Hydrogeit / www.h2-international.com / Issue 1 / January 2025 / 21.90 €

H2 international

THE E-JOURNAL ON HYDROGEN AND FUEL CELLS

→ QUEST ONE ELECTROLYZER STACKS IN SERIES PRODUCTION

→ INTERVIEW WITH NEW NOW CEO DAGMAR FEHLER

Hydrogen regions, Part XIX: Heilbronn-Franken

HYDROGEN + FUEL CELLS EUROPE

CONNECTING INDUSTRY WITH HYDROGEN AND FUEL CELLS TECHNOLOGY

31 March – 4 April 2025 ▪ Hannover, Germany
h2fc-fair.com

CONNECT. CREATE. SUCCEED.

HYDROGEN FUEL CELLS EUROPE

HANNOVER MESSE

CHANGES ON THE HORIZON

What developments! We are living in turbulent times. Several transformative processes are currently taking place at the same time: Not only the energy, transport and heating transition with the move away from fossil fuels or the social trend towards increasingly autocratic structures, but also the complete transformation of the information and communication sector with AI (artificial intelligence).

It is therefore not only all industrial companies that are faced with the question of how their energy supply can be CO_2-free by 2045. We are not only faced with the question of how we can end wars and strengthen democratic structures. The transformation process affects the whole of society – worldwide. Newsrooms, media houses and press agencies must also face new challenges and, for example, find a way of dealing with computer-generated information and fake news – whether they like it or not.

And of course the advancing climate crisis also plays a decisive role here: Will journalists continue to research live on location and report from there? How many trips will be justifiable in the future from an environmental point of view? How will paper prices and postage costs develop? Will publishers still be needed at all in the future? Will readers still want to receive print copies tomorrow or will other formats be needed in addition to more digital offerings as well as podcasts, videos and webinars?

Hydrogeit Verlag has been dealing with all of these questions for years. Originally started as a one-man publishing house, the range of activities has changed considerably since the company was founded in 2004. For some time now, there has been a team responsible for publishing HZwei and H2-international – now around ten people who work part-time.

Despite the diligent and sustained commitment of all these players, we are constantly reaching our limits. While the hydrogen sector and interest in H_2 and FC topics continue to grow, our offering has remained largely the same in recent years – high quality, as many readers keep telling us – but still focused primarily on the print sector and the printed HZwei magazines. And not really up to date. That may well change.

To ensure that HZwei and H2-international continue to be perceived as leading media in the industry in the future, innovations are needed now. In order to enable up-to-date reporting online and to be able to offer more modern formats, appropriate structures and more power are needed.

For this reason, we looked around for suitable cooperation partners months ago and found a player in Gentner Verlag that is a perfect fit for us both thematically and structurally. With its "Photovoltaics" and "Renewable Energies" brands, the Stuttgart-based publishing house publishes two important magazines that fit well with our magazine on hydrogen and fuel cells.

We have therefore decided to work together from this year onwards in order to be able to cover the energy sector even better together. So you can look forward not only to more up-to-date and comprehensive information, but also to new formats in the future.

As a first step, we have increased the frequency of publication. HZwei and H2-international will be published five times a year in 2025 and even six times a year starting 2026. We will also have our own stand at Hydrogen & Fuel Cells Europe in Hanover, where we will be able to interact with you, our readers. Further measures will follow in the course of the year.

We look forward to a more intensive exchange and constructive feedback.

These are turbulent times and we not only want to accompany them with information, but also actively contribute to shaping them sustainably. •

Sincerely,

Sven Geitmann
Editor of H2-international

CONTENTS

10 Valerie Bouillon-Delporte from Clean Hydrogen Partnership in Brussels

31 Next generation of racers try out hydrogen

Source: Formula Student Austria

38 Electrolyzer series production in Hamburg has started

46 Interview with the governor of New Mexiko

HIGH-RANKING VISITORS AT THE BRANDENBURG HYDROGEN DAY

The Telegrafenberg in Potsdam is usually all about geology and climate. However, on October 16, 2024, the focus was on hydrogen. Prof. Jörg Steinbach, then Minister of Economic Affairs of the State of Brandenburg, had invited guests to the third Brandenburg Hydrogen Day and included a visit from Brussels.

Fig. 1: Dr. Sopna Sury from Hydrogen Europe

In Potsdam, Dr. Sopna Sury, chair of the board of directors of the association Hydrogen Europe, presented her view of the current political situation and emphatically stated that now is the time to act. She said: "Please let's not allow the next few months to pass us by. [...] The time for PowerPoint is over, now is the time for concrete action."

She also called for an "end to the rainbow", i.e. an end to H_2 color theory. Instead of arguing about the suitability of blue or red hydrogen, Hydrogen Europe advocates the introduction of a CO_2 footprint for hydrogen so that it is clear how harmful the respective H_2 atoms are to the climate.

> "Collaboration is needed: with Europe, between politics and industry, between the federal and state governments. Hydrogen is team play."
>
> *Dr. Sopna Sury, Hydrogen Europe*

Former Brandenburg economy minister Jörg Steinbach also appealed to industry to "invest in risk." As some of the CO_2 certificates will be withdrawn from the market in the future, it is foreseeable that the prices for fossil fuels will rise, said the minister, whose last official event for the time being was this hydrogen day, as the state parliament will be reconstituted after the elections.

Jörg Steinbach and Klaus Müller (see Fig. 2) had to put up with significant criticism for the planned hydrogen core network. Some stakeholders voiced their displeasure that the originally planned route of the "doing hydrogen" pipeline between Rostock and Thüringen was not part of the "H_2 highway network" from the outset (see p. 20).

Fig. 2: Klaus Müller, President of the Federal Network Agency

Both Steinbach and Müller explained why this section was not considered, stating that the line "was not regarded as economically viable." This was countered by the fact that there would now be a huge blank spot on the map to the west of Berlin, cutting off an entire region from potential H_2 projects – despite the abundance of renewable energy available. •

PROTON MOTOR LAYS OFF EMPLOYEES

Fig.: The HyShelter® system from Proton Motor [Source: Proton Motor]

The German fuel cell manufacturer Proton Motor has announced the provisional end of its production activities at the end of 2024 if no new investor is found. Despite diligent efforts to save the Bavarian company, it announced in mid-September that the employees of the Puchheim branch would have their employment contracts terminated at the end of the planned period in order to ensure an orderly winding down of business activities.

Proton Motor is part of the British company Proton Motor Power Systems PLC, whose Board of Directors came to the conclusion in November 2024 that "the orderly shutting down of the company" was the "most appropriate course of action." Although alternative sources of funding were still being sought to keep the company in operation in 2025, no viable solution had been identified by the end of November. Proton Motor Power Systems shares have lost around 85 percent of their value in the space of a year.

At the end of August 2024, the main investor announced that it would be withdrawing from the financing by the end of 2024. Although outstanding customer orders would be fulfilled as far as possible, new contracts could only be concluded once financing and the future direction of the company had been clarified.

In the summer of 2024, Manfred Limbrunner, the Director of Communications, who has since been made redundant, announced that his company was planning to move to Fürstenfeldbruck by mid-2025, where a factory was to be built in which up to 5,000 fuel cell systems and 30,000 stacks could be produced automatically every year. •

ZBT expands HyTechLab4NRW

Nordrhein-Westfalen is further expanding its capacities in the H_2 research sector. In September 2024, the expanded HyTechLab4NRW in Duisburg went into operation. Since then, the site of the Center for Fuel Cell Technology has provided even better conditions for research into fuel cells and electrolyzers thanks to its improved infrastructure.

As part of extensive renovation work, the HyTechLab4NRW, which opened in 2019, was brought up to the latest state of the art and better equipped, particularly in terms of media supply, so that larger systems can now also be tested. ZBT Operations Manager Bernd Oberschachtsiek was visibly relieved: "Our temporary facility was the ugliest container in the world. Now we finally have a fully equipped laboratory that is not only technically up to date, but is also visually impressive."

ZBT CEO Dr. Peter Beckhaus explained: "Today we are talking about fuel cell drives for ships, aircraft and trucks, with outputs ranging from 300 kW to the megawatt range. We have now created the right infrastructure to further research these applications." Silke Krebs, State Secretary in the NRW Ministry of Economic Affairs, explained: "Hydrogen is a growth market and is of central importance for NRW in particular as an industrial location. We need new technologies and research to shape this future." Prof. Astrid Westendorf, Vice-Rector for Research at the University of Duisburg-Essen, added: "This is a real gain for our research infrastructure."

The first ZBT Hydrogen Days on February 4 and 5 will provide an opportunity to view the improved facilities. •

Fig.: View of the new laboratory [Photo: ZBT]

HH2E FILES FOR INSOLVENCY

Big plans and professional marketing – HH2E's appearance was downright impressive, but on November 8, 2024, the Hamburg-based start-up filed for insolvency on its own initiative. The reason for this was probably that the British majority shareholder Foresight Group did not want to finance the planned large-scale H_2 project in Mecklenburg-Vorpommern after all.

Plans included the construction of electrolyzers near Leipzig and in Lubmin. On the Baltic Sea, there was talk of building a 100-MW plant (1,000 MW by 2030) on the site of the former nuclear power plant and investing over €45 million. Although the planning for this is continuing for the time being, there is currently no investor, according to the latest reports.

Fig.: Company boss Alexander Voigt already solicited investors at the H_2 Forum 2023 in Berlin

HH2E CEO Alexander Voigt told Mitteldeutsche Zeitung: "We remain committed to maintaining continuity and stability in our operations while we work on a long-term solution. I am convinced that we will soon find a strategic partner who shares our passion for green energy and can support the vision of HH2E AG." Voigt founded the solar company Solon in 1996 and is considered a pioneer in renewable energy.

The planned HH2E project Thierbach near Borna in Sachsen, which is to include a further 100-MW electrolyzer on the site of the demolished lignite-fired power plant, is initially only indirectly affected as HH2E-Thierbach-GmbH is a wholly owned subsidiary of the Hamburg company founded in 2021, but remains solvent itself. As part of this Net Zero LEJ project, Leipzig/Halle Airport is to be supplied with green fuel together with DHL.

Götz Ahmelmann, Director of Leipzig/Halle Airport, explained: "As a company, we are convinced of the environmental and economic importance of the industrial production of sustainable aviation fuel (SAF)." In his opinion, however, the conditions for the production of sustainable aviation fuels on an industrial scale "remain excellent." "With strong partners and extensive areas, supported by an important customer such as DHL, which is committed to climate-neutral flying, we are ideally positioned."

In insolvency proceedings instigated on the company's own initiative, the company management can continue to run the business if there are justified hopes of being able to restructure the company. A trustee appointed by the court monitors the process. There is justified hope that the insolvency will enable the company to shed previous constraints and gain more room for maneuver through new collaborations. •

ENERTRAG OPENS OFFICE IN HAMBURG

Fig. 1: The historic Laeiszhof on Nikolaifleet in Hamburg [Photo: Monika Rößiger]

To strengthen its "role in the global hydrogen economy," Enertrag, a developer and producer of renewable energies, opened its Hamburg office in fall 2024. At the new branch, Enertrag wants to contribute to the decarbonization of the logistics and shipping industry. And: "We want to supply not only the shipping industry, but also numerous other industries with green hydrogen," announced CEO Gunar Hering in front of more than 80 invited guests at the official opening of the new premises. These occupy the top floor of the historic Laeiszhof, a magnificent, richly decorated clinker brick building in the center of the Hanseatic city.

As the center of wind energy in Germany, Hamburg will also be an important location for the hydrogen industry in the future. This is demonstrated by the construction work underway since last year for the 100-megawatt electrolyzer in Moorburg and for the Hanseatic city's H_2 industrial network (see H2-international, May 2024). The port therefore offers "ideal conditions to act as a hub for the import and export of hydrogen and its derivatives," continued CEO Hering. In close cooperation with the shipping company F. Laeisz, the H2Global Foundation and other neighbors in the Laeiszhof, Enertrag wants to advance the infrastructure for the trade and use of green hydrogen.

Nikolaus Schües, CEO of the F. Laeisz Group, which operates its own ships for the transportation of ammonia, emphasized the importance of maritime logistics for the energy transition. The development of a sustainable and competitive energy supply can only succeed through cross-sector cooperation, he said, adding that "Shipping is an important link in this, not only as a transporter, but also as a user of hydrogen-based energy sources." The traditional shipping company, which celebrated its 200th anniversary in spring 2024 and used to transport saltpeter, bananas and wheat, among other things, is focusing on green methanol and green ammonia for the future. And is planning to convert parts of its fleet to these energy sources.

Enertrag, in turn, takes care of the production and availability of hydrogen derivatives. The CEO of the company, which has more than 1,100 employees on four continents, refers to the many years of experience in the production of green hydrogen, for example at the Uckermark combined-cycle power plant, which Enertrag has been operating since 2011.

Hamburg's Finance Senator Andreas Dressel was delighted by the arrival of the business in the city. In a greeting to the future neighbors, who reside just a short walk away from City Hall, he said: "Our city offers good framework conditions and investment opportunities, especially in the area of large-scale hydrogen projects." In this respect, he continued, Enertrag is an asset for Hamburg in terms of advancing the ramp-up of the hydrogen economy here and in Germany. •

Fig. 2: CEO Gunar Hering with Finance Senator Andreas Dressel and ship owner Nikolaus W. Schües (from left) [Photo: Monika Rößiger]

Werner Diwald no longer a DWV board member

HYDROGEN ASSOCIATION WITH NEW LEADERSHIP

The German Hydrogen Association (DWV) has had new leadership since November 1, 2024. Werner Diwald is no longer at the helm of the association. As announced on October 30, the Executive Committee appointed Friederike Lassen as the new head of the association. **Author:** Sven Geitmann

Fig. 1: Werner Diwald in his former function as DWV chief

Werner Diwald, who took over the management of the association in 2014, was removed from his position by the DWV Executive Committee, earlier than originally planned. His contract would actually have run for another year or so. Dr. Oliver Weinmann, the hitherto president (since 2020), is also stepping down with him. Weinmann held management positions at Vattenfall AG for many years and has been a purely freelance consultant since summer 2023. He is considered a close confidant of Diwald, but is now stepping down for personal reasons according to an official communication. His duties will initially be assumed by Vice President Silke Frank together with Manuela Heise and Tim Heisterkamp, who are also vice presidents, as has been the case for numerous engagements in the past. A new Executive Committee will then be elected by democratic vote at the General Assembly on February 27, 2025, in Berlin.

The new board member, Friederike Lassen, was previously responsible for policy and regulation at DWV. The Executive Committee has announced that she will be joined by another person so that the board will be headed by two people in future. H2-international was told that redundancies should be created, as one person alone would no longer be able to cover the ever-increasing number of tasks. The selection process to fill the vacant position is underway.

This change in personnel will inevitably be accompanied by a realignment of the association – not only because a number of office staff, some of whom have been with the association for many years, have already left DWV in recent months and weeks. For example, the Initiative Energien Speichern e.V. (INES) announced at the end of November that Norma Kemper will head up its communications department from February 2025. Birte Sönnichsen, the former Head of Strategy, moved to BDEW at the beginning of December.

In addition, there will probably be changes to the articles of association so that individuals can no longer accumulate too many votes on behalf of other members. The speculations of the business magazine Capital, which was the first to report on Diwald's departure, that this personnel matter could also be a consequence of the so-called Bonhoff affair, in the context of which the names of Diwald and Weinmann were mentioned in spring 2024 (see H2-international, May 2024), have not yet been verified by H2-international. •


Fig. 2: Friederike Lassen, new board member of DWV [Source: DWV]

HY-FCELL 2024 WITH MANY EXHIBITORS FROM THE REGION

Fig.: Also Arnd Franz, chairman of the Group management of the Mahle Group, spoke about the current economic challenges in the Mahle Hall named after his company

A beautiful regional fair in southern Germany – especially for the supplier companies in and around Stuttgart. What was already apparent at Hy-Fcell in 2023 was confirmed on October 8th and 9th, 2024: The event, originally conceived as an international symposium with an accompanying exhibition, is losing importance in the Europe-wide event competition, but is intensifying contact with Africa.

According to information from the trade fair company Landesmesse Stuttgart, the number of exhibitors increased by ten percent compared to previous years to 189. And there were also quite a few Asian companies represented in the Mahle Hall. However, the Hy-Fcell did not live up to its own claim of being an important international trade fair.

Among the 3,000 participants of both the conference and the trade fair were guests from 35 countries. Roland Bleinroth, managing director of Messe Stuttgart, summarized: "The cooperation with the delegation from Africa – among others, from Nigeria, Rwanda and Uganda – was an important aspect at Hy-Fcell that deepened relations between the two regions. The network meeting and the Side Events were very well attended." As part of the Hy-Fcell, this year for the first time the Global Partnership for African Development Forum took place.

The conference seemed smaller than in previous years, as it was integrated into the exhibition hall, but recorded according to the organizers "significantly more influx." From the expert side it was said that the quality was – not least thanks to the professional scientific support – good. The dominant topic, particularly in the opening session, was the future history of the energy sector. The lack of planning security lies like an insulating mat over all decisions and prevents potential investments.

With great interest, the first official speech by Dagmar Fehler was followed. The new managing director and spokesperson of the Nationale Organisation Wasserstoff und Brennstoffzellentechnologie (NOW GmbH), who has been in office since September 2024 following the departure of her predecessor Kurt-Christoph von Knobelsdorff, took enough time to describe the current situation at NOW (see the interview on page 12). She described the financial situation as critical, but assured that the construction of the H_2 infrastructure would be pushed forward in accordance with the AFIR (Alternative Fuels Infrastructure Regulation) guidelines.

This year's Hy-Fcell Awards, each worth 10,000 euros, went to H2Fly GmbH with their hydrogen aircraft HY4 as well as to WS Reformer GmbH (also already winner of the F-Cell Award 2001) for their ammonia cracker for decentralized hydrogen production. The startup prize went to CellForm Hydrogen GmbH & Co. KG with their high-performance bipolar plates. •

WHERE IS THE EUROPEAN H_2 INDUSTRY HEADING?

Fig.: Jorgo Chatzimarkakis, CEO of Hydrogen Europe, was very present

Four days of energy policy cooperation in Brussels – The European Hydrogen Week took place for the third time in Belgium from November 18 to 21, 2024. Organized by Hydrogen Europe, the European hydrogen association, a total of 220 exhibitors and, during the conference, numerous stakeholders presented their projects and concerns in the two exhibition halls.

Unlike other H_2 events in Hamburg, Rotterdam or Hanover, the focus in the European capital was on energy policy issues. There were relatively few exhibits on show at the trade fair, and hardly any components or products, but there were some comparatively large stands – at least by H_2 industry standards – where there was plenty of space for networking and conceptual discussions.

The conference, which was integrated into the exhibition hall, focused on political demands, regional flagship projects and international cooperation, among other things. More than 200 speakers presented proposals and debated in 25 panel sessions on the need for H_2 underground storage facilities, better links between the H_2 sector and the energy sector, deregulation and better framework conditions for making final investment decisions.

Among other things, Hydrogen Europe signed cooperation agreements with both H_2 Chile and the Green Hydrogen Association (GH2) from India to facilitate cross-industry and public-private exchange between the European Union and these two countries.

In 2025, this event will take place from September 29 to October 3. •

HYDROGEN TECHNOLOGY EXPO IN HAMBURG FOR FIRST TIME

Fig: Strategic Forum at the Hydrogen Technology Expo [Source: Eva Augsten]

The hydrogen conference and trade fair Hydrogen Technology Expo took place in Hamburg for the first time in October 2024. There is still a lot of potential for growth there. This is not only because the Hamburg exhibition center is larger than the one in Bremen – where this event has been held in the past three years – but also because Hamburg is developing into a hydrogen hub in northern Germany.

With around 800 exhibitors, 15,000 trade fair visitors and 1,500 conference attendees, the event, which is still in its early days, is already one of the larger industry meet-ups. The exhibitors were satisfied with the connections made at the trade fair. According to the organizers, more than 80 percent of the spaces for next year have already been booked. With six parallel lecture series, the conference program was also very diverse. It ranged from overarching topics such as the international trade in hydrogen in the "Strategic Forum" to technical details about fuel cell test procedures.

However, the Hydrogen Technology Expo is not just an H_2 event. The numbers of exhibitors and visitors also include those who are involved in the second main topic of the congress fair – carbon capture and storage (CCS). The Strategic Forum is also sponsored by the oil giant Exxon Mobil.

This theme also attracted environmental activists from Greenpeace, who protested against CCS at the exhibition center. The "Carbon Capture Technology Expo" is being advertised with its own website for 2025. The topic of CCS is barely mentioned on the Hydrogen Technology Expo website. However, with a few more clicks, it quickly becomes apparent that the exhibition layout and conference agenda are identical. •

Interview with Dagmar Fehler, CEO of NOW

PRIORITY ON BATTERY-ELECTRIC MOBILITY IN THE FUTURE

Since September 2024, the National Organisation for Hydrogen and Fuel Cell Technology (NOW) GmbH has had a new management spokesperson in the form of Dagmar Fehler. Her predecessor, Kurt-Christoph von Knobelsdorff, had to resign relatively suddenly. NOW is also now to be given completely new structures by summer 2025. Two good reasons for H2-international to talk to Dagmar Fehler in person. **Interviewer:** Sven Geitmann

Fig.: Dagmar Fehler

H2-international: Ms. Fehler, from the outside it seemed as if you came to your new post quite unexpectedly. Did this "promotion" come as a surprise to you last fall?

Fehler: It may have seemed that way from the outside, but I was very happy to accept the challenge. NOW is a unique think tank with great colleagues. Everyone here is highly motivated to help make the transport sector as a whole more climate-friendly. And so am I.

How was the collaboration with the previous CEO Kurt-Christoph von Knobelsdorff? Did you get on well with him?

We worked very well together and also achieved joint successes. I appreciate his commitment to the cause.

Some suspect a connection between his sudden departure and the "Bonhoff affair," in the context of which von Knobelsdorff's name was once mentioned. Is there a connection?

I don't know of any. Rather, due to the ruling of the Federal Constitutional Court on the Climate Transformation Fund (KTF) in November 2023, funding was cut, which had a very significant impact on the tasks of NOW GmbH. As we were founded as a program management company, organizational adjustments had to be developed. One of these was to sharpen NOW's profile. The change of personnel at the top is a visible sign of this process.

I see. Please tell us briefly what you have done at NOW so far.

I was co-head of the National Charging Infrastructure Control Center and helped set it up. I have over 20 years of experience in business process and organizational development, combined with the areas of digitalization, data and information.

We work on many mobility issues at NOW and we work very well together across teams. That's why I'm no stranger to the areas of hydrogen and fuel cells. And if I have detailed questions, there are many excellent experts around me who can help me critically and independently.

How do you approach the subjects of hydrogen and fuel cells?

For me, hydrogen and fuel cells are a building block for achieving the climate targets in transportation, but also in other sectors. It won't work without this building block.

Your employer is still called the National Organisation for Hydrogen and Fuel Cell Technology. Originally, NOW was only responsible for the National Hydrogen and Fuel Cell Technology Innovation Program. Over the years, many other areas have been added: electromobility, charging infrastructure, fuel strategy, etc. How do you now see the weighting? How much share has the H_2 and FC sector had recently?

The weighting of the individual areas has changed over time because they have grown to varying degrees. This was dependent on social and political priorities as well as the objectives of and opportunities available under the federal government. The KTF 2023 ruling also plays a role in this context. The hydrogen and fuel cell sector remains a central component of NOW GmbH's work, particularly with regard to the implementation of the national hydrogen strategy in transport, the development of a hydrogen refueling infrastructure and the development of a strong supplier base in Germany.

So it seems understandable that NOW is restructuring and perhaps renaming itself – even if many players in the H_2 and FC community are reluctant to admit it. Please give us an insight into what we can look forward to.

We remain a central point of contact at federal level for climate protection in mobility. However, the political priority in future will be more on battery-electric mobility and, above all, on expanding the charging infrastructure. Nevertheless, our shareholder would like us to support the development of further technologies for climate protection in transportation in all modes of transport. We see ourselves as a service provider for the federal government and want to provide it with the best possible support in its mobility-oriented projects. We want to do this digitally in a data-driven approach in order to provide an even more reliable basis for decision-making. We will continue to be available and supportive with our expertise.

Does this mean that the importance of hydrogen and fuel cells is being downgraded?

I am not setting the technologies against each other. It won't work without hydrogen and renewable fuels.

What does this mean in concrete terms? For months now, the impression has been growing that electromobility and charging infrastructure are receiving more and more financial support, while hydrogen mobility is receiving little to no support.

There have also been painful cuts in electromobility and all other areas relevant to transportation. This is by no means limited to hydrogen mobility.

The Federal Transport Minister Volker Wissing, who is currently still in office, has made no secret of the fact that he only sees hydrogen as an aid for e-fuels, but otherwise doesn't think much of it. What do you hope for from a new transport minister, regardless of which party they belong to?

I do not share the view that Federal Minister Wissing does not believe in hydrogen. The industry has set technological priorities for itself as part of technological openness. The basis for this are the production plans for cars and trucks, which we are aware of thanks to the closed-door talks. The incoming head of the Federal Ministry of Transport must ensure the necessary infrastructure ramp-up and also keep an eye on the vehicle ramp-up. This means building on the Federal Ministry of Transport's successful preliminary work and continuing the acceleration.

In your opinion, how should NOW be restructured? According to the original plan, it should have a new name and a new concept by the summer of 2025. Are you sticking to this timetable despite the early federal elections?

We are sticking to it – also because we owe our colleagues and all our stakeholders security and reliability.

Will you stay on or are you now only filling the position on an interim basis? I've heard that there will be a call for applications. Will you then also apply for it?

I really enjoy working for NOW. The job means that difficult decisions have to be made, but I can make them together with the management team and our works council. I would very much like to continue doing this.

What is your hope as to when there might be more clarity on how things will continue with the former NOW?

Why the former? We have been commissioned to continue working in all areas until the end of 2026. The shareholder would like to give us a new name that takes greater account of the equivalence of the technologies. We expect a decision on this in the next few months.

H2-international: Thank you very much for your time.

Fig. 1: Avacon has successfully converted small parts of its gas network to hydrogen [Source: Avacon]

"Hydrogen can come, the gas distribution network is ready"

CONSTRUCTION AND CONVERSION OF THE INFRASTRUCTURE FOR H_2 DISTRIBUTION

There is extensive demand for hydrogen in both municipalities and industry. In this environment, plans for implementing these market requirements are now becoming more concrete. The recent decision to set up an H_2 core network (see p. 20) is seen as the initial spark for this. In view of the supply situation, however, it is clear that the focus must increasingly be on the distribution network, which was also made clear at the DVGW Congress. **Author:** Michael Nallinger

"The pace of transformation with the aim of accelerating the hydrogen ramp-up must be maintained, if not increased," emphasized Prof. Dr. Gerald Linke at the DVGW Congress in Berlin in mid-September 2024. The Chairman of the Board of the German Technical and Scientific Association for Gas and Water also called for further regulatory measures that go beyond the political decisions that have already been made, such as the Hydrogen Acceleration Act, the import strategy and the hydrogen core network.

Stefan Dohler takes a similar view. The President of the German Association of Energy and Water Industries (BDEW) and Chairman of the Board of Management of

EWE AG in Oldenburg emphasized the spirit of optimism with regard to the expansion of electrolysis capacities that has begun and the climate protection agreements for industry that were launched last summer: "We have to keep at it and must not lose momentum." Dohler has observed a very high demand for hydrogen in EWE's supply area.

Jörg Höhler, DVGW President and CEO of ESWE Versorgung in Wiesbaden, shares this view: "We have to keep the pressure on." Höhler favors the broadest possible approach. It is not a question of deciding on electricity or hydrogen in the energy supply; no, you need both. Together with the energy supply companies Mainova and Entega, ESWE is working on a feasibility study for the development of a hydrogen infrastructure in the Rhine-Main region – a project that has since been awarded the New Gases Innovation Prize. However, Höhler is also calling for clear guidelines and support for the distribution network operators in converting the gas networks to hydrogen.

PORTFOLIO OF CO_2-FREE ENERGY SOURCES NEEDED This appeal appears to have found a sympathetic ear at the Federal Network Agency (BNetzA). "The all-electric world is an economically inefficient path. We therefore need a portfolio of CO_2-free energy sources," stated Dr. Markus Doll at the event. For the Head of Systems and Grid Operation at the BNetzA, it is clear that a common target picture is required for consistent planning of the respective infrastructures. The goal must be integrated grid development across all energy sources, emphasized Doll in Berlin.

He sees the decision to build the approximately 9,000 km long H_2 core network as the initial spark to solve the hydrogen sector's chicken-and-egg problem. This project, which has now been approved by the BNetzA, is seen by the Bonn-based authority as the "basis and transition to the cyclical process of network development planning for hydrogen/natural gas." For BNetzA expert Doll, the next steps are clear: appropriate infrastructure is needed for CO_2-free energy sources. According to Doll, there are two prerequisites for feeding hydrogen into the grids. On the one hand, its use makes sense where it is economically efficient and, on the other, where no other decarbonization alternatives are available. In Doll's opinion, biomethane plays a role in the concert of climate-neutral gases, especially at regional level.

With regard to the required storage facilities, in particular the cavern storage facilities suitable for hydrogen, he hopes that these will develop "from the market". However, he promised that the regulatory authority would take this into account in the network development plan (NDP).

BRINGING HYDROGEN TO THE SURFACE Dr. Thomas Gößmann describes it as a mammoth project to maintain the gas infrastructure and develop the hydrogen infrastructure at the same time. At the event in Berlin, the head of Thyssengas used the example of North Rhine-Westphalia to explain how hydrogen can be rolled out across the country. To this end, a total of six regional clusters are to be developed as potential regions along the main lines of the core network: Cologne, Ruhr region, Middle Lower Rhine, Lower Rhine, Bentheim-Westmünsterland and Münster-Hamm. Thyssengas believes that these key regions are particularly suitable as nuclei for the development of an integrated H_2 infrastructure. According to Gößmann, great attention should also be paid to the development of cross-border capacities. This would enable a broad diversification of supply sources.

Fig. 2: Prof. Linke, DVGW: "In order to accelerate the hydrogen ramp-up in Germany, the focus in the expansion of hydrogen infrastructures must be placed more on the distribution networks." [Source: Bildschön GmbH/Vollmeyer]

Schwaben Netz is also already in the middle of developing a changeover strategy. Specifically, the activities are divided into three major projects. Project 1 deals with the gas grid transformation plan. Where are the connection points to the H_2 core network? Where and when will the switch to hydrogen take place? These are the questions that are being investigated. Another project is target grid planning: the H_2 requirements of large anchor customers in the grid area and grid areas that can be transformed cost-effectively are the challenges that the grid operator is addressing there. And the third project is a pilot project for the supply of hydrogen. Specifically, it involves an area with several residential units that is to be supplied with hydrogen from a chlor-alkali electrolysis plant in an industrial park.

These activities are already attracting serious interest. The Technical Managing Director of Schwaben Netz, René Schoof, reports "significant" hydrogen demand from industry and municipalities in Bavarian Swabia with a view to achieving the 2030 climate targets. A joint web query by Bayernets, Schwaben Netz and the Swabian Chamber of Industry and Commerce (IHK Schwaben) produced concrete figures. A total H_2 demand with a capacity of 1,903 MW was reported for the year 2030. The Managing Director is certain that pure electrification of the energy supply would be too much for many. "We must also give small and medium-sized companies the chance to find the right solution for them," emphasized Schoof in Berlin.

GREAT SUPPORT FOR CONVERSION TO HYDROGEN This year's Gas Network Transformation Plan (GTP) also shows that gas network operators are working on implementation scenarios on a broad scale. This is the central planning instrument for the transformation of gas distribution grids towards climate neutrality. Following its launch in 2022, the number of participating gas distribution system operators rose to 252 in the third planning year. The GTP now covers gas pipelines with a total length of 450,000 km and reaches 381 out of 401 German districts.

The trend is clear: the majority of the approximately 1,100 municipalities supplied by the GTP participants plan to use climate-neutral gases in both industry and private households in the long term. (Only two percent of the municipal-

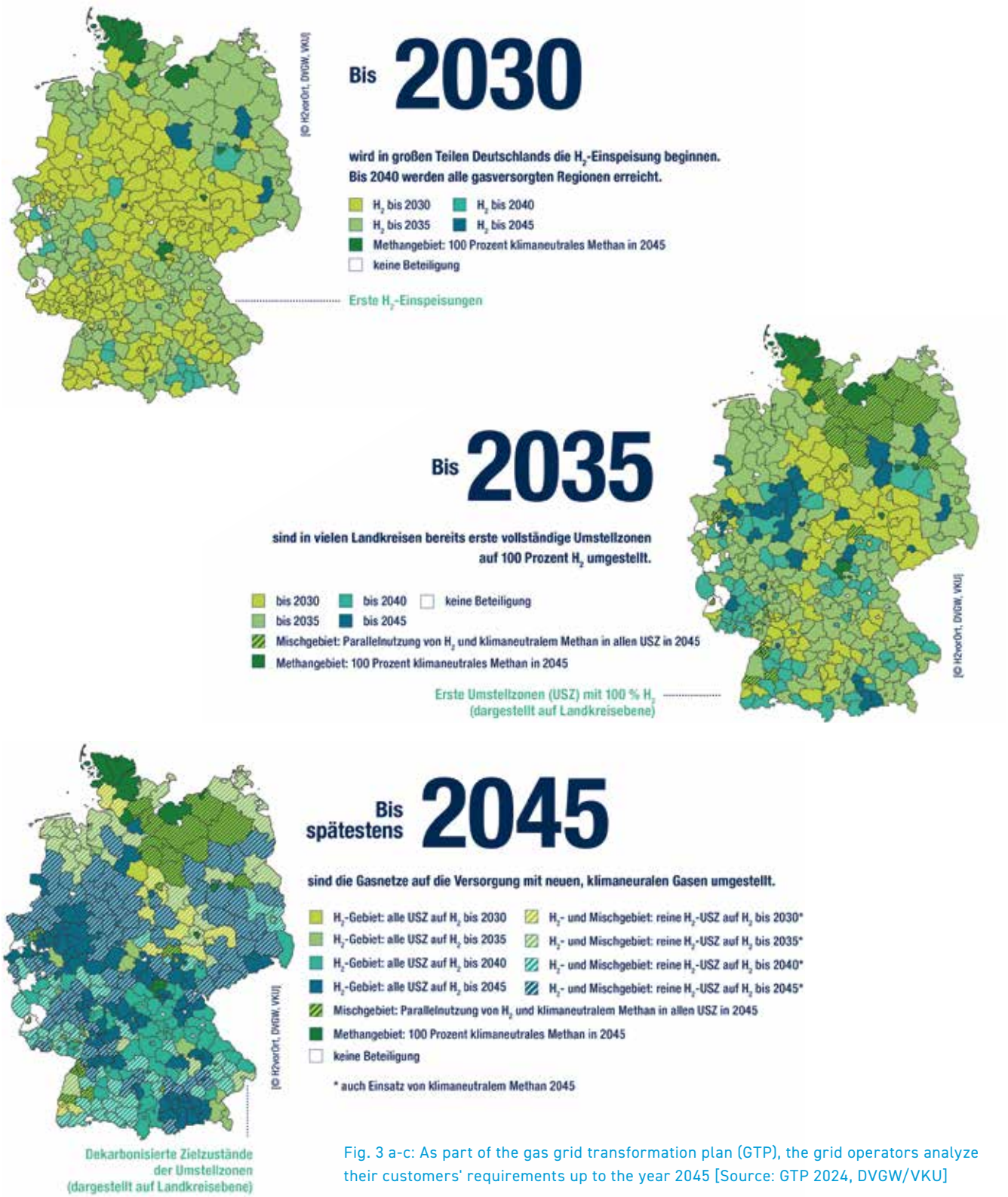


Fig. 3 a-c: As part of the gas grid transformation plan (GTP), the grid operators analyze their customers' requirements up to the year 2045 [Source: GTP 2024, DVGW/VKU]

ities were against the use in industry, seven percent rejected such use for private households). And two thirds of the more than 3,500 industrial and commercial customers surveyed also see a future need for hydrogen, with over 80 percent of large customers even expecting 10 million kWh or more each by 2030.

"Extensive studies by the DVGW and its institutes show that the German gas distribution networks can be technically upgraded for the safe distribution of hydrogen at comparatively low economic cost. This must be tackled now," demands DVGW head Linke. For the technical conversion, the DVGW offers VerifHy, the central platform for quickly and conveniently checking the hydrogen suitability of gas networks and the products, components and materials used. Reliable information on H_2 readiness can be called up at the touch of a button. VerifHy supports gas network operators in checking the suitability of their infrastructures for hydrogen. The database is thus set to become the central accelerator for the H_2 network conversion.

UNPROBLEMATIC CHANGEOVER AT AVACON Avacon Netz has proven that a changeover is also possible in practice (see H2-international, Oct. 2022). Torsten Lotze from Asset Management Gas/Hydrogen refers to eight successful pilot pro-

jects with PE and steel networks as part of the DVGW project group "Hydrogen in gas distribution." The network operators did not replace any components based on the analyses carried out in advance. "The above-ground inspection of underground pipelines before and after the conversion confirmed the technical tightness in each case," reports Lotze. No technical anomalies occurred during operation.

An integrity assessment was carried out in advance in accordance with DVGW data sheets G407 (conversion of steel pipes up to 16 bar operating pressure) and G408 (for PE pipes up to 16 bar operating pressure). The materials are "safe." Nothing was found in the networks that was actually critical, emphasizes Manager Lotze.

With this knowledge, they are already in a position to take the next steps. "We can already evaluate grids and draw up a conversion roadmap," summarizes the Avacon employee. This plan envisages five concrete steps:

- Inventory and documentation of the current network structure, materials and operating conditions
- Mesh analysis, material analysis and evaluation of hydrogen resistance
- Replacement measures for incomplete documentation
- Technical adaptations
- Conversion

On this basis, the grid operator has developed the Avacon gas grid transformation factor (GTF). Specifically, this assesses how well a gas network or individual components can be transferred to a future decarbonized energy system. In the integrity assessment, an H_2 assessment as well as an assessment of safety, condition and data inventory are each presented as a key figure. Lotze explains that the GTF can be used to immediately determine where the overall grid stands and where individual local sections stand. In view of these findings and the progress made, the Avacon expert's conclusion is not surprising: "Hydrogen can come, the gas distribution network is ready."

DISTRIBUTION GRID OF PARTICULAR IMPORTANCE Industrial customers are obviously also ready: According to the H_2 market index (see info box), 76% of market players rate the importance of climate-neutral hydrogen for the future energy supply in Germany as high or very high. An important area of application there is process heat with temperatures between 100 and 1,500 degrees Celsius. This demand has amounted to around 200 TWh in recent years. This corresponds to almost a tenth of the final energy demand (reference year: 2020) of 2,318 TWh and a fifth of the gas demand in Germany.

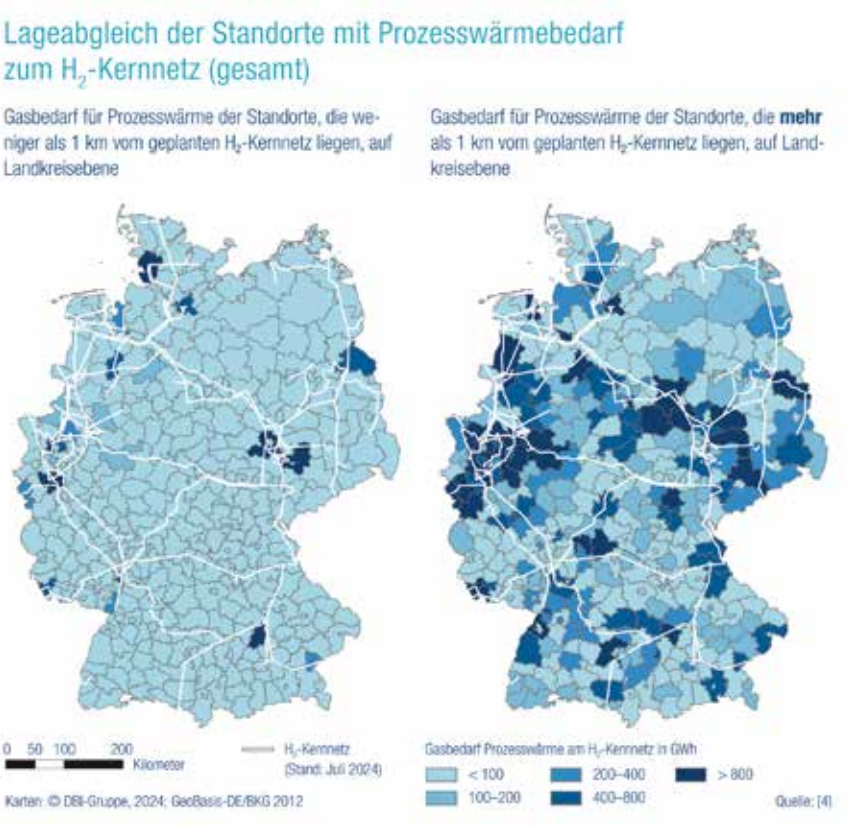


Fig. 4: It is clear that the H_2 core network does not reach all industrial and commercial gas consumers with process heat requirements. [Source: Study Process heat - where does the energy come from? DVGW, DBI, DMT]

A study commissioned by the DVGW (German Technical and Scientific Association for Gas and Water) analyzed the supply situation at over 5,600 industrial sites. The result shows the importance of the distribution network: 27 percent of the sites surveyed are less than one kilometer away from the planned H_2 core network and could be supplied directly via it. However, 78 percent of the gas demand for process heat will arise at a distance of more than one kilometer from this network. A hydrogen-capable distribution network is therefore required to supply these locations. "In order to accelerate the hydrogen ramp-up in Germany, the expansion of hydrogen infrastructures must focus more on the distribution grids. They are of particular importance," says DVGW head Linke, summing up the situation. •

THE H_2 MARKET INDEX – BAROMETER FOR THE MARKET RAMP-UP

The H_2 market index serves to determine the perception of market players regarding the development of a hydrogen market in Germany. The objectives are to map the perceptions of various stakeholders, to identify challenges and potential problem areas and to record relevant indicators for measuring the progress of the hydrogen market ramp-up. The H_2 market index covers the four areas of innovation environment, political and regulatory framework, infrastructure expansion and market development. The index results are mapped on a scale from 0 (negative) to 100 (positive).

An online survey of stakeholders in the hydrogen economy was conducted to determine the H_2 Market Index 2024. A total of 311 index-relevant responses were included in the evaluation. The survey was conducted by the Institute of Energy Economics at the University of Cologne gGmbH (EWI) on behalf of the DVGW, the German Chemical Industry Association (VCI), the German Engineering Federation (VDMA) and the German Steel Federation (WV Stahl).

European multi-gas network is launched

THE SHIMMER PROJECT

In the EU project SHIMMER, the German institute for materials research and testing BAM is working on a comprehensive knowledge database. There, important information on standards for safe materials and components as well as on the European gas infrastructure is to be made available. SHIMMER will be led by the Norwegian research organization SINTEF. The project brings together twelve European institutions, including national institutes and gas network operators from the countries Spain, Italy, Norway, Poland, Belgium, the Netherlands and Germany. **Author:** Anette Weingärtner

Fig. 1: European H_2 network [Source: SHIMMER]

The injection of hydrogen (H_2) into existing gas networks brings with it both technical and regulatory challenges. They particularly concern the material integrity of pipelines and the harmonization of legal requirements. The project SHIMMER (Safe Hydrogen Injection Modelling and Management for European Gas Network Resilience) involves improving understanding for the integration of hydrogen into the existing gas infrastructure and with that support overall the market ramp-up of safe hydrogen technologies. The research project already started in September 2023 and will end in August 2026. Financing comes from the EU program "Horizon Europe – Clean Hydrogen Partnership."

FUNCTIONALITY AND SECURITY OF THE GAS NETWORK

Already the title Safe Hydrogen Injection Modelling and Management for European Gas Network Resilience indicates the objectives associated with the project: For a planned higher injection of hydrogen into the existing gas network, reliable models or simulation tools and secure management systems is to be provided, to ensure the reliability and robustness of the European gas network.

"Injecting H_2 into the existing gas network in higher proportions or in higher concentrations is associated with technical challenges, because the infrastructure was not originally designed for this. Therefore, tools, test methods and

simulation programs for planning and operation as well as an overview of the existing infrastructure must be created, to guarantee the security of the network and its functionality," explains the project manager Dr.-Ing. Oded Sobol from the Bundesanstalt für Materialforschung und –prüfung (BAM).

As part of the stated overarching objective, additional specific goals are being pursued, such as mapping and providing an overview of the existing infrastructure with regard to materials, components, technologies used and the suitability of these for H_2. This data will be part of a public knowledge database, through which users should receive early information about the suitability of the infrastructure. In addition, suitable material testing procedures as well as tools or methods for inspecting and detecting leaks should be developed.

It also involves creating simulation tools, for example for planning or simulating gas quality with varying feed-in and varying consumption based on rate and concentration. The gas composition of the project partners is also a question for the researchers. A certain gas quality is to be ensured by the project, and strategies for the injection of H_2 into the gas grid are to be developed. Last but not least, planned is to create guidelines for risk management and to develop simulation studies for running through various scenarios.

For the project partners, these topics are not new, though. The gas network operators have firmly anchored H_2 injection into their strategy and future plans. And the research companies involved have already gained experience with the topic in their respective specialist areas.

Fig. 2: European projects [Source: SHIMMER]

PRECEDING PROJECTS TO BE TAKEN INTO ACCOUNT Thus, in SHIMMER, data from participating industry partners – mainly European long-distance grid and distribution network operators – will be collected. The SyWest report – tests of representative material samples from pipes in the German gas grid – will be made use of in the project. "There will possibly be a correlation to the VerifHy database (www.verifhy.de), in which pipeline manufacturers have altogether provided information on the H_2 readiness of their products," explains the project manager Dr. Heiner Schümann from SINTEF Industry.

Other projects that are being examined for results that can be used for the database include:

- the EU project HIGGS (list of suitability of TSO pipe material – incomplete)
- the British project HyDeploy (field tests with 20% H_2 injection in the UK)
- the EU projects THyGA (test end consumption devices and their suitability for H_2–natural gas mix, such as heat pumps, water boilers and ovens, CHP – combined heat to power, distributors, etc.), CEN H2 PNR (literature research for many critical areas, including gas quality and steel pipes) and CANDHy (compatibility for non-metallic materials).

The possibility of collaboration is being discussed with those involved in these projects.

FIVE WORK PACKAGES In terms of content, the project consists of five work packages, which are to be carried out simultaneously. "There are dependencies on different tasks within the work packages, however, that must be taken into account when planning the schedule," says Schümann.

The first work package, led by SINTEF, bears the title "Projektmanagement und Koordination (Project Management and Coordination)." "The aim here is to ensure that the project is carried out on schedule with the given resources and the expected quality," says Schümann.

The second work package "Gasinfrastruktur und Betriebsbedingungen (Gas Infrastructure and Operational Conditions)" is under the direction of BAM. "Our task is to obtain information about the existing European gas infrastructure in relation to metallic materials (pipes). For this, we're using existing data from other projects as well as from the literature and are also collecting new information from our partners," says Sobol. In addition, they are obtaining information about operating conditions. Applicable standards and laws will also be viewed, compiled and checked for agreement. "Ultimately, we want to organize all information into a user-friendly database and make it publicly accessible," says Sobol.

The third work package is entitled "Integritätsmanagement und Sicherheit (Integrity Management and Safety)" and falls under the responsibility of the Spanish research center TECNALIA. The aim here is to check the suitability of common material and compatibility test procedures for the planned higher H_2 feed-in. In addition, a GAP analysis is carried out from the perspective of the need for adaptation, changes or new procedures and regulations. Also guidelines for inspection methods for pipes will be worked out and recommendations for leak test methods conceived. Ultimately, it is about making recommendations for risk analysis regarding leaks and developing tools for this.

In the fourth work package "Sicherung des Durchflusses (Flow Assurance)," led by the Dutch organization for applied scientific research TNO, realistic test procedures will be described and existing simulation programs evaluated for their suitability. In addition, a selection of suitable programs are to be improved and adapted so that corresponding scenarios can be played out. Finally, suitable technologies for the measuring and monitoring of gas quality will be evaluated.

In the fifth and final work package "Verbreitung, Kommunikation und Verwertung (Dissemination, Communication and Exploitation)," led by the European gas research company GERG, the dissemination of the results will be ensured, meaning that they reach the right end users, decision-making bodies and stakeholders. GERG is responsible for the publication of articles in magazines and other public media as well as for the organization of conferences. Furthermore, their task is to communicate with interest groups during the project phase in order to obtain feedback and necessary information.

In their work, the researchers within the consortium face a number of challenges: "First of all, the confidentiality of information from industrial partners should be mentioned. At the same time, we intend to publish as much as possible," says Sobol. In addition, the designation of materials, for example steel qualities, is not 100% standardized and different materials with sometimes different names are used across Europe. The environment (gas quality, climate) to which the different materials are exposed also differs. In addition, the industrial partners pursued different interests with regard to the scenarios for simulation studies. A consensus on the blend of H_2 (2, 5 or 20 %) does not exist either. "In our project, seven countries are represented. The problem is also how we should cover the information from the rest of the European countries," says Schümann.

PUBLICATION OF THE INTERIM RESULTS IS IMMINENT The first results are already available. "We are currently awaiting approval and clearance from the European Commission, however. These will then be accessible online and will also be linked on our website" says Schümann. The publishing of the database on the project website (https://shimmerproject.eu/) as well as other scientific publications is projected to happen, according to Sobol, by the end of the project.

INDUSTRY AND LEGISLATION BENEFIT After the project is completed in August 2026, most results, including the database, should be publicly accessible. Benefitting from this could, on the one hand, be industry: Planning for H_2 injection will be simplified. Network operators, suppliers and manufacturers of pipes and equipment save time and money. On the other hand, legislative bodies can adapt their guidelines. "Today there are neither harmonized requirements nor feed-in limits nor regulations for testing and suitability procedures for H_2 feed-in for Europe. The results of this project will be a basis for such a standardization process," says Schümann. •

→ www.shimmerproject.eu

20

Gas network operators continue to count on political support

NO DOUBTS ABOUT THE CORE NETWORK

In October 2024, the German Federal Network Agency approved the plans for the hydrogen core network. Hydrogen is expected to flow through some sections as early as 2025. Despite turbulent times, the network operators remain confident about the new infrastructure. **Author:** Eva Augsten

The approval of the H_2 core network should create planning security for storage and network operators as well as hydrogen users. This was stated by the Federal Minister for Economic Affairs and Climate Protection Robert Habeck on October 22, 2024.

Just 15 days later, the Ampel Coalition leading the federal government collapsed. The word "planning security" seemed like a bad joke. In the meantime, some things are falling into place and even some important legislative amendments could still make it through the German Parliament.

NO TIME FOR WORRIES The prospective operators of the H_2 core network are largely unfazed by the fuss. They are optimistic that they will continue to receive political support. This is certainly partly due to the fact that the advanced status of the project leaves no time for doubt. The first hydrogen pipelines are due to go into operation as early as 2025. And conversely, every meter of hydrogen pipeline built increases the pressure on politicians to continue.

In addition, the hearing on the Hydrogen Acceleration Act showed that almost all parties support hydrogen as a raw material – with the exception of the AfD. "The current political situation has no influence on these decisions," says Sebastian Luther from Corporate Communications at Ontras Gastransport, which is already working on the conversion of a pipeline route. "I don't expect the situation for the hydrogen core network to deteriorate if there is a change of govern-

The H_2 core grid is to gradually go into operation by 2032 and have a feed-in capacity of 101 GW. The variant approved by the Federal Network Agency in October is slightly smaller than the application: 9,040 instead of 9,666 km of lines, 18.9 instead of 19.8 billion euros.

ment. It might even get better with a CDU-led government," says an employee of another grid company. He hopes that the pipeline negotiations with Norway might even be resumed.

And the German Association of Energy and Water Industries (BDEW) summarizes: "The implementation of the hydrogen core network is now underway. The application has been approved and the companies can start implementing it."

HYDROGEN FOR REFINERY Three network operators who want to complete the first sections as early as 2025 are Ontras Gastransport, Gascade and the consortium around the GET H_2 Nukleus. Ontras plans to connect the Total Energies refinery in central Germany first. "We continue to assume that we will connect the customer in the real-world laboratory for the energy transition Energiepark Bad Lauchstädt to the emerging hydrogen core network as planned in 2025 – making it the first in the country," says Ontras.

According to the press release, the entire supply chain has already been contractually agreed. The ground-breaking ceremony for the 25-km section from Bad Lauchstädt to Leuna took place in summer 2023, followed by the installation of the pig lock a few months later (Fig. 1). The section is part of the Bad Lauchstädt Energy Park, which is being funded by the BMWK as a real-world laboratory for the energy transition. In the pilot project, the gas network operator wants to gain experience that will save time and work when converting other gas pipelines, explains Gunar Schmidt, Ontras Managing Director of Operations and Safety. As part of the H_2 core network, Ontras intends to create a total of around 600 km of hydrogen transport pipelines in central Germany.

FROM THE BALTIC SEA TO SACHSEN-ANHALT Gascade Gastransport is also in the starting blocks. "We have been working on the planning for the implementation of the H_2 transportation projects for some time. Now we can actually get started – with conversions of current natural gas pipelines and new construction projects," said Managing Director Christoph von dem Bussche in October. Gascade primarily wants to build import pipelines in the North Sea and Baltic Sea regions. The first pipeline project entitled "Flow - making hydrogen happen" should be able to transport large quantities of hydrogen from Lubmin on the Baltic coast to Bobbau, a district of Bitterfeld-Wolfen in Sachsen-Anhalt, by 2025.

The Lubmin-based electrolyzer operator HH2E, of all companies, has just made headlines with its insolvency (see p. 7). However, this does not affect the pipeline project, as Gascade explains. On the one hand, the company is hoping for a new investor and, on the other, there are other producers who want to feed into the pipeline.

Pipelines in the Baltic Sea region and southwest Europe are to follow in subsequent years, as well as the AquaDuctus offshore pipeline, which will bring hydrogen from a North Sea wind farm with a capacity of 1 GW to land.

HYDROGEN IN THE WEST Construction work on the first core network section, the GET H2 Nukleus project, is also underway in the Ruhr region. The overall system with many partners involved is scheduled to go into operation as early as mid-2025. It includes a large electrolyzer (RWE), a conversion of existing pipelines (Nowega and OGE) and a partially new pipeline route (Nowega, Evonik). Construction of several pipelines has already begun in 2023.

Fig. 1: Installation of the pig launching station at Ontras' Bad Lauchstädt energy park in November 2023. [Source: Ontras]

INVESTMENT SECURITY REQUIRED A grid operator would secure the construction of a normal new pipeline with watertight contracts with customers. However, for a complete grid for a new energy source, the sums involved and the uncertainties are too great. Many grid operators say that the H_2 core grid is a historic task for them. Even for large corporations, the investments are at least very unusual, if not unique.

And so, despite being financed by the private sector, state aid is still needed. In addition to the IPCEI projects (Important Projects of Common European Interest), which receive large subsidies from the federal and state governments with the explicit blessing of the EU's state aid watchdogs, the assistance consists primarily of government backing for amortization via the grid fees. The Federal Network Agency is to set the standardized nationwide ramp-up grid fee at the start, so that the first customers are not deterred.

The high level of investment at the beginning and the delay in income has resulted in a financial gap. The federal government wants to bridge this gap with a so-called amortization account. Initially, money is to flow from this account to the network operators, and later back again – at least that is the plan of the Ampel Coalition. "Offsetting costs via the amortization account allows us to invest in the core network without having to have all the deals clear," says Dr. Dirk Flandrich, Head of the "Flow - making hydrogen happen" program at Gascade.

The northern German grid operator Hamburger Energienetze, which wants to supply several industrial companies in the port area with hydrogen, has expressed similar views. The prospect of uniform grid fees now gives the grid operators financial security, they say.

So the foundations are there. However, neither the H_2 ramp-up nor the core grid are in the bag. For the amortization account to fill up again as planned, the conditions must also be right for H_2 producers, storage companies and consumers. They all have to come together to conclude long-term contracts.

And this in turn requires a stable political framework, both in Germany and in Europe. The expansion of renewable energies, the definition of green or low-carbon hydrogen and the EU's gas package are just a few of the keywords. While the grid operators are working on their core grid construction sites, there are therefore also plenty of political construction sites for the German government and the EU. Tackling these will be the task of the new EU Commission and the future German government. •

Interview with Marco Lazzaroni, CEO of UFI Hydrogen

THE HYDROGEN ECONOMY NEEDS TO DEVELOP AT GREATER SPEED

UFI Hydrogen may not yet be particularly well known to many industry participants in Germany, but the company, based in the Trento area of Italy, is part of the globally active UFI Group, which has 57 commercial offices and 22 plants worldwide (in Europe, Tunisia, China, India, Korea and Brazil, among others). Its products, mainly filters and components for thermal management, are in demand in many sectors. H2-international spoke to Marco Lazzaroni, CEO of UFI Hydrogen, the youngest company in the UFI Group, about the current economic situation in Europe, the potential of the H_2 economy and, of course, the ambitions of UFI's hydrogen business. **Interviewer:** Sven Geitmann

H2-international: Mr. Lazzaroni, you have just come from the German-Italian Energy Forum, an initiative by the Italian Chamber of Commerce for Germany (ITKAM). What impressions did you get from the forum in Frankfurt am Main?

Lazzaroni: Regarding the event, I had a very good impression. It represented an important opportunity to make connections with those involved in the hydrogen value chain in the German market.

Fig.: Marco Lazzaroni [Source: UFI Hydrogen]

Among other things, you yourself discussed the potential of green hydrogen decarbonizing European industry from the podium. What were your essential points from this exchange?

There is a lot of potential in the German-Italian relationship: On the one hand, we need to address the transportation infrastructure for hydrogen that has yet to be connected with the SouthH_2 Corridor project. This is a 3,300-km hydrogen pipeline connecting North Africa, Italy, Austria, and Germany. This aims to supply competitive renewable green hydrogen to clusters of demand within Europe. Italy plays a crucial role in this corridor. The Italian H_2 Backbone is composed of around 2,300 km of pipelines and several hundred megawatts of compressor stations, expected to become dedicated hydrogen assets by 2030.

On the other hand, the technology behind the production of hydrogen and its use in industry open up a lot of opportunities for European collaboration. UFI Hydrogen will play a major role in this, thanks to its new production plant in Serravalle, Trentino, in the center of one of the important hydrogen valleys in Italy. UFI Hydrogen is also active in Tunisia, collaborating on the Mattei Plan for a green hydrogen pilot plant, which will transport hydrogen to Europe via the SouthH_2 Corridor.

Your parent company has expanded significantly in recent years with 22 locations worldwide and over 4,400 employees. Could you please briefly specify what the UFI Group does?

Founded in 1971, UFI Filters Group is a global leader in filtration technology and thermal management. It serves a wide range of sectors – from automotive, aerospace and marine through to specialized industrial and customized hydraulic applications. Renowned for its innovation, UFI's products and know-how are found in all kinds of vehicles – from top F1 teams, including Ferrari, through to the European ExoMars spacecraft. For seven years now, UFI Group's innovative power has also been focused on the hydrogen business. It is the big effort and wish of our chairman and owner, Giorgio Girondi, to play an active role in the transformation of the economy. The research and development

capacity at UFI has led to 320 patents being registered by the group, and this path of innovation forms the basis of the patent strategy being used by the hydrogen business.

Your company UFI Hydrogen is a subsidiary of the UFI Group and was only founded in 2023. What do you offer that your parent company doesn't already provide?

As you know, green hydrogen is emerging as one of the most promising solutions to the challenges of decarbonisation. UFI Hydrogen is at the forefront of this revolution, driving innovation through the development of next-generation catalystcoated membranes with four types of application: the production of green hydrogen through water electrolysis, zero-emission electricity production using fuel cells, the production of e-fuel through the transformation of CO_2, and electrochemical compressors of green hydrogen. Our mission is to industrialise and develop advanced solutions based on Membrane Electrode Assemblies (MEA) that are applied in several key sectors of the green hydrogen transition.

Among other things, you have a patented membrane technology. Is that correct?

Yes, our flagship product is membranes for water electrolysis coated with platinum and also with iridium catalysts, one of the most expensive materials in the world (MEA UFI.Iridium™). These membranes enable efficient separation of hydrogen from oxygen and represent a key solution for large-scale production of green hydrogen. UFI Hydrogen will introduce this innovation to the market as early as the beginning of 2025, with a high-performance technology solution, aiming to significantly lower costs. This will make the technology more affordable and sustainable for industrial-scale adoption. The second product line, based on fuel cell membranes (MEA UFI.Platinum™), enables the conversion of green hydrogen into electricity via fuel cells, offering indispensable solutions for zero-emission mobility and also for stationary applications. UFI Hydrogen aims to bring this technology to market by 2026/2027, with the goal of developing a green, PFAS-free MEA membrane, free of fluoropolymers and therefore totally environmentally friendly.

The MEA UFI membranes can also be used for the electrolysis of CO_2 to produce e-fuels, with a great strategic impact in the transport market (automotive, aviation and shipping), as well as for electrochemical compressors. The latter open up a whole new market due to their ability to compress gas without the use of moving mechanical parts. This reduces operating costs and improves energy efficiency, eliminating wear and maintenance problems typical of traditional compressors. Being able to reach high pressures, these compressors are crucial for the storage and distribution of green hydrogen – two key processes to ensure its adoption in both industrial and transportation applications.

Why have you only now entered the H_2 business?

Seven years of intense research & development, conducted since 2017, were needed to come out with something revolu-

tionary which we believe we have to offer now in order to industrialize and transform hydrogen production. The hydrogen economy needs to develop at greater speed and we do have the technology to make the production and storage affordable, to enable competitive prices in comparison with competitors in our market, as well as other energy sources.

UFI Hydrogen is the only Italian company to receive funding from the Commission as part of the European Hy2Move project within the IPCEI scheme. What is this project about?

The goal of this project is to reduce emissions in the mobility and transport sectors by 90 percent by 2050, in line with the European Green Deal. UFI Hydrogen is promoted in the IPCEI Hy2Move project for the development of innovative MEAs (Membrane Electrode Assembly) for fuel cells, intended for sectors such as road transport, maritime, aviation and stationary applications.

I hear that your chairman and owner of the UFI Group, Giorgio Girondi, has close contact with the Italian government and even advises EU parliamentarians. Can you be more specific about the role he plays?

Mr. Girondi is surely one of the most experienced business developers in our country. In this respect, he has been appointed advisor to the Italian delegation in the European Parliament for Italy, Europe and China. This is an honor and obligation in one. With 42 years' experience in expanding and innovating the UFI Group worldwide from a small 2 million Euro business to an enterprise with a turnover of almost 600 million Euro, he is certainly a valuable political advisor. His expertise and insights from UFI Group's production in China are especially interesting in regard to the process of strengthening the relationship between Italy, Europe and China in promoting valuable industrial investments and joint growth opportunities.

For UFI Group, China is a very important market. Currently it has seven production sites in China with 1,800 employees and the market is responsible for a third of the group`s turnover. In May, the group established UFI GREEN in Jiaxing, the first industrial site fully dedicated to green technologies in China. Within this site, UFI Hydrogen will also occupy 5,000 square meters as it accelerates the development of advanced solutions for the production and use of green hydrogen in China. To support this expansion, UFI Hydrogen has signed a memorandum of understanding with Sinopec, China's largest oil and petrochemical company, to explore new solutions in green hydrogen and promote its integration into the Chinese energy market.

You obviously assume that the market will grow rapidly. In Italy, you are also currently building a new production facility near Verona. What will be produced there?

That's right. We are currently in the process of moving into the new premises in Serravalle, which is situated between Trento and Verona, in the Province of Trento. The new 14,000-square-meter industrial facility – 6,000 square metres of which will be indoors – will initially employ around 30 people including researchers, technicians and production staff. In January 2025, production will begin using our MEA-technology the aforementioned membranes for water electrolysis and the fuel cell membranes. Over the next four years, the company expects an investment of around 50 million Euro and the creation of around 100 new jobs for the area.

Are you already seeing a growing demand for your membranes or is the demand still low?

Yes, there is definitely a growing demand. We are now in the phase of entering the market with our high-performance technology that is especially efficient in allowing very high hydrogen production with lower energy consumption. Several international customers have already been in contact with us to assess purchasing our MEA technology. We will start industrialised production in our new plant from January 2025 onwards.

Recently we read that Giorgio Girondi is looking for partners in the H_2 sector, and possibly also intends to take UFI Hydrogen public? Is this true, and if so, what is the current situation?

We are looking for operational and strategic partners, that's right. Going public would be a possible further step in our journey in the future. Right now, 100 per cent of the shares are inhouse. Half of UFI Hydrogen belongs to UFI Filters Group and the other half to the Giorgio Girondi Holding Group. The legal entity is an S.p.A., this gives us sufficient leeway to take on external investors if the conditions are right for this opportunity.

Right now, we are looking for partners in Germany, our core market within Europe, to further develop and also customise our technology. To shape a future European H_2 economy, we will have to gather all our innovative power together, as we already do in the IPCEI project, where in Germany (this might be interesting for your readers) we cooperate among others with BMW, Airbus and the family business Neumann & Esser. Additionally, we already have ongoing strategic relations with all the German major hydrogen stakeholders.

For months, German commercial enterprises have been complaining about a decline in demand and a lack of planning certainty. Are you affected by this, and what is the mood like for you in Italy?

Italy's economy has been lucky not to shrink like Germany's, but growth has also slowed down. Despite this, we are very optimistic for the hydrogen industry, as the hydrogen supply chain is supported by the market. In Italy, the Italian government has just published the national hydrogen strategy, which demonstrates Italy's conviction in supporting the key role of the hydrogen sector in the country's decarbonization and energy security, and also provides a clear strategic direction needed to reassure investors. •

Interview with Bryan Glover, CTO of Honeywell

FROM CO_2 CAPTURE TO LOHC TECHNOLOGY

After more than 50 years of experience with hydrogen, Honeywell is also banking on green hydrogen with its company Energy and Sustainability Solutions (ESS). The US conglomerate takes the entire value chain into account: from more efficient PEM electrolysis all the way to transport infrastructure.

Interviewer: Monika Rößiger

Fig. 1: Bryan Glover, Chief Technology and Growth Officer at Honeywell [Source: Honeywell]

H2-international: Honeywell is focusing strongly on a future with green hydrogen. Why?

Glover: Honeywell is aware of the enormous importance that green hydrogen will play in the clean energy transition. Because of its energy density, hydrogen is a good alternative to fossil fuels. It is therefore expected that the demand for green hydrogen will increase significantly in the coming years. A report from Wood Mackenzie shows that low-carbon hydrogen will account for seven percent of global energy demand by 2050, which corresponds to 211 million metric tons.

Global support and investment in green hydrogen confirms this, as governments around the world are adopting policies to promote its use. Among other things, Germany's national hydrogen strategy aims to achieve its climate protection goals with the help of green hydrogen. Furthermore, the European Investment Bank and Germany increased the Green Hydrogen Fund at the end of 2023 to stimulate the global hydrogen economy.

Your company sees itself as a pioneer in the development of innovative solutions related to green hydrogen. What are they, for example?

Honeywell can look back on more than 50 years of experience driving innovation in the production and use of hydrogen. We offer solutions that cover the entire hydrogen value chain – from production to conversion, transport, storage and distribution.

Since 1966, when the first industrial application of our PSA (Pressure Swing Adsorption) technology came into operation, Honeywell has been leading in the field of hydrogen processing. To date, we have delivered more than 1,000 PSA systems worldwide that produce around 25 million standard cubic meters of pure hydrogen per hour, which plays a crucial role in improving production efficiency and scalability.

Another example are Honeywell's catalyst-coated membranes (CCMs), which enable customers to produce a larger quantity of green hydrogen at a lower overall cost. Leading electrolyzer manufacturers have demonstrated that these membranes can produce 30 percent more hydrogen than current commercially available CCMs and reduce the cost of non-CCM stack components by 29 percent.

In what ways can Honeywell help significantly improve the efficiency of producing green hydrogen?

We are continually investing in research and development to enable even broader production with even greater end-to-end efficiency and cost savings. In addition to the CCM technology from Honeywell, we also support the development and scaling of next-generation electrolyzer technologies via Honeywell Ventures. This part of the company invests in early-stage, high-growth companies that have breakthrough technologies. Our strategic investment in the financing round of Series B from Electric Hydrogen contributed to a total of 198 million US dollars. This money is assisting Electric Hydrogen in the development of high-throughput electrolyzers, to reduce costs and increase efficiency for large-scale industrial and infrastructure projects.

What solution does Honeywell offer for building a hydrogen infrastructure, for example in terms of storage and transport?

In 2023, Honeywell introduced its LOHC (liquid organic hydrogen carrier) solution. This innovative technology enables the transport of hydrogen over existing oil and gas infrastructure. That is a safer and more cost-effective solution compared to other transportation methods currently on the market. With the LOHC technology from Honeywell, hy-

drogen gas is chemically bound to the liquid carrier methylcyclohexane (MCH). The MCH can be converted back into hydrogen at the intended destination.

The Hydrogen Council predicts that around 400 million tonnes of hydrogen and derivatives will have to be transported by 2050. Since producing green hydrogen is water-intensive, many countries around the world will need to import it. Our LOHC solution can increase hydrogen production by around ten percent and has the potential to produce between 3,000 and 100,000 metric tons of hydrogen per year.

What about the consumption of resources, including water, for electrolysis?

The consumption of resources, including water, is a crucial factor in hydrogen production via electrolysis. Our green hydrogen solutions are specifically designed to improve resource efficiency. The catalyst coated membranes (CCMs) from Honeywell optimize the process by significantly reducing the amount of water and other operating media for electrolysis. This also reduces the overall costs.

What is "revolutionary" about Honeywell's developments?

The International Energy Agency (IEA) has highlighted the importance of utilizing existing industrial ports and infrastructure to create hubs for low-cost, low-carbon hydrogen. The LOHC solution from Honeywell is an example of this approach, because it uses existing fossil fuel infrastructure to transport hydrogen, which significantly reduces costs and improves scalability. Our technology not only contributes to the energy transition, but also strengthens investors' confidence in the hydrogen economy.

Are your developments already usable in practice and scalable?

Yes. An example of this is our collaboration with ENEOS, a leading energy company in Japan. ENEOS will employ the LOHC technology from Honeywell at several sites to develop the world's first commercial project for liquid organic hydrogen carriers. The ENEOS project shows how our technology can be integrated into existing transport networks. This strategic partnership with ENEOS is one of several projects in the field of hydrogen transport in which we cooperate with this company.

How does Honeywell fundamentally contribute to sustainable development in industrial production?

Our world today is based on hard-to-defossilize industries such as petroleum refining, gas processing, petrochemical production, and cement and steel manufacturing. The transition to cleaner energy solutions will take time here. Therefore, Honeywell is also developing solutions to reduce emissions from heavy industry today. An example is Honeywell's technology for the capture of carbon dioxide (CO_2). ExxonMobil plans to employ our technology for CO_2 capture and hydrogen purification in a facility for the production of lower-carbon hydrogen in the USA. It is expected that with Honeywell's technology, around seven million tonnes of carbon dioxide will be captured from this plant every year, which corresponds to the emissions of 1.5 million cars per year. •

Fig. 1: The hydrogen terminal in Braunschweig [Source: enapter]

Green hydrogen for research

HYDROGEN TERMINAL IN BRAUNSCHWEIG

A research environment along the H_2 value chain is being created at the Research Airport in Braunschweig. Research is being conducted on green hydrogen production as well as the storage, transportation and use of hydrogen in heavy-duty mobility. Based on designs by Jahn Architektur, a unique H_2 research landscape on a real laboratory scale has been created on the approximately 5,000-m^2 (54,000-ft^2) site, making it a demonstrator of a future energy center in the megawatt range.

Authors: David Sauss, Markus Hartwig

The transportation and storage of renewable energy is one of the biggest challenges of the energy transition. One solution is emerging in connection with technologies related to hydrogen as an energy source. The construction of Hydrogen Terminal Braunschweig will create a location for pooling research expertise along the H_2 value chain in the megawatt range. The project, funded by the German Ministry of Education and Research (BMBF) with a total funding volume of over 20 million euros, is being implemented as a joint project under the leadership of the Steinbeis Innovation Center Energieplus (SIZ Energieplus), the Technical University of Braunschweig and the University of Hamburg together with the project partners BS Energy and the Fraunhofer Center for Applied Nanotechnology (CAN).

MOTIVATION FOR THE PROJECT The heart of the project is currently the AEM multicore electrolyzer from Enapter with a power class of 1 megawatt, which is the world's first prototype to bring AEM (Anion Exchange Membrane) technology to Braunschweig. In addition, STOFF2's innovative zinc intermediate-step electrolysis system for hydrogen production is to be installed on the site in the coming months. In addition to the electrolyzers located outside the building, electrolysis test benches have been set up in the research building to investigate alkaline electrolysis and PEM (Proton Exchange Membrane) electrolysis.

With the various electrolysis technologies, the essential range of existing production approaches for green hydrogen is represented for direct comparison within the hydrogen

Fig. 2: Markus Hartwig (right) and David Sauss (left) with Sebastian Sipp, Managing Director of STOFF2, on the site of the hydrogen terminal in Braunschweig [Source: STOFF2]

terminal. As part of the project, research is being carried out to increase the efficiency of all technologies. In addition, the production of hydrogen by (co-)pyrolysis of hydrocarbon-containing feedstocks is being tested and further developed as part of the research project.

STATUS QUO IN IMPLEMENTATION The green hydrogen generated with renewable electricity from the electrolyzers is used in various ways. On the one hand, it is used in internal test benches to carry out ageing tests on fuel cell and electrolysis membranes. Secondly, other external (fuel cell) test benches at the Fraunhofer Center for Energy Storage and Systems (Fraunhofer ZESS) and the Niedersachsen Research Center for Automotive Engineering (NFF), which is around one kilometer away, are supplied with the green hydrogen via pipeline.

Parallel to the supply of hydrogen, Fraunhofer ZESS is supplied with waste heat from electrolysis. For this purpose, the temperature level of the waste heat from the electrolysis processes is raised using a high-temperature heat pump and made available via a local heating network. In addition to the use of the hydrogen in the test benches, it is used to test hydrogen storage in the world's largest metal hydride storage facility, currently operated by GKN Hydrogen.

In addition to being used in test benches, the hydrogen produced on the Hydrogen Terminal site is used to operate a hydrogen refueling station from the manufacturer Maximator. At this filling station, heavy-duty vehicles can be refueled with green hydrogen at a pressure level of 350 bar.

The project is also investigating how the electrolyzers and fuel cells, in conjunction with a large battery storage system (storage capacity: 1.1 MWh) and the solar system, can be used to stabilize the grid when conventional fossil fuel power plants are no longer available.

After the opening ceremony in late summer, the time-consuming commissioning work was then carried out. The high-temperature heat pump from Combitherm, which was designed together with the TGA planner EGS-plan from Stuttgart, is already in operation, as are the redundant propane heat pumps from Viessmann. The ventilation system from Trox and the electrolyzer from Enapter are currently being put into operation. The certified system builder H_2 Core Systems from Heide is also being trained on this system and will be able to carry out the construction and commissioning of the Nexus1000 independently in future.

The battery system will be put in operation by SMA by the end of the year. They are working together with the marketer Next Kraftwerke and the Elenia Institute for High Voltage Technology and Energy Systems to investigate the grid-forming properties for voltage and frequency stabilization of the inverter.

GREEN HYDROGEN WITH PV ON SITE In addition to the now mandatory solarization of the roof areas, an agrivoltaic system was installed on the remaining ecological compensation area as a demonstration. Concrete foundations were completely dispensed with and screw anchors were used. This means that the ground-mounted photovoltaic system can be completely dismantled and is also suitable for temporarily usable areas. The amount of electricity generated is not sufficient to cover the electricity requirements of the systems; therefore, currently for the start of operation, certified green electricity is being purchased on the spot market.

In the future, a 3 MW_{peak} ground-mounted photovoltaic system will be built on the neighboring property. Empty conduits have been laid for this as well as a feed-in field in our medium-voltage customer system. In the long term, direct, local renewables will not be sufficient for green hydrogen certification. To this end, they will conclude further direct supply contracts (PPAs) in order to achieve the necessary full-load hours and production volumes.

EXPANSION TO INCLUDE INTERMEDIATE ZINC ELECTROLYSIS STOFF2 and SIZ Energieplus are currently investigating the integration of a zinc intermediate-step electrolysis on site. This is a new and innovative electrolysis technology. It takes in green electricity over four hours, stores the energy safely in the form of zinc in the electrolyzer and then discharges green hydrogen over 12 to 24 hours. The charging and discharging process can be flexibly controlled. This ensures that, on the one hand, electricity from renewable energy sources is charged when it is available at low cost and, on the other hand, hydrogen is made available exactly when customers need it.

At the hydrogen terminal site in Braunschweig, the zinc intermediate-step electrolysis is intended to further improve H_2 supply security in conjunction with the other components. At the same time, this technology is intended to increase the degree of self-consumption of PV electricity.

Hydrogen Terminal Braunschweig has created an innovative learning, training and research environment for hydrogen, which other projects can now dock onto. •

Authors:
David Sauss
siz energieplus, Braunschweig
→ david.sauss@siz-energieplus.de

Markus Hartwig
STOFF2, Berlin
→ markus.hartwig@stoff2.com

Regions series: Heilbronn-Franken

HYDROGEN BOOST – FAR BEYOND THE REGION

When it comes to hydrogen, the Heilbronn-Franken region in Germany is a thought leader and doer. The responsible players from business, politics and research have been working together successfully for years to develop innovative and practical solutions for the hydrogen ramp-up. The H2-Impuls initiative was launched to make the knowledge gained from the various projects accessible to everyone, create synergies and jointly accelerate the hydrogen ramp-up locally. The development of a comprehensive hydrogen strategy, the designation of 2 percent of the regional area for wind farms and ground-mounted photovoltaic plants and cooperation with other regions are the first concrete steps that show how Heilbronn-Franken is already actively shaping the future of hydrogen in the southwest of the country. **Authors:** Iris Ley, Bettina Pany

Fig.: The Öhringen hydrogen island [Photo: Wirtschaftsförderung Raum Heilbronn]

Funding totaling € 550,000 was secured in fall 2024 as part of the H2-Impuls initiative. The Federal Ministry of Housing, Urban Development and Building is contributing € 450,000 to create a strategic regional development concept and support the development of sustainable H_2 infrastructure. A further € 100,000 will come from the Baden-Württemberg Ministry for the Environment, Climate Protection and the Energy Sector to develop a hydrogen strategy for the Heilbronn-Franken region.

"Hydrogen is not only of central importance for our region, but will also play a key role in the future energy supply for the whole of Baden-Württemberg," said Norbert Heuser, District Administrator of the Heilbronn district and hydrogen spokesperson for the Heilbronn-Franken region and the hydrogen working group in the Stuttgart metropolitan region, at the 3rd Metropolitan Congress of the European Stuttgart Metropolitan Region in early November 2024. "That's why many other regions are currently looking at what's happening in

Heilbronn-Franken." Heuser also emphasized how important it is to coordinate and bring together the various projects at state level – just as the H2-Impuls initiative is already doing at regional level.

A NETWORK OF RELIABLE CONNECTIONS The aim of the Heilbronn H2-Impuls initiative is to bring together companies, local authorities and scientific institutions in order to create synergies and pave the way for the sustainable use of hydrogen as quickly as possible. The constantly growing H_2 network initiates (cooperative) projects, provides regular information about ongoing activities, initiatives and funding and makes up-to-date knowledge available to companies and local authorities. This raises local awareness of hydrogen applications and connects the various players in the region – including renowned institutions such as the Fraunhofer Institute for Industrial Engineering IAO, Heilbronn University of Applied Sciences (HHN) and the Technical University of Munich (TUM) – with companies and local authorities.

HYDROGEN-ACTIVE – EXAMPLES FROM THE REGION

"H2Orizon" and "Zero Emission" technology transfer projects:
As one of the largest consumers of liquid hydrogen in Europe, the German Aerospace Center (DLR) in Lampoldshausen (Heilbronn district) uses extensive hydrogen infrastructure for space propulsion. With technology transfer projects such as H2Orizon and Zero Emission, it uses green hydrogen to promote the development of hydrogen-based technologies that go beyond space applications. The aim is to achieve a sustainable and CO_2-free energy supply for the research location.

RegioWIN lighthouse project "Hydrogenium":
A test and application center is being built at the DLR site in Lampoldshausen to support companies in the development and testing of hydrogen technologies. The test field enables research and development of liquid hydrogen-based systems and components. The project is funded as a "project of strategic importance" by the European Union and the state of Baden-Württemberg.

H_2 innovation lab:
The research partners Fraunhofer IAO, Heilbronn University of Applied Sciences, the Technical University of Munich and the Ferdinand Steinbeis Institute have laid the foundations for the development of a regional hydrogen economy with the Heilbronn-Franken H_2 innovation lab joint project. This involved identifying key players, developing an H_2 ecosystem model and drawing up recommendations for action for the Heilbronn-Franken region.

The Öhringen hydrogen island:
In a geographically limited area, the proportion of hydrogen in the natural gas network was gradually increased to up to 30 percent by Netze BW. The Center for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW) supported the integration of an electrolysis plant into the system concept and monitored the technical implementation.

Conversion of the Heilbronn coal-fired power plant:
EnBW's coal-fired power plant in Heilbronn will be converted to natural gas by 2026. From 2035, energy production is to be completely powered by green gases, which could make Heilbronn one of the first climate-neutral cities.

Hydrogen Day:
For the past eleven years, the business development agency Wirtschaftsförderung Raum Heilbronn GmbH, together with the Technology Transfer Center Lampoldshausen (TTZ), DLR Lampoldshausen and the municipality of Hardthausen, has been organizing Hydrogen Day – a specialist congress for the regional and national hydrogen economy.

THE RIGHT STRATEGY FOR SECURITY OF SUPPLY In addition to specific projects for the application, production, storage and transportation of hydrogen, Heilbronn-Franken is currently focusing on developing a workable hydrogen strategy. In view of the national H_2 road map, which gives northern and eastern German states an advantage, the southwest must take action itself in order to obtain sufficient hydrogen. Under the leadership of District Administrator Heuser, several strategy discussions have already taken place with network operators, municipal utilities, large commercial enterprises and representatives of local authorities and business development agencies.

"By designating new areas for wind and solar energy, we are creating the legal conditions to promote the expansion of renewable energies in our region. This is the basis for enabling the production and use of green hydrogen on a larger scale locally. Surplus wind and solar power can then be used for hydrogen electrolysis and energy storage," explains Dr. Andreas Schumm, Association Director of the Heilbronn-Franken Regional Association. However, according to Schumm, it is also important to consider sector coupling – i.e. the linking of electricity, heat and hydrogen grids – which is considered a central component of future energy infrastructure, as well as the use of all energy sources to advance the transformation of the heating sector at an early stage, in other words now.

REMOVING BARRIERS TO ACCELERATE H_2 RAMP-UP Anyone who talks to companies or representatives of local authorities will hear the urgent call to finally adapt the regulatory framework. All too often, this stands in the way of climate targets and the market ramp-up of renewable energies and green hydrogen. "We support companies in the Heilbronn region in exploiting the potential of hydrogen technology. Through our initiatives, we offer targeted assistance and promote discussion. Our aim is to further expand our pioneering role in the hydrogen economy, which we hold primarily thanks to the engagement of the DLR," explained Dr. Patrick Dufour-Bourru, Managing Director of Wirtschaftsförderung Raum Heilbronn GmbH. •

H2-IMPULS INITIATIVE: LINKING COMPANIES, LOCAL AUTHORITIES AND POLITICS
The H2-Impuls initiative is supported by the Heilbronn District Office, the Heilbronn-Franken Regional Association and Wirtschaftsförderung Raum Heilbronn GmbH. This consortium of stakeholders sees itself as an active link between business, local authorities, politics and the public. Regular network meetings promote the exchange of ideas in order to make the region's energy supply fit for the future.

Authors:
Iris Ley (right),
Wirtschaftsförderung Raum Heilbronn GmbH
→ ley@wfgheilbronn.de
Bettina Pany,
RegionalverbandHeilbronn-Franken, Heilbronn
→ pany@rvhnf.de

Formula Student relies on H_2

HYDROGEN FOR RACING CARS

In the summer of 2025, the first hydrogen vehicles will compete against vehicles with conventional drive systems at the Red Bull Ring in Spielberg, Styria, Austria. To ensure that both fuel cells and combustion engines can be used there, Formula Student Austria, in cooperation with other race organizers, has published corresponding H_2 regulations that will enable student teams to design, build and race hydrogen-powered racing cars in the future.

Authors: Romana Močnik, Steffen Schmitt

Source: Formula Student Austria

Formula Student Austria (FSA) is the Austrian event of the Formula Student racing series and has been held every year since 2009. This racing series enables young, dedicated students from universities and universities of applied sciences from all over the world to demonstrate their knowledge, design and development skills as well as their organizational and commercial talents in several different disciplines.

Formula Student Austria takes place annually at the Red Bull Ring in Spielberg. In 2025, 58 international teams from almost 20 different nations and more than 1,600 students will be taking part. Different disciplines challenge the students on several levels. In addition to the obligatory technical scrutineering, the five dynamic disciplines are all about the speed and reliability of the racing cars they have designed and built themselves. The three static disciplines include the engineering design and thus the evaluation of the construction of the respective vehicle by international jurors. In addition, the business plan and marketing strategy are evaluated, as is the cost breakdown.

TECHNOLOGICAL OPENNESS FOR THE FUTURE As Formula Student is traditionally divided into two classes, one with a combustion engine (CV – combustion vehicle) and one with an electric motor (EV – electric vehicle), Formula Student Austria now also gives students the opportunity to develop and build hydrogen vehicles. The organizer is concerned with technological openness. In order to enable the participation of vehicles with H_2 drive systems at the 2025 event, Formula Student Austria started to look into the topic almost three years ago.

Maximilian Jauk, Head of Design at Formula Student Austria, reports: "Our motivation is that we want to offer future engineers the opportunity to deal with the topic of hydrogen outside of their studies. This topic is becoming increasingly important for employers from various industries. We are aware that alumni of Formula Student teams do not only apply for jobs in the automotive industry, but that hydrogen expertise is also of interest to employers in the fields of commercial vehicles, energy infrastructure and hydrogen production."

HYDROGEN CONCEPT CHALLENGE Since 2023, there has been a Hydrogen Concept Challenge in cooperation with two other Formula Student events, FS Alpe Adria (Croatia) and FS East (Hungary). The Hydrogen Concept Challenge is an ideas competition in which students present their concepts for Formula Student vehicles with a fuel cell or combustion engine to experts from the industry and judges from FSA. The teams engage in the topic of hydrogen for the first time and think about future concepts. Teams from Vienna, Deggendorf and Stuttgart have already taken part in Formula Student Austria 2023.

In 2024, the Formula Student events in Portugal and France as well as Formula Future in Germany were also won over to the topic of hydrogen. Together with these events, the Hydrogen Concept Challenge has now been revised to create an even closer link to the actual

Fig. 2: Everything in youthful hands [Source: Formula Student Austria]

construction of hydrogen vehicles. The teams were asked to think about the arrangement of the components in order to define installation space for the additional components required, such as the tank or fuel cell.

Furthermore, an analysis was required to examine the effects of the new drivetrain and the additional weight of the heavy high-pressure tanks on lap times compared to conventional Formula Student vehicles. In addition, the tank system and the cooling system were to be analyzed and the tank, battery and fuel cell were to be dimensioned. Finally, the costs should also be taken into account.

This year, the team from FH Campus Wien presented their concept for converting a conventional combustion engine to run on hydrogen and for integrating the H_2 components into a Formula Student vehicle. Teams from the University of Vienna and the University of Karlsruhe presented concepts with fuel cells. German, Swiss and Dutch teams presented themselves at other events.

SUPPORT FROM THE BUSINESS WORLD The INNIO Group, a globally active company headquartered in Tyrol, was the first partner on the topic of hydrogen, without whose support the Hydrogen Concept Challenge at FSA would not be possible. As a leading provider of energy solutions and related services and a pioneer in green technologies, the INNIO Group supports its customers in moving towards net zero. The company has more than 50 years of experience in the conversion of renewable energy sources and already offers engines with a "ready for H_2" option.

TARGETS FOR 2025 After two successful years with the Hydrogen Concept Challenge, the first version of the Hydrogen Rules for 2025 was published in July 2024. With the help of feedback from industry, H_2 experts and interested teams, the set of rules defines the boundary conditions that teams must adhere to in order to ensure safety and fairness.

The vehicles may have a maximum of 2 kg of hydrogen on board. The hydrogen is stored at a pressure of up to 350 bar in tanks certified in accordance with the standards. To ensure safety, sensors must be implemented that switch off the vehicle and in particular the hydrogen supply in the event of a malfunction.

"We are currently considering whether we can offer standard tanks in collaboration with a company in order to reduce costs for the teams, make procurement easier, increase safety and give us more options for refueling. For example, a swap system might be conceivable, similar to that used in gas barbecues. According to the regulations, the tanks should be removable within 15 minutes so that refueling outside the vehicle is possible and the teams can work on the vehicles with the tank removed. This ensures that there are no significant amounts of hydrogen in the car when it is in buildings, such as the pit lane of the Red Bull Ring or the workshop at the university," says Paul Mayr-Harting, founder of the engineering firm HoKiTech and the main person responsible for the technical approval of the racing cars at Formula Student Austria.

To facilitate the switch to hydrogen, the Formula Student teams are allowed to convert existing combustion or electric vehicles. The focus should be on the commissioning and implementation of a hydrogen-based powertrain. This means that neither a new monocoque nor a new frame needs to be manufactured. The existing chassis and wing package can also continue to be used.

In order to compensate for the weight disadvantage of fuel cell vehicles compared to conventional electric vehicles in Formula Student, the teams are allowed to drive with 100 kW instead of 85 kW system power. The teams have a free hand in the selection and dimensioning of the fuel cell

and the design of the battery, although at least half of the energy must be provided by the fuel cell in the 22-kilometer endurance race.

The hydrogen-powered combustion vehicles can be equipped with four-stroke engines with a displacement of up to 1.6 liters. Most teams will probably use motorcycle engines and convert them to run on hydrogen. The amount of air drawn in and the amount of hydrogen injected are not regulated. "It is becoming increasingly difficult for existing combustion engine teams to attract partner companies. By switching from fossil fuels to hydrogen, we are also opening up new opportunities for the teams to find long-term sponsors. They are also looking at alternative drive systems and reducing the CO_2 footprint for a green future," explains Christoph Hirt, Event Manager of Formula Student Austria.

COOPERATION AND NETWORKING For many students, Formula Student is an important part of their studies. The theory they have learned is put into practice, while at the same time teamwork and self-organization are required. International contacts with like-minded people and potential employers can be made at the competitions. At Formula Student Austria, volunteer alumni from student racing teams take care of the professional organization and implementation. If you and your company would like to become part of Formula Student Austria, we look forward to talking to you. You can find our contact details in the box. •

The next opportunity to take part in Formula Student Austria will be from July 20 to 24, 2025 at the Red Bull Ring in Spielberg, Austria.

→ www.fsaustria.at/hydrogen-rules-publication/

Authors:
Romana Močnik
→ mocnik@fsaustria.at

Steffen Schmitt
→ schmitt@fsaustria.at
both Formula Student Austria, Graz

Various training courses at different institutions

SHORTAGE OF SKILLED WORKERS IN THE HYDROGEN ECONOMY

For around five years, the number of employees in the renewable energy sector has been steadily increasing again. Nevertheless, in Germany, it is not at its historic high. That was in 2011, at over 400,000 employees. Due to political and regulatory circumstances, this number fell by around 100,000 workers over the next eight years. The solar industry in particular has recorded heavy losses. Now, it is on the upswing again. Similar to green hydrogen, which is right where the solar industry was 20 years ago. **Author:** Fabian Kauschke

The hydrogen industry faces the same challenges as other energy sectors: How can companies specifically train specialists for the necessary applications and techniques? Can the foreseeable shortage of skilled workers still be avoided? And do companies actually see a need to train their employees in the areas of the hydrogen economy?

In order to counteract these open questions with offers, various training centers are offering training programs for interested companies. The content is usually based on the essential stages of the H_2 value chain. The fundamentals of generation, storage and infrastructure therefore play a central role. Also conveyed are the overarching importance of hydrogen for the energy transition as well as the goals of the German and European hydrogen strategy.

Basic knowledge also includes chemical and physical properties. The training centers thus teach the various technologies for the production and use of the energy source H_2, for example in power-to-gas, in gas turbines or fuel cells. In addition, the integration into existing networks, the effects on distribution network operators and the far-reaching ap-

Source: HdT Journal

plications in the industrial, energy and mobility sectors are being intensively discussed.

Also the issue of safety is covered by many training programs. Most of them teach safe handling of hydrogen, explosion protection and the tightness of hydrogen systems. In some cases, the academies are planning to offer the building sector and heating technologies as well.

But which companies should actually be concerned with the topic of hydrogen now? The main influencing factor here is the energy intensity of a company's processes. The steel or chemical industries are therefore often mentioned, which require such large amounts of energy that they cannot be electrified. Of course, this also includes companies that are directly involved in the planning of hydrogen projects and the development of the necessary infrastructure.

However, utilities or municipalities can also use hydrogen to expand a city's energy portfolio in the direction of climate-friendliness and resilience. They are all therefore the target group of further education institutions. "These training courses should ensure cross-departmental awareness and training within the company, as well as be offered for qualified and technical personnel, energy officers, development engineers, production managers, occupational safety, quality control and management," says Frederike Westenberger from the TÜV-Nord-Akademie.

In this way, basic knowledge about the topic can be conveyed, and future projects can be approached as future qualified on this basis. As particularly critical the training of the technical divisions that deal with research and development may be viewed.

TRAINING FOR MANAGERS To demonstrate the need for green hydrogen in a company, trained managers and administrators are also needed. They make resources available and support critical divisions. "One of the main challenges here is to reconcile the interests and the different perspectives of the companies and partners involved," confirms Jan Heinze, managing director of the Hamburger Heinze Akademie. Therefore, in his opinion, managers should acquire deeper, in-depth knowledge.

INTEREST INCREASING Directly "at the beginning of the ramp-up of hydrogen activities, we saw a great willingness to deal with the previously little-known properties and applications of hydrogen," says Gunter Maetze from the Weiterbildungszentrum für innovative Energietechnologie (WBZU). At the WBZU in Ulm, participants in the area hydrogen mobility gain for example the Zertifikat für Gasanlagen in Fahrzeugen (certificate for gas drives in vehicles) in accordance with standard DGUV-FBHM-099.

The Haus der Technik (HdT) is likewise seeing a growing interest. This is motivated by social demands for more sustainability. The aim is to partially or completely change the energy supply. "To keep up with rapid technological developments, people are increasingly turning to us," confirms Michael Graef, chief editor of the HdT-Journal.

This interest can also be seen at the Heinze Akademie. Since May 2021,135 participants have successfully completed the full-time course there. In the part-time IHK certificate course, 80 module exams were taken in one and a half years. The academy expects an increasing need for further training among engineers by 2027, for masters and technicians as well as commercial workers by 2029.

FRAMEWORK CONDITIONS UNSETTLED Not all continuing education academies share this view, however: "From our experience, we observe a rather reserved level of interest. Of course, it may be that other offers on the market are more widely accepted. We assume that this is also due to the currently uncertain economic conditions and the wait-and-see attitude of many companies regarding the future development of the hydrogen economy," says the BDEW-Akademie. Here, the still not clearly defined framework conditions are decisive.

A similar situation is recognized by the TÜVNord-Akademie: "There is uncertainty due to a lack of legal and normative foundations as well as the economic viability of projects. These factors lead companies to wait and see whether they will actually invest in hydrogen technology and train their staff accordingly."

ALREADY A SHORTAGE OF SKILLED WORKERS The reluctance of companies to offer hydrogen training from the bottom up goes hand in hand with the current situation in the labor market of the hydrogen economy. Here, there is already a shortage of skilled workers, but this is a fundamental phenomenon that is not only associated with the growth of this particular labor market. The shortage of skilled workers in the hydrogen economy can be traced back to the fundamental problem that, due to demographic change, there is a shortage of young talent everywhere.

The HdT sees a possible solution in the further qualification of existing staff. The WBZU recognizes that a gap in suitable qualification offers has now been closed for many subject areas with further training opportunities. "Things look a little different in the area of training. Here, the mills are grinding more slowly and it will still be a while before hydrogen topics find their way into curricula everywhere," says Gunter Maetze.

The demand for qualified specialists will increase in the next few years according to the current trend. "If companies can no longer find skilled workers on the free market, we can further qualify those looking for work through resources and support from the Bundesagentur für Arbeit," proposes Jan Heinze. This requires, however, some lead time.

Fig. 2: Peter Pioch from WBZU shows an H_2 flame with a thermal imaging camera [Source: WBZU]

H_2 RAMP-UP INCREASING NUMBER OF EMPLOYED PEOPLE How labor demand and labor supply will come together for the hydrogen value chain in the coming years is the subject of a study by the Institut für Arbeitsmarkt- und Berufsforschung, a research institution of the Bundesagentur für Arbeit (federal work agency). Using scenario analysis, the influence of green hydrogen on the labor market until 2045 was examined. The scenarios compare the influence of a developed hydrogen economy with the influence of one that is missing.

The results show that the ramp-up of hydrogen has consistently positive effects on the number of employed people. In this scenario, by 2045 it will be an average of around 57,000 people higher than in the reference scenario. In absolute terms, the construction industry in particular is facing a higher demand for labor, which is accompanied by the expansion of renewable energies for the production of green hydrogen and the development of the hydrogen infrastructure.

There are also positive effects in the areas of architecture and engineering firms, technical investigations, childcare and teaching as well as in mechanical engineering. The research report shows more demand for administrative jobs. It becomes clear that there are already bottlenecks in many of these professional groups, which could delay the development of the hydrogen economy.

The study identifies the price of electricity as an important influencing factor and the associated costs of hydrogen and its derivatives ammonia and methanol. With 20 percent lower electricity prices for electrolysis abroad, the gross domestic product (GDP) would be an average of 7.7 billion euros by 2045 and the number of employed people would be an average of around 66,000 higher than in the reference scenario. If electricity prices were 40 percent lower, domestic GDP would be higher by an average of 11.2 billion euros and the number of employed people would be higher by an average of around 76,000 people.

The cheaper hydrogen can be made available, the higher the GDP and employment figures will be. However, it is also important to compare the costs of fossil fuels. If fossil fuels become more expensive, this will have a positive impact on the value of the hydrogen economy and thus on the number of people employed in this area. Government measures could also have a supportive effect here.

THE SHORTAGE OF SKILLED WORKERS CAN BE ADDRESSED Clear is: The offer of training and further education programs exists. The educational centers offer what addresses the individual important areas of the topic of hydrogen. Nevertheless, the interest from companies is rather mixed. Although the energy industry is clear about the importance of the energy source, the political and economic conditions are a deterrent factor.

The hydrogen industry is probably heading towards the overall shortage of skilled workers that is affecting many sectors of the economy. The study of the Institut für Arbeitsmarkt- und Berufsforschung, however, also makes it clear that there is great economic potential waiting in hydrogen as an energy source. Once the ramp-up really starts, companies will no longer see any reason to hold back – and the shortage of skilled workers can still be counteracted. •

The problem with iridium dependency

MAXIMIZING MEA EFFICIENCY WITH MINIMAL IRIDIUM

The demand for more sustainable hydrogen production has never been stronger, fueled by industries striving to decarbonize. And although green hydrogen production via water electrolysis holds immense promise for decarbonization, it grapples with a harsh reality: an almost complete dependence on an expensive and environmentally harmful resource. But what's the deal with iridium? And can hydrogen live up to its reputation as a key instrument for industrial decarbonization? **Author:** Lowie D'Hooghe

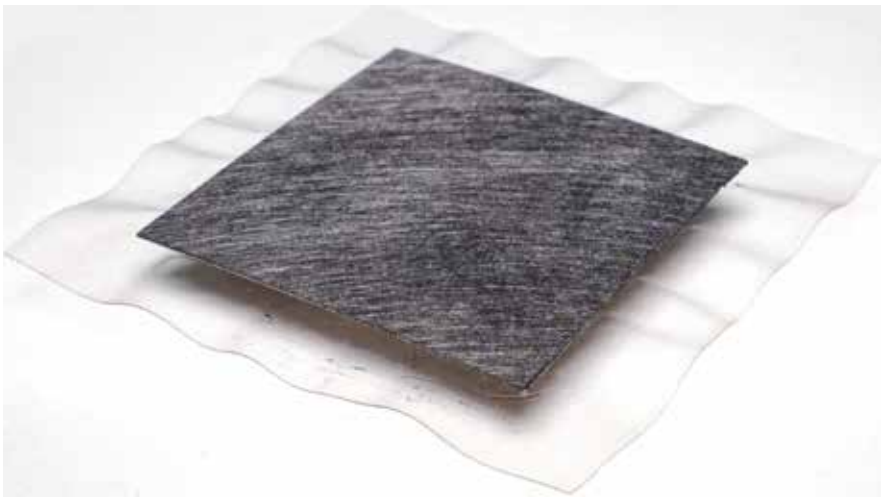


Fig. 1: MEA from Toshiba [Source: Bekaert]

High conductivity and a high melting point are just a few of iridium's unique properties. Above all, iridium serves as an excellent catalyst for water electrolysis in proton exchange membranes (PEMs). So much so, that virtually all PEM electrolyzers in use today depend on iridium as a catalyst for the oxygen evolution reaction (OER) on the anode side of their cells. There are, however, some drawbacks with this approach.

Iridium also happens to be one of the rarest elements on Earth. In fact, it's over 50 times rarer than gold. And with only 7 to 9 metric tons mined annually, its labor-intensive extraction adds to its already troubling environmental impact. This is because iridium's extraction and refining processes are highly CO_2-intensive, further complicating its use in alternative energies.

The cost of iridium adds yet another layer of complexity to its use in hydrogen production. As one of the rarest and most expensive precious metals, prices fluctuate between US$ 4,000 and US$ 6,000 per ounce. As such, iridium's limited supply poses a particular challenge to scaling renewable hydrogen production. Its scarcity, combined with the high demand for PEM electrolyzers, drives up costs. And with the iridium loading of the anode side of these systems requiring 1 to 2 mg/cm², this dependency makes iridium reduction not just a technical priority but a critical step toward making hydrogen an economically viable energy solution.

As global demand for electrolyzers rises, the reliance on iridium presents a growing challenge. Iridium is a by-product of platinum refining, hence both markets are interlinked. Increased adoption of iridium-dependent technologies only heightens its scarcity, making a reduction in dependency critical for the scalability and sustainability of hydrogen production.

If the market for internal combustion engine (ICE) vehicles declines in the long term, the supply of platinum (and consequently iridium) may decrease, as the primary market for platinum today is in catalytic converters for ICE cars and trucks. However, efforts to optimize iridium usage are already well advanced, ensuring the hydrogen industry's ability to meet future demand without the constraint of rare resources.

But as the global demand for iridium-based hydrogen technology grows, the element's scarcity will only increase. This further highlights the critical efforts needed to reduce iridium usage to ensure affordability, scalability and sustainability. Therefore, to meet demand, collaborative efforts to reduce dependency on such an elusive metal are already well underway.

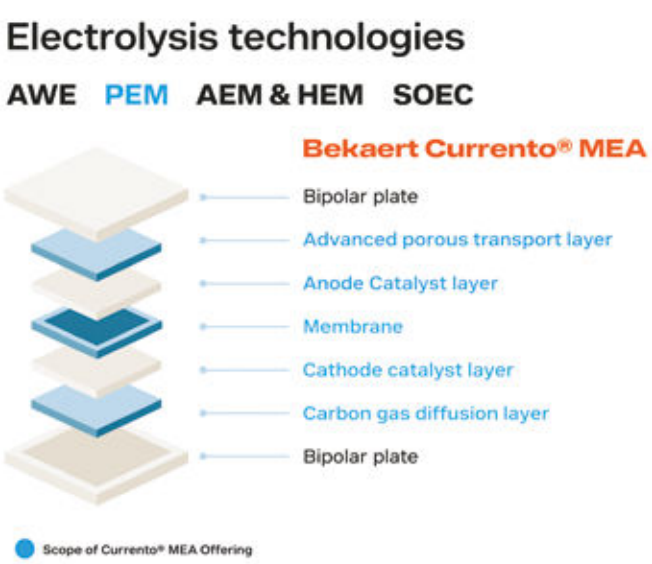


Fig. 2: MEA stack [Source: Bekaert]

PEM ELECTROLYZER TECHNOLOGY PEM electrolyzers are used to produce hydrogen through water electrolysis, a process that splits water into hydrogen and oxygen using electricity. These electrolyzers are used for green hydrogen production, supporting a wide array of applications such as steel manufacturing, transportation and chemical production. The electrolyzer is made up of multiple components, including the anode, membrane and cathode, to name a few. However, it's the anode that becomes a bottleneck in this process.

Despite its vital role in facilitating the oxygen evolution reaction, the anode's dependence on high iridium loadings remains a persistent challenge. Because of its excellent corrosion resistance, conductive properties and high activity for the OER, iridium is relied upon by PEM electrolyzers as a critical element of the anode catalyst.

The membrane electrode assembly (MEA) is at the heart of a PEM electrolyzer. It's at this point in the process where water is split into hydrogen and oxygen ions through electrolysis. In fact, the MEA's design is crucial for efficiency, ensuring effective proton transfer, minimal energy losses and durability under harsh conditions. By optimizing catalyst usage and enhancing material performance, modern MEA technologies are paving the way for scalable hydrogen production, making renewable hydrogen an increasingly practicable solution for decarbonization.

The components of the PEM electrolyzer are interdependent in terms of their functionality and ability to ensure efficient hydrogen production. Given the reliance on such a precious element, iridium usage should be optimized to make the PEM hydrogen production process cost-effective. The growing urgency to reduce reliance on iridium for financial and environmental reasons has sparked innovation within the hydrogen sector. For PEM electrolyzers, this has meant the development of new component technology to minimize the impact of scarce materials while maintaining optimal performance.

A PARTNERSHIP BUILT ON PROGRESS The demanding operating conditions of the PEM electrolyzer present unique challenges, particularly in terms of material degradation over time. With durability being such a critical factor, iridium's inherent resilience has long made it a key component. However, as hydrogen production scales up, reducing iridium use becomes essential. But providing solutions to these types of challenges requires innovation and collaboration.

In 2017, Toshiba began developing innovative iridium-reducing MEA technology that decreases the cost of the catalyst and increases the catalytic surface area. In turn, this reduces iridium loading by up to 90 percent. The move away from catalyst coated membranes (CCMs) to direct coating onto a porous transport layer (PTL) results in a significant reduction in iridium use in hydrogen production.

By 2022, Toshiba partnered with Bekaert to improve the availability of Toshiba's MEA technology. And, in 2024, the companies entered into an official licensing agreement, which enables Bekaert to industrialize Toshiba's innovation and means the cost-saving technology can be brought to the market.

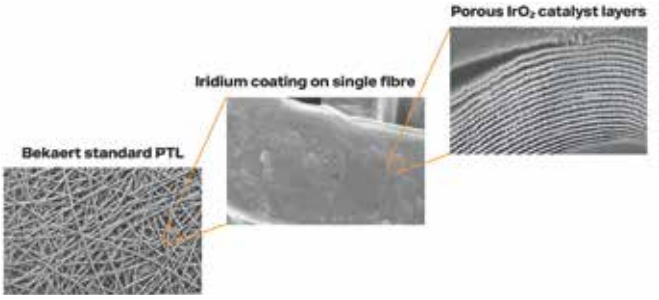


Fig. 3: Close-up view [Source: Bekaert]

INNOVATING SUSTAINABLE COMPONENTS Sustainability is deeply embedded in every stage of Bekaert's innovative process chain. This ensures that every solution is developed to meet or surpass customer needs, while also contributing to a more sustainable future for the planet. And the reduction of iridium consumption, in partnership with Toshiba, exemplifies Bekaert's commitment to sustainability. This development not only tackles the environmental implications of rare metal extraction, but also the economic pressures tied to iridium's scarcity.

SHAPING THE FUTURE OF HYDROGEN As the energy sector pivots toward cleaner alternatives, innovations like iridium-saving PEM-MEA technology are vital to ensuring that PEM electrolyzers are both practical and scalable. By making use of advanced technology and collaborative breakthroughs, Bekaert is setting a new standard for sustainability without compromising durability or efficiency. This approach positions hydrogen technology as not just a solution for today's energy demands, but a cornerstone for a cleaner, more resilient future. •

Author:

Lowie D'Hooghe
Bekaert, Zwevegem, Belgium
→ Lowie.dhooghe@bekaert.com


Source: Quest One

38 *Factory opening at Quest One*

GIGAHUB FOR ELECTROLYZERS IS RUNNING

The MAN subsidiary Quest One, formerly H-Tec Systems, celebrated the opening of its "Gigahub" in the north of Hamburg at the end of September 2024. It wants to produce flexible PEM electrolyzers with meter-high stacks on a large scale. **Author:** Eva Augsten

It was one of those success moments of the energy transition where everyone gladly stood on stage and whose importance can be easily recognized by the number of celebrities. First and foremost, of course, was German chancellor Olaf Scholz. It was a long time since Scholz was in Hamburg-Rahlstedt, he said. As a young kid, he had gone to school there. "But back then, we didn't yet learn that hydrogen could be used to power airplanes. This was at most a topic for researchers," recounted Scholz in the brand new factory hall of Quest One.

From Hamburg politics, the first Bürgermeister Peter Tschentscher as well as the economy senator Melanie Leonhard made an appearance – usually no more than one of them comes to such celebrations. From Berlin came the parliamentary secretary Michael Kellner from the federal economy and climate protection ministry and Till Mansmann, green hydrogen officer of the federal ministry for education and research. From Quest One's parent company MAN Energy Solutions and its parent company Volkswagen, the heads of the supervisory board arrived respectively, Gunnar Kilian und Hans Dieter Pötsch.

The reason for all the fuss: The company Quest One, who the day before was called H-Tec Systems, wants to start electrolyzer production on a gigawatt scale in the northeast of Hamburg.

PEM ELECTROLYSIS GETTING BIG The company story of Quest One is a story of the scaling of PEM electrolyzers.

PEM electrolysis runs at moderate pressure and medium temperatures, so it offers a good compromise between efficiency and flexibility. This makes it the technology of choice when it comes to producing hydrogen using the unsteady energy sources of wind and sun. But compared to alkaline electrolysis, it has decades of industrial scaling to catch up on.

H-Tec Wasserstoff-Energie-Systeme, as Quest One was called until the end of September, began producing mini PEM electrolyzers in 1997. They were primarily intended to introduce schoolchildren to the physical principle of electrolysis. With alkaline electrolyzers powered by hydropower, at this point in time ten thousand cubic meters of hydrogen hourly was being generated in Norway and Egypt for fertilizer production. That hydrogen could seriously become a storage technology for solar and wind power was believed at the time by at most a handful of visionaries.

Since then, not only renewable energies have become significantly cheaper. PEM technology has also caught up significantly. In 2010, the northern German energy transition company GP Joule bought H-Tec. The electrolyzers grew to a few hundred kilowatts, at least suitable for small applications. In 2019, MAN Energy Solutions got aboard and H-Tec brought the first megawatt electrolyzer onto the market: nine stacks of 110 kW each, each the size of a beer crate, together with the associated peripheral systems, mounted ready for connection in a 40-foot container – a practical solution for small wind farms and individual hydrogen refueling stations.

GIGAWATT PLANS FOR GREEN HYDROGEN To supply steel mills, fertilizer manufacturers and refineries with hydrogen, this is still far from enough, nor is it enough for the target of 10 GW of electrolysis output that the former Ampel Coalition leading the federal government set for 2030. That is the dimension in which Quest One also wants to get involved. The new name should make that clear. It should not only say that climate protection is the most important of all tasks, but also that the company wants to avoid one percent of global greenhouse gas emissions with green hydrogen from its electrolyzers, explained Robin von Plettenberg, CEO of Quest One at the opening ceremony.

The approximately 800 guests applauded loudly. In general, when the "Gigahub" was officially put into operation, there was no shortage of buzzwords and emotion. Across the screen flickered images of parched soils, raging floods, burning forests, followed by an hourglass – and the shiny, metallic, donut-shaped logo of Quest One. The project is "part of something really big," said von Plettenberg.

FROM HANDCRAFT TO SERIES PRODUCTION So far, the production hall has primarily provided space for large plans. On the opening day, the clean room with the actual production almost completely disappeared behind the huge video screen. But innovations are not always reflected in large machines. While today you can buy turnkey solar and battery factories with little out of pocket, Quest One with each production step that runs automated and reliably in Rahlstedt has conquered a piece of new technological territory.

Fig. 2: Moment of success in the energy transition: Children symbolically pressed the start button for electrolyzer production from Quest One [Source: Quest One]

The research and development center, which is also located at the gigahub, helps here. Until recently, for example, employees still assembled the electrolysis cells into stacks by hand, which took hours of work. This step requires absolute precision, because the tiny hydrogen molecules can escape through the smallest gap and thus make the entire stack unusable. As Quest One celebrated its opening at the end of September, it had already succeeded in delegating this task to robots. They get the job done in a quarter of the time. Less than an hour is what it now takes to produce a stack.

Now that the automated handling is running, Quest One is also daring to speak of a new generation of megawatt stacks. Three meters high and weighing three tonnes is what they will be, it was said. The hall should be largely full by the end of 2026; then production of the megawatt stacks should begin. Such stacks could also make it easier to implement projects beyond the 100-MW mark with PEM electrolyzers. In the course of 2026, Quest One wants to move in the direction announced in the press release – a manufacturing capacity of 5 GW annually.

A few months after the opening, everyday life has returned to Quest One. For the offices, there is still some expansion work to be done. In the clean rooms, however, series production is taking place. In the huge hall, instead of bistro tables and chairs, there are now shelves to store the stacks. They will be sent to the company's headquarters in Augsburg, where the production of the electrolyzers is located.

For these electrolyzers to be able to produce really clean hydrogen, a lot still has to happen outside the factory. Wind and solar parks must be built and financed, as well as networks and storage for the hydrogen.

Even at the opening, the panel discussion after the ceremonial push of a button showed that those present were very aware of the challenges. "The real work is just beginning now," concluded Jürgen Klöpffer, chief financial officer of MAN Energy. •

B2B platform Hyfindr enables global supplier enquiries

ACCELERATING PURCHASING PROCESSES

Employees in development and purchasing departments are always searching for suitable technical products for their projects. Without sufficient transparency regarding the supply chain, there is a risk that manufacturers will be overlooked and not requested to quote, even though they offer suitable products. The company Hyfindr has developed an approach to make the corresponding initiation of business relationships more efficient for the global hydrogen industry. Their newly developed supplier module makes it possible to address all suppliers listed on Hyfindr in a product category with just a few clicks. H2-International had the opportunity to talk to Dr. Björn Lüssow, Managing Director and co-founder of the Stuttgart-based company, about this.

Interview Partner: Björn Lüssow

Fig. 1: Dr. Björn Lüssow [Source: Hyfindr]

H2-International: We talked about Hyfindr back in early 2023. How has your company and the B2B marketplace you operate developed?

Our digital B2B platform has grown continuously. Several thousand professionals already use Hyfindr every day. If you compare the origin of the users of our platform with the locations of international projects in the industry, you can clearly see that Hyfindr is being used where the hydrogen industry is currently taking place globally. We are very pleased about this. Professionals appreciate the fact that technical products and services are presented in high quality and are easy to find. Our team has also grown, which has resulted in a move to a larger office. We have also brought strategic investors on board to support our mission. Finally, we are currently establishing an international partner network to support our customers locally in relevant markets. We are all driven by the desire to bring greater transparency to the hydrogen industry with the Hyfindr B2B platform and to offer digital business processes that help this important industry grow faster and better worldwide.

What is the aim of the new supplier module and what advantages does it offer?

The supplier module is intended to radically simplify the procurement processes for technical products in the hydrogen industry. Due to the lack of transparency in the technical supply chain, the problems start with the question "Who supplies what?" Over the past few years, we have continuously built up a high-quality database behind the scenes, from which it is possible to see which companies can cover which product categories globally. Thousands of suppliers are stored in it – and only for the hydrogen industry. We would now like to make this wealth of data available to professionals in an intelligent way. With the new supplier module on our B2B platform, users can contact all relevant suppliers in a category with just a few clicks, without having to research and contact each individual supplier themselves. This also offers advantages for suppliers. They are efficiently informed about business inquiries in a category and can contact potential customers via efficient workflows. This saves a lot of time for both sides and ensures that no potential suppliers are overlooked.

Where does the supplier data come from and how do you ensure its quality?

Our data comes from various sources: from the companies themselves, from publicly available data and through our collaboration with industry experts. We rely on regular data

updates and a clear quality process in which we validate the company data to ensure that all information is up-to-date and correct.

How exactly does an inquiry via the new supplier module work?

A user fills out a form to specify which component or service is required, for example an air compressor for a fuel cell system. Care should be taken to explain clearly and in detail what exactly is needed and for what purpose. The tool is therefore only for serious requests between companies. The user can also choose the countries from which a user would like to source from. The suppliers known to us in the respective product category are displayed and can be selected. With just a few clicks, the enquirer can determine the exact scope of their inquiry. After the inquiry has been sent, our team briefly checks whether it is a serious inquiry. If this is the case, our B2B platform automatically forwards the inquiry to all selected suppliers. If the companies contacted do not yet have a user account with Hyfindr, they can create one to respond to the request and submit a quote. The process is efficient and transparent.

What are the advantages for suppliers who receive inquiries via Hyfindr?

Suppliers benefit from being approached directly by qualified customers. They receive relevant inquiries from their target group without having to actively search for new customers. This increases the efficiency of their sales processes and opens new business opportunities. Nowadays, the principle of "digital first" applies, especially when initiating business relationships. Companies should be represented on all relevant business channels. Due to the significantly increased importance of our B2B platform, registering as a supplier with Hyfindr is certainly not a disadvantage.

Is use of the supplier module free of charge?

Companies that want to use the new supplier module can test it several times free of charge. This applies to both the enquirer and the supplier. We have currently set it up so that three inquiries in categories are free of charge, and three responses to inquiries are also free of charge for suppliers. After that, an annual fee is payable by the companies. In our opinion, however, the amount is not significant in view of the increased efficiency the R&D, purchasing or sales departments can achieve with our new module. There are no additional costs for companies that already list their product portfolio on our B2B marketplace.

How can suppliers that are not yet in your database become part of Hyfindr?

It's very simple: Suppliers can register directly on our platform. Setting up such an account for the respective company does not initially generate any costs. The company then can select from a range of digital services from us that are the right digital services for their business. We are also happy to advise the relevant companies personally.

What feedback do you get from users, both on the buyer and supplier side?

The supplier module has only been available for a very short time, so there are no reliable findings yet. The response from professionals who we showed the digital product to in advance at trade fairs was very positive. With the supplier module, we now want to make our data available to the hydrogen industry, even if not all functionalities were launched immediately. I would be delighted if companies would test the supplier module. I am very confident that it will be very well received on the market.

In which direction is Hyfindr developing? Is it on its way to becoming the "Amazon of the hydrogen industry"?

Comparison is often made in that regard, but we see ourselves more as a specialized B2B platform that has set itself the goal of mapping the requirements of the hydrogen industry as well as possible and offering innovative digital services. One example of innovative digital services is the supplier module.

What role does your YouTube channel play in your strategy?

Our YouTube channel is very important to us and is an integral part of our strategy. We want to share knowledge and strengthen the community with our tech videos. We regularly publish videos on technology, innovative products and practical use cases. My co-founder, Steven Oji, conducts detailed technical discussions. In this way, we reach interested parties and professionals who want to be educated or inspired in equal measure. The companies that present themselves in the Hyfindr videos also benefit, because they can communicate their expertise to potential customers. We are delighted that our YouTube channel is growing rapidly. Further innovative formats are also planned.

What innovations are you currently working on?

We are currently making our B2B platform even more user-friendly. We have also been heavily involved in the topic of artificial intelligence for some time now. An AI assistant is already helping registered suppliers use Hyfindr. But we are pursuing much more ambitious goals. I am very curious to see how the hydrogen industry will react to our innovations in 2025. For us, this is not about being in love with technology. Rather, we are convinced that we can further increase the customer benefits of Hyfindr with our IT innovations. Our goal is to make Hyfindr the central point of contact for professionals in the hydrogen industry worldwide if they are looking for something and want to initiate and conduct business efficiently.

Thank you very much for the interview and the insights into Hyfindr.

Share analysis by Jörg Weber, ECOreporter

ONLY A FEW STOCKS ARE ON THE WINNING SIDE

The great excitement surrounding hydrogen seems to be over for the time being: Most H_2 shares have been on a downward trend for some time. This seems paradoxical, as climate change is accelerating and time is running out to slow it down. This makes a consistent energy transition all the more necessary, and that includes the hydrogen sector. However, energy policy is currently running with the handbrake on when it comes to renewable energies. Meanwhile, the companies that earn their money with fossil fuels are securing their sinecures. **Author:** Jörg Weber

Fig. 1: Collection of Bloom Boxes [Source: Bloom]

Hydrogen produced in an environmentally friendly way still has enormous potential when it comes to making industrial processes climate-neutral. Low-emission steel cooking is just as possible with it as the production of fertilizers or the decarbonization of transport. Although the latter applies less to cars, it applies all the more to the heavy goods transport sector, i.e. trucks, trains and ships. But there are problems everywhere. Even at steel producer Thyssenkrupp, which advertises: "We also only cook with hydrogen." However, less and less steel is currently being produced in the Ruhr region, and Thyssenkrupp is facing a huge wave of redundancies. This will also slow down efforts to produce green steel using hydrogen.

IT REMAINS EXCITING The political hydrogen targets are – still – ambitious, and the corresponding budgets are large: The German government wants to invest 9 billion euros with its National Hydrogen Strategy, and Germany is set to become number one in the world hydrogen industry. The EU and the USA are also planning to invest billions in green hydrogen. However, it is uncertain whether the plans will be realized, as changes of government and changes in the entire political landscape can lead to a U-turn. Donald Trump is planning huge tax breaks for companies, while Germany has been discussing its budget for months – both of which could lead to start-up funding for green hydrogen industries being cut.

The excitement surrounding the potential energy source of the future has cooled considerably in recent years. Growth stocks, which include H_2 shares, have a hard time in turbulent times like these anyway because they find it more difficult to obtain loans – and at worse conditions. Professional investors in particular often look for established and supposedly safer stocks. Especially as the real H_2 revolution is still a long time coming; demand remains weak and most companies are presenting fluctuating figures. As a result, some shares have lost more than 90 percent of their value since the great hydrogen buzz in 2021.

Investors often think they can only make one mistake with a technology that seems to be on the verge of a breakthrough: not jumping on the bandwagon. In the past, however, it has often been shown that selecting the right securities is particularly important when it comes to future technologies. It is impossible to reliably predict which companies will ultimately be among the winners in the hydrogen market. Shares in companies that are exclusively active in the hydrogen economy are often more of a bet than a strategic investment. An exception in the sector are companies that also focus on hydrogen, but not exclusively. There are established and profitable examples of this. Two of them are presented here first: Linde and Air Liquide.

LINDE Linde, the world's largest industrial gases group, also did good business in 2024. On the stock market, the interna-

Fig. 2: The hall in Saerbeck stands, but was never occupied by Enapter (photo from Nov. 2022) [Source: Enapter]

tional group has mostly been on the up for years. In the third quarter of 2024, Linde increased its turnover by two percent year-on-year to USD 8.4 billion. Net profit remained stable at just under 1.6 billion dollars. A higher profit was prevented by the Group's current cost-cutting measures, which, together with other extraordinary expenses, resulted in one-off costs in the last quarter. "As expected, the weak economic development continued in the third quarter, especially in the industrial end markets," said Linde CEO Sanjiv Lamba. "We do not currently expect the economic environment to improve in the short term. However, we have taken measures to mitigate the economic headwinds."

Linde has slightly lowered its forecast for the full year 2024: Earnings per share adjusted for special items are now expected to be between USD 15.40 and USD 15.50, eight to nine percent higher than in the previous year. Linde shares can still be considered an attractive investment. The Group has an excellent market position, is very well financed and generates robust profits even in downturns. However, the expected price/earnings ratio of 32 for 2024 remains high, and is only slightly more moderate at 28 for 2025. Investors who are currently planning to enter the market may need a lot of patience. Defensive investors should wait for a price setback before buying.

Linde is an ECOreporter favorite share and, according to its own information, the world's largest hydrogen producer. Linde is continuously expanding this segment. The Group has initiated sustainable hydrogen projects on several continents. At the beginning of 2024, Linde announced a project in Eemshaven, the Netherlands, in cooperation with the Norwegian natural gas group Equinor. Linde will increase the quarterly dividend by nine percent to USD 1.39 (EUR 1.29) per share. This will be the 31st consecutive year of dividend increases.

AIR LIQUIDE French Linde competitor Air Liquide is also involved in numerous green hydrogen projects, for example in its home country and in Shanghai, China. At the beginning of 2024, Air Liquide announced a joint venture with the oil company Total to build more than 100 hydrogen refueling stations in Europe over the next ten years. Around 20 stations in France, the Netherlands, Belgium, Luxembourg and Germany are to be put into operation as early as 2024.

The Air Liquide share price has performed well over the last five years. The share reached a high of almost EUR 180 in May 2024, falling to below EUR 160 by the end of November. The expected price/earnings ratio for 2024 is 27. Air Liquide is in a robust position, but ECOreporter considers Linde's sustainability targets to be more ambitious. According to an assessment by the renowned and independent Science Based Targets initiative (SBTi), the sustainability targets of both Linde and Air Liquide are compatible with the goal of global warming of no more than 1.5 degrees.

BLOOM ENERGY – INTERESTING DESPITE RISKS From October to the end of November 2024, the shares of the US company Bloom Energy shot up from under EUR 10 to over EUR 26. The reason: the company was able to secure the world's largest order for solid oxide fuel cells to date. The energy supplier American Electric Power (AEP) has ordered up to 1 gigawatt (GW) of fuel cells. They are intended to supply data centers for artificial intelligence (AI) with electricity. According to Bloom Energy, the agreement comprises an initial order of 100 megawatts (MW), with further deliveries planned starting 2025. The fuel cells are to be installed directly at the customers' sites and supply electricity with one third lower CO_2 emissions compared to the current supply.

According to the company, Bloom Energy's solid oxide fuel cells can run on 100 percent hydrogen or any mixture of hydrogen and natural gas. Connected together to form power plants, the technology can supply entire building complexes with electricity. Solid oxide fuel cells are therefore not necessarily a clean solution – they are only clean when they are

Fig. 3: At the new headquarters of the international supplier of electrolysis technology Thyssenkrupp Nucera in Dortmund, 560 new jobs will be created [Source: Thyssenkrupp Nucera]

fueled with green hydrogen. Bloom Energy itself emphasizes that the carbon footprint is already significantly better when operating with natural gas than with conventional fossil fuel power plants.

Analysts reacted enthusiastically to the news. Experts from the US investment bank Piper Sandler described the deal as "groundbreaking" for Bloom Energy. The contract could generate sales of up to USD 3 billion for the Group and at the same time open the door to further cooperation with other energy suppliers. Above all, however, the order proves that Bloom Energy is indeed capable of supplying large data centers with its technology.

Bloom Energy is one of the more interesting companies in the H_2 sector. While companies such as Ballard Power, Plug Power and Nel have not yet been able to keep their full-bodied promises, are incurring ever greater losses and are often left out of major contracts, Bloom is growing and is apparently also being considered for large projects. This year, the Group wants to be in the black operationally. In 2025, a net profit is to be achieved for the first time.

However, cautious investors should wait and see how Bloom's business develops and whether it will actually be in the black in the foreseeable future. The rise in Bloom Energy's share price is probably also related to the fact that the order touches on the topic of artificial intelligence.

Bloom Energy has also been building hydrogen generators (electrolyzers) since 2022. The Group generated revenue of more than USD 1 billion for the first time in 2022 and USD 1.3 billion in 2023. Bloom could reach the profit zone for the first time in the 2024 financial year.

ENAPTER – RISKY Things are looking worse for the Hamburg-based hydrogen company Enapter: It expects less turnover for 2024 than initially hoped. Significant revenue is expected to be postponed until next year. However, Enapter is optimistic about its medium-term prospects. Enapter is small: Turnover for the current financial year is expected to be between EUR 22 and 24 million. The company had previously expected sales of EUR 34 million. The management's forecast for earnings before interest, taxes, depreciation and amortization (EBITDA) remains unchanged at EUR 7 to 8 million. According to Enapter, the forecast is based on a current order backlog of around EUR 50 million. Due to delays in the production of 1-MW electrolyzers and postponements of customer projects, Enapter expects that "significant parts of sales" will not be realized until 2025.

Enapter changed its strategy in 2024. Originally, the company wanted to set up mass production in Saerbeck near Münster in Nordrhein-Westfalen. However, the plans for the Enapter Campus research and production center were abandoned at the beginning of June 2024. In future, the Group will focus on the production of stacks – the core components of an electrolyzer. The complete electrolyzers with the Enapter brand name will now be built by Wolong in China as part of a joint venture.

Enapter also wants to offer its stacks to other customers. At the end of October 2024, the company received its first order from the Dutch energy group Adsensys, which wants to build electrolyzers with Enapter technology. Adsensys is also acquiring a software license from Enapter. According to Enapter CEO Dr Jürgen Laakmann, the successor to company founder Sebastian-Justus Schmidt, the company is "very confident that further core partnerships can be concluded in 2025 and that extensive major orders in Asia, Europe and the USA can be realized."

The prospects for Enapter shares are difficult to assess. The share has always been a bet – but according to ECOreporter, it has become much less attractive since the campus project was canceled. Enapter admits that there is currently not enough demand to set up mass production for its electrolyzers. In addition, the company is still deep in the red. It is therefore not advisable to get aboard for the time being.

SFC ENERGY – SMALL AND QUITE SOLID Fuel cell manufacturer SFC Energy from Brunnthal near Munich has increased its sales and margins in the first three quarters of 2024. The company considers itself strategically very well positioned and is raising its earnings forecast slightly. From January to September, SFC Energy generated sales of EUR 105 million, an increase of around 20 percent compared to the previous year. According to the company, it benefited in particular from the strong demand for fuel cells for industrial applications and a significant expansion of the project business.

Business grew most strongly in Asia, where turnover increased by almost 70%. Earnings before interest and taxes (EBIT) climbed by 60% year-on-year to EUR 7.2 million. Net profit increased by almost 35% to EUR 8.7 million in the first three quarters. In the third quarter, however, profit fell by 27% to EUR 2.3 million.

SFC Energy has opened its largest factory to date in Romania and acquired businesses from Ballard Power, setting the stage for further growth.

Nevertheless, the poor earnings performance in the third quarter is cause for concern. Nevertheless, SFC Energy has successfully occupied a niche with its technology. The fuel cells are primarily used for stationary power supply – either when there is no access to the power grid or as a replacement for diesel emergency generators. SFC has achieved what many other hydrogen companies are far from: The company is making a profit.

The expected price/earnings ratio of the SFC Energy share remains high at 27 for 2024 and could be a moderate 18 in 2025 thanks to the prospect of further increases in profits. And that would be an astonishingly low value for a growth sector. Despite the business successes, however, the SFC Energy share has also suffered from the correction on the hydrogen market in the last three years, and the price has

fluctuated strongly since 2021. The share is only an option for investors with a heightened risk awareness. It is not suitable for defensive investors.

THYSSENKRUPP NUCERA ON THE DECLINE The Dortmund-based hydrogen company Thyssenkrupp Nucera is a giant compared to SFC Energy: In the third quarter of its 2023/2024 financial year alone (April to June), it generated sales of over a quarter of a billion euros – more than expected. However, earnings before interest and taxes (EBIT) fell from EUR 7 million in the previous year to just EUR 1 million. Overall, annual turnover is likely to be between 800 and 900 million euros. Alkaline water electrolysis (AWE) is expected to generate EUR 500 to 550 million of this. According to the Group, EBIT is expected to be "in the negative mid double-digit million euro range."

The company is suffering from delays to new projects on the customer side. Since its IPO in July 2023, the share price has fallen significantly, with the average share price falling sharply. Nucera therefore remains a high-risk investment. Sustainable investors may also be concerned about the Group's participation in the NEOM project in Saudi Arabia. This is a futuristic city that is being built in the desert in north-western Saudi Arabia and is often criticized internationally.

CONCLUSION H_2 shares remain speculative investments. The gas companies Linde and Air Liquide in particular, whose businesses are not dependent on hydrogen, offer reliable entry opportunities. Among the speculative stocks, Bloom Energy and SFC Energy are making significant progress – SFC is already in the black and Bloom Energy could achieve this in the current financial year. Nevertheless, the risks here remain high.

You should keep an eye on the shares of Thyssenkrupp Nucera and Enapter. However, these shares are currently still more of a bet than an investment. Former industry favorites such as Plug Power, Ballard Power and Nel have failed to live up to expectations, resulting in significant price falls. Here too, a bet seems less attractive at present.

Even very risk-averse investors should consider a hydrogen fund or ETF if they want to make a bet on hydrogen in order to at least diversify their investment somewhat. And the following applies to all H_2 stocks except Linde and Air Liquide: Only invest money in the H_2 market that you can fully afford to lose. The unexpected can happen at any time – and you have to be able to cope with losses if you invest here. •

The author of this article is Jörg Weber, founder and editor-in-chief of ECOreporter.de. The internet publication has been reporting exclusively on sustainable investments for 25 years. ECOreporter is financed by subscriptions from readers and is therefore independent of advertising revenue and the like. ECOreporter tests sustainable funds, ETFs, banks, bonds, participation rights and others and analyzes sustainable shares. Specific advice and warnings show readers where they can invest their money wisely.
When investing in shares, every investor should always be aware of their own risk assessment and think about spreading the risk sensibly. This analysis does not constitute a recommendation to buy.

Interview with Michelle Lujan Grisham, Governor of the US state of New Mexico

THE CLEANER, THE MORE SUPPORT

The US is investing a lot of money in renewable energies and also in hydrogen. With the Inflation Reduction Act (IRA), the Biden administration has released large sums of money to promote sustainable technologies. Even if at least some of this is likely to be reversed under a new Trump administration, a number of states have embarked on this path and – like New Mexico – are focusing on hydrogen. H2-international spoke to Governor Michelle Lujan Grisham about this in Rotterdam in the summer of 2024. **Interviewer:** Sven Geitmann

Fig. 1: Michelle Lujan Grisham
[Source: Office of Governer Grisham]

H2-international: Governor, it is an honor to be able to speak with you here today. What prompted you to come here to Europe?

Grisham: We have 2.2 million residents that we represent. To be able to do that, we need to know what is happening in the world and see for ourselves. This particular conference is important for us for two reasons: First, there are foreign investors who want to build hydrogen campuses in New Mexico. For them, we are here to present New Mexico as an interesting location with all its assets. And secondly, our global partners are convinced that hydrogen is a fuel for the transformation process of the energy sector.

The awareness in the Netherlands as well as in Europe about climate justice is a powerful role model for the United States as well as some governors to – how shall I say – achieve their own climate goals. We need to become part of a much larger international movement to achieve Net Zero as planned and stop the temperature rise. We also need to address the living conditions of underprivileged populations in particular – New Mexico is a poor state – who are exposed to many emissions or live in regions where fossil fuels dominate.

That is what is being addressed here. That is why we are here.

What kinds of companies are involved in New Mexico?

We are already home to a number of hydrogen companies. At the same time, we are the second largest oil and gas producer in the United States. These companies, such as Exxon Mobile, need to reduce their emissions in our state. But, of course, here too, as they are the largest US employer in the Netherlands. They therefore have a great responsibility. We want to keep them in the country and at the same time support their efforts to reduce emissions by facilitating the transition to cleaner fuels, such as hydrogen.

With the H_2 campuses you mentioned – are they about research and development, production or what?

Everything. We have acreage (fifth largest US state). And we have two of the five national US research centers. We have incredibly productive soils. We have the largest wind farm in the US, with more to come. And we've invested heavily in new power lines. So we can bring green electrons to the grid. That's why we want everything: fuel cells, hydrogen as a fuel, production, heating and cooling – on any scale.

Of course, we have interesting challenges when it comes to water: We have desert and drought due to the climate crisis. This desert geology is good for fossil energy deposits, but we mainly have brackish water. The oil and gas extraction process also produces process water. Both brackish water and process water can be harnessed using modern technology, as we learned from the local environment minister at the COP in Dubai. This means that we too can purify or desalinate our water so that it can be used for hydrogen without reducing our drinking water resources.

As the transformation process from fossil fuels to renewable energy sources is so complex, we want to make use of all these technologies and invite investors and commercial enterprises to settle here. For example, an Australian company recently announced that it will invest 100 million US dollars in a production and research campus.

Where do you see the challenges and opportunities?

This transformation process is cost-intensive. At the same time, there are great opportunities to shape it – not least through the Inflation Reduction Act. Our state has added further tax incentives on top of this, and there are other economic development instruments, so the conditions are really good. This results in good conditions with high profit margins when helping to shape this new market. In this way, we get a foot in the door before the competition starts.

We have the right locations for this. When it comes to settlements, it's all about location advantages – and we have them. Our geology, our connections to the ports on the Gulf Coast and in Los Angeles. Or simply the connection by truck and rail to California and Mexico.

You mentioned additional instruments you have in New Mexico to complement the IRA? What are they?

We do indeed have other incentives, such as the Advanced Energy Equipment Tax Credit, which has been in place since March 2024. This credit offsets up to 20 percent of the manufacturing costs of renewable energy components – up to a maximum of $25 million per project.

What do you think of the IRA?

This was not only productive by President Biden, but also strategically an important step for the transition we all want. We are increasingly realizing that we need this transition, otherwise we might as well stop trying to save the planet. That's why we need to invest a lot of money, which is right, because the US is a big energy consumer and a big oil and gas producer. We need to lead by example, not telling other people what to do.

Back to your state: How do you intend to manage the balancing act between the fossil fuel economy and a sustainable energy economy?

In any case, carbon intensity must be reduced in all areas – including oil and gas. The factories must achieve the net zero targets. We now need to decarbonize the mobility sector and move towards hydrogen. We need workers for this and we have to look at where we can get them from. A large proportion of them will obviously come from the oil and gas sector – worldwide – over the next 25 to 35 years. I can tell you exactly how many workers there are, where they come from, what they earn and what their family environment is like.

We have 150,000 people working in the oil and gas industry who need the easiest possible transition to a future energy supply. Because of their previous experience, they all need comparatively little training for other sectors. We have already proven that we can do this with the Energy Transition Act by providing new jobs for over 800 Navajo coal plant employees.

New Mexico is a leader in the United States on many issues. The oil and gas companies are becoming energy companies that are developing low-carbon solutions to take hydrogen from an idea to a reality. We are supporting these companies along the way. And even if the companies don't help the employees who are laid off, we'll help those workers.

What about hydrogen? Which production pathways are you focusing on?

We don't worry so much about the colors. I worry more about the carbon intensity. Your hydrogen can be green-plus or white or whatever. What matters is where the origins are. The tax incentives are there to replace your effort to reduce CO_2 emissions. All the companies that are here presenting their products want the same thing – and we want to support them.

People out there don't understand the whole discussion about the different colors of hydrogen, because it's all about the same molecules. And we want to be green – or better – greener. However, green hydrogen is now associated with a greater need for water. That's why we need to get as many green electrons as possible into the power line.

This requires a transition scenario, but it will probably be difficult to operate economically with gray hydrogen. Because the cleaner you are, the more support you get from us. We are open to new technologies, but we are certain about carbon intensity.

What do you assume, how can this hydrogen be transported in the most sensible way? By pipeline? Bound in ammonia or methanol? Or in LOHCs?

Yes, all of them. Ammonia seems to be a good solution for oversea transport. There is not enough pipeline infrastructure around the globe. So it has to be all of those formats.

Going to politics, what do you expect from the US election? Will there also be fundamental changes to the IRA if Trump is elected?

Even Republican states don't like it when Washington DC tells us what to do. For example, you can't run a state if you don't have the right infrastructure. Trump will be very aggressive with his statements about not spending his money, but I assume that it will be tight again in Congress. Presidents usually have limited options to do or not do things. So, I'm not really worried. •

BUSINESS DIRECTORY

BIPOLAR PLATES

SITEC Industrietechnologie GmbH, prototypes, series production, production systems for your bipolar plates, stack assemblies and balance of plant, *info@sitec-technology.de, www.sitec-technology.com*

Whitecell Eisenhuth GmbH & Co. KG,
Friedrich-Ebert-Str. 203, 37520 Osterode am Harz, Germany,
Phone +49-5522-9067-14, Fax -44, *www.eisenhuth.de*

COATING

Aalberts Surface Technologies GmbH, Seelandstr. 7, 23569 Lübeck, Germany, Phone +49-451-39006-0, *www.aalberts.com*

Holzapfel Metallveredelung GmbH,
Unterm Ruhestein 1, 35764 Sinn, Germany,
Phone +49-2772-5008-0, Fax -55,
www.holzapfel-group.com

COMMUNICATION & MARKETING

contact@hydrogen-moves.de
Phone +49-7195-90430400
www.hydrogen-universe.com
Hydrogen Universe: Knowledge | Network | Collaboration

Mission Hydrogen GmbH,
Einsteinstraße 55,
89077 Ulm,
Tel. 0731-790605-0,
www.mission-hydrogen.de

mummert – creating relations,
Uta Mummert, German-French Communication Services – Media, Events, Marketing,
85 Chemin du Vignal, 07230 Lablachère, France,
Phone +33-652980552, *info@mummert.fr, www.mummert.fr*

COMPRESSORS

Mehrer Compression GmbH, Rosenfelder Str. 35,
72336 Balingen, Germany, Phone +49-(0)7433-2605-0,
Fax -7541, *www.mehrer.de*

Neuman & Esser Group,
Werkstraße o.Nr.,
52531 Übach-Palenberg, Germany,
Phone +49-2451-481-01, Fax -100,
www.neuman-esser.de

J.P. Sauer & Sohn Maschinenbau GmbH,
Brauner Berg 15,
24159 Kiel, Germany,
Phone +49-(0)431-3940-0, *sales@sauercompressors.de, www.sauercompressors.com*

sera Hydrogen GmbH,
sera-Str. 1, 34369 Immenhausen, Germany,
Phone +49-5673-999-04, Fax-05,
info-compress@sera-web.com, www.sera-web.com

CONSULTING

Bernard Gruppe ZT GmbH, Bahnhofstr. 19,
6060 Hall in Tirol,
Austria, Phone +43-5223-5840-118, Fax -201,
www.bernard-gruppe.com

Griesemann Gruppe, Studies, Basic & Detail-Engineering, Implementation, Industriestr. 73, 50389 Wesseling, Germany, Phone +49-2232-7080, *kontakt@griesemann.com, www.griesemann.com, https://griesemann.com/en/*

DISTRIBUTION

Kälte- und Systemtechnik GmbH,
Refrigeration systems for cooling hydrogen according SAE, Heavy duty refueling, Strassfeld 5, 3441 Freundorf, Austria,
Phone +43-2274-44109, *office@kustec.at, www.kustec.at*

ELECTROLYZERS

Asahi Kasei Europe GmbH,
Fringsstr. 17,
40221 Düsseldorf, Germany, Phone +49-211-3399-2000,
info@asahi-kasei.eu, www.asahi-kasei.eu

Cummins Inc., Am Wiesenbusch 2 – Halle 5, 45966 Gladbeck, Germany,
Phone +49-2043-944-133, Fax -146,
powersales@hydrogenics.com,
www.cummins.com

Elogen GmbH, Eupener Strasse 165, 50933 Köln, Germany, Phone +49-221- 2919073-0, Fax -9, *www.elogenh2.com*

Enapter srl, AEM eletrolyzers for all applications, Pisa, Berlin, Chiang Mai, Via di lavoria 56G, 56040 Crespina Lorenzana (PI), Italy, Phone +39-50644281, +49-30-921008130, *www.enapter.com*

FEST GmbH, Experience for future, Harzburger Str. 14, Goslar (head office), 38642 Goslar, Germany, *kontakt@fest-group.de, www.fest-group.de*

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

H-TEC SYSTEMS GmbH, PEM electrolyzers for industry application, Alois-Senefelder-Allee 1, 86153 Augsburg, Germany, Phone +49-821-507697-0, *info@h-tec-systems.com, www.h-tec.com*

Hytron Energy & Gas Ltda., Eritrina, 181, Condomínio Industrial Veccon Zeta, Sumaré – SP – Brasil, CEP.: 13.178-543, Phone +55-19-30322522, *www.hytron.com.br*

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

thyssenkrupp Uhde Chlorine Engineers GmbH, Vosskuhle 38, 44141 Dortmund, Germany, Phone +49-231-547-0, Fax -2334, *info-uce@thyssenkrupp.com, www.thyssenkrupp-uhde-chlorine-engineers.com*

ELECTRONICS

plating electronic GmbH, DC Power Supplies, Rheinstr. 4, 79350 Sexau, Germany, Phone: +49-7641-93500-0, *info@plating.de, www.plating.de*

Prüfrex Innovative Power Products GmbH, Egersdorfer Str. 36, 90556 Cadolzburg, Germany, Phone +49-(0)9103-7953-0, Fax -55, *www.pruefrex.com*

ENGINEERING

ARGOVIA Hydrogen AG, Germanenstr. 10, 4313 Möhlin, Switzerland, *www.argovia-h2.com,* Automated filling stations for H_2 transport – also for your project

H2 Core Systems GmbH, Construction, Service, Electrolyser, Fuel Cell, Compressor, Storage, Berliner Str. 82–88, 25746 Heide, Germany, Phone +49-15777438466, *sales@h2coresystems.com, www.h2coresystems.com*

MACEAS GmbH, Königstr. 2, 26676 Barßel-Harkebrügge, Germany, Phone +49-4497-9269-90, Fax -18, *www.maceas.com*

VAF GmbH, Automation expert for cell stacking, Bergstr. 13, 73441 Bopfingen, Germany, Phone +49-7362-96030, *info@vaf-bopfingen.de, www.vaf-bopfngen.de*

FITTINGS, REGULATORS, VALVES

Bürkert Werke GmbH & Co. KG, Solenoid Valves, Mass Flow Controller, Fluid Power System Solutions, Christian-Bürkert-Str. 13-17, 74653 Ingelfingen, Germany, Phone +49-7940-10-0, Fax -91204, *www.buerkert.com*

Buschjost GmbH – IMI Precision Engineering, Detmolder Str. 256, 32545 Bad Oeynhausen, Germany, Phone +49-5731-791-0, Fax -179, *www.norgren.com, hydrogen@imi-precision.com*

Festo SE & Co. KG, Automation Electrolyser, HRS, Compressor, Stack & Fuel Cell Production, Ruiterstr. 82, 73734 Esslingen, Germany, Phone +49-711-3471185, *markus.ott@festo.com, www.festo.com*

GSR Ventiltechnik GmbH & Co. KG, Im Meisenfeld 1, 32602 Vlotho, Germany, Phone +49-5228-779-0, *info@ventiltechnik.de, www.ventiltechnik.de*

Nova Werke AG, H_2 High Pressure Solenoid Valves, Vogelsangstr. 24, 8307 Effretikon, Switzerland, Phone +41-52-3541616, *www.novaswiss.com*

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

FUEL CELLS

SFC Energy AG, EFOY Fuel Cells, Eugen-Sänger-Ring 7, 85649 Brunnthal, Germany, Phone +49-89-673592–555, *info@sfc.com, www.sfc.com, www.efoy-pro.com*

FUEL RECIRCULATION AND AIR SUPPLY

Celeroton TurboCell AG, Industriestr. 22, 8604 Volketswil, Switzerland, Phone +41-44-25052-20, *info@celeroton-turbocell.com, www.celeroton-turbocell.com*

GAS DIFFUSION LAYERS (GDL)

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

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

HYDROGEN GENERATION

RIX Industries, 4900 Industrial Way, Benicia, CA 94510, USA, Phone +1-707-747-5900, *learnmore@rixindustries.com, www.rixindustries.com*

INTEGRATION

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

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

MANUFACTURING

Matthews International GmbH, Gutenbergstr. 1-3, 48691 Vreden, Germany, Phone +49-2564-120, *vreden@saueressig.com, www.saueressig.com/en/engineering/hydrogen-solutions/*

ODONICS Your-Tool GmbH, Strassfeld 10, 3441 Freundorf, Austria, Phone +43-2274-30601, *www.your-tool.net*

MEASUREMENT AND CONTROL TECHNOLOGY

Henze-Hauck Prozessmesstechnik / Analytik GmbH, Wasserstoffanalysatoren, ATEX zertifiziert, Sicherheitstechnik, Dünnhauptstr. 14, 06847 Dessau, Tel. 0340 5169363, *info@henze-hauck.de, www.processanalytik.de*

HYDAC Electronic GmbH, H_2 pressure transmitters with approvals for hazardous environments as well as EC 79/2009, Hauptstr. 27, 66128 Saarbrücken, Germany, Phone +49-6897-50901, *electronic@hydac.com, www.hydac.com*

JUMO GmbH & Co. KG, Measurement, control and automation technology for hydrogen applications, Moritz-Juchheim-Str. 1, 36039 Fulda, Germany, Phone 0661-6003-0, Fax -500, *mail@jumo.net, www.jumo.de, https://en.jumo.de/web/applications/hydrogen*

S++ Simulation Services, Ralf Kraume, Waldstr. 5, 82418 Murnau-Westried, Germany, Phone +49-8841-672147-0, *ralf.kraume@splusplus.com, www.splusplus.com*

MEASUREMENT DATA MANAGEMENT AND MONITORING

DiLiCo engineering GmbH, Lorenzweg 43, 39124 Magdeburg, Germany, Phone +49-(0)391-505859-86, *info@dilico.de, www.dilico.de*

Smart Testsolutions GmbH, Rötestr. 17, 70197 Stuttgart, Germany, Phone +49-711-25521-46, *www.smart-testsolutions.de*

MEMBRANES AND SEPARATORS

AGC Chemicals Europe, Ltd., FORBLUE™ Membrane Technology, Commercial Centre, World Trade Center, Zuidplein 80, 1077 XV Amsterdam, Netherlands, Phone +31-20-880-4170, *forblue.info@agc.com, www.agcce.com*

CMC Klebetechnik GmbH, Rudolf-Diesel-Str. 4, 67227 Frankenthal/Pfalz, Germany, Phone +49-6233-872-300, *info@cmc.de, www.cmc.de*

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

ORGANIZATIONS

German Hydrogen and Fuel Cell Association, Deutscher Wasserstoff- und Brennstoffzellen-Verband e.V. (DWV), Moltkestr. 42, 12203 Berlin, Germany, Phone +49-(0)30-398209946-0, Fax -9, *www.dwv-info.de*

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

ORGANIZERS (EVENTS)

ees Europe – International Exhibition for Batteries and Energy Storage Systems / Solar Promotion GmbH, P.O. Box 100 170, 75101 Pforzheim, Germany, Phone +49-7231-58598-0, Fax -28, *www.ees-europe.com*

European Fuel Cell Forum, Obgardihalde 2, 6043 Luzern-Adligenswil, Switzerland, Phone +41-(0)4-45865644, Fax 35080622, *forum@efcf.com, www.efcf.com*

Messe Stuttgart, hy fcell – International Expo and Conference in Stuttgart and worldwide, *www.hy-fcell.com/worldwide*

Tobias Renz FAIR, Berlin, Tobias Renz, *tobias@h2fc-fair.com,* Phone +49-30-60984556, *www.h2fc-fair.com*

PLANT ENGINEERING

Kloeckner DESMA Elastomertechnik GmbH, Injection molding machine manufacturer for the production of elastomer articles, An der Baera, 78567 Fridingen, Germany, Phone +49-7463-8340, *www.desma.biz*

REFORMERS

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

RESEARCH & DEVELOPMENT

DBI Gas- und Umwelttechnik GmbH, Karl-Heine-Str. 109/111, 04229 Leipzig, Germany, Phone +49-341-2457-113, *www.dbi-gut.de*

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

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

Fraunhofer-Institut für Windenergiesysteme IWES, Postkamp 12, 30159 Hannover, Germany, Phone +49-471-14290-456, *www.iwes.fraunhofer.de*

HyCentA Research GmbH, Inffeldgasse 15, 8010 Graz, Austria, Phone +43 (0)316-873-9501, *office@hycenta.at, www.hycenta.at*

IAV GmbH Ingenieurgesellschaft Auto und Verkehr, Carnotstr. 1, 10587 Berlin, Germany, Phone +49-30-39978-0, Fax -9926, *www.iav.com*

Wenger Engineering GmbH, Research and Development Center for Thermodynamics, CFD Simulation & H_2-Technology, Einsteinstr. 55, 89077 Ulm, Germany, Phone +49-(0)731-790605-0, Fax -99, *mail@wenger-engineering.com, www.wenger-engineering.com*

STORAGE

AMBARtec AG, Supplier of compact, efficient and sustainable H_2-storage systems, Erna-Berger-Str. 17, 01097 Dresden, Germany, Phone +49-351-30993666, *www.ambartec.de*

GKN Hydrogen GmbH, Pennefeldsweg 11-15, 53177 Bonn, Germany, *www.gknhydrogen.com*

Hexagon Purus GmbH,
Hannoversche Str. 1, D-34134 Kassel
Hexagon Purus Weeze GmbH,
Industriestr. 60, D-47652 Weeze
Phone +49-2837-9135-0, *www.hexagonpurus.com*

Kessels Prüfwerk Gmbh & Co. KG, Lehmkuhlenweg 13, 41065 Mönchengladbach, Germany, Phone +49-(0)2161-65907-0, Fax -68, *www.kessels-pruefwerke.de*

SUPPLIERS

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

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

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

Kerafol Keramische Folien GmbH & Co. KG,
Ceramic Electrolytes, Solid Oxide Cells, Glass Tapes, Koppe-Platz 1, 92676 Eschenbach, Germany, Phone +49-(0)9645-884-30, Fax -90, *www.kerafol.com/sofc*

Pajarito Powder, LLC,
3600 Osuna Road NE, Suite 309, Albuquerque, NM 87109-4427, USA, Phone +1-505-2-935367, Fax -448040, *www.pajaritopowder.com*

Sandvik High Precision Tube, ZN der SMT D GmbH, 33824 Werther, Germany, Phone +49-5203-91090, *info.hpt@sandvik.com,* H_2 Stainless Steel Tube Applications / Coil Container Service – On Site Tubing Solution

Sorst Streckmetall GmbH – Use in OEMs and electrolyzers made of titanium, stainless steel, nickel, also prefabrication, planning, implementation. Phone +49-511-67675650, *info@sorst.de, www.sorst.de*

Spir Star AG,
Auf der Rut 7, 64668 Rimbach-Mitlechtern, Germany, Phone +49-6253-9889-0, *info@spirstar.de, www.spirstar.de*

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

TESTING

baltic FuelCells GmbH, *www.balticfuelcells.com,* PEM- and electrolysis-single cell testing equipment for R&D and QA

JA-Gastechnology GmbH,
Albrecht-Thaer-Ring 9, 30938 Burgwedel, Germany, Phone +49-5139-9855-0, Fax -33, *www.ja-gastechnology.com*

Maximator GmbH,
High Pressure Hydrogen Technology, Testing Equipment, Customer Testing Services, Lange Strasse 6, 99734 Nordhausen, Germany, Phone +49-3631-9533-5040, *info@maximator.de, www.maximator.de*

Resato International B.V., H_2-Pressure Testing, H_2 gas booster for refueling stations, high pressure technology,
Duitslandlaan 1, 9400 AZ Assen, Netherlands, Phone +31-(0)501-6877, *h2sales@resato.com, www.resato.com*

Sonplas GmbH, H_2 test stand, Testing of hydrogen-carrying components with real fuel, Sachsenring 57, 94315 Straubing, Germany, Phone +49-9421-9275-0, *info@sonplas.de, www.sonplas.com*

TesTneT Engineering GmbH,
Eschenallee 11, 85445 Oberding
Phone +49-(0)89-237109-39,
info@h2-test.net, www.h2-test.net

Zeltwanger, Leak and Functional Testing, Automated Lines for Laser Applications and Assembly Tasks,
Maltschachstr. 32, 72144 Dußlingen, Germany, Phone +49-7071-3663-106, *e-mobility@zeltwanger.com, www.zeltwanger.de*

TEST STANDS

AIP Automotive GmbH & Co. KG, Hojen 30, 87490 Haldenwang, Germany, Phone +49-8374-24090, *info@aip-automotive.de, www.aip-automotive.de*

EVENTS

More events at www.h2-international.com/events

JANUARY

22nd International Conference on Renewable Mobility
January 20 – 21, 2025
CityCube, Messe Berlin
www.kraftstoffe-der-zukunft.com

The 2nd Future Hydrogen Congress Australia 2025
January 21 – 22, 2025, Sydney
www.szwgroup.com/future-hydrogen-Congress-australia/index.html

Hyvolution Paris 2025
January 28 –30, 2025
Paris Porte de Versailles
paris.hyvolution.com/fr

FEBRUARY

3. Regionale Zukunftskonferenz Wasserstoff
February 5, 2025
www.region-a3.com/innovation/zukunftskonferenz_wasserstoff/

E-world energy & water 2025
February 11 – 13, 2025
Messe Essen
www.e-world-essen.com

India Energy Week 2025
February 11 – 14, 2025
Yashobhoomi, Sector 25
www.indiaenergyweek.com

14. Workshop Zulassung – Zertifizierung – Normung
February 18 – 19, 2025
Zentrum für BrennstoffzellenTechnik Duisburg
www.zbt.de

H2 & FC Expo
February 19 – 21, 2025
Tokyo Big Sight, Japan
www.fcexpo.jp

3minutes2talk "Wasserstoffanwendungen in der Industrie"
February 24, 2025
Vertretung des Landes Niedersachsen beim Bund
messe-events.miovent.com/3minutestotalk2025/

Brennstoffzellen – Grundlagen und Anwendungen – Hybrid-Seminar
February 26 – 27, 2025
Haus der Technik + online
www.hdt.de

MARCH

H_2 Forum Berlin
March 4 – 5, 2025
Estrel Concress Center (ECC Berlin)
www.h2-forum.eu

LEGAL NOTICE

H2-international

H2 international – THE E-JOURNAL ON HYDROGEN AND FUEL CELLS

ISSN 2367-3931
Issue / Years 11. (2025) / Issue No. 1, January 2025

Publisher
Hydrogeit Verlag
Sven Geitmann
Gartenweg 5
16727 Oberkraemer, Germany

VAT ID No. DE 221143829

Legally Responsible for Content Dipl.-Ing. Sven Geitmann
Phone +49 (0)33055 21322
Email info@h2-international.com
Web www.hydrogeit-verlag.de, www.h2-international.com

Editorial & Research
Eva Augsten, Sven Geitmann, Michael Nallinger, Monika Rößiger, Jörg Weber, Anette Weingärtner

Design & Typesetting NEONBOLD
Dipl.-Des. Henrike Hiersig & Dipl.-Des. Robert Müller, Berlin

Adverts Correct Conception GmbH, Kathrin Lewitz, Oberkrämer, Germany

Translation Nicola Bottrell Hayward, the hydrogen translator, Bristol, United Kingdom
Karlee H. Archer, Biedenkopf, Germany

Frequency	5 digital issues per year
Copies	2,700 downloads per issue per year
Single issue	EUR 21.90 (excl. VAT)
1-year sub	EUR 99.90 (excl. VAT)
Students	50 % off standard prices
Termination	3 month before end of reference period

News articles that show an author's name represent the opinions of said author and do not necessarily represent the views of the editorial board.

H_2YDROGEIT Verlag

Cover image: Quest One is expanding production capacity near Hamburg [Source: Quest One]
Photo on p. 3: derBildmacher, Rüdiger Tesch-Zapp

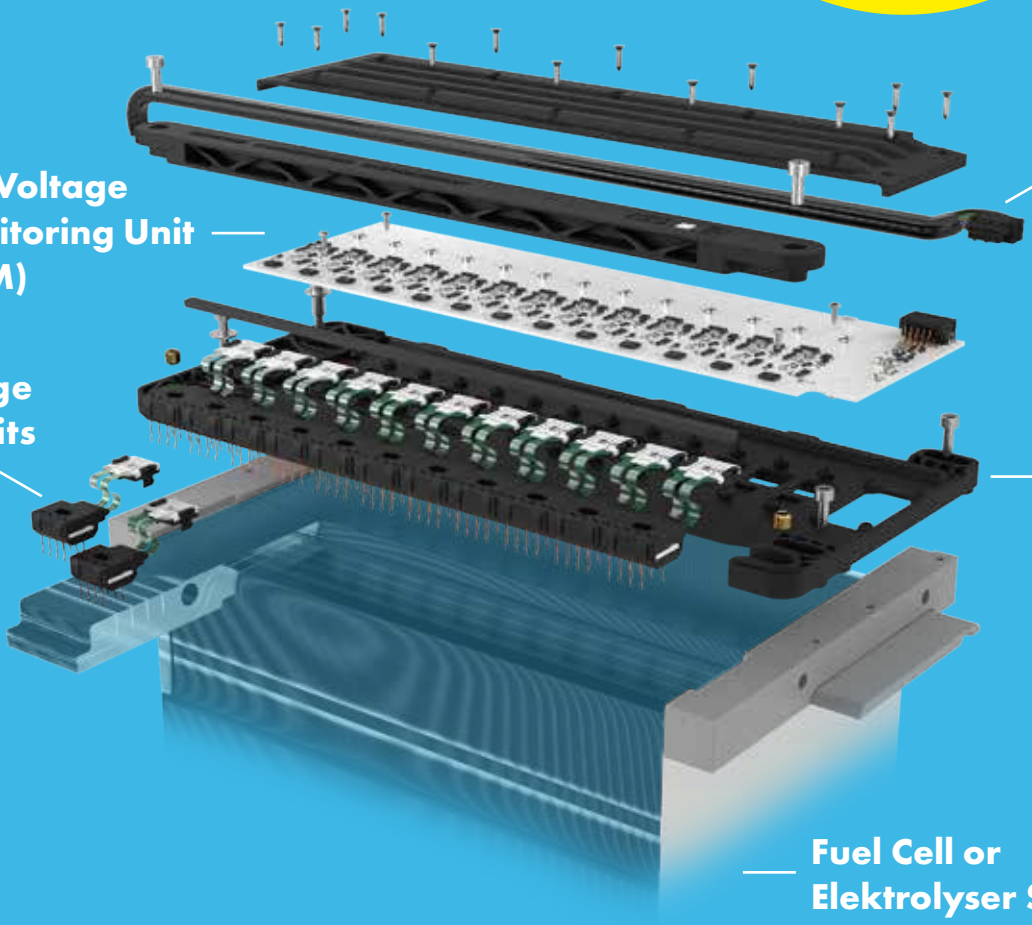
CELL VOLTAGE MONITORING SYSTEMS

FOR FUEL CELLS AND ELEKTROLYSERS

SMART TESTSOLUTIONS

MEET OUR CVM EXPERTS
H2 & FC EXPO TOKYO
19–21 February 2025
in Tokyo, Japan

Hydrogen + Fuel Cells EUROPE
31 March–4 April 2025
in Hanover, Germany



SMART TESTSOLUTIONS GmbH
For more information visit
www.smart-testsolutions.de/en

Headquarter Stuttgart
Rötestrasse 17, 70197 Stuttgart, Germany