



H2 Green Steel

The BILSTEIN GROUP is an investor in the new Swedish steelmaker H2 Green Steel.

Climate neutral by 2035

Management Board resolution of May 17, 2021: a clear commitment to sustainability and climate neutrality.

Everybody wins

Investment decisions can have positive long-term effects on both an environmental and economic level.

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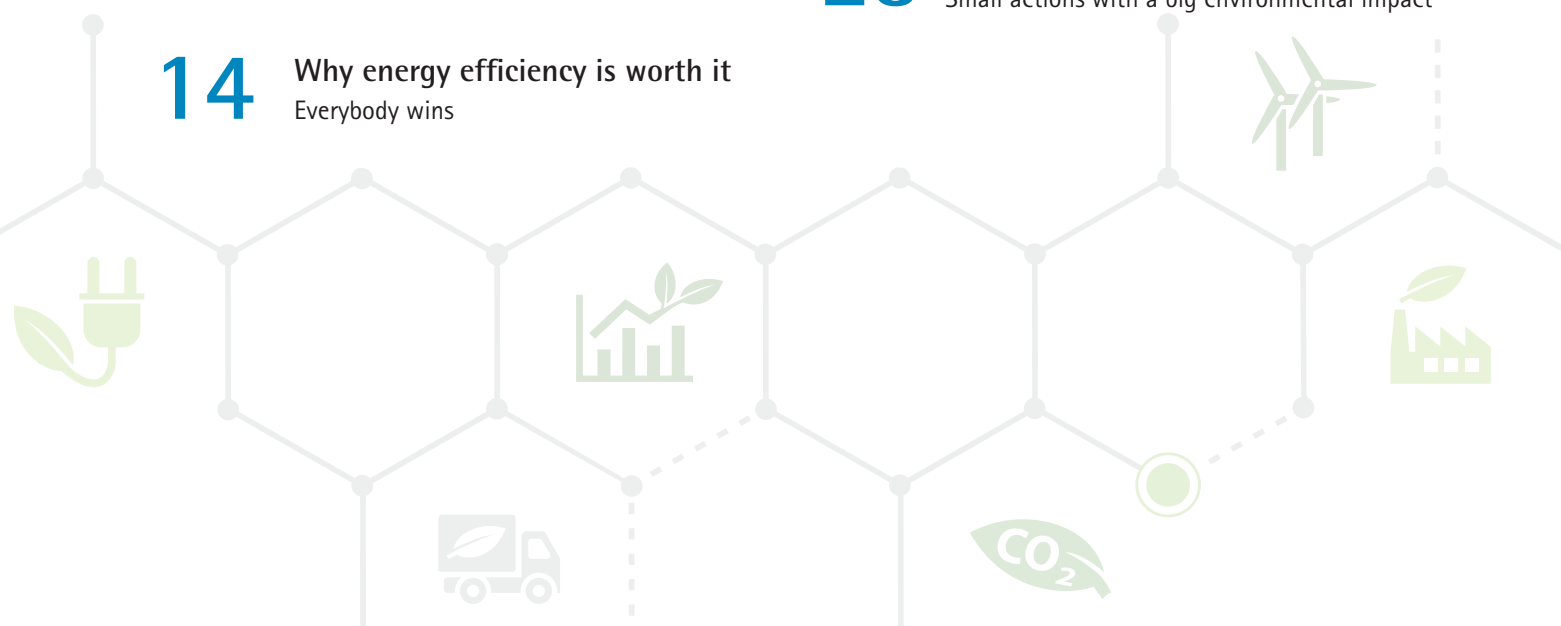
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At some point, we are all asked to act in a way that is sustainable and conserves resources. That's why this issue of the newsletter is dedicated to this important topic.

Dear partners, dear customers,

Sustainability, climate neutrality, reducing our carbon footprint, renewable energies, greater use of hydrogen – all of these terms are increasingly defining our everyday lives, both at home and at work.

Climate protection affects us all – and it's not just about meeting the ambitious goals of the European Union (EU) and the German federal government. Protecting the environment, avoiding a huge increase in global warming and using resources efficiently – these are all issues that surely everyone can agree are critical to the future of our planet.

But what does it mean for a cold-rolled strip company like the BILSTEIN GROUP? For some time now we've employed various approaches to reduce our CO₂ emissions in production, but we've also started thinking on a bigger scale.

This issue of our newsletter aims to give you an overview of the different sustainability topics we're currently focusing on in the BILSTEIN GROUP. Furthermore, we'd like to give you an insight into the challenges associated with reducing CO₂ emissions in steel production. After all, the biggest chunk of cold-rolled strip's carbon footprint comes from steel production. And that's exactly why, in spring 2021, we took a stake in the newly founded Swedish steel manufacturer H2 Green Steel. From 2024, H2 Green Steel will be the first company worldwide to supply steel produced exclusively by carbon-neutral means, and is therefore the

ideal partner for us and our customers, who are increasingly requesting steel grades from low-CO₂ production.

Additionally, we are currently engaging in intense dialog with our long-standing raw material suppliers and, for example, deploying Salzgitter hot-rolled strip in BILSTEIN production, which – through the use of existing electric arc furnace capacities – results in significantly lower CO₂ emissions than steel produced via the conventional blast furnace route.

As you'll see, there's lots happening in the sustainability space at the BILSTEIN GROUP. The BILSTEIN GROUP wants to and will be the *No. 1* partner for our customers in the implementation of climate-friendly steel supply chains.

I hope you enjoy reading this issue!

Kind regards,
Marc T. Oehler



Marc T. Oehler
Chief Executive
BILSTEIN GROUP



Management Board resolution of May 17, 2021 on sustainability/climate neutrality in the BILSTEIN GROUP:

The BILSTEIN GROUP Management Board resolves that, by 2035, the German companies in the BILSTEIN GROUP will make their production, logistics and administrative processes carbon-neutral – providing sufficient carbon-neutral (renewable) energy sources (electricity and hydrogen as a substitute for fuel gas) are available by then.

Furthermore, the BILSTEIN GROUP commits, depending on the availability of raw materials and customer expectations, by 2035 to transition a large proportion of its raw material procurement to steel grades that have either been produced in a way that is carbon-neutral or that results in a significant reduction in CO₂ emissions compared with today.



Sustainability as a matter of principle

"Going green" for a better future!

Sustainability is not just a trend. The need for environmentally conscious and resource-efficient practices came to the attention of politics, industry and society some time ago. And sustainability is a key element of the BILSTEIN GROUP's strategic path forward, too.



„Sustainability is an integral part of our company's strategy – and in light of the automotive sector's goal to achieve carbon neutrality, reducing CO₂ emissions is a particular priority. In our processes, CO₂ is emitted during the combustion of natural gas. But there are specific projects underway to replace this fossil fuel with green hydrogen. Furthermore, with each new investment, we place great value on ensuring energy efficiency through the use of the latest technologies. This includes recovering waste heat – for example, from our annealing processes – and converting it into electricity. But the biggest driver of our carbon footprint remains our raw material, where we do not have any direct influence over carbon emissions. So, we are also supporting our current suppliers to take steps toward climate neutrality. We've also invested in the construction of a "green" steelworks in Sweden – H2 Green Steel. In just a few years' time, this will give us our first and (for now) only opportunity to procure steel in a 100% carbon-neutral way. It therefore marks an important step in safeguarding our competitiveness and the future viability of the company. After all, if we are unable to make our production sustainable and resource-efficient in the long run, we will simply be cut out from important customer structures.“



Michael Ullrich



Dr. Bernhard Gräwe



Dimitar Yotsov

“The importance of sustainability has grown exponentially in our industry; after all, the steel industry is one of the biggest emitters of greenhouse gases. At the same time, steel will always be an important raw material. That's why we're getting involved in projects like the carbon-neutral steel plant H2 Green Steel in Sweden. To allow us to tackle the challenges of the future, we have to be extremely innovative in this area. Sustainability also affects how we structure our systems and processes. At the end of the day, the term goes beyond ecological aspects like protecting the environment and conserving resources. Our approach is to make our organization as sustainable and modern as possible, i.e. not just functional, but process and network-driven. We want to use modern, digital solutions to bring our work environment into the future. To do this, we're taking a close look at current trends in remote working, and we're in the process of drawing up a road map for the BILSTEIN GROUP. Ultimately, in IT it's about setting up structures that safeguard the sustainable growth of the BILSTEIN GROUP.”

“Sustainability is a key success factor; without it, the BILSTEIN GROUP's products will not find acceptance on the market in the required volumes, now or in the future. It's critical that we demonstrate success in different segments. And this issue is on all of our customers' agendas, too. Above all, reducing CO₂ emissions is a priority. Auto suppliers in particular want to know that we're being proactive when it comes to sustainability. Our involvement in H2 Green Steel is being very well received in this respect: customers across all sectors support our investment and are already expressing interest in receiving deliveries from the new plant. Green steel is currently on everyone's minds; but there is still limited willingness to pay more for it. I believe that will change: I think the political and social discussion around conserving resources will continue to gain momentum, and ultimately clarify that we have no other choice but to spend more money to preserve our planet for future generations. The road to get there may be long and difficult – but we don't have any other option.”



Bernd Grumme

“Sustainability and climate neutrality are becoming compulsory for the BILSTEIN GROUP across the entire supply chain, from suppliers to customers, and they are therefore of existential importance for us. Our customers are increasingly defining mandatory sustainability requirements, and they're getting stricter. If we fail to implement the relevant goals, we will have no basis for future business models. Established business models will also cease to be viable. So, the issue of sustainability remains critical, right down to the procurement of raw materials. This is why all our suppliers have issued a "Vision Map" for achieving carbon-neutral steel production by 2050 at the latest.”



Climate neutral by 2050

A new era in steel production

Completely rethinking steelmaking: this is the challenge the European steel industry is currently facing. The European Union (EU) has set a deadline of 2050 for achieving climate neutrality, marking the start of a new era. The race to develop the best strategies and solutions has begun...

At present, the blast furnace is the preferred technology for the production of steel from iron ore. In this process, iron ore is made into pig iron using coke, which is almost pure carbon. Up to four percent of the pig iron is carbon: this is burned off during processing of the pig iron into crude steel in a downstream converter (refining). For this purpose, the material is treated with oxygen (causing the carbon to oxidize), and CO₂ is released, as well as CO. The high energy requirements, the use of coke and the refining process all add up – on average, producing one ton of steel currently results in 2.6 to 2.7 tons of CO₂ emissions. Altogether, the steel industry is responsible for around seven percent of global carbon dioxide emissions – and for around 30 percent of industrial CO₂ emissions. So it's not surprising that the steel industry is a focus of discussions of climate protection, and that demand for green steel is growing rapidly.

By its own account, ArcelorMittal – the biggest steelmaker – became the first in the world to offer green steel in late 2020 through its "XCarb™ green steel" certification program. Here, any CO₂ savings achieved are passed on to its customers, allowing them to report a corresponding reduction in their emissions. The aim is to deliver 600,000 tons of green steel through the program by 2022. But this is just a small first step in terms of the volumes needed worldwide. Global steel production amounted to around 1.9 billion tons in the past year.

Three concepts, one goal: climate neutral by 2050

As per its European Green Deal, the EU aims to be climate neutral by 2050. This means the steel industry faces the historic task of decarbonizing steel production, i.e. making it carbon-free. So, how can it do that?

PRODUCE



Steel manufacturers are generally taking three approaches: one approach is avoiding the emission of CO₂ altogether (i.e. carbon direct avoidance – CDA). Here, the focus is on treating iron ore with green hydrogen instead of carbon (or natural gas). Another approach is focused on collecting the CO₂ emitted during the process and using it elsewhere, which is known as carbon capture and usage (CCU). The third approach is capturing the greenhouse gas and storing it (i.e. carbon capture and storage – CCS).


To advance the decarbonization of steel production as quickly as possible, many steel manufacturers are taking a multi-pronged approach.

Avoiding CO₂: a blast furnace without coke

The biggest drawback of the conventional blast furnace-converter route is the high carbon dioxide emissions. So, efforts are underway to replace some of the coke used as a reduction agent in the blast furnace with hydrogen. The hydrogen reacts with the iron oxides to create steam; no carbon dioxide is emitted. It therefore offers an excellent way to make steel production carbon neutral in the long

term. Critical to the overall carbon footprint is the way the hydrogen is manufactured, i.e. it is extracted from water using electricity, with a high proportion of this electricity coming from renewable energy.

To quickly deliver the initial CO₂ reductions and a truly green product, thyssenkrupp Steel, for example, aims to replace the pulverized coal in the furnaces at its Duisburg-Hamborn plant, and therefore some of its carbon requirements, with hydrogen. In theory, this could reduce CO₂ emissions by up to 20 percent. The plan is to connect the plant to the Air Liquide hydrogen network via a pipeline. The technology has already been put through its paces, and now the group aims



CING sustainably



to incorporate it in large-scale industrial use, enabling the production of around 50,000 tons of virtually climate-neutral steel annually from 2022.

Direct reduction: the blast furnace alternative

Many industry experts believe that the future of steel production lies in replacing blast furnaces with the direct reduction of iron ore into iron. Direct reduction (DR) plants like this are powered by gas. Using natural gas rather than furnaces results in an approx. 50 percent decrease in CO₂ emissions. And if green hydrogen is used, DR plants are emissions-free.

ArcelorMittal has already been producing steel using a natural gas-based DR plant at the Port of Hamburg for more than 50 years. As part of its H2H project ("H2 from Hamburg"), it is also aiming to build a further DR plant at the location, which, for the first time, will see hydrogen deployed on an industrial scale. The plan is to produce green steel using hydrogen from renewable energy sources from 2025 onward. In the medium term, ArcelorMittal is striving to create further electrolysis capacities to ensure the 100 percent carbon-neutral operation of the Hamburg plant. With the planned expansion of hydrogen infrastructure in Germany, the market leader also plans to construct an industrial DR plant in Bremen and a DR pilot plant combined with an electric arc furnace in Eisenhüttenstadt by 2026. Using green hydrogen, this will enable the production of up to 3.5 million tons of steel with significantly lower CO₂ emissions.

With its SALCOS® concept (Salzgitter Low CO₂ Steelmaking), Salzgitter AG is also focusing on replacing blast furnaces with DR plants, with the aim of reducing CO₂ emissions in

its steel production by up to 95 percent. The necessary hydrogen will be acquired through electrolysis, using electricity from renewable sources. The company will rely on natural gas for now, until hydrogen is available in sufficient volumes. The plan is to commission the first hydrogen or natural gas-operated DR plant as a technology center by 2022. The Lower Saxony steelmaker wants to reduce greenhouse gas emissions by 50 percent by 2030 and to have transitioned entirely to DR plants by 2050. By then, Salzgitter will be producing 5 million tons of direct reduced iron annually.

thyssenkrupp Steel also plans to significantly cut its CO₂ emissions by 2030 – by 30 percent. To do this, the steel giant is also relying on the construction of DR plants. thyssenkrupp Steel's first large DR plant, powered by natural gas, will go into operation in 2024. From 2030 onward, it's targeting annual production of 3 million tons of carbon-neutral steel – along with a reduction of around 6 million tons of CO₂. Unlike blast furnaces, DR plants do not produce any molten pig iron, so thyssenkrupp Steel is also working with a plant manufacturer on integrating a submerged arc furnace, which will allow DR plants to continually produce a molten product. This means it can be seamlessly integrated into the existing smeltery network.

Reusing CO₂: recycling gases as raw materials

In addition to avoiding greenhouse gases, thyssenkrupp Steel is also looking at ways to process CO₂. Since 2018, the company's Carbon2Chem® project has pursued a parallel strategy of capturing the gases emitted during steel production, including the carbon they contain, and processing them for use in the



chemical industry. This allows the extraction of base chemicals for the production of fertilizer, plastics or fuels, which would otherwise require syngas from imported fossil fuels like oil or natural gas. By taking this parallel approach – Carbon2Chem® and the injection of hydrogen as a reduction agent – thyssenkrupp can achieve a significant, long-term reduction in emissions from the existing blast furnace process, until it is phased out and replaced by DR furnaces.

Due to the lack of green hydrogen available, ArcelorMittal is also taking a dual-pronged approach that involves capturing and processing CO₂. In Belgium, the firm is constructing a pilot plant that converts CO₂ into ethanol, which can then be used as a fuel source.

Capturing and storing CO₂

In a first step, Europe's third-largest steelmaker, Tata Steel Europe, is planning a system that should cut CO₂ emissions at its plant in IJmuiden, Netherlands, by up to 30 percent. Together with two energy companies and the Port of Amsterdam, Tata aims to transport the gases emitted during steel production via pipelines and store them in empty gas fields under the North Sea. If the relevant approvals are issued and necessary grants provided, Tata Steel Europe aims to put a corresponding plant into operation in 2027. In a second step, as an alternative to storing gases beneath the seabed, chemical factories could also process some of the captured CO₂ into new raw materials. "Hlsarna" technology, which the company hopes will replace the blast furnace process, plays a key role here. If Hlsarna can be scaled up for industrial use, in future it may enable steel production with a 20 percent smaller carbon footprint. Together with

the technology for CO₂ storage, this will result in an approx. 80 percent drop in total emissions.

Conclusion: a revolution for the entire industry

For the time being, green steel will remain a niche product that is green more on paper than anywhere else, for example through emissions certification. But steelmakers are facing the greatest technological change in their histories: the transition to carbon-neutral production processes. To successfully navigate this, they will have to invest billions of euros. The Federation of German Steel Companies estimates that, unless the energy supply structure is adapted, the transition will cost around 30 billion euros in Germany alone. For manufacturers in countries with high wages, energy costs and environmental standards, this poses a huge challenge. There's already a huge number of competitors worldwide, as well as new carbon-neutral steel suppliers entering the market (see the article on page 10). 🌱

! Read more about...
...green steel

- H2 Green Steel in Sweden (page 10)
- The new hydrogen project in the Ruhr region, Germany (page 20)



H2 Green Steel

Green steel on green land

The BILSTEIN GROUP is an investor in the new Swedish steelmaker H2 Green Steel. The ability to deliver carbon-neutral steel in the near future is an existential matter – and this strategic partnership with the Swedish startup will be critical to ensuring the BILSTEIN GROUP is fit for the future.



CO₂ emissions are a key driver of climate change. So, reducing these emissions is becoming extremely important in steel production and processing. The global steel industry is one of the world's largest emitters of carbon dioxide, accounting for around seven percent of global CO₂ emissions. As a result, demand for "green" steel is growing quickly. "Climate change affects us all. The faster the steel industry, one of the biggest emitters of greenhouse gases, makes progress here, the better it is for everyone," underlines Chief Executive Marc T. Oehler. "Ambitious projects like H2 Green Steel are helping accelerate the transformation of the steel industry. That's exactly why the BILSTEIN GROUP invested in it in spring 2021."

Through the strategic partnership with the newly established Swedish steelmaker, the BILSTEIN GROUP is continuing its focus on the environmental core of its strategy; the company wants to be in a position to offer its customers steel grades from carbon-neutral production from as early as 2024. This will also considerably expand the benchmark for raw materials.

Green steel: an enormous challenge

Nearly all steel manufacturers are looking at ways to reduce their CO₂ emissions (read more on page 16). Approaches include replacing conventional blast furnace methods with electric steelworks and substituting carbon or natural gas with hydrogen. "Traditional steelmakers are currently facing huge challenges here, especially since production needs to continue in parallel," says Managing Director Michael Ullrich. So of course, the BILSTEIN GROUP is also supporting its existing partners on the supplier side in their efforts to reduce the carbon footprint of steel manufacturing and offer green steel.

What makes the new steelmaker H2 Green Steel so attractive? Location, location, location: in the Boden-Luleå, Norrbotten region of Northern Sweden, where the steelworks is being built, wind energy and hydropower are in plentiful supply. This means steel can be produced using entirely renewable energy sources, as the steelworks is being built on what is more or less a green field site so completely new concepts can be explored. The team behind H2 Green Steel is approaching the build with fresh, innovative ideas, from electricity generation, to digitalization, to the steel production processes them-



Who exactly is behind H2 Green Steel?

The initial investors include a number of companies and individuals, from strategic and technology partners to long-term investors with a focus on green impact, sustainability and Industry 4.0. The current investors include Altor Fund V, Ane & Robert Maersk Uggla, BILSTEIN GROUP, EIT InnoEnergy, Exor, FAM, IMAS Foundation, Kingspan, Marcegaglia, Mercedes-Benz AG, Scania, SMS Group, Stena Metall Finans, Cristina Stenbeck, Daniel Ek and Vargas.



selves. This means the entire infrastructure can be designed with carbon neutrality top of mind as there's no need to worry about existing systems and structures.

H2 Green Steel: a lighthouse project

The Swedish startup is setting the benchmark for the paradigm shift in the steel industry: H2 Green Steel is guaranteeing steel from up to 100 percent carbon-neutral production. The company aims to start production in 2024 and reach an annual production capacity of five million tons of high-quality green steel by 2030.

As a strategic partner and customer, the BILSTEIN GROUP has been involved since the inception of the project back in February 2021. This gives the company the opportunity to help determine which material grades should be manufactured in the initial stages – namely those that are important to the BILSTEIN GROUP and its customers. In regular meetings, the BILSTEIN GROUP communicates its requirements and shares its expertise and experience from the steel and auto industries, securing a fixed production quota in its role as a strategic partner. The BILSTEIN GROUP is also represented on the Investor Advisory Board.

Future opportunities

It is extremely important for the BILSTEIN GROUP to be able to source carbon-neutral hot-rolled strip in the foreseeable future, and at a predictable cost. That's because demand among customers in the automotive and automotive component industries for steel grades with a significantly lower carbon footprint is growing rapidly. Auto manufacturers in particular, and a number of auto suppliers too, have already laid out very

clear road maps defining the maximum CO₂ emissions they'll accept per ton of steel, and until when. "We're seeing a huge increase in demand for steel that's produced with reduced greenhouse gas emissions, especially in relation to the large number of electric mobility projects being pursued," explains Managing Director Bernd Grumme. "Our involvement in H2 Green Steel shows that, even in challenging times, we are working hard to address how we'll procure raw materials in the future – and not just from conventional steelmakers."

Through its collaboration with H2 Green Steel, the BILSTEIN GROUP can fulfill the growing demand for steel with a small carbon footprint in a timely way. News of the BILSTEIN GROUP's investment in the new Swedish steelmaker was officially announced on March 4, 2021, and was extremely well received by customers. "Our customers have already started asking for supply details," says Michael Ullrich, who is pleased about the great interest that's been shown. "The biggest appeal of this project is that we should be able to offer our customers initial volumes of carbon-neutral steel as early as 2024/25."

Paving the way to 100% carbon-neutral steel

For some time now, the BILSTEIN GROUP has also been pursuing various technologies to help it reduce CO₂ emissions in its production process, and with some notable successes. So there is a realistic chance of supplying exclusively carbon-neutral cold-rolled strip from 2030/35 onward. "Our strategic partnership with H2 Green Steel is our chance to be the first company in the industry that is really in a position to supply exclusively carbon-neutral steel," explains Michael Ullrich. 🌱



SWEDEN

Green steel
is on its way

Capital city: Stockholm
Area: 450,295 km²
Population: approx. 10.6 million

Sweden is a pioneer in green energy. 54.5 percent of its energy already comes from renewable sources, compared with Germany where this number is 15.5 percent (June 2020, bdew.de).

Luleå, which is located close to Boden in Norrbotten County, Sweden, has become a hub for the country's green steel industry. Besides H2 Green Steel, Swedish steelworks SSAB is working on steel production using hydrogen.

QUESTION

Is the BILSTEIN GROUP building a steel plant in Sweden?

"Let's clear this up: no! We've invested in the startup H2 Green Steel so that this extremely important project has the financing to be able to go ahead. We're just one of a consortium of investors who are driving the project forward together. As a strategic partner, we have taken on a consulting role, which in turn will guarantee us access to 100% carbon-neutral hot strip from 2024."



Michael Ullrich



Read more about...
...green steel

- The efforts underway in the steel industry (page 6)
- The new hydrogen project in the Ruhr region, Germany (page 20)



Everybody wins

Why energy efficiency is worth it



Investment decisions can have a sustainable impact from both an environmental and an economic standpoint. The BILSTEIN GROUP is focusing its attention on conserving resources and improving energy efficiency – and in turn safeguarding the future of both the company and the planet.

The BILSTEIN GROUP's strategic investments in recent years are proof that sustainability and profitability aren't at odds with one another, but can actually go hand in hand. With targeted investments such as the new rolling concept and the establishment of BILSTEIN COLD ROLLED STEEL in the USA, the company's plants all employ cutting-edge technology that is optimally designed for energy and resource efficiency – and that is more productive as a result.

A firm focus on sustainability

Whether annealing, rolling or shearing – the BILSTEIN GROUP is turning to energy-efficient systems for all its plants. Integrating the resulting process heat into a cycle and making it reusable is another key aspect. This means the halls that house the rolling mills no longer require heating independently because a heat exchange system utilizes the plant's waste heat. Furthermore, the heat produced in batch annealing is

fed back into the process via an Organic Rankine Cycle (ORC) plant. The electricity generated in the plant, as well as the heat, are introduced into the plant's own supply network, leading to a significant reduction in CO₂ emissions. The solution truly represents a pioneering undertaking by the BILSTEIN GROUP.

But even if these measures allow the company to cut energy costs in the long run, these kinds of investment decisions are primarily a matter of principle: "Anyone making these kinds of investments based on economic factors alone would likely go for something different. That goes for almost everything that we're doing. Until now, natural gas and electricity have been too cheap in Germany to justify a change of strategy," says Managing Director Michael Ullrich. "We're doing this based on our beliefs and priorities as a business – because we want to leave a green legacy. At the end of the day, I also have kids and I like living on this planet."

INVESTI



Investing in the future

"Our investment strategy for the future is about aligning the value creation of the BILSTEIN GROUP with the shift toward electric mobility and the demands made by carbon neutrality," explains Michael Ullrich. To this end, the BILSTEIN GROUP is looking at deepening parts of the added value chain, at new technologies, new materials – there are plenty of innovative ideas in the pipeline. "Right now we are in the process of breaking down the various approaches and analyzing them for their profitability and opportunities," he continues. The aim is to optimally support the transformation underway in the auto industry and to continue to position ourselves on the market as a strong partner.

"BILSTEIN cold-rolled strip will continue just as it is now," says Michael Ullrich, confidently. With the successful implementation of its rolling concept, the company has laid the foundations for a bright future. And plants resumed normal operations in the first quarter of this year. "But to continue to grow, we need to expand our portfolio with new processes and products. We're also looking at different technologies, like using hydrogen and fuel cells," continues Michael Ullrich.

BILCUT®

One project is already set in stone: BILCUT®, a high-speed laser-cutting method for making shaped blanks for the auto industry. The BILSTEIN GROUP developed the process together with the Fraunhofer Institute for Laser Technology ILT in Aachen, and is currently working with a plant manufacturer to create a prototype based on the patented technology. Once the prototype delivers on a 1:1 scale, the BILSTEIN GROUP will incorporate it into its production plant. The new technology should start production in 2023.

Sustainable technology...

"The technology is very innovative," says Michael Ullrich, happily. "This laser-cutting method hasn't existed before and is the first of its kind in the world." It means the BILSTEIN



NG sustainably

→ GROUP is in a position to design the manufacturing process for shaped blanks in a highly resource-efficient way. Thanks to the agility of the laser-cutting head, significantly more blanks can be formed from a single sheet than with a conventional die cutter. This results in much less waste, and is therefore more resource-efficient. Additionally, a laser system like this is much smaller, which means the entire production process is significantly more carbon neutral overall than with die cutting, which is currently used around the world.

...for the electric cars of the future

The BILSTEIN GROUP is investing in the new BILCUT® technology in order to pitch itself to the market as a manufacturer of shaped blanks. This will help the BILSTEIN GROUP master a segment in the auto industry, outside of drive trains, that will continue to play a key role despite the sector's shift toward electric mobility. "At present, applications for combustion engines make up a significant portion of our product volume,"

says Michael Ullrich. "BILCUT® puts us in a position to be able to replace some of this volume as it drops off in future." Investing in BILCUT® technology is therefore critical to both resource efficiency and the future viability of the BILSTEIN GROUP – and is a good example of how economic and environmental factors are not necessarily at odds.

Now is exactly the right time to launch a technology like BILCUT® on the market because the automotive sector is currently drawing up and defining concepts around electric mobility. "If you look at electric vehicles today, with very few exceptions, they are mainly converted vehicles with combustion engines," explains Michael Ullrich. "But plans are being drawn up now for what the electric vehicles of the future will look like." And the BILSTEIN GROUP now has an opportunity to be directly involved in the design of the new models. With this in mind, the BILSTEIN GROUP is currently presenting its BILCUT® technology to its automotive customers. 🌱



Better air quality and less noise

Freight journeys for internal company purposes within the BILSTEIN GROUP are short; electric-engined rather than diesel-engined trucks can therefore be used for this purpose. The switch is helping to reduce both CO₂ emissions and noise pollution.

Whenever harmful emissions and global warming are mentioned, greenhouse gases like CO₂ are often the focus of the conversation. But noise pollution can also have a negative impact on people and the environment. Switching from traditional diesel trucks to electric vehicles is an effective way to reduce both CO₂ emissions and noise pollution at the BILSTEIN GROUP locations.

Reducing emissions...

Each day, an average of around 16 trucks travel between the Weinhof and Berchum locations for purely internal company purposes. Because the journey is relatively short, it's completely viable for electric trucks to take over. Switching from a vehicle with a combustion engine to an electric-powered

truck saves 26 kg of CO₂ per journey, corresponding to a reduction of nearly 105 tons of greenhouse gas emissions per year.

...and noise

To test the transition's impact on noise levels, the BILSTEIN GROUP requested an independent study from the Engineering Office for Acoustics and Noise Emissions Protection Buchholz Erbau-Röschel Horstmann. A group of engineers visited the Weinhof site on the evening of April 23, 2021 to assess the noise. For the purposes of the test, the haulier borrowed an electric tractor unit with engine power of 210 kW, to which a three-axle semitrailer with standard tires was coupled, carrying a load of approx. 10 tons.

Microphones and measuring devices were positioned at defined intervals along the 40-meter-long test route. To capture the noise emitted by the electric truck accurately, the vehicle drove past the measuring devices four times at a consistent pace at three different speeds – first at 10 km/h, then at 20 km/h, and finally at 30 km/h. "The noise emitted by an electric truck driving at 30 km/h is only half that of a truck with a combustion engine. And at 10 km/h, the noise is on a par with a car traveling at 30 km/h," says Deputy Head of Plant and Process Technology Helmut Mühlnickel, who was pleased with the results. The conclusion? Electric trucks traveling at low speeds are almost inaudible off a plant's premises. 🌱





Heat recovery

Systematically reducing CO₂

Lots of processes and production stages result in waste heat. To ensure this excess energy isn't simply blasted out of chimneys, in 2012 the BILSTEIN GROUP implemented a comprehensive heat recovery system spanning all stages of the rolling concept.

When it came to putting the new rolling concept into action, energy efficiency and returning waste heat to the process cycle were a focus from the very beginning. (You can read about the BILSTEIN GROUP's investment strategy on page 14.) Now, a complex heat recovery system is helping significantly reduce the carbon footprint. With the completion of the rolling concept in the first quarter of 2021, all plants and systems for which the energy concept was intended are now connected to it – and there is naturally the option for further growth.

Pioneering ORC plant

One genuinely outstanding solution developed by the BILSTEIN GROUP is the integration of an Organic Rankine Cycle (ORC) plant into the annealing process. The system was awarded the KlimaExpo.NRW environmental program certificate in 2016.

At the heart of the ORC plant is a thermal oil cycle. Here, thermal oil absorbs the waste heat that is emitted when the material cools during the annealing process. In the cascade stage of the ORC plant, when the material and the thermal oil are still hot enough, electricity is produced via a steam expansion engine with a generator hooked up to it. This

electricity is used to improve the efficiency of the annealing plant, i.e. it is used directly in the annealing process, which means significantly less natural gas is required. Thanks to the ORC system, both the new, fully automated batch annealing system and the annealing line modernized in 2019 (cost center 320) in Plant I can be operated with a much lower carbon footprint. Specifically, it results in 306 kg less CO₂ per batch for each annealing campaign, i.e. when the steel is heated to 400–700°C, depending on the type of material, and then cooled down. For several thousand annealing campaigns per year on 32 annealing bases, this equates to a huge reduction in greenhouse gas emissions. The ORC plant is already designed so that further annealing bases can be connected to it as soon as the fully automated batch annealing system or other parts of cost center 320 are modernized.

A sophisticated heat recovery system

When, in the further course of the cooling process, the material is no longer hot enough to be fed into the thermal oil cycle and the engine/generator, the annealing plant switches in a second step to a water cycle. Here, thermal energy is extracted from the waste heat by means of a conventional heat exchanger. In fact, this water cycle is the backbone of

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the BILSTEIN GROUP's entire heat recovery system. As part of the rolling concept, one large centralized heat recovery system and an in-plant heat network were constructed and have been continuously expanded since 2012. In addition to the ORC plant, a number of other plants and components where process heat occurs are connected to this water cycle. Waste heat also flows into the system from a total of 32 annealing bases in the two annealing plants (cost centers 340 and 320) and the air compressors of the new rolling mill (cost center 280).

This energy is then used to heat the hall in cost center 100, hot strip warehouse II, the joinery, the high-bay warehouse and dispatch. The process heat is also used to bring the water-oil mixture in the emulsion plants in the new wide-strip rolling mill (cost center 280) and the tandem mill (cost center 270) up to the required operating temperature: the rolling plant uses a cooling fluid that paradoxically must be heated and kept at a constant temperature of around 50°C. Process heat is used for this in Plant I, instead of natural gas. Natural gas is only used when no waste heat is available.

The new wide-strip rolling mill: a self-contained system

The wide-strip rolling mill (cost center 280) is one of the only plants at BILSTEIN to use natural gas, outside of annealing. To operate as energy efficiently as possible, the rolls have a self-contained cooling system: the waste heat from electric motors, converters, pumps and other units that need to be cooled is used to preheat the fresh air flowing into the hall via a water-to-air heat exchanger. (Air needs to be fed in from outside as steam and air are discharged during the rolling process.) To prevent the hall from cooling down and having to be heated, warm air flows in.

What drives us: the goal to always get better

With all these components, the BILSTEIN GROUP has implemented a comprehensive heat recovery system that spans all phases of the rolling concept, and is now working on innovative measures that will help it make further reductions to CO₂ emissions.

A novel combustion technology in annealing hoods aims to help mix air and natural gas more effectively in the preheating of the combustion air supply. First, this makes the burners more environmentally friendly as it further reduces nitrogen oxide emissions. Second, it boosts heat recovery in the annealing hoods and, as a result, makes the process of preheating air more energy efficient. In turn, this helps cut gas consumption and CO₂ emissions. The BILSTEIN GROUP was already exploiting the most advanced technology currently available in the previous burners. So the new combustion

technology offers an important chance to make improvements. The burners' innovative design has been made possible by the huge advances in 3D printing technology; there is no other manufacturing process that can replicate its complexity.

The BILSTEIN GROUP worked with the burner manufacturer Kueppers Solutions GmbH to test a prototype in the annealing plant, in a pilot project spanning several months. The results were so impressive in terms of process reliability that an entire annealing hood was fitted with the new burners. While this new combustion technology may still be in its early stages, the results so far are extremely promising. And the BILSTEIN GROUP will continue working on developing and improving this technology. 🌱



The new burner technology is the result of 3D printing.

Did you know...



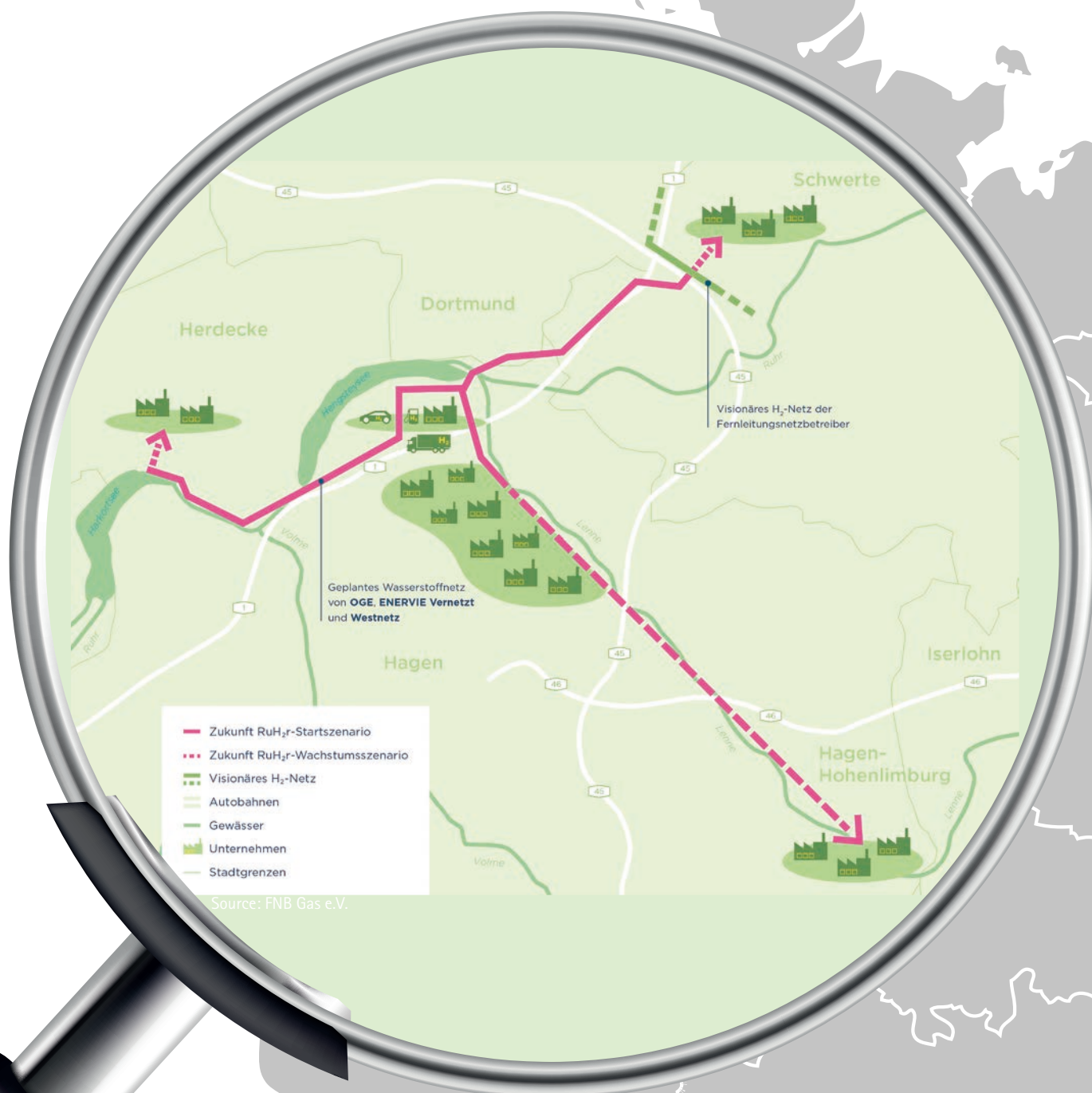
...that the ORC plant generates at least 160 kWh of electricity per annealing campaign? The ORC plant itself requires around 30 kWh of this electrical energy, while 130 kWh is used to make the automatic annealing machines more efficient.

160 kWh of electricity is enough energy to boil nearly 1,600 liters of water, wash 200 loads of laundry at 60°C, or keep 160 LED light bulbs on for around 140 hours.

...that the ORC plant also generates 1,152 kWh of thermal energy per annealing campaign, which is used to heat the building via an in-plant heat network?



NG sustainably

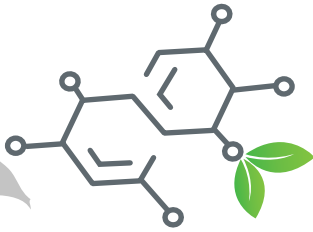


The Lennetal hydrogen initiative

Green energy for Lennetal



As part of the "Future RuH₂r" project, five local companies and three grid operators have teamed up to build a high-performance hydrogen infrastructure. It's an important task, not least because Lennetal is home to an industry for which zero-emissions energy is a matter of survival.



Read more about...
...green steel

- H2 Green Steel in Sweden (page 10)
- The efforts underway in the steel industry (page 6)

Lennetal has been the center of the cold-rolled strip industry for more than 200 years; both the BILSTEIN GROUP and its competitor C.D. Waelzholz are among the world-leading firms based here. Now, together with two other manufacturing companies – thyssenkrupp Hohenlimburg and Kabel Premium Pulp & Paper – as well as the service provider H2 Green Power & Logistics, as part of "Future RuH₂r", these companies are tackling the challenge of how to develop a local hydrogen cluster for the area between the Ruhr industrial region and Sauerland, with the aim of eventually connecting it to a nationwide hydrogen grid.

Zero CO₂: demand for green steel grows

"Our main focus right now is on carbon free steel," emphasizes Managing Director Michael Ullrich. "We've already gotten some very clear specifications from our automotive customers, like how many kilos of CO₂ may be emitted in the production of a ton of steel as of 2030 and 2039, if we are to continue to supply to them." For example, Mercedes-Benz AG has determined that, as of 2030, only 1.5 tons of CO₂ may be emitted during production of one ton of steel, while it has to be carbon neutral by 2039. In setting these standards, automakers are implementing the requirements laid out by the European Union and the German government as part of the climate protection program; and some are even going a lot further.

Substituting natural gas with hydrogen

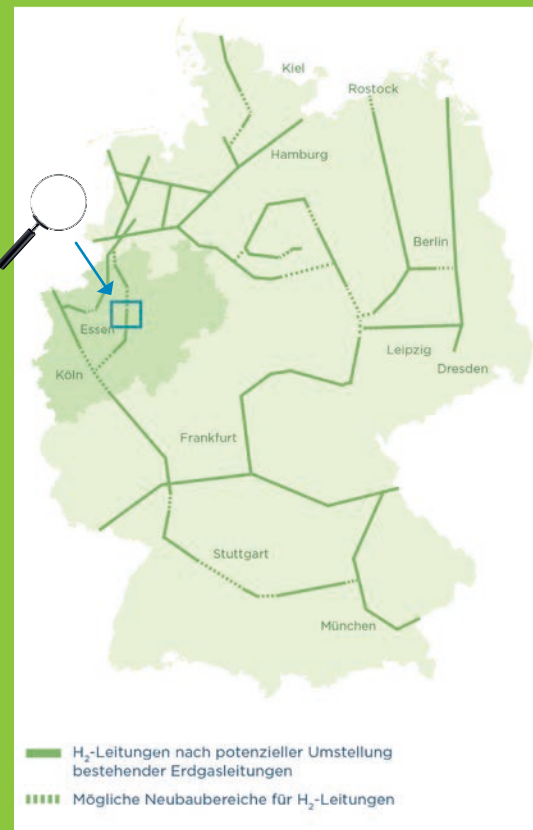
The main source of CO₂ emissions in hot industries is fuel gas, which is used in any step where material is annealed and needs to be softened for processing. At the moment, companies based in Lennetal mainly use natural gas to generate heat in their production processes. "Together with the pipeline network operator Open Grid Europe GmbH (OGE) and the grid operators ENERVIE Vernetzt and Westnetz, we came up with the idea of joining forces and officially petitioning the regional government with our hydrogen requirements," explains Michael Ullrich. "If we want industry to have a viable, successful future here in Lennetal, we have to be able to connect to a hydrogen supply grid. This is the only way we can make our production processes green."

The companies have requested that Lennetal connects to the pipeline that will be built between Rotterdam and Duisburg, providing thyssenkrupp Steel and HKM with green hydrogen and enabling steel to be made without coal. Lennetal is home to industries facing overwhelming demand for "zero CO₂" – that will struggle to continue production in Germany long term without hydrogen. It's also essential that government policies support the transition to sustainable energy sources to enable German industry to remain competitive around the globe.

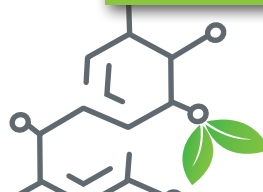
Technically, it is already possible to operate the natural gas burners in the batch annealing furnaces at the BILSTEIN GROUP with hydrogen, with some small modifications, allowing natural gas with its high CO₂ emissions to be substituted by a more carbon-neutral medium. Christian Hagenkord, who's in charge of energy management at the BILSTEIN GROUP, has already calculated how much hydrogen would actually be needed: "When one cubic meter of natural gas is burned, it produces 10 kWh of energy. For one cubic meter of hydrogen, you get 2.4 kWh. Of course, I already know how much natural gas we need for our annealing plants and have taken into account potential efficiency increases and additional annealing bases." These numbers are now with the relevant authorities to evaluate the total demand.

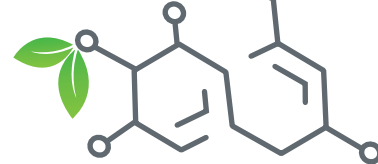
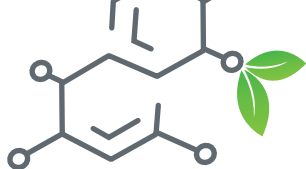


Project: "Future RuH₂r" A visionary H2 network



Source: FNB Gas e.V.





→ At the same time, Westnetz, the potential network operator, is drawing up a detailed business plan that asks some important questions: what will it cost to bring a hydrogen pipeline to Lennetal? What infrastructure and technology are needed? Could existing pipes be used? After all, cost efficiency is the decisive factor: it's no help to anyone if the hydrogen ends up costing 10 euros per kilowatt hour.

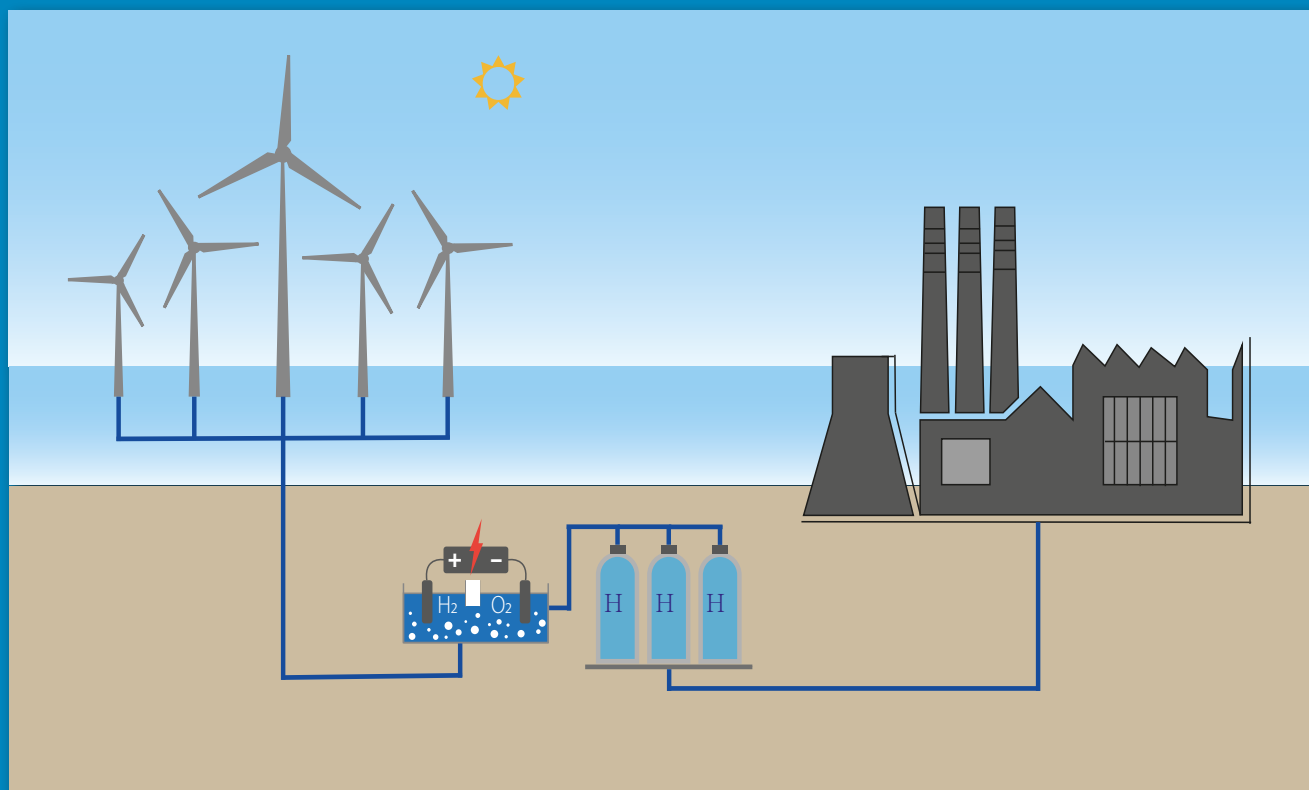
Outlook: a hydrogen network for Lennetal

"I'm certain that Lennetal will get a hydrogen pipeline," says Michael Ullrich confidently. "First, this initiative has shown me that it's actually relatively easy to convert a natural gas network into a hydrogen one. Second, hydrogen production will only get cheaper in the long run, so will eventually

prevail as an energy source." It may just take a while until that happens. Realistically, the technological challenges likely won't be mastered and the relevant permits and approvals signed off until 2030. And in many places, there are still reservations around hydrogen pipelines; natural gas is still much more widely accepted here.

"There is no denying that all stakeholders are ready and willing," says Michael Ullrich, summarizing his overall impression of the work done by the hydrogen cluster as part of "Future RuH₂r". "Not just because of their economic interests and the need to ensure the continued viability of each company, but also because we take climate protection extremely seriously." 🌱

How hydrogen power works...



Using hydrogen produced in a carbon neutral way as an energy source is currently the only option for making thermal processes carbon-neutral on the scale required by the BILSTEIN GROUP and other companies in the steel processing industry. At the moment, the BILSTEIN GROUP uses natural gas to generate the required process heat.

Hydrogen can be produced via electrolysis – and of course, the electricity needed for this cannot come from coal-fired power plants or other fossil fuels. It has to be sourced using renewable

energies in order to truly qualify as carbon neutral. Germany lacks the area that would be needed for it to generate all the hydrogen required to supply its own industrial plants with green hydrogen. A suitable hydrogen distribution infrastructure would also be needed.

Producing all the green hydrogen we need is a global challenge – like oil and natural gas, hydrogen will become an essential export and import in future.





Small actions with a big environmental impact

Living sustainably

Reducing trash and taking public transit more often: it's with small steps like these that every individual can do their part for sustainability. Our apprentices talk about what they're doing to help protect the planet.

"Although I have a car and a scooter, I prefer to use my bike for shorter journeys. Car pooling is another great way to help support the environment. It's not necessary for everyone to take their own car to work if a coworker is already traveling the same way."



Labinot Gashi, process technologist

"All of us are responsible for doing our part to protect the environment. For example, I switched to a green electricity provider. Of course, politicians are responsible for creating opportunities like this, but it's up to us to take advantage them. I also try to buy fruit and vegetables that come from the local region. My parents even grow their own in their garden — they always taste better."



Stefan Schwan, industrial business manager

"When I'm shopping, I try to only buy what I need — and not to buy what I don't need. A big problem right now is that we buy in excess and throw away a lot of things that others might be able to use. I also find it sad that there are lots of rock gardens around, which means less flowers. We only have a balcony, but we have lots of plants — to give a little something back to nature. I think we can only protect the environment if we are all singing from the same song sheet and if everyone lives in a more sustainable and environmentally friendly way, starting with themselves and their immediate surroundings."



Marcel Kuhn, technical product designer

"Sustainability and environmental protection are the responsibility of everyone, including the government and individual citizens. Nowadays, McDonald's serves all its food in cardboard instead of plastic. That's a positive change. Personally, I separate my waste and I make sure I don't leave any trash behind anywhere — I take it with me so I can dispose of it properly. What I don't like is that vehicle taxes and gas prices are being hiked up to dissuade people from driving — it's just a way to make money, and it isn't fair!"



Kaan Ali Kale, electrician



