenstein or Switzerland, since OMV – so I have heard – is also considering locations along the freeway in Linz and Salzburg.” Dr. Walter Böhme, Director of Investment Management at OMV summarized matters clearly in 2014: “Things will really start to pick up around 2025, since by then, almost all of the vehicle manufacturers will need so-called zero emissions vehicles to be able to fulfill their CO₂ requirements.”

H2 Filling Stations for Switzerland

[6. October 2015](#) by [Hydrogeit](#)



H. J. Vock (Source: H2energy)

In Switzerland, the initial trials for the development of an infrastructure for fuel cell vehicles are now underway. At the start of April 2015, a consortium of companies announced that the first public hydrogen filling station is to be built in early 2016. The fuel to be used there is to be produced sustainably using hydroelectric power. For this purpose, the energy services group Axpo, one of the biggest producers of renewable energy in the Alpine state, is planning to construct an electrolyzer directly adjacent to one of its existing run-of-the-river power plants. The hydrogen which is produced in this way will then be sold in the Zürich region at a filling station owned by Coop Mineraloel AG, a subsidiary company of the Coop retail group. A corresponding declaration of intent was signed on 7th April 2015 in Baden, Switzerland. According to the statement of the responsible person at Coop, Jörg Ackermann, it was agreed in the declaration that “the development of the network of filling stations with hydrogen pumps will take place in stages, according to demand.” To help increase demand, Coop will also use fuel cell vehicles in its own fleet in the future. The project management is being provided with the support of H2 Energy AG, in whom Coop has a minority share of capital. The Project Coordinator and Operational Director of H2 Energy is Hans Jörg Vock, who is also a Managing Director at BeBa H2 Storage Systems and Diamond Lite, which has been selling electrolyzers from Proton OnSite (formerly Proton Energy Systems) since 1999.

First German Truck Stop with H2 Station

[6. October 2015](#) by [Hydrogeit](#)



H2 refueling at truck stop (Source: Daimler)

As part of the *50 H2 stations by 2015 program*, on 4th May 2015, the first hydrogen filling station to be situated on a German freeway was opened. The Clean Energy Partnership (CEP) officially opened the facility, which is situated at the Geiselwind truck stop, in the presence of the Parliamentary State Secretary in the Federal Ministry for Transportation and Digital Infrastructure, Dorothee Bär. The station is situated on the A3 between Würzburg and Nuremberg, and therefore closes a gap in the network which will now mean that FC cars can travel safely from Frankfurt to Munich via Nuremberg. State Secretary Bär said: "The financial support to help build this filling station, totaling almost one million Euros, is well invested money because excellent infrastructure is the requirement for ensuring that this new form of mobility is able to really take hold." Alexander Ruscheinsky, Executive Director of the Association for German Truck Stops (Vereinigung Deutscher Autohöfe e.V. / VEDA), highlighted that the truck stops which are situated on freeways are "a cost-effective opportunity for an efficient expansion of new supply networks," as they serve both directions of travel as well as the intersecting state and county highways.

VDMA: Leap forwards to series production

[5. October 2015](#) by [Hydrogeit](#)



Johannes Schiel, VDMA

The *Fuel Cells Working Group* in the German Engineering Federation (VDMA) has presented its new *Fuel Cell Business Survey*. To gather the latest data, the working group completed a survey of approximately 60 members and calculated representative figures on the basis of 40 substantial answers. According to the comments made by the director of the working group Johannes Schiel, “2014 didn’t go so well”. The turnover in the fuel cells industry in Germany with commercially available FC heating devices and power supply systems in 2014 was only a moderate 70 million Euros, after 50 million Euros in 2013. As, according to Schiel, these figures correspond to “something of a sideways development” at a low level, the authors of the business survey promptly reduced their expectations for 2020 from a previous 2 bn. Euros to 1.8 bn. Euros. Among other reasons, Schiel described the cause for the stagnation as being “uncertainty caused by the amendment of the *German Renewable Energy Act (EEG)*”.

In a further result, it was determined that there are also delays to the short- and medium-term introduction of technology. For example, the 100 million Euro threshold of sales in Germany has been achieved around two years later than originally expected. Despite this, the VDMA is looking to the future with optimism, and for the current year it is expecting growth to total 80%. As expected, according to the employment figures for 2015, approximately 1,900 people currently work in the parts of the FC industry that were surveyed.

Although the authors describe the technology as largely having matured, the VDMA has requested additional methods for a “successful leap forwards to series production.” Executive Chairman of the *Fuel Cells Working Group*, Dr. Manfred Stefener, also Managing Director of Elcore, said the following: “What the fuel cells

sector needs is reliable framework conditions". Moreover, Schiel also reported that discussions had taken place with the corresponding government ministries and that "the world of politics has signalized that funding will be provided".

The figures stated in the business survey include a premium in total of 75% (2014/2015) and/or 100% (2020) which the authors of the study added to the basic results of the survey.

FCH JU: ene.field had a slow start

5. October 2015 by Hydrogeit

So that additional FC heating devices go into use throughout Europe, work is currently underway on a successor program to the currently existing *ene.field* project. Its goal is to achieve a further reduction in the costs of micro-CHP units (of approx. 30%). The new program aims to constitute the second demonstration step for manufacturers of all types of FC. To this end, financial resources in total of approx. 30 to 40 m. Euros might be provided by the EU so that every manufacturer is able to install around 500 additional devices (< 5kW). In total, 2,500 new systems are to be brought into use and their running time extended. Moreover, the profile of the FC heating devices is also to be raised. An appropriate call for proposals was started by the *Fuel Cells and Hydrogen Joint Undertaking (FCH JU)* on 5th May 2015 as part of the *Horizon 2020* program.

In the current *ene.field* demonstration project, 1,000 units have been subsidized by up to 40% in twelve EU countries (in total, 53 m. Euro over 5 years) since September 2012. Project Coordinator Fiona Riddoch admitted that *ene.field* "had got off to a slow start," but also stated with confidence that "the project is now on the right path". The new edition of the *Fuel Cells and Hydrogen 2 Joint Undertaking (FCH 2 JU)* is to have a total funding volume of 123 m. Euros and covers the areas of both the transportation and the electrolysis.

Roland Berger study calls for investment incentives for end customers

[5. October 2015](#) by [Hydrogeit](#)



“Stationary fuel cells in Europe are on the threshold of a commercial market launch.” This finding in the study by Roland Berger Strategy Consultants implies that the market launch of FC heating devices is yet to take place. So that a commercialization can take place, according to the analysis on the status of stationary fuel cell technology in Europe, “support by the state is required in the initial phase”.

In the scope of the study commissioned by the Fuel Cells and Hydrogen Joint Undertaking (FCH JU), the authors considered different types of stationary fuel cells in differing output ranges and areas of use, and ascertained that in Europe “some are ready for market launch on a large-volume series scale, while others are focusing on research and development and on demonstration projects”. They contrasted fuel cells with several other processes for decentralized energy production, and compared them over a projected time frame of 35 years in three different scenarios (low, moderate and high degree of decentralization). The focus here was on the markets in Germany, Great Britain, Italy and Poland. Natural gas played a key role in the analysis, but biogas and hydrogen were also considered. A focus was also made on the increase in efficiency currently being pursued in Europe as well as on the reduction of emissions.

Most of the statements made on the 185 pages aren't really new, however, such as “stationary fuel cells can reduce energy consumption and emissions” or “fuel cells can only be competitive if their production costs are reduced”, or “fuel cells are not only able fulfill customers' requirements concerning home energy supply systems appropriately homogeneously, industry is also able to provide customized solutions

on a multi-megawatt scale for special industrial applications, such as in breweries or waste water treatment plants.” With a range of statements like these ones, the authors of the study have attempted to explain in great detail that in their view, fuel cells have the potential to “enable Europe to move across to a new era in energy”.

In this context, it is interesting that the greatest market potential for the conversion and new construction of heating systems in the home energy sector is to be found in Great Britain. By 2030, around 904MWel are expected in the form of new constructions in the UK, while Germany will require around 500MWel. In terms of commercial buildings, Germany is in third place behind Great Britain and Italy – in both 2012 and in 2030. The federal republic will likely only be able to maintain its leading position in the area of industrial applications. In terms of the global competition for micro-CHP systems and selected industrial solutions, author of the study Heiko Ammermann made the following comment: “In Japan, South Korea and the USA, systems of this kind have been on the market for many years. It is now up to the European industry to catch up.”

Expensive findings

While in other countries, six-digit numbers of fuel cell devices are being sold, in Germany, a new and comprehensive study, which was also expensive, was required in order to tell us that there is a “high degree of market potential” for this technology. FCH-JU Director Bert De Colvenaer told *H2-international* the following: “The study took a whole year to complete (March 2014 until March 2015), and we paid for it – after a formal tendering process – to the tune of 1 million Euros”.

Many of the key statements in the study relate to the demands made by German and European fuel cell companies. In addition to new models of financing such as contracting offers, market activation methods are also demanded, since “stationary fuel cells are not currently competitive from the total costs of ownership perspective”. In particular, the need to reduce the initial investments required (30,000 to 40,000 Euros per micro-CHP unit) is highlighted, with investment incentives for end customers for example, so that bigger unit volumes can be produced quickly, for which further automation and more standardization is required.

Specifically, the authors recommend funding for the market launch from 2015 onwards in sum total of 8,000 to 12,000 Euros per kWel for 5,000 to 10,000 FC heating devices. In a second industrialization phase, from 2017 until 2020, a further 2,000 to 4,000 Euros per kWel should be invested for another 5,000 to 10,000 units, which corresponds to a total funding volume of 50 to 160 million Euros. Supplemented with funding steps for commercial buildings (5 to 22 million Euros) as well as industrial applications (15 to 60 million Euros), this would result in a total funding volume of 70 to 242 million Euros.

Bert de Colvenaer, Executive Director of the *Fuel Cells and Hydrogen Joint Undertaking*, explained: “Stationary fuel cells have reached a decisive point in Europe and they have a genuine chance for commercialization. The industry should now make good on its technological and commercial promises – with initial financial support provided by the state.”

The following statement, made by Heiko Ammermann, partner of Roland Berger Strategy Consultants, caused some irritation: “Supplying hydrogen doesn’t present a

problem.” This is so because it gives the impression that FC heating devices are to be converted to hydrogen-only operations over the long term, which is not the current intention, however.

The study, [Advancing Europe’s energy system: stationary fuel cells in distributed generation](#), was completed by over 30 participants from the industry, who contributed articles in the form of a “study coalition” – as it is called in the masthead. In contrast to scientific studies by independent authors, this paper does not constitute a neutral market analysis but a presentation of the FC industry, how it evaluates the current and also the future situation in the area of stationary fuel cells, and the steps which it considers necessary to be able to work on an economically efficient basis as quickly as possible.

Literature:

Advancing Europe’s energy system: stationary fuel cells in distributed generation, FCH JU, March 2015

Brussels has decided on H2 fuel

[2. October 2015](#) by [Hydrogeit](#)



Oliver Weinmann requested at least a triple offsetting.

While the further development of the H2 and FC technology is diligently perfected in the laboratories and workshops using new catalyst materials or production processes, elsewhere – just as diligently – discussions are taking place about the political framework conditions. In spring 2015, it was decided in Brussels that in the future, during the refining of fuels, hydrogen which is produced from renewable energies will gain a multiple offsetting against the biofuel quota, but “only” by a factor of two and not – as requested by many – by a factor of four.

On 19th September 2014 the German upper house of parliament, the Bundesrat, discussed the draft legislation from the German federal government on the

amendment to the Federal Immission Control Act (BImSchG), and expressly welcomed the fact that – as planned in 2009 – the previous biofuel quota in the transport sector was to be abolished and in its place, a greenhouse gas reduction quota would be introduced in 2015. The Bundesrat described this step as being a clear improvement to the climate balance of biofuels, as an incentive for the decarbonization of fossil fuels, and therefore as an important contribution to protecting the climate. Since power-to-gas technology had been ignored in the previous draft legislation, the Bundesrat also expressly requested the federal government to include power to gas as a method for the production of green hydrogen in the paper.

On 13th October 2014, the German lower house of parliament, the Bundestag, then passed the legislation with these amendments. The federal government also confirmed that over the medium to long term, fuels of this kind could make a contribution to climate protection with fuels.

In April 2015, the European Parliament discussed the Renewable Energy Directive (RED) and the Fuel Quality Directive (FQD) concerning the offsetting of different fuels against the greenhouse gas reduction quota. It decided that the EU member states will have to ensure that by 2020, at least ten percent of the energy consumed in the transport sector is covered by renewable energies. While the proportion of biofuels from the first generation is limited to seven percent, biofuels from the second and third generations will be subsidized with multiple offsetting. In the case of hydrogen which is gained from renewable energies, the politicians decided against quadruple offsetting, but in favor of the double offsetting of its energy content for the greenhouse gas reduction quota.

Werner Diwald, DWV Chairman and Speaker of the performing energy initiative, said the following: “With the double offsetting of the green hydrogen, at a three-gigawatt electrolysis performance, it would be possible to reduce greenhouse gases by three percent when compared with the reference values for the second and third generation biofuels.” In the run-up, the German Hydrogen and Fuel Cell Association (DWV) vehemently argued in favor of a quadruple offsetting. On this basis, for example, Dr. Oliver Weinmann, member of the DWV board and Managing Director of Vattenfall Europe Innovation, made the following complaint during the trade fair in Hanover: “With a double offsetting it isn’t profitable. You might as well forget it.” A spokesperson from the renewable energy sector said: “The quadrupling is important for those who are backing motor vehicles.”

Diwald further explained that a temporally limited triple offsetting would be enough so that the price of fuel does not increase in the future. With a double consideration, it would be 0.1 to 0.2 percent more expensive. Diwald stated further that this multiple offsetting was actually a “cheat” from the climate point of view, since the multiple quantity of carbon dioxide won’t really be saved. He justified this step by pointing out that with the use of hydrogen at the end of the energy conversion process, with the fuel cell, a highly efficient energy transformer was available, so that in comparison with the consumption of crude oil in combustion engines, a gain in both efficiency and environmental friendliness was evident.

The DWV Director also pointed out that biofuels in combustion engines. He stated that engines of this kind have almost reached the end of their scope for optimization, however, which means that an effectiveness level of 21% is barely achievable. Fuel

cells, however, offer the possibility of an “increase in efficiency of 50%”. Hydrogen also helps to reduce the dependency on crude oil.

Whether this decision is actually the last word from Brussels remains to be seen. Different sources have already reported that a step model could be used to improve the position of hydrogen. The next step, however, is for the Brussels regulation to be implemented into national law via an ordinance in every EU country on a voluntary basis. The DWV therefore appealed to the German Bundestag to complete this step consistently and with immediate effect. Bernd Westphal, member of the German Bundestag and member of the Committee for Economy and Energy, explained that it may be possible for this to take place during this legislative period. According to the EU decision, the European regulations have to be implemented by 2017.

Federal Office of the Environment

According to the Federal Office of the Environment, purified biogas and electricity which is produced on a renewable basis are viewed to be “the most promising long-term candidates in terms of climate protection for providing an important contribution to the sustainable provision of energy to transport on the basis of volume”. Biofuels from the first generation, however, are viewed to be inefficient, while further research is needed into biofuels from the second generation (e.g. BtL). According to the UBA study on Post-fossil energy supply options for a greenhouse gas neutral mobility, hydrogen is described as being “a very long-term option (beyond 2050)”.

WES integrates green2market

[2. October 2015](#) by [Hydrogeit](#)



This year, the *World of Energy Solutions* will be taking place from 12th until 14th October in Stuttgart together with the *green2market*. The company Peter Sauber Messen und Kongresse GmbH initially tried to stage a “Dialog Forum for Environmental Psychology and the Economy” last year. Together with Angela Imdahl from the Imdahl Institute, initiator Peter Sauber had planned to hold an independent conference on this topic in November 2014. This project failed, however, because it didn’t manage to achieve the requisite number of registrations. The *green2market 2014* was then canceled at short notice. However, Sauber and Imdahl immediately announced their intention to give the project a second try this year, because they view the topic to be a source of “exciting and valuable ideas.”

The *green2market* 2015 has the self-explanatory subtitle “Successfully marketing green products” and is affiliated to the *WES* on 12th October to enable the participants to benefit from synergy effects. This time, the initiators have made a bigger effort than before to address “green players” and environmental psychologists at this dialog forum.

This year, the World of Energy Solutions has chosen the Netherlands as its partner country. It isn't without good reason that the *Electric Vehicle Index* from McKinsey has the Netherlands in second place; Telsa, for instance, has its European assembly site in Tilburg, where a second production hall is set to open in the summer of 2015. The province of Noord-Brabant thus organized the construction of a 100m² pavilion for the Netherlands at the Stuttgart trade fair in the fall. Another new development this year: the presentation of the *f-cell award* is to take place in the old Stuttgart riding hall at the Maritim Hotel.

Fuel Cell Forklift Trucks Undergoing Testing

[2. October 2015](#) by [Hydrogeit](#)



(Source: Daimler)

Mercedes-Benz doesn't only sell vehicles powered by hydrogen fuel cells; it also uses them at its production facilities. Since the start of June 2015, the firm's transporter plant in Düsseldorf has been operating two forklift trucks which are powered by hydrogen fuel cell. The forklift trucks were manufactured by Linde Material Handling and are supplied on location at a mobile H₂ filling station provided by Air Products. One of the goals of the project, which will continue to the end of 2016 and has been supported by the Federal Ministry of Transportation, is to increase the availability of the forklift trucks at the plant.

BMW has also taken a similar path: since December 2013, as part of the *H2IntraDrive* project, five fuel cell forklift trucks and four fuel cell haul trucks have been used to assist with the production of the *i3* in Leipzig. Another demonstration project has been up and running since the end of 2014 at Gelo-Holzwerke GmbH in

Weißensadt. Here, a prototype from the Italian manufacturer Baumann is being used. Wolf-Christian Küspert, Managing Director of Gelo-Holzwerke, told the *Frankenpost* newspaper: “The company gave us the prototype for research purposes.”

Frömmel and Melczer elected to the NEW-IG

[28. September 2015](#) by [Hydrogeit](#)



At its annual meeting earlier this year, the New Energy World Industry Grouping (NEW-IG) elected its new executive board. The new members, who will initially serve for two years, are Thomas Melczer and Andreas Frömmel. Melczer, Director of Business Development at Proton Motor Fuel Cell, is now responsible for the Membership/JU Commitment, while Frömmel, Vice President of Commercial and Business Development at FuelCell Energy Solutions, has become responsible for Energy Transition Solutions. Gaëlle Hotellier, Director of Hydrogen Solutions at Siemens, was elected to serve another term as the Head of the Energy department.

The NEW-IG currently counts 85 companies and members from the Fuel Cells and Hydrogen Joint Undertaking (FCH JU), which supports research, technical development and demonstration projects for fuel cell and hydrogen technologies in Europe.

www.new-ig.eu

Biogas plants become control energy power plants

[24. September 2015](#) by [Hydrogeit](#)



GP Joule installed 24 electrolyzer stacks (Source: GP Joule)

At the end of April 2015, GP Joule began testing its electricity fill-in concept. As part of the 200 kW H₂ biogas project, the engineers at the head office of the company in Reussenköge, Germany, installed two electrolyzers, each with 5 kW stacks. In May, the plant was extended, with 16 additional stacks initially being installed. By the summer of 2015, the first four stacks were set to be replaced with a total of 24 new modules so that the nominal output then totals 200 kW. This enables 40 cubic meters of hydrogen to be produced every hour, and the electrical energy which is stored can then be fed into the network on a time-delayed basis.

The electrolyzer stacks, which are supplied by the Lübeck subsidiary company H-Tec Systems, use excess solar- and wind-generated electricity to produce hydrogen. The gas which is produced in this way is stored on a temporary basis. If required, it is mixed with the gas mix from the local biogas plant, which contains methane in a 30/70 ratio, and then burnt in a CHP plant. The electrical energy which is generated as a result goes to the electricity network, while the thermal energy that is set free goes to the local heating network. According to the manufacturer's details, the degree of effectiveness with the use of the electricity and heat totals up to 95%.

As the next step in this 5.9 million Euro project, which has been supported to the tune of 2.1 million Euros by the Federal Ministry of the Environment, GP Joule is planning to build a megawatt plant. To this end, completely new components will have to be developed for the PEM stack, however. The goal of this concept is to reduce the required quantities of biomass resources with the help of solar and wind energy, and to be able to operate the biogas plant as a flexible control energy power station at the same time. This concept sees biogas plants gaining a new role, so that they don't have to be operated at full capacity for 8,700 hours. One major shortcoming of this concept, however, is the end-consumer levy, payable in this case due to the latest legislation governing the use of hydrogen produced in electrolyzers. Timo Bovi, Spokesman of GP Joule, had the following to say: "This double levy has hit us hard. We want the same conditions for everyone."

Hydrogeit Verlag offers 25 percent early bird discount for H2-international subscribers

22. September 2015 by [Hydrogeit](#)



There is a major information deficit with the topic of hydrogen and fuel cell technology – both in expert circles and in the public realm. There are almost no affordable English magazines that cover the research results from other regions of the world. The few press releases which are published on the internet often suffer from a lack of detailed facts. For this reason the Hydrogeit Verlag is now offering a new information service which reports on the latest developments in the hydrogen and fuel cells sector: *H2-international*.

H2-international is a blog and a newsletter. The newsletter appears monthly and is published worldwide via the internet. On the blog at www.h2-international.com news reports and technical reports are regularly published which provide detailed information on the latest research results and the progress of the developments in the area of H2- and FC technology. The texts are based on articles which appear in the [Magazine for Hydrogen and Fuel Cells HZwei](#). This contains reports from specialist journalists and well-known scientists on the technical developments, the current developments and demonstration projects.

Most of these reports cover topics from German-language regions, although numerous texts are also published on international activities. On this basis, the US hydrogen expert Robert “Bob” Rose reports on the technical developments in North America and in Japan while Sven Joesting analyses the share prices at leading global fuel cell companies, and foreign correspondent Alexandra Huss informs on a wide range of other regions worldwide.

All of the texts will initially be free to access but from autumn 2015 onwards, it will only be possible to read them in return for payment. Those who sign up to an annual subscription until October 2015 can save 25 % by using the early bird discount.

H2-international – International News about Hydrogen and Fuel Cells

Publisher: Hydrogeit Verlag, Sven Geitmann, geitmann@hydrogeit.de

www.h2-international.com

The Hydrogeit Verlag was founded 2004 by Sven Geitmann and is now located in Oberkraemer nearby Berlin in Germany. It is the first and only publishing house for hydrogen and fuel cells. The Hydrogeit Verlag publishes books, e-books, and the German Magazine for Hydrogen and Fuel Cells HZwei.

ENE-FARM installed 120,000 residential fuel cell units

[21. September 2015](#) by [Hydrogeit](#)



Nedo, Japan, showed their first CHP fuel cell systems in Hannover 2008

Japan's ENE-FARM program is arguably the most successful fuel cell commercialization program in the world. ENE-FARM has supported the deployment of well over 120,000 residential fuel cell units and is providing proof that long term public-private partnerships can push new technology into the marketplace. New models coming on the market in 2015 are smaller, more efficient, cheaper and more easily installed than previous models. Models have been developed for apartment buildings as well as for homes and are being offered as a customer option by apartment complex developers, along with other appliance options. New units can operate independently if the power grid fails – a response to consumer concerns over electric power reliability in post-Fukushima Japan. While a number of companies have participated in development and early deployment, the main participants today are Panasonic and Toshiba, which offer PEM units, and Aisin Seiki, offering SOFC units. The PEM units are exceptionally durable, achieving greater than 60,000 hours while cycling daily, an achievement that a few years ago would have been regarded as wildly impossible.

Panasonic claims its 2015 model achieves 95% combined heat and electrical efficiency. Earlier models were estimated at 80% to 90%, and manufacturers compare those efficiencies to grid efficiency of 35% to 40%. The units operate in partnership with the grid, cycling on and off in response to the home's demand for electricity and hot water. The overall result is a reduction of as much as 50% in household CO2 emissions, and a consumer electricity cost savings of ¥60,000 to ¥75,000.

Osaka Gas, which is offering fuel cell units in combination with rooftop solar power for new homes, claims even better performance, a 57% reduction in household CO2 and a consumer savings of ¥129,000.

Japan's interest in residential fuel cells dates to the 1999. The *Millennium Project* included support for PEM research. Japan's residential energy sector is relatively large as a percentage of total demand, and the sector has been growing as consumers have developed higher expectations for housing. A large scale demonstration program, totaling 3,300 units, began in 2005 and was successful enough to justify commercial launch in 2009, supported by a deep government subsidy.

The commercial program included a collective marketing strategy called ENE-FARM, which carried out a consumer education and advertising strategy complete with a cute cartoon monkey and humorous video advertising that generated a very high level of consumer awareness. The average Japanese person may not know what a fuel cell is, but very likely has heard of ENE-FARM. Natural gas suppliers have begun doing more of their own marketing but the ENE-FARM brand endures.

The ENE-FARM program is a model public-private partnership. In 2009, the government agreed to pay ¥1.4 million per unit, or up to half the unit cost, and made a multi-year commitment with a declining subsidy per unit, but an increasing overall budget. About 2,300 units were installed in 2009; the number installed has grown steadily to more than 120,000, while the per-unit subsidy has declined to ¥500,000 to ¥600,000. Sales have approximately doubled annually since 2012. The 2015 budget for ENE-FARM subsidies is ¥22.2 billion, according to a government presentation at the 2015 FC Expo, a showcase for Japan's fuel cell programs. Subsidies are scheduled to end at the end of next year. Discussions have begun with the government to develop a follow-on support program. Meanwhile, residential fuel cell companies are looking to Europe for new markets.

The commitment to hydrogen in Japan's new *Fourth Energy Plan* certainly is based in part on the exceptional success of Japan's commitment to residential fuel cells. The ENE-FARM program demonstrated the capability of fuel cells and the capacity of developers to improve their products rapidly given a significant early market. Japan's "central role" for hydrogen includes targets of 1.4 million residential units by 2020 and 5.3 million by 2030 (about 10% of Japan's homes). Japan is exploring hydrogen pipelines to support these units, hybrid and micro-grid systems to take advantage of generating capacity and make room for slightly larger SOFC systems, and, of course, a transition from petroleum to hydrogen for transportation.

Author: Robert "Bob" Rose

H2 Mobility Joint Venture Established

21. September 2015 by [Hydrogeit](#)



On the basis of the *H2 Mobility* initiative which was established in September 2009 – as previously announced – a joint venture has been initiated. At the end of 2014, the partners Air Liquide, Daimler, Linde, OMV, Shell and Total completed the final steps required to establish the company *H2 Mobility Deutschland GmbH & Co. KG*. The new company, which is based in Berlin, has been in its development phase since January 2015. Frank Sreball is its Managing Director. His goal is to get approximately 400 H₂ filling stations up and running and under the company's operation by the year 2023. The partners initially concluded a basic agreement on the development of a nationwide network of H₂ filling stations for fuel cell vehicles (comprising of 50 stations by 2015), which is now set for further expansion. www.h2-mobility.de

Timetable

- October 11th to 14th 2015, **World Hydrogen Technologies Convention**, Sydney, Australia, www.whtc2015.com
- October 12th 2015, **green2market**, Stuttgart, Germany, www.green2market.com
- October 12th to 14th 2015, **World of Energy Solutions**, Stuttgart, Germany, www.world-of-energy-solutions.de
- October 19th to 21st 2015, **International Conference on Hydrogen Safety - HySafe**, Yokohama, Japan, www.ichs2015.com
- October 20th to 22nd 2015, **eCarTec**, Munich, Germany, www.ecartec.com
- November 16th to 19th 2015, **Fuel Cell Seminar & Energy Exposition**, in Los Angeles, California, at the Westin Bonaventure, www.fuelcellseminar.com
- November 17th to 19th 2015, **8th FCH JU Stakeholder Forum**, Program Review Days (17th - 18th), in Brussels, Belgium, www.fch.europa.eu
- November 17th to 20th 2015, **Zing Hydrogen & Fuel Cells Conference**, Cancun, Mexico, www.zingconferences.com

Companies

Do you also want to be part of this **List of Companies on H2-international**? Such an entry on the website and also in the newsletters costs only US-\$ 135 (120 Euro).

Please let me know if you want to book this entry and you will be part of every newsletter twelve times a year.

see: www.h2-international.com/companies/

Fuel Cells



- Fuel Cells · Power Systems

Proton Motor Fuel Cell GmbH, Benzstrasse 7, D - 82178 Puchheim, Tel. +49-(0)89-1276265-0, Fax -99, www.proton-motor.de

Fueling



- **Busch Clean Air S.A.**

Chemin des Grandes-Vies 54, 2900 Porrentruy / Switzerland, Tel. +41 (0)32-46589-60, Fax -79, info@buschcleanair.com, www.buschcleanair.com



- **Gardner Denver Thomas GmbH**, www.gd-thomas.com

Electrolyzers



- **AREVA H2Gen**, Maarweg 137, D - 50825 Cologne, Tel. +49-(0)221-88824488, www.arevah2gen.com



Diamond Lite SA

- **Diamond Lite S.A.**, Rheineckerstr. 12, PO Box 9, CH - 9425 Thal, Tel. +41-(0)71-880020-0, Fax -1, diamondlite@diamondlite.com, www.diamondlite.com
- **H-TEC SYSTEMS GmbH**, PEM-Electrolyzers, Maria-Goeppert-Str. 9a, D - 23562 Lübeck, Tel. +49-(0)451-39941-0, Fax -799, info@h-tec-systems.com, www.h-tec.com
- **Heliocentris Industry GmbH**, Tel. +49-(0)30-340601-500, Fax -599, sales@heliocentris.com, www.heliocentris.com

HYDROG(E)NICS

SHIFT POWER | ENERGIZE YOUR WORLD

- **Hydrogenics GmbH**, Am Wiesenbusch 2, D - 45966 Gladbeck, Tel. +49-(0)2043-944 141, Fax -6, hydrogensales@hydrogenics.com, www.hydrogenics.com
- **ITM Power GmbH**, Energy Storage – Clean Fuel, Hegewiese 4C, D - 61389 Schmitten, Tel. +49-(0)6084-950012, www.itm-power.com
- **McPhy Energy Deutschland GmbH**, Oberer Mainkai 1, D - 97070 Würzburg, Tel. +49-(0)931-35987-244, www.mcphy.com

Measurement



GREENLIGHT
INNOVATION

- **Greenlight Innovation Corp. Canada**, tlutz@greenlighteurope.com, www.greenlightinnovation.com

Membrane and Separator



- **FuMA-Tech Gesellschaft für funktionelle Membranen und Anlagentechnologie mbH**, Carl-Benz-Str. 4, D - 74321 Bietigheim-Bissingen, Tel. +49-(0)7142-3737-900, Fax -999, www.fumatech.com

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

Organization

- **hySOLUTIONS GmbH**, Steinstrasse 25, D - 20095 Hamburg, Tel. +49-(0)40-3288353-2, Fax -8, hysolutions-hamburg.de

Reformer

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

Research & Development

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



- **Fraunhofer ISE**, Heidenhofstrasse 2, D - 79110 Freiburg, Tel. +49-(0)761-4588-5202, Fax -9202, www.h2-ise.de

Storage

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

Suppliers



- **Borit NV**, Bipolar Plates and Interconnects, Lammerdries 18d, BE - 2440 Geel, Belgium, joachim.kroemer@borit.be, www.borit.be



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



- **Heraeus Precious Metals GmbH & Co. KG**, Electronic Materials Division, Business Unit Circuits & Components, Heraeusstr. 12-14, D - 63450 Hanau, Tel. +49-(0)6181-35-5466, Fax -7850, www.heraeus-circuits-components.com



HYDROGEN AND INFORMATICS
INSTITUTE OF APPLIED TECHNOLOGIES

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



VERSORGUNGSTECHNIK

- **Theisen GmbH & Co. KG**, GH2 & LH2, info@theisen-gmbh.de, www.theisen-gmbh.de



CRYOGENICS

- Member of the **ARCEP** Group

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

System Integration



**Deutsches Zentrum
für Luft- und Raumfahrt**
German Aerospace Center
Institute of Engineering Thermodynamics

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



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

Specials

- **Free tickets** for the trade show [World of Energy Solutions](#) from October 12th to 14th 2015 in Stuttgart, Germany
- **20% discount** for travel costs to [green2market & World of Energy Solutions](#) from October 12th to 14th 2015 in Stuttgart, Germany
- **Free tickets** for the trade show [eCarTec](#) from October 20th to 22th 2015 in Munich, Germany

Please contact *H2-international* for more details.

Advert

INTERNATIONAL NEWSLETTER

ABOUT HYDROGEN AND FUEL CELLS

NEW
Get your early bird
discount and
save 25 %



www.h2-international.com

H2 INTERNATIONAL NEWSLETTER FOR
HYDROGEN AND FUEL CELLS
international

Imprint & Social Media

H2-international – Hydrogeit Verlag, Sven Geitmann, Gartenweg 5, 16727
Oberkrämer, Germany, Tel: +49 (0)33055-21322, Fax: +49 (0)33055-21320

E-Mail: info@h2-international.com, Homepages: www.h2-international.com &
www.hydrogeit-verlag.de, UID/VAT: DE221143829

