BILFINGER now!

we can

EV batteries – Energy for climate-friendly mobility

We create Green hydrogen – Boom market

we care

TECHNOLOGIES FOR THE ENERGY OF THE FUTURE



CLIMATE-NEUTRAL ENERGY PRODUCTION

TECHNOLOGIES FOR THE ENERGY OF THE FUTURE

e currently find ourselves in the midst of the energy transition: An ever-increasing number of regulatory policies and laws are being adopted, fossil fuels are gradually being replaced by renewable energies and a multitude of countries have set ambitious climate protection targets. Europe wants to be climate-neutral by 2050 at the latest.

The energy industry and the process industry are particularly impacted by these developments – though each of them for different reasons. In the process industry, plant operators must reduce the CO_2 emissions of their plants, because these are a major source of greenhouse gas emissions. The energy industry must ensure that it is possible to meet increased demand for renewable energies. This transformation brings with it

massive changes and presents major challenges. There is so much that needs to be completely rethought.

Renewable energies already make up a significant part of the energy mix. Wind and solar energy are contributing more and more to industry's energy needs. To achieve the goal of climate neutrality, however, additional technologies are needed to generate, store and transport climate-friendly energy. A lot is riding on electric batteries and green hydrogen. And there is still a lot of potential in hydroelectric power and district heating. If all these technologies can be used profitably and efficiently, a climate-neutral economy will be close to becoming a reality in just a few decades.



INTERVIEW

"WE ARE SIGNIFICANTLY EXPANDING OUR SUSTAINABLE INDUSTRIAL SERVICES PORTFOLIO"

Mr. Hall, sustainable business practices are becoming increasingly important in the process industry. What steps is Bilfinger taking to provide even better support for its customers in this area?

Bilfinger has been delivering a very comprehensive range of what we call sustainable industrial services for many years. These services include our solutions to enhance energy efficiency, flue gas treatment, combined heat and power generation or waste heat utilization, to name just a few examples. And for decades we have also been providing support in the extraction, transport and supply of energy along the entire life cycle of a plant or power station. In this respect, we are already positioned as energy transition experts and have established an outstanding reputation in the markets that are relevant for us. We do, however, intend to expand this range of services significantly in the future.

What services will these be in concrete terms?

Overall, demand for all our sustainable industrial services is increasing. We will therefore expand our capacities in our existing services portfolio. At the same time, we will increasingly offer services that are key drivers of a successful energy transition: These include, for example, plants for battery production, green hydrogen production as well as carbon capture and storage. There is also strong growth in demand for our services in the areas of hydroelectric power, district heating and nuclear energy. We already have a very strong presence in all these sectors and can offer our customers substantial added value.

What kind of added value do you mean?

As a major industrial services provider, Bilfinger is in a position to offer its customers comprehensive support. We are familiar with different technologies, quickly pick up on successful innovations due to our international presence and help our customers optimize their entire plant – not just when it comes to individual trades or aspects of the plant. Because we offer everything from engineering and manufacturing to maintenance and modernization as well as the dismantling and decommissioning of a plant, we are in a position to provide customers with an integrated portfolio. For the customer, this means better, interface-free support for a wide range of services. They also benefit from a significant reduction in the time and effort required to coordinate the work of different service providers.

Why is this particularly important for services that help reduce CO₂ emissions?

Companies in the energy and process industries are currently undergoing an intensive transformation phase. There is so much that needs to be reworked and rethought. In transition phases, it is reassuring to be able to rely on partners who can contribute decades of experience and who are able to participate in the thought process and design of new solutions and technologies. This is exactly where I see Bilfinger: Not only do we want to provide our customers with operational support through various services, we also want to accompany and advise them much more in the future. The role we play is clear: We make sustainability work!

Duncan Hall, member of the Executive Board and Chief Operating Officer, Bilfinger SE

BATTERIES FOR E-CARS

ENERGY FOR CLIMATE-FRIENDLY MOBILITY

E-mobility keeps gaining momentum, forcing the automotive industry to undergo one of the most significant transformations it has ever experienced. It is not only the industry itself that is impacted – the process industry is also affected. Because process industry competence and expertise is in demand when it comes to the production of batteries, their preliminary products and individual components.

> emand for batteries for electric vehicles (EVs) is huge: According to current estimates, production of EV batteries will have to increase more than tenfold by 2030 in Europe alone in order to meet the increasing demand for climate-friendly e-cars. Billions of euros of investment is necessary, especially in Central and Eastern Europe. The money is needed for the establishment of European supply chains and reduction of the currently heavy dependence on supplies from Asia. Roughly 90 percent of the EV batteries needed in Europe are still produced in Asia.

> Investment has already begun in Germany, Poland, Hungary and other countries, where a significant number of new automotive industry battery factories are currently in either the planning or construction phase. But it is not only plants for the production of mobile energy storage devices that are being built. Raw material processing companies and chemical producers have also long since adapted to the boom in demand for EV batteries. These companies are working to align their plants accordingly. There is one thing they know for certain: It is necessary to produce precursors and individual battery components before the batteries themselves can be manufactured.

SUBSTANTIAL EXPERTISE REQUIRED

The EV supply chain begins with the engineering and construction of plants for processing raw materials needed for batteries - including graphite, lithium and manganese - as well as plants for the chemical production of battery components. These primarily include cathodes, anodes and electrolytes, but also so-called separators which are used to help convert the stored chemical energy into electrical energy. "Substantial expertise and experience is required for the design and construction of such plants in line with customer demands as well as environmental requirements," says Magda Zemanova, Automotive & Battery Market Leader for the Central and Eastern Europe region at Bilfinger Tebodin. "This is because the chemical and process engineering steps that need to be implemented in the plants are usually highly complex and often require customized solutions."

Plant operators who want to produce battery precursors or components would therefore be well advised to find competent and strong partners to implement their project – and to do so at an early stage of investment. "The foundations for success are al-



ways laid before construction begins, even with investment projects in the field of e-mobility," Zemenova says. During the planning phase, for example, a project partner helps select a suitable location, draw up a business plan or conduct a feasibility study. The partner also assumes responsibility for both the technical and construction-related aspects of the engineering work.

Investors should also take advantage of the expertise of an experienced service provider during the construction and operating phases. "Bilfinger's multidisciplinary teams deliver a broad portfolio of services," says Zemenova. These include procurement and construction management through to commissioning, as well as plant operation and maintenance. "We have a winning combination of over 60 years of experience in the automotive industry combined with many years of experience with chemical-sector projects. This allows us to comprehensively support our customers in many ways – and support them in their efforts to contribute to climate-friendly mobility," says the Bilfinger manager.

Major order from BASF PRODUCTION PLANT FOR BATTERY PRECURSORS

Substantial expertise and experience is required for the design and construction of such plants in line with customer demands as well as environmental

> MAGDA ZEMANOVA, AUTOMOTIVE & BATTERY MARKET LEADER CENTRAL & EASTERN EUROPE, BILFINGER TEBODIN CZECH

requirements."

REPUBLIC, S.R.O.

In Harjavalta, Finland, Bilfinger supported the chemical group BASF in the construction of a production plant for precursors for cathode materials (pCAM). Around 4,000 tons of steel structures were erected for the production building, ancillary buildings and the pipe bridges. Bilfinger also assumed responsibility for prefabrication and installation of piping systems, installation of equipment and machinery as well as insulation and painting work. The cathode materials (CAM) produced in the new plant serve as the basic material in the manufacture of batteries for electric vehicles. With the help of these materials, charging times can be shortened and at the same time the range and service life of the batteries can be extended.



Your contact for questions



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BYOND
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GREEN HYDROGEN

BOOM MARKET

Markets for the production, transport and utilization of hydrogen are showing dynamic development. Not surprising given the fact that more and more industrial companies believe that hydrogen will play a key role as a future source of fuel in the energy transition. This applies in particular to green hydrogen – hydrogen produced with renewable energies.

he demand for fossil fuel substitutes in industry is immense. A great deal of hope is being placed in green hydrogen. This is because it produces no direct emissions when used in industry. According to a study from auditing and consulting firm PwC Germany in collaboration with the World Energy Council and the Electric Power Research Institute, global demand for hydrogen as a source of energy will rise from 76 megatons at present to up to 600 megatons a year by 2050.

However, in order to be able to meet such demand, a corresponding infrastructure is required. And this includes not only industrial plants for the production of green hydrogen, but also, for example, routes for high-voltage lines, high-performance gas networks, and the corresponding supply chains.

Major industrial companies have positioned themselves to enter this market at an early stage, and an increasing number of hydrogen projects are being launched. There are many attractive growth prospects in the market: Forecasts suggest that the share of hydrogen in global final energy consumption could rise to as much as 25 percent by 2050 – depending on the cost of producing hydrogen, the infrastructure required and the degree of technological maturity.

"THE HYDROGEN MARKET PROMISES HIGH GROWTH RATES"

How are hydrogen production and transport markets developing? What technological solutions are currently emerging? And how is Bilfinger helping its customers use green hydrogen? Ulrich Trebbe, hydrogen expert at Bilfinger, explains the market developments we are seeing at the moment.

Mr. Trebbe, how can green hydrogen be produced on a large scale, allowing it to be used profitably in industry?

Green hydrogen must become cheaper – and this requires large-scale production. And standards are needed to achieve this level of production. As long as components for the production, transport and use of hydrogen are designed and manufactured on a highly individual basis, each time according to the specific needs of the customer, such processes will continue to be extremely costly. Production in accordance with national or international standards makes it possible to achieve automated industrial manufacturing – and thus high cost efficiency. Ultimately, this requires global partnerships that map the entire value chain of this energy supply.



H-H

What progress has been made in the field in the last two years? What approaches are there to solving the problem?

The development of hydrogen markets is heavily dependent on politics. Initial framework conditions have been defined, but many questions are still open or have not yet been satisfactorily resolved. For example, various regulations in Europe still need to be adapted to give the industry the security to invest in large projects. Market development has recently been greatly helped by the fact that significant subsidies are available for relevant projects. They are leading to the creation of industrial hydrogen production plants that set new standards and to the development of pioneering electrolysers. In order to further fuel the market, however, there must soon be further steps taken by policymakers.

In addition to hydrogen production, hydrogen transport is also key to its widespread use. Are there any signs of suitable technological solutions on the horizon right now?

A number of different solutions for transporting green hydrogen are currently being intensively discussed and tested. In addition to conventional transport in gaseous form – through pipelines, for example – technologies that use other media for transport are also increasingly gaining in importance. One of these technologies is the so-called LOHC technology (Liquid Organic Hydrogen Carrier). For transport over longer distances (for example from the Middle East or Australia), it will be an alternative to variants using methanol or ammonia. Bilfinger is therefore cooperating with technology owners in order to be able to deliver integrated solutions in the hydrogen cycle.

What hydrogen projects in particular are currently underway? What projects is Bilfinger working on?

There are quite a few projects at the moment. The focus, however, is on helping customers develop industrial plants for the production of green hydrogen. In cooperation with electrolysis producers, we are developing the balance of plant and ensuring the interfaces to the customer and their existing plant are managed in a meaningful way. As an integrator of energy generation projects, but also of hydrogen infrastructure and utilization, we serve as a link between hydrogen users and hydrogen producers. In addition, we contribute our expertise when it comes to the future use of existing hydrogen systems. In recent years, we have acquired a great deal of expertise in testing system technology, components and materials for what is known as hydrogen readiness.

What is your assessment of the hydrogen market? How strong will it be in terms of growth?

We expect very high growth rates in the hydrogen market, which has experienced significant movement recently. This is because international and national CO_2 targets are very ambitious and will lead to a large number of projects that will no doubt require our specialist expertise in many different respects. We therefore anticipate a significant increase in orders for engineering and plant construction in Europe in the years ahead. We have also set the goal of moving into additional markets and combining our experience in other technologies to an even greater extent.



Your contact for questions



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HYDROPOWER

LIMBERG III: CONSTRUC-TION IS UNDERWAY

It is currently one of the single largest renewable energy expansion projects in Austria: Electricity company Verbund is investing around €480 million in the Limberg III pumped storage power plant. Construction began last fall near the town of Kaprun in the Hohe Tauern mountain region.



ustria's objective is to meet one hundred percent of its energy needs from renewable sources as early as 2030. The Limberg III pumped storage power plant will make an important contribution in this respect: It expands the capacity of the existing Kaprun power plant group and will produce up to an additional 480 megawatts of climate-neutral electricity from 2025. At the same time, the new pumped storage power plant ensures the efficient intermediate storage of energy in times of surplus while allowing it to be quickly fed into the Austrian and Central European grids when needed.

Limberg III is, in a sense, a twin of the Limberg Il power plant which was built between 2007 and 2011. Like its namesake, Limberg III is being built between the high mountain reservoirs of Mooserboden (2,036 m) and Wasserfallboden (1,680 m). "The underground installation of the penstocks is particularly challenging from a technical point of view", says Stephan Ebner, Head of the Hydropower Business Unit at Bilfinger Industrial Services Austria. "These pipes not only have to cover a height difference of more than 350 meters, they also have to be extremely pressure-stable once the system is in operation." The reason for these special requirements relates to the way the pumped storage power plant works: Water is pumped through the penstocks into the upper reservoir. From there, it is released into the lower reservoir when needed, thereby powering the turbines to generate electricity. "Limberg III can only function when these pipelines fully perform their task", says Ebner.

TIME-SAVING ASSEMBLY TECHNOLOGY

Bilfinger is responsible for the engineering, manufacture, delivery, assembly and commissioning of the penstocks for the construction of Limberg III. Due to intense scheduling pressure, it is not possible to take to more traditional approach of first transporting the individual pipe sections up the mountain, where they are then roped down into the penstock shaft and welded together. Instead, to save time, the 35 pipes, each weighing 45 tons, are to be lifted from the valley floor into the 585-meter-long and 42-degree-inclined pressure shaft, placed upstream and welded directly in parallel with the other work in 48-hour shifts – the first time this has been done in assembly technology.

In addition to the penstocks, Bilfinger is also designing, manufacturing and installing the intake manifold dampers for the new hydropower plant, each of which is five meters wide and more than one-and-a-half meters high. These devices regulate the flow in the water distribution system through controlled opening and closing.



Your contact for questions



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DISTRICT HEATING

HOW INDUSTRIAL WASTE HEAT CAN BECOME A SALES HIT

Industrial plants produce heat that often goes unused. Energy suppliers, however, would benefit from feeding industrial waste heat into their district heating networks. With this in mind, Bilfinger has co-developed a concept that creates a win-win situation: The concept relies on the intelligent integration of industrial waste heat into the district heating supply.

MODEL-BASED NETWORK OPTIMIZATION



ScaleGrid analyzes the potential of a wide range of sources for the district heating network.

ow can industrial waste heat contribute to the sustainable heating of cities and communities? "Waste heat can make a huge contribution," thought Christian Strondl. The Managing Director of Bilfinger Industrial Services therefore worked on a solution that would allow industrial companies to determine precisely how much waste heat they generate – and how much of it they could sell to municipal energy suppliers for their mutual benefit.

This thought process resulted in the "ScaleGrid" concept. It analyzes the potential of various heat sources and at the same time shows possibilities for their use as an energy source. Bilfinger is cooperating with two partners in the implementation:

IT specialist ProCom, based in Aachen, Germany, provides comprehensive analyses of the energy market and price developments. Using this as a basis, municipal utilities and plant operators can decide whether and when it makes sense for them to do business with each other – in other words, when they should buy or sell waste heat.

- The Vienna-based consulting firm Decision Advisory Group brings industrial companies and utilities together at one table and manages communication with all stakeholder groups.
- Bilfinger ensures the optimal use of energy. This involves improving heat flows in the plant, identifying possible savings and evaluating whether and to what extent industrial waste heat can be used in the district heating network.

"A key factor in the success of ScaleGrid is the interaction of all relevant players," says Strondl. From the initial contact with the city to talks with local industry and transparent public relations, the concept follows a defined process, the goal of which is to ensure that all parties benefit. "In this way, we achieve broad acceptance and offer a forward-looking solution for municipal heat supply, from which plant operators in particular can also benefit considerably," says Strondl.



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