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Pilot plant: Drying hydrogen on an industrial scale

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FULL STEAM AHEAD WITH HYDROGEN

A market on the move

BILFINGER

INTERVIEW

"AN AWAKENING COMPARABLE TO THE SPACE RACE"

Great hopes are associated with green hydrogen. But there are still a lot of unanswered questions about using hydrogen on an industrial scale. Steve Hill and Axel Funke talk about current challenges and provide an outlook on the development of the market.

In your opinion, what are currently the greatest technological challenges for the industrial use of hydrogen?

Steve Hill: The biggest technological challenge is that 200 to 400 MW plants are needed and in demand from industry, but with today's technology only 10 or 20 MW electrolysers are possible. There are also still a lot of unanswered technological questions regarding the storage and transport of hydrogen so that it can be used industrially – i.e. in large quantities.

Axel Funke: Storage and transport of hydrogen are so important because the best locations for hydrogen plants are areas with high solar irradiation or with a lot of wind. This, however, makes it necessary to transport the hydrogen. It can be transported in a chemically converted form such as ammonia, methanol or bonded to a carrier such as LOHC (Liquid Organic Hydrogen Carrier). It is also possible to cool the hydrogen into a liquid form, which again requires a significant amount of energy. No one technology has emerged as a frontrunner so far, which means that project developers are focusing on different solutions.

How can these challenges be overcome?

Steve Hill: They can only be overcome if there is even more investment in technology and intensive cooperation on a global scale. At Bilfinger, we are therefore testing various new processes together with other companies. These include, for example, the use of LOHC that allows hydrogen to be transported safely and efficiently. We are also using innovative approaches to help various companies gradually increase the capacities of their stacks.

What role does research play?

Axel Funke: Although electrolyser technology is more than 100 years old, the large number of hydrogen technology research projects and plants that have been initiated are extremely important. This is because they contribute significantly to the further development of the technology. For example, Bilfinger is collaborating with the Institute of Thermodynamics at Leibniz University in Hanover and EWE Gasspeicher in the field of hydrogen drying. The drying of hydrogen is a prerequisite if hydrogen is to be

> At Bilfinger we have already gained extensive experience with hydrogen technology – in production, storage and transport."
>
> STEVE HILL, STRATEGIC BUSINESS DEVELOPMENT DIRECTOR

put to industrial use. Research into alternative membranes for electrolysers, however, and the use of base metals instead of precious and rare earth metals as catalysts for hydrogen production are also crucial. Without such research activities, the technology needed for the industrial use of hydrogen would develop far too slowly.

How do you see market development with regard to hydrogen? Will the momentum already observed continue or even intensify?

Steve Hill: I am convinced that we are currently experiencing an awakening comparable to the space race. This is evident from the very high level of investment on the part of companies, the funding programs from the federal states and the interest shown by science and society in hydrogen as an energy storage medium. We don't yet know how high the demand for hydrogen actually is, but the potential is enormous.

Axel Funke: I also think the positive momentum will certainly continue. Once the breakthrough for industrial use of hydrogen has been achieved, a range of other applications will open up. One day, hydrogen could also replace batteries in the automotive industry. This is because refueling hydrogen is much faster than charging a battery, and longer ranges are possible with hydrogen. With the war in Ukraine and rising oil and gas prices, hydrogen technology is getting a further boost anyway.

How does Bilfinger support companies in the production, storage and transport of hydrogen?

Steve Hill: At Bilfinger we have already gained extensive experience with hydrogen technology – in production, storage and transport. Our outstanding competences in the field of natural gas have been helpful in this regard. We have also already helped a large number of companies set up hydrogen projects, analyse the economic and legal framework conditions and obtain permits.

Axel Funke: With our global reach and our ability to combine competences from very different areas, we offer a comprehensive range of services. Today, we are able to provide our customers with full support across the entire value chain, from feasibility studies to commissioning and maintenance. We therefore see ourselves as a technology integrator for the hydrogen business: We are familiar with the various technological options and which technology is best suited for which purposes.

> Once the breakthrough for industrial use of hydrogen has been achieved, a range of other applications will open up."
>
> AXEL FUNKE, HEAD OF BUSINESS LINE INTEGRATED PROJECTS

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DEMONSTRATION PLANT

INDUSTRIAL DRYING OF HYDROGEN

Hydrogen has to be dried before it can be converted into electricity or fed into the transport grid. But what is the best way to dry hydrogen industrially? And what are the technical requirements for the process? A demonstration plant currently being developed and built by Bilfinger is seeking the answers to these questions.

There are a number of processes for drying hydrogen. These include, for example, the absorption, adsorption, condensation and membrane separation processes. It is not entirely clear, however, which process offers the greatest advantages for the industrial drying of hydrogen, ensuring that, once it has been dried, it can easily be converted into electricity or fed into the transport grid. Experience regarding the design and manufacture of large-scale plants for industrial hydrogen drying is currently limited.

GemeBilfinger is therefore participating in a hydrogen drying research project together with the Institute of Thermodynamics at Leibniz University in Hanover and EWE Gasspeicher. The goal of the project is to build a demonstration plant that can dry hydrogen on a large scale and highly economically. The project is being funded by the German state of Lower Saxony and is considered an important milestone in the further development of hydrogen technology.

DRYING BY ABSORPTION

The demonstration plant is currently being developed and built at Bilfinger Engineering & Maintenance's Cloppenburg site. It is based on an innovative process that dries hydrogen by absorbing moisture using a suitable scrubbing liquid. Bilfinger is benefiting from its many years of experience in the development of natural gas plants, since very similar processes are used in these plants. They have been operating for decades with a high degree of reliability and efficiency.

The plant will be delivered to Rüdersdorf in Brandenburg in early 2023. There, it will first undergo extensive testing before being integrated into the hydrogen storage plant planned by EWE Gasspeicher. The goal is that this facility will enable hydrogen to contribute to the energy supply the way natural gas does today. Scientific support for this project is being provided by the Institute of Thermodynamics at Leibniz University in Hanover.

MILESTONE FOR AN EFFICIENT HYDROGEN ECONOMY

"The implementation of this project is a major step forward for the energy transition", says Lower Saxony's Environment Minister Olaf Lies. "Decentralized hydrogen drying by absorption for gas storage and feeding into the grid is an essential step for the hydrogen economy. With this technology, hydrogen can be treated economically on a large scale, thus enabling the integration of renewable energies into our energy system. This means that hydrogen produced using wind and solar power, or hydrogen soon to be stored in caverns, can be fed into the transport grid."

> We are putting our decades of experience in building natural gas drying plants all over Europe to good use with this innovative development for the energy transition powered by green hydrogen."
>
> KARSTEN HOFFHAUS, CHIEF OPERATION OFFICER OF BILFINGER ENGINEERING & MAINTENANCE GMBH

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FEASIBILITY STUDY

GIVING GREEN MOBILITY A BOOST

Bilfinger has assessed production and transportation options for hydrogen by-product on behalf of Spolchemie, a major Czech chemicals manufacturer. In a feasibility study, Bilfinger Tebodin Czech Republic s.r.o. also evaluated the technical requirements and economic output of the production of green hydrogen using photovoltaic systems and transporting hydrogen to public mobility solutions such as filling stations for cars or trains.

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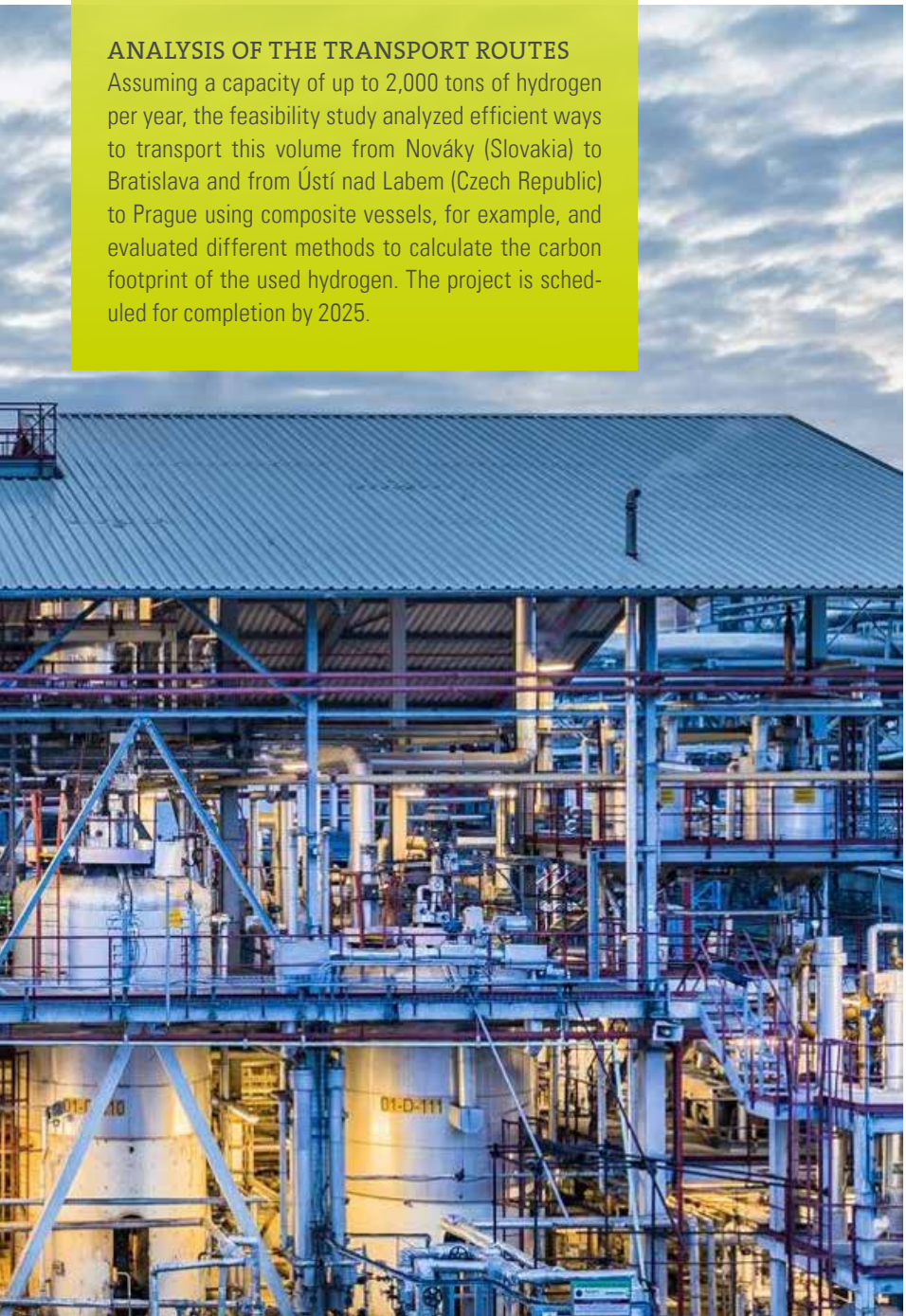
Spolchemie is a major manufacturer of basic and added value chemicals, including chlorine. Hydrogen is a by-product of this production process and has to date been used to power steam-turbine generators.

ALTERNATIVE USES

Bilfinger was commissioned to carry out a feasibility study to identify any other potential uses for the hydrogen. The aim of the feasibility study was to evaluate ways to improve the use of hydrogen and, at the same time, help Spolchemie achieve its ambitious sustainability goals. The study looked at the capital and operating costs, technical requirements and innovative options for various uses of the hydrogen by-product and also evaluated the production of additional green hydrogen and whether or not it could be efficiently transported to cities up to 100 kilometers away.

ANALYSIS OF THE TRANSPORT ROUTES

Assuming a capacity of up to 2,000 tons of hydrogen per year, the feasibility study analyzed efficient ways to transport this volume from Nováky (Slovakia) to Bratislava and from Ústí nad Labem (Czech Republic) to Prague using composite vessels, for example, and evaluated different methods to calculate the carbon footprint of the used hydrogen. The project is scheduled for completion by 2025.



> Our many innovations, investments and efficiency improvements clearly demonstrate that we take our environmental responsibility seriously, including using by-products from our production processes to increase sustainable mobility, for example“.
>
> DANIEL TAMCHYNA,
> CEO OF SPOLCHEMIE

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