GREAT FUEL CELL POTENTIAL IN RAIL AND CARGO TRANSPORTATION

SWITZERLAND TO SET UP HYDROGEN INFRASTRUCTURE
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STUTTGART – THE ELECTRIC INDUSTRY’S MEETING POINT
EVS30, f-cell and Battery+Storage

One of the biggest electric transportation conferences in the world will open its doors from Oct. 9 through 11 in the German state capital of Baden-Württemberg. Stuttgart. In 2017, the city’s show grounds will see three events run in parallel – the Electric Vehicle Symposium or EVS for short, the f-cell and the Battery+Storage. One day before the start of those, Stuttgart will have its Electric Transportation Day, Afim.

This year, one ticket will give attendees access to three conferences – EVS30, f-cell and Battery+Storage – and free choice between all their sessions. The trio will offer the latest research findings, best practice examples, technology advancements and hands-on experience from projects on vehicles and transport means, electric engines and applications, components, charging and refueling infrastructures, commercialization and marketing strategies, energy and environmental analyses, and transportation designs. Discussions will also revolve around the technological and political developments at German, European and international level.

With the EVS turning 30, the bar has been set higher than ever. All 650 conference submissions have had to pass the exam twice, once on the subject and once on the quality of the presentation. The event will certainly reflect the political mood in possible negotiations with the European Commission’s vice president for energy union, Maroš Šefčovič, or the state’s environment minister from the Greens, Bernd Hömberg, Haus der Technik e.V., essen  |  Phone: +49 201 1803-249  |  email: b.hoemberg@hdt.de

The host of EVS’s thirtieth installment are the World Electric Vehicle Association and the European Association for Electromobility. After the opening remarks, the floor will be given to Espen Hauge, WEVA’s president, Winfried Kretschmann, the head of Baden-Württemberg’s state government, and Maros Šefčovič, the European Commission’s vice president for energy union.

The state’s economy minister, Nicole Hoffmeister-Kramp, did admit to nemo, a local Swabian magazine, that we “are experiencing a paradigm shift from the car as a product to transportation as a service.” However, before Stuttgart’s ground-breaking court decision, she had been doubtful as to whether “there really will be any bans on driving.” She said: “In my eyes, there are a lot of reasons, for providing exceptions in the case of commercial operations and residents impacted by such bans. I would like to see an end to the oft-experienced diesel bashing. That doesn’t help us.”

She didn’t see any parallels between Stuttgart’s situation and the one in Detroit, where the three largest American carmakers – GM, Ford and Chrysler – had to deal with drastic cuts that almost led to a complete breakdown in production ten years ago. “First, the Stuttgart region has a much more diversified economy than Detroit. Second, the American city had started to miss out on important trends,” she said.

Thomas Walter from Messe Stuttgart had a different opinion: “Fossil fuels are past their peak. We believe that electric transportation will fundamentally change the way we travel. But for this to happen, the technology needs to be available on the mass market.”

THE CAPITAL CITY OF ELECTRIC TRANSPORTATION

The main items on this year’s f-cell agenda will be the intelligent transportation, new trends and applications for electric drive systems. The discussions on electric transportation will already start a day earlier, just as the joint exhibition in hall 1 (the L-Bank Forum), networking opportunities, the poster session, catering and outdoor activities. And the day before, on 8 October, people can participate in the Electric Transportation Day in Stuttgart on Marktplatz and Karlsplatz. Titled “Stuttgart, the global capital of electric transportation,” the inner-city event will provide details on the program at the show grounds to road users and potential customers, a chance to Ride & Drive, an electric car rally, and an extensive Q&A on infrastructure and transportation offerings.

The exhibition – at which more than 250 organizations are expected to showcase their technology and services – will provide a platform for manufacturers, users and decision makers to get an up-to-date overview of all forms of electric transportation, new trends and applications for electric drive systems. One exhibitor on the 20,000 square meters will be 3M, a technology supplier whose Advanced Materials Division intends to illustrate together with the company’s Dyneon subsidiary how the fluoropolymers developed in-house can increase a fuel cell’s or battery’s performance and life (booth 1G14 in hall 1). The organizers of the entire three-day show are Messe Stuttgart, the federal Solar Mobility Association, Baden-Württemberg International, e-mobil BW, Peter Sauber Agentur and Stuttgart Region Economic Development Corporation. They will be supported by local businesses from the automotive industry and its suppliers. Wolf-Henning Scheider, chair of Mahle’s management board, said: “Mable considers Stuttgart’s EVS30 to be an important event sending the clear message that drive systems will continue to be developed in the region where the automobile was born.”

Fig. 1: Thomas Walter, Messe Stuttgart, and Franz Loogen, e-mobil BW

© Messe Stuttgart

POLITICAL DISCOURSE
Considering the starting date, exactly two weeks after Germany’s general election, the event will certainly reflect the political mood in possible negotiations about a governing coalition. The election may have considerable impact not only on the development in the hydrogen and fuel cell industry, but also on energy storage and electric transportation. When listening to past speeches of the hydrogen and fuel cell industry, but also on energy storage and fuel cell stakeholders.

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CARBON-FILLED AIR AS RAW MATERIAL SOURCE

CO₂ Capture to Produce Plastics and Fuels

Carbon dioxide may be a greenhouse gas, but it can also be a raw material source in industries such as plastics processing and renewable energy generation, where it could gradually replace natural gas and crude oil. Capturing carbon dioxide directly from air provides several advantages for combating climate change. While limiting the atmospheric concentration of CO₂, it offers new opportunities in the chemical industry to synthesize hydrocarbons.

As much as it may be a surprise, one future raw material source is carbon dioxide, whose environmental exposure we aim to limit, and air is a virtually inexhaustible resource. The latter we intend to tap into as part of the three-year CORAL project launched last fall. Its objective is to show power plant operators who have no access to concentrated CO₂ sources that they do have an economically feasible and environmentally sensible solution at their disposal.

SEARCH FOR THE MOST EFFICIENT SOLUTION

There have already been several methods available to extract carbon dioxide from air and use it to synthesize raw materials. The aim of CORAL is to determine the most efficient and inexpensive technique. The next step would be to build a demonstration system and test the selected method, showing that key chemical compounds, such as ethanol, dimethyl ether and propylene, could be created based on nothing but renewable resources in the future.

Air capture will be of particular interest to energy suppliers at remote locations. To give an example, wind power plants on Chile’s coastline could convert electricity directly into hydrogen and methane through on-site power-to-gas systems. The carbon dioxide for methanation could be extracted from the surrounding air and would no longer have to come from sites a few thousand kilometers away. There would be no need for any power lines either, since electricity is put into chemical storage. To create carbon dioxide, one could recover the waste heat from electrolysis and synthesize and reduce the overall energy consumption throughout those processes – another focus area of CORAL.

FROM CO₂ SUPPLY TO WASTE HEAT RECOVERY

The last point also seems to distinguish their capture from similar, but very energy-consuming methods for extracting CO₂. It is their power demand that won’t allow them to leave the R&D stage. ZSW’s experience with cost-benefit analyses dates to 2016, when a pilot plant was built to demonstrate successfully that heat, which had been captured in the exhaust of the furnaces at voestalpine – were awarded the contract for setting up a 6-megawatt pilot between the furnaces at voestalpine in Linz. By their own account, the objective was to construct one of the world’s largest PEM electrolysis systems for producing green hydrogen and determine whether it could be deployed as a load-following power plant and whether the hydrogen itself could be used in industry. Their efforts will be supported by the Fuel Cells and Hydrogen Joint Undertaking and the project ENergySTORAGE.

HYDROGEN TO REPLACE COAL

H₂ Pilot System at Steelmaker

Now, there’s another installation to add to the growing list of hydrogen production systems: H2Future in Linz, Austria. Supported by the European commission, it is managed by a consortium aiming to produce “green” hydrogen in large quantities to bring the energy and industrial sector closer together.

On Feb. 7, 2017, the consortium partners – APG, Siemens, VERBUND and voestalpine – awarded the contract for setting up a 6-megawatt pilot between the furnaces at voestalpine in Linz. By their own account, the objective was to construct one of the world’s largest PEM electrolysis systems for producing green hydrogen and determine whether it could be deployed as a load-following power plant and whether the hydrogen itself could be used in industry. Their efforts will be supported by the Fuel Cells and Hydrogen Joint Undertaking with around EUR 12 million in funds from the EU’s Horizon 2020 program.

More precisely, the EUR 18 million project will have hydrogen produced by an on-site Siemens electrolyzer feed directly into the in-house grid for use in steelmaking, while the required power will be supplied by Austria’s largest utility, VERBUND. Dutch-based ECN is said to conduct the related research throughout the four-and-a-half year test run, for example, if and how the process could be adapted for other industries. Additionally, APG will test the comparatively “flexible” PEM system for its feasibility in the load-following power plant market.

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Fuel Cells Put to the Test
Highly Integrated and Versatile Engineering Environment

The automotive industry is working in high gear on the mass-market introduction of hydrogen and fuel cell technologies. To support their efforts, AVL List partnered with HyCentA Research to develop and build test equipment for researching polymer electrolyte membrane or PEM systems. The result has been a unique research setup that makes it possible to analyze fuel cell systems by simulating the vehicle, driver, drive cycle, powertrain and other car components, such as battery, electric motor and gear, in real time. The stand can be used for applied science projects on energy and thermal management, calibration and integration at vehicle and subsystem level, and investigations into component behavior, cold starts and material aging under real-life ambient and operating conditions.

FCVs’ range and refueling time (three to five minutes) are similar to conventional cars powered by diesel or gasoline. A fuel cell’s significantly higher energy density compared to a battery lowers powertrain weight and costs, making hydrogen a particularly recommended option in scenarios requiring high power output and large amounts of energy (heavy loads, high mileage).

Hydrogen-powered PEM fuel cell systems have proved to be the most promising technology in use today. They offer a great many benefits (e.g., zero emissions locally, high efficiency levels, frost, vibrations and pollution, have added particularly high requirements for finding a suitable testing environment. These prerequisites and activities can be met and implemented with the use of the innovative Highly Integrated Fuel Cell Analysis Infrastructure. The test stand, which received financial support from the Austrian Research Promotion Agency – FFG and the Federal Ministry of Science, Research and Economy – BMWFW was developed in partnership between HyCentA Research and AVL List and set up by the former at the Graz University of Technology. It marks a milestone in the design of test stands for PEM fuel cell systems.

Real-life conditions have been made possible by a climate chamber offering temperatures from minus 40 °C and plus 85 °C to simulate extreme ambient operating temperatures to the fuel cell and BoP elements, for example, as would be the case near the arctic circle or in Death Valley. These tests additionally use the hardware-in-the-loop method to include a feed-in of all media, such as air, hydrogen and cooling fluids, based on a typical operating scenario. Driver, vehicle and drive cycle data and BoP and powertrain information can be changed and transmitted as virtual parameters to the fuel cell system in real time.

R&D ACTIVITIES

One field in which HIFAI research activities are concentrated is the investigation of aging phenomena and test life-test ambient and operating conditions. Automotive applications require a lifecycle expectancy of 5,000 to 8,000 hours at 10 percent performance degradation and high powers. Improves the efficiency of new advances and the rate at which they occur.

Further R&D activities can be found in the field of component and system integration. Models capable of real-time simulation can be used for a great number of powertrain components to investigate application and integration scenarios. Besides targeting only certain uses for enhancement, it is also possible to have the test stand equipment replace individual BoP elements and stack come with their own set of difficulties.

At present, the control devices integrated into fuel cell systems and vehicles must be calibrated by hand or semi-automated. However, a calibration of several thousand parameters complicates things considerably. The HIFAI test stand solves this problem of multi-variable optimization with the help of models that provide a solution to the problem of re- al-time capable, model-like approach based on design of experiments methods. It increases the potential for enhancement and improves the efficiency of new advances and the rate at which they occur.

Ideal Engineering Tool

HyCentA is an independent, non-university research organization whose innovative idea offers R&D departments at system suppliers and OEMs a valuable tool to speed up in-house processes. In close collaboration with universities and engineering companies, it has been working tirelessly to improve HIFAI and expand it in modules based on requirements from industry and research. The test stand as an integrated development tool will be key to efficient zero-emission transportation in the future.

Authors:
Dr. Alexander Trattner
Stefan Brandstätter
Michael Striednig

Fig. 1: HIFAI test stand

Table 1: Properties and key figures of HIFAI test stand equipment

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<td>Voltage range</td>
<td>8 to 800 V</td>
</tr>
<tr>
<td>Current range</td>
<td>-400 to +600 A</td>
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<tr>
<td>Maximum thermal power</td>
<td>200 kW</td>
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<tr>
<td>Climate chamber temperatures</td>
<td>-40°C to +85°C</td>
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<td>Cathode</td>
<td>0 to 580 kg / hour</td>
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<tr>
<td>Anode</td>
<td>0 to 12 kg / hour</td>
</tr>
</tbody>
</table>

All from HyCentA Research GmbH, Graz, office@hycenta.at
NEW ZBT HYDROGEN TEST FIELD
15-Year Anniversary in Duisburg

ZBT based in Duisburg in the German state of North Rhine-Westphalia has just received approval for four individual publicly funded projects that will make it possible to set up a unique hydrogen array and develop new inspection and testing methods for hydrogen infrastructures. These projects will expand the technology portfolio of an organization which has just celebrated its 15th anniversary and enable it to establish partnership initiatives focused on user and infrastructure scenarios.

ZBT is now planning to set up the field on its premises within the next two years to provide opportunities for exploring hydrogen infrastructure potential in industry-research partnerships. The testing and inspection platform that is being developed could soon be used in collaborative efforts between manufacturers, suppliers and research institutes to advance the aim of safe and secure, nationwide and, above all, inexpensive hydrogen supply.

**CARBON2CHEM**
Subproject L1 of Carbon2Chem, which has received financial support from the Federal Ministry of Education and Research, offers a thorough investigation of systems (alkaline, membrane and solid oxide electrolysis) and stacks under highly variable operating conditions. It has two main purposes, with the first being the provision of operational data to identify material aging factors. The second is to use this data to arrive at simulation models for the design of optimal operation profiles ensuring technological durability in industrial settings. The entire project was launched on June 1, 2016, and will run for four years.

**H2-TESTOPT**
The objective of H2-TestOpt, supported by the Federal Ministry for Economic Affairs and Energy, is to construct a test stand consisting of a compressor, storage space for 500 and 850 bars, an H2 dispenser for 350, 500 and 700 bars, cooling units and an inspection and control room. Together, these individual units comprise a refueling station that could be used to test both components and a station’s subsystems. The outstanding features will be its extensive metering and analysis functionality and the option to recover hydrogen after refueling, coupled with a high degree of flexibility when simulating the most varied fill-ups. Equal weight will be put on considering economic feasibility, energy consumption, technological issues, safety concerns and component and subsystem efficiency. The station will additionally offer an extended range of analytical functions to determine inspection intervals and methods. The test stand is expected to be available for research projects on hydrogen infrastructures by spring 2018.

**MOBFUEHL**
This venture aims at designing a mobile refueling unit for decentralized, stationary and non-stationary storage up to 700 bars. It has received funds from the Ministry for Environment, Agriculture, Conservation and Consumer Protection of the state of North Rhine-Westphalia as part of HydrogenHighway NRW. The design base is a truck with a maximum weight of 7.5 tons and enough room for the storage tank, the compressor, dispensing systems and the necessary control and safety equipment. One use of the mobile unit will involve the supply of locations that are difficult to reach, such as remote cell towers. The vehicle is planned to be operational in twelve months’ time and will then undergo a series of tests based on real-life conditions. It will also be available to support research and demonstration projects. MobFuehl started on May 1, 2017, and is planned to run for two years in cooperation with Anleg based in Wesel, Germany.

**HYLAB**
The fourth endeavor will deal with ensuring proper hydrogen quality at filling stations. Supported by the Federal Ministry for Transport and Digital Infrastructure as part of the second National Innovation Program Hydrogen and Fuel Cell Technology – NIP 2, it has the primary aim of developing technologies and methods for an inexpensive, standardized analysis of hydrogen fuel quality. Together with the ZSW Center for Solar Energy and Hydrogen Research in Ulm in the state of Baden-Württemberg, ZBT will identify suitable methods for analysis and sample-taking, conduct a series of measurements at filling stations and rate the quality of the hydrogen samples. Combined with the above-mentioned projects, ZBT offers excellent opportunities for extensive testing and the subsequent improvement of new solutions in research and development. HyLab was also launched on May 1 and will run for two-and-a-half years.

**15 YEARS OF ZBT**

ZBT celebrated its 15-year anniversary on June 29, 2017. As part of the JRF On-Site event series by Johannes Rau Forschungsgemeinschaft, Angelika Heinzel, ZBT’s managing director, presented the research institute and its accomplishments over past years. Other speakers included North Rhine-Westphalia’s education minister, Svenja Schulze, Reinhold Achatz from thyssenkrupp and Jorgo Chatzimarkakis, secretary general of Hydrogen Europe (see interview in August 2017 issue of H2-international). All of them stressed the importance that hydrogen technology has in this German state.
The zero-emission future of the transportation sector has prompted an increasing number of energy policy debates on railroad electrification. At Hannover Messe, it was Alstom’s new fuel cell train that garnered much attention. After having been developed in less than two years, it had its first run in March and will reportedly be used to transport passengers starting in 2018.

The attention of fuel cell stakeholders is slowly but gradually shifting away from personal transport and turning to railroad and commercial operations. Whereas European automakers are pulling out all the roadblocks when it comes to fuel cell development, it seems that everyone else is beginning to view hydrogen as a plus for heavier vehicles (buses, trucks and trains) to extend their range way beyond what batteries would be capable of on their own. Hydrogen-powered trains and fuel cell trucks could soon be outmaneuvering H₂ cars.

**RIDE ON A FUEL CELL TRAIN**

**Alstom: Uncontested No. 1 for Railroad and Commercial Vehicles**

Up to now, everything has been right on schedule. On May 27, 2015, Alstom Transport signed an exclusive agreement with Hydrogenics, a technology supplier from Canada (see October 2015 issue of H₂-international). Valued at over EUR 50 million, it has provided the grounds for a ten-year collaboration between both businesses and the prospect of at least 200 drive systems based on the HD series by the Canadian-based business. Last year, Alstom received the first fuel cell system based on this agreement and presented it to the public as part of the Coradia LINT prototype at InnoTrans 2016. It said that the March test trip on the HD series by the Coradia LINT prototype at InnoTrans 2016. It said that the March test trip was the first of a low-floor fuel cell passenger train at 80 kph (50 mph). The train didn’t leave the company’s own track system in Salzgitter, and the next scheduled tests at up to 140 kph (87 mph) will be done in Velim in the Czech Republic. But in 2018 – just around three years after the agreement was signed – the train will make its first regular run from Buxtehude to Bremen and from Bremen to Cuxhaven (see November 2016 issue of H₂-international).

**INNOVATIVE TECHNOLOGIES**

With EUR 8 million in support from the National Innovation Program Hydrogen and Fuel Cell Technology, Alstom converted a diesel model from the Coradia LINT family into a fuel cell version. Two units offer enough room for 300 passengers (150 seats) and have been equipped with an entirely new smart energy grid supplying power on demand to all components of the train.

Energy is stored in in-roof hydrogen tanks manufactured by Xerion and installed by Wystrach. The roof is also the place where the Hydrogenics fuel cell system is located. The lithium ion batteries were placed between the train wheels, where they can additionally be used to recover braking energy.

**LOWER SAXONY BACKS FUEL CELL TRAIN ROLL-OUT**

**H₂-international 02 | 17**

**Fig. 1: H₂ refueling station in Sindelfingen**

**Fig. 2: Sprotte, Lies and Bonhoff having an expert discussion on fuel cell trains**

**THREE H₂ FILLING STATIONS IN GERMANY’S SOUTH**

Germany is experiencing a further ramp-up of hydrogen filling stations. On July 31, two new ones started serving customers in Sindelfingen at the A81 freeway and in Pforzheim at the A8. The former, a Shell station southwest of Stuttgart, is in direct vicinity of the Daimler factory that houses the carmaker’s R&D facilities on fuel cell technologies. Stijn van Els, chair of the German Shell companies, said: “Hydrogen is a promising technological field. We expect this alternative engine fuel to play an increasingly stronger role in markets such as Germany, the Benelux countries, the UK and the US from the 2020s on.”

There is also a new multi-energy Total station, which was brought online on Sept. 6 in Karlsruhe. In contrast to comparable stations, it uses a Sunfire electrolyzer running on solar energy to produce hydrogen on-site.

that the big problem was the cost of electricity. “The renewable energy surcharge adds eight to ten cents to the price tag. It is our hope that the next years will see changes in this policy, so that we can make large-scale use of electrolyzers.” The only reply Klaus Bonhoff, chair of NOW, could give was that the issue was “being debated intensively” and that there had already been many people who had “realized that there is great potential.”

Olaf Lies immediately followed up by saying: “We need to double our efforts to install a decentralized H₂ infrastructure – it be for passenger cars, trucks, buses or trains. This expansion will require an increase in the use of electrolysis.”

Some German states have already started requesting bids for zero-emission commuter rail, putting Alstom in competition with other businesses, for example, from the battery industry. GP Juile’s managing director, Dve Petersen, has said that his company was currently bidding on a project to adapt diesel train tracks for fuel cell use. This one project alone would require 20 megawatts of electrolysis capacity, he said.
As early as last November, Switzerland saw the opening of its first public hydrogen station. But soon, it will create a whole new chapter with a fleet of hydrogen trucks to be brought into operation. A prototype has already been in use in the Zurich area.

In the beginning, the endeavor seemed to go on and off track. Shortly after Axpo, a big Swiss-based renewable energy producer, and the Coop retail chain launched a joint project on hydrogen transportation, the former announced its exit (see October 2015 and June 2016 issue of H2-international). H₂ Energy, a Swiss-based project management business in which Coop has a minority interest, was there to fill the void.

The initial objective was to produce hydrogen through a 2-megawatt system at Axpo’s Eisglut-Glatfelden power plant near Zweilinden at the German-Swiss border and transport it to a Coop station in the Zurich area. This station’s yearly demand from a planned commercial fleet of fuel cell vehicles was projected to be 200 tons.

**TWENTY TONS OF H₂ FOR 170 PASSENGER CARS**

Now, plans have changed. The electricity will come from IBAarau’s hydropower plant instead. The Proton OnSite C30 PEM electrolyzer installed on the premises includes one of Diamond Lite’s pressure swing adsorption dryers and will be run by H₂ Energy if there is surplus power available, meaning when it is in direct vicinity of our large distribution center in Schaffhausen. However, as Hansjörg Vock, vice president of H₂ Energy’s board of directors and managing director of Diamond Lite, stressed when talking to H2-international: “Passenger cars aren’t the target market; the truck industry is.”

The gaseous hydrogen will be directed through a Seesa brand compressor to end up at 200 bars or 2,900 psi and will be transported in ten steel tanks holding 338 kilograms each to Switzerland’s first public H₂ refueling station, which had likewise been set up as part of this project. Once the hydrogen arrives, it will be pumped into a stationary tank at 50 bars or 725 psi, and an iononic compressor by Linde will ensure supply ranging up to 950 bars or nearly 14,000 psi for the quick refueling of trucks and buses at 350 (5,000 psi) and passenger cars at 700 (10,000 psi).

The primary objective of building the public Coop Pronto gas station in Hünzenschwil was to supply the fuel cell truck prototype and twelve Hyundai fuel cell cars, type ix35 Fuel Cell, all of which are in use by the retail chain’s distribution center in Schaflheim. However, as Hansjörg Vock, vice president of H₂ Energy’s board of directors and managing director of Diamond Lite, stressed when talking to H2-international: “Passenger cars aren’t the target market; the truck industry is.”

The hydrogen is stored directly behind the driver’s cab in seven 350-bar high-pressure tanks (see fig. 2). These composite pressure vessels hold up to 35 kilograms, enough to get as far as 400 kilometers or 250 miles. The fuel cell system is additionally used to supply power to peripheral systems (cooling). The 18-wheeler, the first fuel cell vehicle in the 35-ton category – 19 tons plus 16-ton trailer, with renewable-powered trucks being permitted to weigh a ton above the limit – has been part of Coop’s logistics chain since May 31, 2017. From Schaflheim, it supplies stores across Switzerland’s entire northwest region. Initially, after the public gas station opening on Nov. 4, 2016, it had been used only during test drives and received a new stack before being integrated in day-to-day operations. Rolf Huber, chair of H₂ Energy’s management board, told H2-international: “It was important to all stakeholders to avoid any risk of downtime. The critical routes were first completed with artificial weights in the back. This has led to enhanced waste heat management, water separation, and retarder, gear and fuel cell fine-tuning.”

Max Senn, the Coop employee driving the vehicle throughout the test stage, was satisfied with the outcomes and recommended the truck for regular use. It was said that even thirty percent inclination at 32 tons proved to be easily overcome. After 3,500 kilometers or 2,175 miles with a company license plate, the truck finally received its official road permit in early June.

Huber said that Coop would like to add more of those trucks over the coming months. But that would require negotiations with OEMs. If the test truck has a successful run, the retail chain would be willing to replace most of its fleet vehicles with fuel cell versions by 2023 and help grow the gas station infrastructure. In that case, the target would be ten trucks per station. Several Swiss-based forwarders and production companies had already shown interest in the technology. But Huber added: “Unfortunately, European truck manufacturers haven’t been as involved as the ones in Asia.”

**CHICKEN AND EGG**

Joos Sutter, CEO of Coop, said during an interview with the Blick newspaper: “In 2008, we created a vision for our company, namely to have carbon-neutral operations by 2023. To reach our objective, one half of our efforts has been put into reducing carbon dioxide emissions; the other half has been directed into external projects. The operating range we need for the use of trucks and light commercial vehicles is up to 90 kilometers or 56 miles around a site. We’ve already put five battery-electric trucks into operation – and hydrogen versions are admittedly an intriguing proposition.”

Asked about the expansion of the H₂ grid in Switzerland, he replied: “Fortunately for us, we provided both the chicken and the egg, as the new hydrogen station is in direct vicinity of our large distribution center in Schaffhaim. […] If we succeed in getting the permit, we could bring another two stations online early next year.”

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**FIRST H₂ TRUCK IS A GO**

Switzerland Opens New Chapter in H₂ Development

Soon, Toyota may not only be known for its fuel cell cars and buses, but for trucks as well. A new initiative called Project Portal aims to build a 36-ton truck equipped with two fuel cell stacks originally designed for the Miraí. They will be supported by a 12-kilowatt-hour battery to provide 500 kilowatts of output and 1,800 Nm of torque at a range of 330 kilometers (199 miles). Tests were reported to start this summer at the Port of Los Angeles in close cooperation with the California Air Resources Board and the California Hydrogen Commission.

When the truck was unveiled, Bob Carter, executive vice president sales at Toyota Motor North America, said: “From creating one of the world’s first mass-market fuel cell vehicles to introducing fuel cell buses in Japan, Toyota is a leader in expanding the use of versatile and scalable zero-emission technology. With Project Portal, we’re proud to help explore the societal benefits of a true zero-emission heavy-duty truck platform.”

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**TOYOTA TRUCK FOR L.A.**

Electric Transportation

The Hunzenschwil station also offers customers to pay by credit card (see also editorial in May 2017 issue of H2-international).
ON COURSE FOR LOW-CARBON SOCIETY

The German H2 infrastructure is growing steadily. Early this year, Linde expanded its offering around Munich by turning the Linde Hydrogen Center in Unterschleißheim into a public refueling station. What had previously been the industrial gas supplier’s hydrogen R&D facility has been used since Jan. 12 to fill up fuel cell cars such as the ones owned by Linde’s subsidiary BeeZero.

As part of the Clean Energy Partnership, Air Liquide has so far opened one filling station in Kamen, Limburg an der Lahn and Mulheim in 2017 (see page 3). All three received over EUR 800,000 each by the federal transportation ministry. Their daily capacity of 200 kilograms is enough to refuel up to 40 cars.

The first one was inaugurated on Jan. 18, 2017, on Schattweg at the interchange near Kamen in North Rhine-Westphalia and went online four weeks later. The system in the state of Hesse, on Brüssler Strasse near the A3 freeway, was completed on Jan. 26 and opened in mid-March. The one in Mulheim, where a joint project with Oden Deutschland saw it integrated with a Star gas station, was inaugurated on May 23. Antoine Mazas, managing director of Air Liquide Advanced Technologies, explained: “Hydrogen will be key for progressing toward a low-carbon society.”

A few days earlier – on May 19 – H Mobility brought its first one of its units online, bestowing the total gas station in Rostock with the honor of being the first public multi-energy supply location in the state of Mecklenburg-Vorpommern. It offers both hydrogen and electricity besides fossil fuels. On June 14, Norbert Barthle, parliamentary state secretary at the BMVI, inaugurated the Shell station on Hanauer Landstrasse in Frankfurt am Main. On the same day, there was also the opening of the location on Borsigstrasse in Wiesbaden-Nordenstadt, Hesse.

Bremen seems to be next in line: The gas pressure vessel at the Shell station on Osterholzer Heerstrasse in the city state had already been set up to prepare for the unveiling of the GLC F-Cell – a car to be manufactured by Mercedes in Bremen’s Seabaldbrück suburb – at the International Motor Show in September. A Daimler spokesperson, however, told the local Weser Kurier newspaper: “It certainly isn’t a mass-market product yet. But it’s a good option for the future.”

Other refueling stations will reportedly come online in Penzling, Nuremberg, Bad Homburg, Wolfburg, Düsseldorf and Cologne-Bonn. But some states, namely Brandenburg, Saxony, Saxony-Anhalt, Thuringia, Schleswig-Holstein and Saarland, still have much catching up to do.

In Austria, the fourth OMV station came online in late March. Partly funded with support from the European COHRS or Connecting Hydrogen Refueling Stations program and located in Graz-Liebenau, directly at the A2 inter-state, it is situated at one of the most crucial traffic corridors across Europe. Wilfried Gepp, manager at OMV, said: “It’s the first time that drivers of hydrogen cars have been able to travel around Austria – from north to south, west to east and vice versa.” And in the middle of this year, Wiener Neu- dorf was said to get its own refueling station.

HYUNDAI’S NEW FUEL CELL CAR READY IN 2018

Not only has the second generation of Hyundai’s fuel cell car been unveiled earlier than expected, the price has already been set as well. The first event featuring the Next-Gen Fuel Cell Car was moved up half a year and took place in mid-August in South Korea’s capital, Seoul. The car scheduled to hit the market in early 2018 will cost EUR 54,000 (USD 62,712) outside South Korea, where incentives will push it down to EUR 29,000 (USD 35,596). That’s 20 percent below the price tag of the previous model, ix35 Fuel Cell. Its H2 fuel tanks include an extended range of 800 kilometers or 497 miles on one tank and increases in efficiency (60 percent) and power output.

The five-seat FCEV offers a 100-kilowatt fuel cell (electric engine: 120 kilowatts), a 2-kilowatt-hour lithium-ion battery, an automated parking assist and the latest version of Hyundai’s driver assistance. Expectations are that Hyundai will use the Olympic Winter Games in Pyeongchang to market the vehicle, of which the carmaker intends to produce an initial 3,600 in its factory in Changwon. One thousand units of its predecessor have so far been sold in 17 countries.

A second model that is said to get its own fuel cell option is the Genesis. A first concept study had already been showcased at the International Auto Show in New York earlier this year. The next fuel cell vehicle, the GV80, is planned for 2019. And Hyundai’s subsidiary Kia is reportedly working on its own FCEV. Equipped with fuel cell technology by Hyundai, it could be ready for the market in 2020 or 2021.
CAR OF THE FUTURE TO ARRIVE – SOON
Netherlands: Talks to Form Government Delay Energy Projects

After the parliamentary election in the Netherlands this March, it quickly became clear that the previous coalition partners could no longer hope for a majority. Talks about forming a new government have yet to yield any results. One reason for the breakdown in mid-May negotiations between the parties most inclined to join forces – VVD, Christian Democratic Appeal, Democrats 66 and GreenLeft – was their disagreement on environmental policy. Of course, this offers little planning security in climate protection, energy supply and clean transportation, and subsequently hydrogen and fuel cells, but has so far kept the country on the course it charted in 2007, when the aim was to set up a “green transportation sector.”

In 2013, the Netherlands passed a national energy agreement, Energieakkoord voor duurzame groei, for sustainable energy. The agreement stipulates a yearly reduction in the energy used in transportation of 15 to 20 petajoules (around 10 million normal cubic meters) already available today. The Netherlands is likewise well connected to its neighbors, Belgium, Denmark, Germany, France and the UK, all of which pursue similar avenues for expanding their hydrogen infrastructures. A European leader in the deployment and use of innovative, clean vehicle technologies, it has the highest share of hybrid cars and the greatest market penetration of plug-in vehicles across Europe.

DUTCH PROGRAMS

Consequently, clean transportation has become the focus of H2 and fuel cell technology advances throughout the country. The government, namely the Ministry for Infrastructure and the Environment, Rijkswaterstaat, is encouraging those efforts, mainly by funding research activities and demonstration projects. Additionally, it offers tax rebates and incentives and supports public-private partnerships.

The largest and most important subsidy program on transportation is called De Autovan de toekomst gaat rijden, which roughly translates as: “The car of the future will arrive.” Its objective is to accelerate the market introduction of promising technologies, turning the Netherlands into a test lab for sustainable transportation ideas. Questions to which the project intends to find answers include how vehicles are classified, what “green” vehicle taxation and leasing contracts may look like, for which applications hydrogen could be used as an alternative fuel, and how to set up smart grids and multi-vector transportation value chains.

Today, the most prevalent model to demonstrate H2 and fuel cell potential in transportation is the deployment of buses based on mass transit. These national activities have been closely intertwined with the ones at EU level.

GREEN DEALS

Last April, the infrastructure ministry made an agreement with mass transit operators in the country as part of the government’s Green Deal Initiative. It will ensure that only zero-emission buses will be added from 2025 at the latest and that all of them are emission-free by 2030 (today, there are about 5,000 buses in operation in the Netherlands), while the entire public system also needs to be renewable-on-the-go by that time.

Eindhoven has already had two fuel cell buses in use. In August, another two were added to the fleet in Rotterdam. More are planned to be deployed in Groningen and Arnhem at the end of the year and together with the Benelux countries, the Netherlands has joined FCH JU’s JIVE project, which intends to bring (a minimum of) 50 buses to three or four regions. Currently employed models also include battery-electric versions, such as the 18 vehicles (with overnight charging) in use on several Dutch islands. And the Eindhoven region is planning to add another 42 with opportunity charging.

NATIONAL H2NL HYDROGEN PLATFORM

As a public-private partnership, there is the national H2NL project, which was established in cooperation with the Dutch hydrogen and fuel cell association – Nederlandse Waterstof en Brandstofcel Associatie. It is thought to provide a platform for an exchange of ideas between politics, industry and research to advance H2 developments. It is also intended to ensure that the government can deliver on the 2025 hydrogen targets, namely 20 new H2 refueling stations, 1,500 to 2,000 fuel cell cars and 100 buses (including the relevant opportunities to fill up their tanks), up to 500 delivery vans and 20 trucks for zero-emission logistics in urban areas. When the platform will begin its work, however, will entirely depend on the successful formation of a new government and official approval. A subsidy program to support the installation of a nationwide refueling infrastructure has likewise been delayed by the long search for a new political coalition. This program aims to set up filling stations in cities and regions that promise a certain number of potential hydrogen users and vehicles. To date, the country has had three operational H2 stations in place. Two, one in Arnhem and one near Rotterdam, are accessible to the public; the one in Helmond, where the Dutch bus industry has its R&D center for electric transport, isn’t.

POWER TO FLEX

Power to Flex is a Dutch-German cooperation project during which businesses, research organizations and government agencies from the north of the Netherlands and northwest Germany will develop demonstration systems for renewable storage. There will be individual tasks to design storage solutions in building engineering – both for single-family houses and large residential complexes and commercial premises – and in transportation. The project started last December.
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